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Natural Environment Work Program: Watershed Planning Discussion Paper

Niagara Region
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SUSTAINABLE REGION



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1.0 Introduction

1.1 Introduction

Ontario's *Planning Act* (S. 26, Ministry of Municipal Affairs and Housing (MMAH), 1990) requires municipalities to undertake regular reviews of their official plans to align with provincial requirements. The Act requires alignments to be achieved with respect to conformity/consistency with the Provincial Policy Statement (2014), Provincial Plans, and the goals of the *Planning Act*. Niagara Region's Official Plan was approved in 1973 and while it has been subject to several Regional Official Plan Amendments (ROPAs) over the years, it has not been comprehensively updated. The Niagara Region has initiated a work program to develop a new Niagara Official Plan (NOP) that will provide long range and comprehensive policy direction and inter-related policies, and will reflect current planning practices. The new Niagara Official Plan (NOP) will achieve conformity with provincial plans, provide planning guidance to municipalities, provide direction with respect to Regional operations and interests and lay the foundation for the future of the Niagara Region.

Niagara Region has identified the need to undertake several background studies to properly inform the preparation and writing of the new NOP. Amongst these, and identified as a priority, is a Natural Environment study that focuses on Natural Heritage and Water Systems Planning; this watershed planning discussion paper supports the Natural Environment study report. Current Provincial policy direction includes protection of natural heritage and water resource systems, and reliance on watershed plans to inform land use planning, and to manage water resources and issues like storm water management. As stated in the Provincial Policy Statement (MMAH, 2014a), the Official Plan of municipalities is considered to be "the most important vehicle for implementing the Provincial Policy Statement. Comprehensive, integrated and long-term planning is best achieved through official plans".

Watershed planning is required to inform municipal decisions regarding growth and infrastructure. Watershed planning is a framework used to define values, objectives and targets that support the protection, enhancement, or restoration of the natural resources within a watershed through the development of management plans and policies. This includes the unique landforms, ecosystems, agricultural land uses, tourism, and quality of life; consideration of each of these aspects of Niagara Region is part of an integrated approach to watershed planning.

Niagara Region retained North-South Environmental, in collaboration with Ecosystem Recovery, Meridian Planning, and GLPi to provide consulting services for the Natural Environment Work Program in support of the new NOP. A priority topic within this work program is 'watershed planning' especially in the context of requirements stated in Provincial Plans and in the recent Draft Provincial Watershed Planning guidance document (MOECC and MNRF, 2018), and its implications for the Region and area municipalities.

This discussion paper is intended to provide Niagara Region with an overview of Provincial requirements regarding watershed planning. Recognizing that characterization of various aspects of the natural and physical environments within Niagara Region is already documented through several studies, this paper includes a high level review of those studies to determine their equivalency when compared to Provincial guidelines for watershed planning. Gaps in understanding will be identified and recommendations for addressing these gaps will be made in the context of supporting the new NOP. Through consideration of the Provincial requirements, and both the planning structure and stakeholders within Niagara Region, a Watershed Planning Framework is proposed. This framework informs policy recommendations for the new NOP.

Information provided within this report reflects existing Provincial policies and plans; these are subject to updates/introduction of new legislation/plans/policies.

1.2 History of Watershed Planning in Niagara Region

Traditionally, in Ontario, conservation authorities (CA) have had a lead role in coordinating watershed planning, as it was recognized that the watershed, rather than municipal boundaries, were the appropriate scale to consider water resource interactions. Watershed planning also overlapped with the expertise and other business functions of many CAs. Watershed and subwatershed plans were typically completed with support and consultation of all member municipalities and stakeholders. That approach facilitated collaborative implementation of joint objectives to protect, enhance, or restore various aspects of the natural environment and watershed in which people live, work, and play.

The Province of Ontario first requested that conservation authorities complete watershed plans in 1983. In Niagara Region, the Niagara Peninsula Conservation Authority (NPCA) has historically led most of the watershed planning initiatives, which were typically completed to support the needs and functions of the CA.

In 2003, post Walkerton, the Region, NPCA, and MOE(CP) partnered to develop a Niagara Water Strategy. Implementation of watershed planning recommended by this strategy through its 'Direct Actions' was undertaken by NPCA as the local watershed-based agency between 2003 and 2011. This included significant studies such as the Natural Area's Inventory and Nature for Niagara's Future. Steering Committees for completed watershed plans, led by NPCA and funded by the Region, included representation from the Region and Area municipalities. During this time, NPCA completed 12 of the 18 watershed plans.

The watershed planning program was levied as part of NPCA's operation budget to the Region. Complementary technical studies, programs, and services such as floodplain mapping and water quality monitoring were regularly presented through business cases as supporting the watershed planning program. This integrated watershed planning

approach was discontinued by the NPCA with the rationale of ‘budgetary constraints’ in 2011.

The document entitled ‘Establishing a Framework for Watershed Plans in the NPCA Watershed’ (AECOM, 2016) was funded by Niagara Region in 2016 through the Niagara Water Strategy. The purpose of this framework was to assess the status of the NPCA watershed plans and prioritize the recommended actions for updating watershed plans. The document further re-highlighted the importance of prioritizing watershed planning in addressing water quality issues.

With the completion of the Co-ordinated Plan Review, and release of the new Provincial Plans, there is an increased emphasis on the need for watershed planning to inform land-use planning. This was accompanied by a shift in responsibility for watershed planning. Specifically, section 4.2.1.1 of the 2017 Growth Plan states “*Municipalities, partnering with conservation authorities as appropriate, will ensure that watershed planning is undertaken to support a comprehensive, integrated, and long-term approach to the protection, enhancement, or restoration of the quality and quantity of water within a watershed.*”

Coinciding with this Provincial direction, in late 2017, there was a transfer of responsibility for a number of environmental planning responsibilities from the NPCA to Niagara Region. Through the “Protocol for Planning Services between Niagara Region and Niagara Peninsula Conservation Authority”, responsibility for watershed planning is now with Niagara Region, and completion of subwatershed studies are the responsibility of municipalities. At the time the ‘protocol’ was being revised, it was understood that the Region was developing a new Regional Official Plan, called the “Niagara Official Plan”, and that the process, roles, and responsibilities for watershed planning would be better refined through that process.

1.3 Discussion Paper Organization

This discussion paper is intended to provide the Region with further understanding of the Provincial watershed planning requirements to inform development of the new Niagara Official Plan. The following provides a brief overview of the organization followed for this report.

Chapter 1 – Introduction and background to watershed planning and its relevance to development of the new Niagara Official Plan.

Chapter 2 – Provincial Draft Watershed Planning Requirements/Guidance – the requirements in the Draft (2018) document are summarized

Chapter 3 – Review of Provincial Policies, guidelines, and direction with respect to watershed planning that need to be considered and addressed through the new NOP.

Chapter 4 – Equivalency of Watershed Planning Documents - the equivalency of existing watershed planning documents to the 2018 Draft Watershed Planning in Ontario guidance document is assessed. Gaps and data deficiencies are identified and reviewed with respect to incorporating into the natural environment work program or additional work.

Chapter 5 – Niagara Policy Recommendations - Policy to reflect watershed planning requirements are presented for consideration in the new NOP.

Chapter 6 – Watershed Planning Framework for Niagara Region – an approach is developed that considers geographical scale, hierarchy of stakeholders and respective responsibilities within the Region, triggers and timelines for study initiation, and inter-relationships for studies

Chapter 7 – Conclusions and Summary of Recommendations

A review of the terminology and associated definitions relevant to this watershed planning discussion paper is provided in **Appendix 3**.

2.0 Watershed Planning Overview

Land use planning and development, in Ontario, is guided by the Provincial Policy Statement (MMAH, 2014) which provides direction on matters of provincial interest. Matters of provincial interest include providing for appropriate development while protecting resources such as the natural environment and water resources. Provincial Plans supplement the Provincial Policy Statement by providing additional and more specific policies to address issues facing specific geographic areas in Ontario. Municipal Official Plans supplement Provincial Plans by providing locally generated policies regarding matters that are of municipal interest. The hierarchy chain is summarized below:

Provincial Policy Statement → Provincial Plans → Municipal Official Plans

Watershed planning provides a framework for assessing and documenting existing conditions and establishing goals for the protection, enhancement, or restoration of natural resources (see **Figure 2-1**). Carrying out watershed planning involves a cross-jurisdictional coordination of efforts in order to best assess cumulative and cross-watershed impacts. Essential to the entire process are the principles of monitoring and adaptive management, which address the reality of uncertainty in planning.

The watershed planning framework is a phased process that is undertaken for three key goals:

1. to inform land use planning,
2. to prepare management plans, and
3. to assist in the protection of water quantity and quality.

The framework consists of three phases of study that include:

1. **Phase 1:** Characterization of the watershed.
2. **Phase 2:** Evaluation of various land use and management scenarios to assess cumulative, cross-jurisdictional, and cross-watershed impacts; results are used to set goals for the watershed and inform land use planning.
3. **Phase 3:** Development of an implementation plan that is supported by a monitoring and adaptive management program that inform watershed planning updates.

Through the watershed planning process, several provincial obligations can be fulfilled concurrently including climate change planning as well as the municipalities responsibility to consider cumulative impacts.

Climate change considerations should be incorporated into Phase 2 of the watershed planning framework. Through Phase 2, a preferred land use and management scenario is selected after evaluating a long list of scenarios. The preferred alternative must incorporate protection, management restoration, and enhancement as part of

development recommendations. In order to ensure that these objectives are met, climate change scenarios should be integrated into scenario development and evaluation. A Climate Change Work Program outlines the types of analyses that should be incorporated, including future climate change projections (e.g. rainfall and temperature) and resulting impacts (e.g., areas of vulnerability) (See recommendations in **Section 7.2.1**).

Municipalities are required to consider cumulative impacts as per provincial policy and plans. This refers to accumulating changes in the environment caused by the combined effects of developments, land use changes, permits, licences, climate change and infrastructure over time. Watershed planning can play a role in fulfilling this municipal obligation by incorporating impact considerations into scenario evaluation and modelling in Phase 2 of the watershed framework.

While Phase 2 is an essential process for understanding potential outcomes of land management scenarios and climate change, this process does not guarantee that future outcomes will occur exactly as evaluated/modelled. Recognizing the presence of future uncertainties, Phase 3 is intended to evaluate the execution of land use and management decisions against watershed objectives, and the effectiveness of mitigation measures. Phase 3 incorporates monitoring in order to test the outcomes of the planning process against specific targets and objectives. Ongoing and relevant monitoring data should be collected. Regularly, analytics and trends should be determined from this data to support future recommendations. The success of Phase 3 relies on adaptive management, an iterative process of making decision based on monitoring outcomes, in order to better address the overarching objectives.

The Provincial Policy Statement (MMAH, 2014) identifies the watershed as an ecologically meaningful scale that enables a coordinated, integrated and comprehensive approach for dealing with planning matters within municipalities such as managing growth and development; economic development strategies; managing natural heritage and water resources; ecosystem, shoreline, watershed and Great Lakes related issues; and natural hazards. Each of the Provincial plans also refer to the watershed as the appropriate scale for integrating land use planning with protection of the natural environment.

The Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018) provides municipalities with watershed planning guidance to inform their land use planning activities. That is, land use planning is to be informed by watershed planning. The watershed based planning focus of provincial documents must be reflected in the new Niagara Official Plan. From a provincial perspective, there is an increased emphasis and direction that land use planning should be informed by watershed planning.

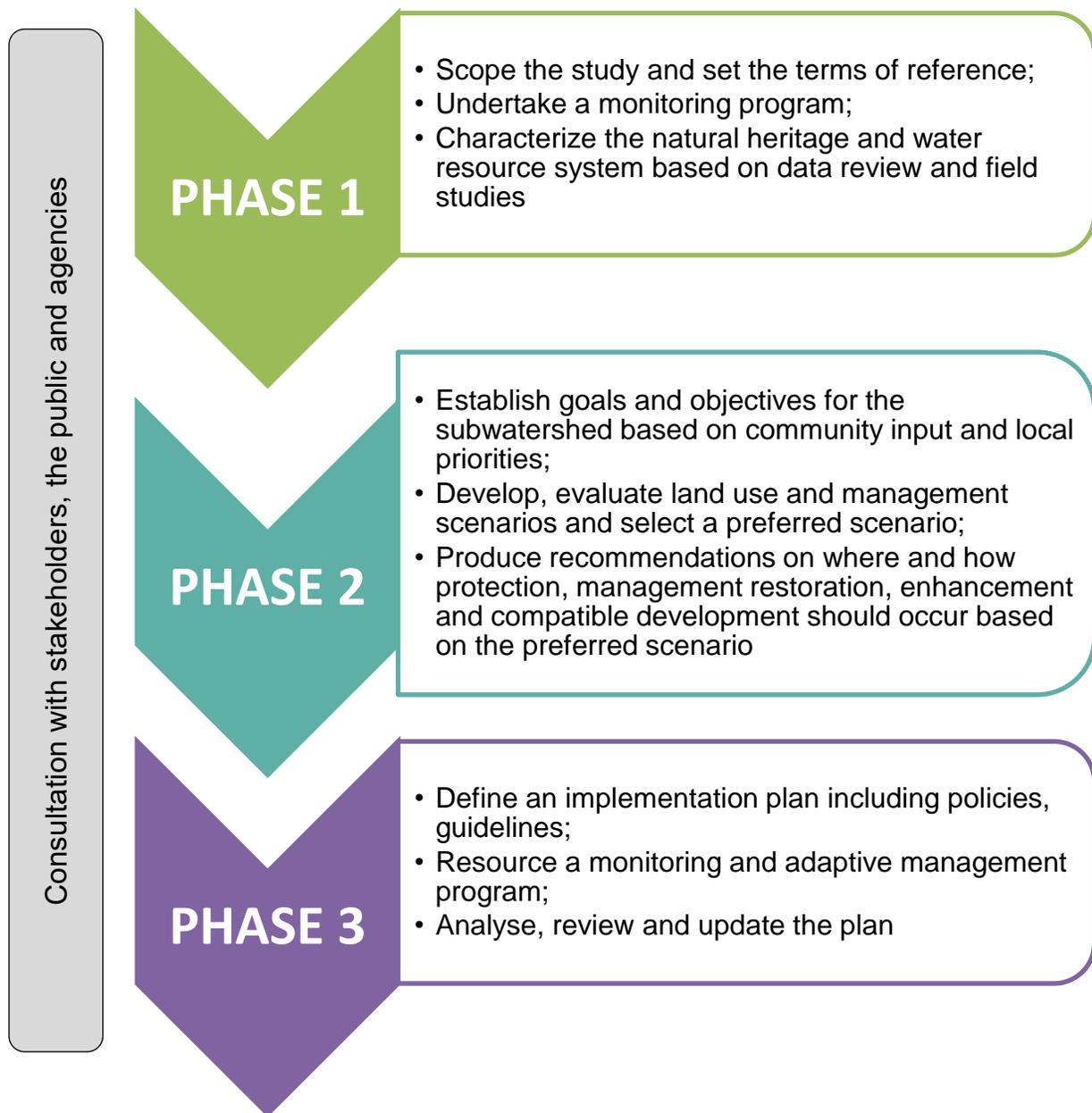


Figure 2-1. Overview of the watershed planning process (from Labbé, 2018)

2.1 Progression of Watershed Planning

The need for, and benefit of, watershed plans was first established with the Conservation Authorities Act in 1946. Since then, the watershed planning process has become more comprehensive and multi-disciplinary and is now formally recognized within Provincial documents as a necessary basis to inform land use planning (See **Figure 2-2**). In this regard, it is beneficial to see the progression of watershed planning in Ontario, and recognize the progressive step that all municipalities are required to undertake to protect, maintain or enhance resources of provincial interest, public health and safety, and the quality of the natural and built environment (MMAH, 2014).

Until the release of the updated Provincial Plans in 2017, undertaking watershed planning studies was recommended and encouraged, but not required. Many municipalities realized the benefit of establishing watershed plans as a foundation for sustainable land use planning and development to support economic development, and therefore it was strongly supported by municipalities; this helped to drive the watershed planning process forward (Summers et al., 2003). One of the biggest challenges for watershed planning is the lack of recommendation implementation, and/or adaptive management, due to a lack of resources.

The following outline of the watershed planning progression draws from the summaries provided in Summers et al., (2003), produced recently by AECOM (2016) for Niagara Peninsula Conservation Authority (NPCA) in their “Establishing a Framework for Watershed Plans in the NPCA Watershed”, and outlined by MOECC and MNRF (2018) in their Watershed Planning guideline document. From these documents, the progression of watershed planning is generally agreed to be as follows:

- **In 1946**, planning on a watershed basis was introduced and formally acknowledged through the Conservation Authorities Act. The watershed planning focus was primarily related to drainage issues (MOEE and MNRF, 1993a) and broad level watershed-scale planning.
- **By the early 1980s**, it was generally recognized that protection and management of water resources would require land use planning at a more local scale. Master Drainage Plans (MDP) were developed that were intended to minimize impacts of development through structural features and floodplain management (e.g., runoff quantity control, erosion/flood control works, major/minor system design, and culvert improvements (MOECC and MNR, 2018). The Province of Ontario first requested that conservation authorities complete watershed plans in the early 1980s.

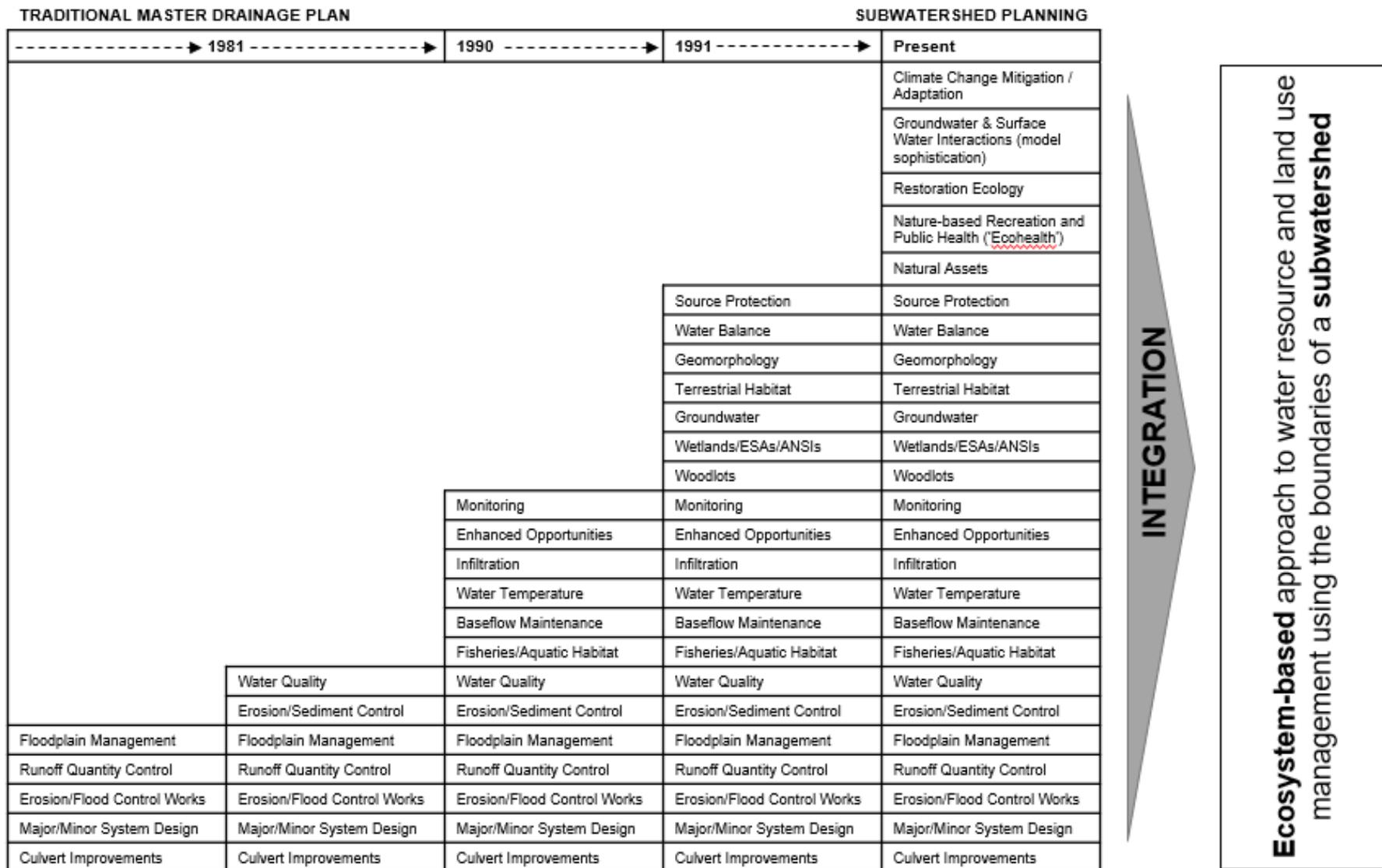


Figure 2-2. Evolution of subwatershed planning (Adapted from: AECOM, 2016 and Labbé, 2018)

- **In the late 1980s**, objectives for environmental management began to focus on smaller geographical scales (i.e., subwatershed) and on maintaining and enhancing the environment, in addition to avoiding development impacts. As such, subwatershed studies began to include consideration of water quality, enhancement opportunities, fisheries/aquatic habitat, and erosion/sediment control.
- **In the early 1990s**, subwatershed planning was expanded further to add monitoring, enhancement opportunities, infiltration, water temperature, baseflow maintenance, and fisheries/aquatic habitat. The watershed or subwatershed became a broadly accepted geographic unit for managing natural systems for planning (MOE and MNR, 1993). Watershed and Subwatershed Planning was formalized, and an effort made to standardize the process of watershed planning through a trilogy of documents prepared by MOEE and MNR (1993a) “Watershed Management on a Watershed Basis: Implementing an Ecosystem Approach” (Conservation Ontario, 2001).

The watershed management plan was defined as ‘a document developed cooperatively by government agencies and other stakeholders to manage the water, land/water interactions, aquatic life and aquatic resources within a particular watershed, in order to protect the health of the ecosystem as land uses change’ (MOEE and MNR, 1993a). Strategies were created to identify natural system form and functions, detail relations to sub-watersheds, address watershed issues, make recommendations and outline implementations (MOEE and MNR, 1993b). The trilogy of documents provided guidance for the integration between watershed planning objectives and municipal planning documents and processes at varying geographic scales.

- **In 1995**, the Ministry of Municipal Affairs strengthened the background for the watershed planning process through their release of comprehensive policy statements and substantive supporting guidelines. This included an integrated approach (air, water, land and biota), a focus on ecosystem integrity, and protection of groundwater resources and sensitive wetlands (MMA, 1995).
- **In 1997**, MOEE and MNR completed an inventory of watershed management projects (completed 1990-1995) and found that those studies typically reviewed surface water flooding, aquatic life, surface water quality, surface storm water, surface low flows, buffers, groundwater quality, wetlands and groundwater quantity.

Mitchell and Shrubsole (1994) suggest that the issues typically examined in the watershed study process are land-use issues and that, to be effective, watershed

plans must directly influence land use planning for agencies working at watershed scales. Land use planning, however, occurs through the municipal planning process (i.e., Official Plan), which is defined by political boundaries. The disconnect between watershed planning and land use planning was identified by Shrubsole and Mitchell (1997). Clearly integration between watershed and land use planning that were already identified in the 1993 trilogy of watershed planning documents required further recognition (i.e., see MOEE and MNR, 1993b).

- **In the early 2000's**, the watershed planning approach, specifically regarding drinking water protection renewed the impetus for integrating the watershed approach to planning; this is attributable to the Walkerton Inquiry. Some of the key lessons learned from the Walkerton Inquiry, with respect to watershed management, including the following:
 - Drinking water sources should be protected by developing watershed-based source protection plans.
 - Where the potential exists for a significant direct threat to drinking water sources, municipal plans and decisions must be consistent with the applicable source protection plan. Otherwise, municipal official plans and decisions should have regard to the source protection plan.
 - The provincial government should ensure that sufficient funds are available to complete the planning and adoption of source protection plans.
 - Conservation authorities (or in their absence, the MOE) should be responsible for implementing local initiatives to educate landowners, industry, and the public about the requirements and importance of drinking water source protection.
 - The MOE should take the lead role in regulating the potential impacts of farm activities on drinking water sources.

As a result, source water protection planning processes were implemented and all source water protection plans were approved by MOECC as of January 2016 (MOECC and MNR, 2018)

- **In 2003**, The Ministry of Environment (MOE) created the Stormwater Management Planning and Design Manual. This document was intended to provide technical and procedural guidance for the planning, design, and review of stormwater management practices. In addition, this manual was intended to be used as a baseline reference document in the review of stormwater management applications for approval under section 53 of the Ontario Water Resources Act as administered by the Ministry of the Environment. Since its publication in 2003, this document has been referenced extensively by designers and reviewers. This document has been one of the strongest influences on the design and development of stormwater infrastructure in Ontario to date.

- **In 2012**, Conservation Ontario produced a document outlining the principles behind an integrated watershed management approach including:

Integrated watershed management (IWM) is the process of managing human activities and natural resources on a watershed basis, taking into account social, economic, and environmental issues, as well as community interests, in order to manage water resources sustainability.

This approach enables us to address multiple issues and stressors across sectors in a more efficient and holistic manner, taking advantage of existing local watershed initiatives, programs and partnerships.

To effectively understand and influence the protection of the Great Lakes, IWM needs to consider the nearshore coastal areas and the inter-relationships with the associated Great Lake shorelines and watersheds.

- **In 2014**, the Provincial Policy Statement was released which states that ‘using the watershed as the ecologically meaningful scale for integrated and long-term planning, can be a foundation for considering cumulative impacts of development’ (PPS 2014); the watershed was thus identified as a means for protecting, improving or restoring the quality and quantity of water.
- **In 2017**, Provincial Plans (Growth Plan, Greenbelt, Niagara Escarpment, Oak Ridges Moraine Conservation) were released. The plans recognize that watersheds are the most important scale for protecting the quality and quantity of water, municipalities are required to undertake watershed planning to inform the protection of water resource systems and decisions related to planning for growth such as wastewater, and stormwater infrastructure.
- **In 2017**, a draft version of the Low Impact Development (LID) Stormwater Management Guidance Manual was released by the Ministry of the Environment and Climate Change. This document was created to include a holistic perspective on water resources management, considering the principles of Green Infrastructure (GI) and Low Impact Development (LID). This manual is intended to supplement the information contained in the 2003 Stormwater Management Planning and Design Manual to provide the guidance and SWM criteria, necessary to implement a holistic treatment train approach to stormwater management in Ontario using the full spectrum of source, conveyance and end-of-pipe controls.
- **In 2018**, MOEE and MNRF released Draft Watershed Planning in Ontario guidance document for land-use planning authorities. This document is intended to support municipalities in land use planning, and implementation of

the four 2017 Provincial Plans. A key focus of the watershed planning process is protection of the water resource system in addition to the natural heritage system.

Summers et al. (2003) describe the history of municipal planning and suggest that the Official Plan is one of a municipality's best planning tools (MMAH, 2002); they suggest that while there is no specific reference to watershed planning in the Ontario Planning Act, it does require municipal governments to 'have regard to' the Provincial Policy Statement. The 2014 Provincial Policy Statement "provides for appropriate development while protecting resources of provincial interest, public health and safety, and the quality of the natural and built environment. The Provincial Policy Statement supports improved land use planning and management, which contributes to a more effective and efficient land use planning system" (MMAH, 2014). Directives with regard to watershed planning are stated in the 2017 Provincial plans (See overview in **Section 3.0**).

2.2 Watershed Delineation and Characterization

Watershed planning relies on watershed and subwatershed studies. Results of the studies are used to inform land use planning such as settlement boundary expansion areas.

2.2.1 Drainage Basin Delineation

A watershed is defined as an area that is drained by a river and its tributaries while a subwatershed is an area drained by an individual tributary to the main watercourse (MOE and MNR, 1993; Hardy et al., 1994; MMAH, 2014). Watershed delineation is influenced by topographic drainage basin divides. Watershed planning typically considers smaller nested drainage areas such as subwatersheds, or sub-basins within those subwatersheds; the sub-basins are sometimes referred to as tributary plans or environmental management areas (Conservation Ontario, 2003). Through watershed planning, priority subwatersheds or sub-basins are identified for more detailed studies and management efforts, especially when these are subject to high development pressure or ecosystem degradation. The focus on smaller areas within a watershed is relevant since it allows for a more detailed approach to planning (e.g., planning for stormwater management, designated greenfield areas, and for development is typically based on subwatershed areas) (Conservation Ontario, 2003).

Watersheds typically cross jurisdictional boundaries since they are based on functional drainage areas in the natural environment and not political boundaries.

Draft Provincial guidance urges the use of existing boundaries and data available from Provincial, Municipal, and Conservation Authorities. Provincially available mapping delineates watersheds at primary, secondary, tertiary, and quaternary levels. Secondary watersheds are subdivisions of primary watersheds, tertiary watersheds are

subdivisions of secondary watersheds, and so on. The province subdivides tertiary watersheds into quaternary watersheds; others refer to the quaternary watersheds as subwatersheds. Guidance suggests that watershed-based organizations in Ontario (e.g., Conservation Authorities) are generally based around tertiary watersheds or a smaller geographic unit.

The Ontario Flow Assessment Tool (OFAT) shows the Niagara Region separated by two secondary watersheds: Lake Ontario and Niagara Peninsula, and Northern Lake Erie. The watershed boundaries are cross-jurisdictional, extending into Hamilton and Haldimand County. The majority of land in Niagara Region drains northerly into Lake Ontario. While the southern part of the region drains into a Lake Erie drainage watershed.

The Niagara Water Quality Protection Strategy Report (Niagara Region, 2014) delineates Niagara Region into 3 (tertiary) watershed or drainage basins, where the basins drain either into Lake Ontario, Lake Erie, or the Niagara River (**Figure 2-4, Table 2-1**). This delineation is reasonable and recommended since the hydrological and ecological functions of the Niagara River differ from those of Lake Ontario or Lake Erie.

Review of Provincial mapping identifies nine quaternary watersheds within Niagara Region (**Figure 2-5, Table 2-1**). Most of the quaternary watersheds follow drainage divides; several of the quaternary watersheds which border the lake shorelines, or the Niagara River, include several unconnected drainage features that outlet directly to the associated waterbody. Since these watercourses drain directly into the Lake or Niagara River they are, by definition, individual watersheds.

2.2.2 Delineation for Planning

NPCA (2013) shows that Niagara Region has been divided into 17 spatial units that are generally referred to as “watersheds” but that do not meet the technical definition (i.e., where boundaries are based on drainage divides) of a watershed as outlined in **Section 2.2.1**. Some of the NPCA watershed resemble quaternary watersheds, while others would be more accurately defined as quaternary subwatersheds or, since they adhere to geographical/municipal boundaries, could be referred to as environmental management areas (Conservation Ontario, 2003). For example, the Welland River is defined by three “watershed” areas; individually, these three areas are more properly defined as “subwatersheds” as defined in **Appendix 3** of this report.

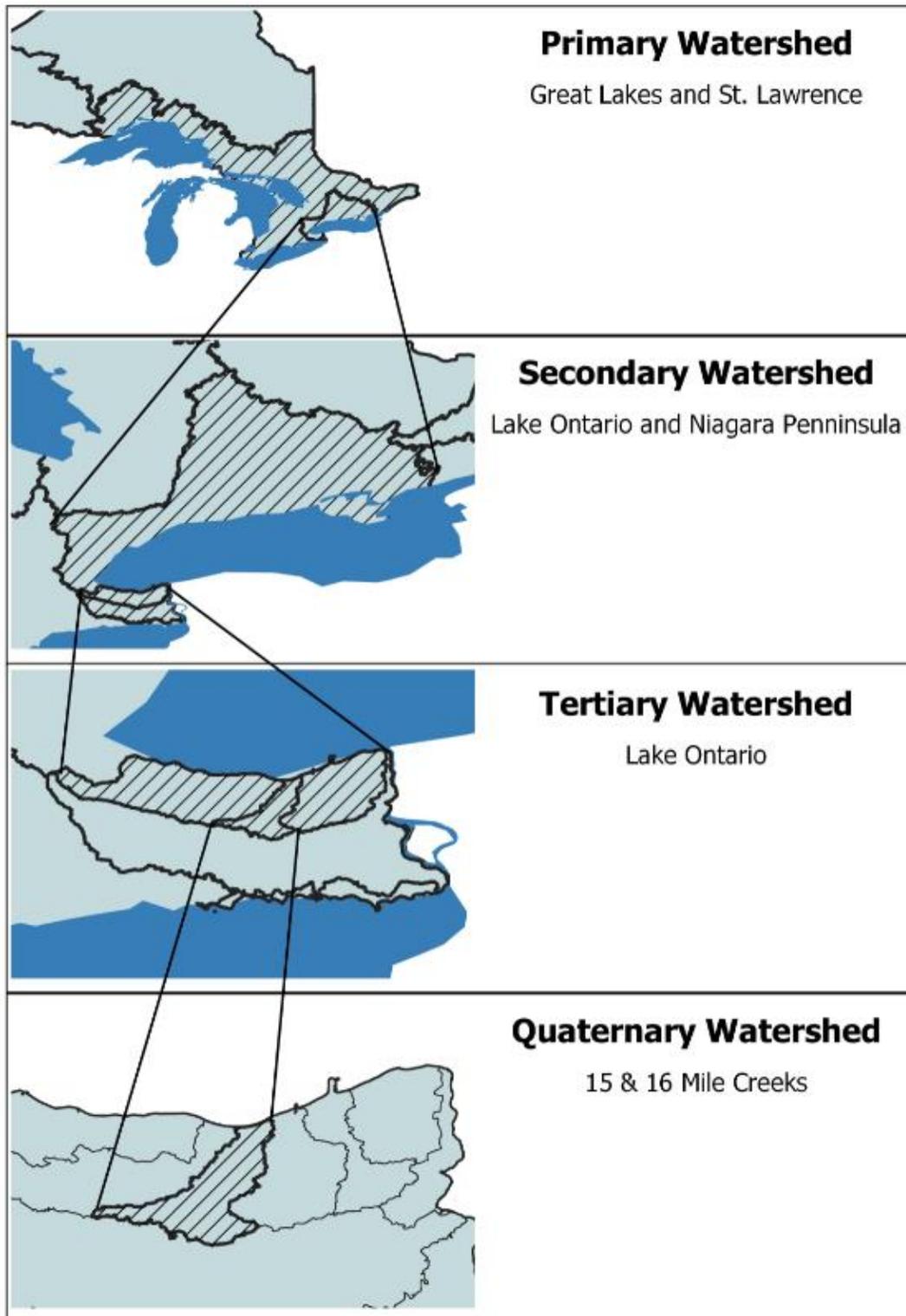


Figure 2-3. Nested watershed scales

Using drainage area based definitions from Conservation Ontario (2003), for planning purposes in Niagara Region, the tertiary watersheds would be defined as ‘watersheds’ since they are > 1000 km². Most quaternary watersheds would be defined as “subwatersheds” since they are between 50 and 200 km² in area (note: While some quaternary watersheds exceed 200 km² in area, it is clear that the area included in Niagara Region is less than this value and therefore meets the Conservation Ontario 2003 subwatershed definition for planning purposes in Niagara Region). Tributary planning refers to areas between 2 and 10 km².

Recognizing that water resources used to supply municipal drinking water systems should be managed on a watershed basis, the Niagara Water Protection Strategy Report (MacViro et al., 2003) refined the level of watershed based study by dividing Niagara region into 32 separate “Local Management Areas” (LMAs) based on drainage basin boundaries, providing a ‘functional geographic or spatial unit’ for watershed assessments (NPCA, 2003).

2.2.3 Summary

The confusion as to the scale to which watershed and subwatershed planning applies, stems in part, from the different meanings assigned to the terminology. That is, the technical definition of watershed or subwatershed varies from the planning definition. Agreement as to the proper terminology, and clarity in its communication should be established amongst all those involved in watershed and subwatershed study and planning.

Watershed scale planning provides the foundation for the protection of the quantity and quality of water. Part of the watershed planning exercise in Niagara will require consideration of scale and logical ecological boundaries, as well as consideration of cross-jurisdictional and cross-watershed impacts. **Table 2-1** provides an overview of the watersheds and municipalities that are situated within them. A tertiary watershed plan could include the implementation plan and priorities for subwatershed study/planning (i.e. quaternary watershed and subwatershed). That is, subwatershed study/planning as defined in the Draft Watershed Planning in Ontario guidance document (MOECC and MNRF 2018) for the purpose of this report, will refer to both quaternary watershed and quaternary subwatersheds.



Figure 2-4. Secondary and tertiary drainage basins in Niagara Region based on Provincial mapping

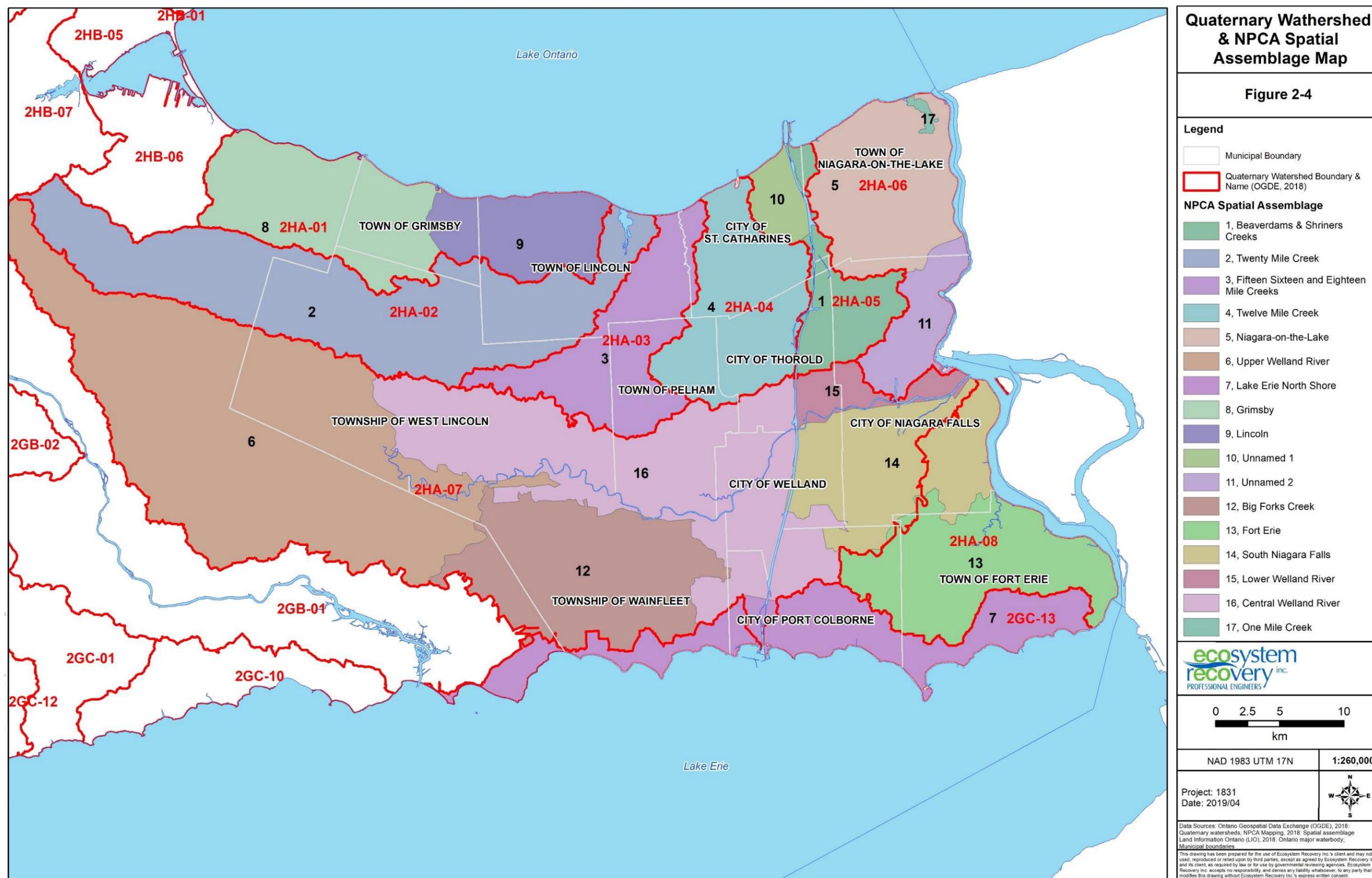


Figure 2-5. Quaternary watersheds (based on Provincial mapping) and NPCA spatial assemblage in Niagara Region

Table 2-1. Overview of Niagara Region drainage basins and watersheds

Note (*): The asterisk (*) notation indicates watersheds (area drained by a watercourse and its tributaries), rather than subwatersheds (area drained by an individual tributary to the main watercourse)							
Primary Watershed ¹	Secondary Watershed ¹	Tertiary Watershed ² (Total Area)	Quaternary Watershed ¹		Subwatersheds ⁴	NPCA Management Areas ⁵ (Area)	Municipalities ⁶
			Identification Code	Tentative Name ³ (Total Area/Niagara Region Area)			
Great Lakes – St Lawrence	Lake Ontario & Niagara Peninsula	Lake Ontario (993 km ²)	2HA-01	Red Hill – 40 Mile Creeks (220.2 km ² / 135.4 km ²)	*Stoney Creek *Battlefield Creek *Forty Mile Creek *Fifty Creek *21 Unnamed Creeks (+/-)	Grimsby (220.2 km ²)	Town of Grimsby Township of West Lincoln
					*Bartlett Creek *Thirty Mile Creek 16 Unnamed Creeks (+/-)		
			2HA-02	20 Mile Creek (311.0 km ² / 201.7 km ²)	*20 Mile Creek Spring Creek Sinkhole Creek North Creek Gavora Ditch 3 Mile Creek *3 Unnamed Creeks (+/-)	20 Mile Creek (311.0 km ²)	Township of West Lincoln Town of Lincoln
			2HA-03	16 Mile – 15 Mile Creeks (126.1 km ² / 126.1 km ²)	*15 Mile Creek *16 Mile Creek *18 Mile Creek *6 Unnamed Creeks (+/-)	15, 16, 18 Mile Creeks (126.1 km ²)	Township of West Lincoln Town of Lincoln Town of Pelham City of St. Catharines
			2HA-04	12 Mile Creek (131.7 km ² / 131.7 km ²)	*12 Mile Creek	12 Mile Creek (131.7 km ²)	City of St. Catharines Town of Pelham City of Thorold
			2HA-05	Lower Welland Canal (86.7 km ² / 86.7 km ²)	*3 Unnamed Creeks (+/-)	Beaverdams & Shriners Creeks (61.2 km ²)	City of St. Catharines City of Thorold City of Niagara Falls Town of Niagara-on-the-Lake
					*2 Unnamed Creeks (+/-)	Unnamed 1 (25.5 km ²)	City of St. Catharines
			2HA-06A	Lower Niagara River (A); 4 Mile – 6 Mile Creeks (117.3 km ² / 117.3 km ²)	*2 Mile Creek *4 Mile Creek *6 Mile Creek *8 Mile Creek	Niagara-on-the-Lake (114.6 km ²)	City of Niagara Falls Town of Niagara-on-the-Lake
		*1 Mile Creek			1 Mile Creek (2.7 km ²)	City of Niagara Falls Town of Niagara-on-the-Lake	
		2HA-06B	Lower Niagara River (B); Unnamed Creeks (65.5 km ² / 65.5 km ²)	*3 Unnamed Creeks (+/-)	Niagara-on-the-Lake (15.9 km ²)	Town of Niagara-on-the-Lake	
					Unnamed 2 (49.6 km ²)	City of Niagara Falls	
		Niagara River (1355.3 km ²)					

Note (*): The asterisk (*) notation indicates watersheds (area drained by a watercourse and its tributaries), rather than subwatersheds (area drained by an individual tributary to the main watercourse)

Primary Watershed ¹	Secondary Watershed ¹	Tertiary Watershed ² (Total Area)	Quaternary Watershed ¹		Subwatersheds ⁴	NPCA Management Areas ⁵ (Area)	Municipalities ⁶
			Identification Code	Tentative Name ³ (Total Area/Niagara Region Area)			
Great Lakes – St Lawrence	Lake Ontario & Niagara Peninsula	Niagara River (1355.3 km ²)	2HA-07	Welland River (1105.0 km ² / 711.2 km ²)		Upper Welland River (478.3 km ²)	Township of West Lincoln Township of Wainfleet
					Sucker Creek Parkers Creek Little Forks Creek Black Ash Creek Beaver Creek	Central Welland River (312.3 km ²)	Township of West Lincoln Township of Wainfleet Town of Pelham City of Thorold City of Welland City of Port Colborne
					Thompsons Creek	Lower Welland River (32.6 km ²)	City of Thorold City of Niagara Falls
					Mill Race Creek	Big Forks Creek (179.8 km ²)	Township of Wainfleet
					Tea Creek Lyons Creek Grassy Brook	South Niagara Falls (partial coverage) (102.0 km ²)	City of Niagara Falls City of Welland City of Port Colborne
			*Usshers Creek *Boyer's Creek	South Niagara Falls (partial coverage) (41.7 km ²)	City of Niagara Falls Town of Fort Erie		
			2HA-08	Upper Niagara River (184.8 km ² / 184.8 km ²)	*Miller Creek *Frenchman's Creek *Baker Creek Black Creek Beaver Creek	Fort Erie (143.1 km ²)	Town of Fort Erie City of Niagara Falls City of Port Colborne
Northern Lake Erie	Lake Erie (138.4 km ²)	2GC-13	Sandusk Creek (138.4 km ² / 122.3 km ²)	*12 Unnamed Creeks (+/-)	Lake Erie North Shore (138.4 km ²)	Town of Fort Erie City of Port Colborne Township of Wainfleet	

Data Sources:

¹Ontario Geospatial Data Exchange (OGDE) (2018) – Watershed boundaries (primary, secondary, quaternary)

²Niagara Region (2014) – The Niagara Water Quality Protection Strategy Report

³Conservation Ontario (August 2010) – Sensitivity Mapping and Local Watershed Assessments for Climate Change Detection and Adaptation Monitoring [Final Report – Appendix C]

⁴Land Information Ontario (LIO) (2018) – Ontario Hydrology Network (OHN) – Watercourses

⁵NPCA (2013) – Niagara Peninsula Conservation Authority Watershed Plan Completion and Board Approval Dates [Map]

⁶Land Information Ontario (LIO) (2017) – Municipal Boundaries

2.3 Planning

Watershed Planning is defined in the Draft Watershed Planning in Ontario guidance document (MOECC and MNRF 2018) as follows:

- “To be undertaken by municipalities, which will inform land use, development, and infrastructure planning for:
 - Location and feasibility of settlement area boundary expansions
 - Water infrastructure planning
 - Planning for new or expanded infrastructure
 - Comprehensive water or wastewater master plans
 - Planning for potable water, stormwater and wastewater systems
 - Stormwater master plans for serviced settlement areas;
 - Protection of water resource systems and decisions related to planning for growth;
 - Allocation of growth and planning for water, wastewater, and stormwater infrastructure;
 - Proposals for large-scale development outside of settlement areas by way of a secondary plan, plan of subdivision, vacant land plan of condominium or site plan; and
 - Infill development, redevelopment and resort development outside of settlement areas in developed shoreline areas of inland lakes.

Goals, objectives and direction contained in watershed plans and municipal official plans for protection of water resources and management of human activities, land, water, aquatic life, and resources, will provide a basis for municipalities when evaluating growth and servicing options.

A tertiary watershed plan could include the implementation plan and priorities for Subwatershed study/planning (i.e. quaternary watershed and subwatershed). Watershed planning is necessary to support land use planning (e.g., settlement boundary expansion).

Watershed Planning and Subwatershed plans are required to inform (as per MOECC and MNRF, 2018):

- Stormwater master plans and settlement areas boundary expansions;
- Planning for infrastructure;
- Municipal and private communal water and wastewater systems;
- Large-scale development, secondary plans, subdivisions, condominium, or site plans;
- Integrated long term planning for water quality and quantity;
- Identifying water resource systems;
- Considering cross-jurisdictional and cross-watershed impacts;

- Planning for water, wastewater, and stormwater infrastructure, and greenfield areas;
- Permitting major development;
- Connecting ecological systems and scales;
- Considering the great Lakes Strategy and agreements;
- Large scale development in key hydrologic areas, or affecting water resources;
- Infill, redevelopment, and restore development in developed shorelines of inland lakes;
- Recommendations for renewable resource activities;
- Recommendations for non-renewable resource activities; and Official plan policies

Provincial policy directions indicate subwatershed planning should be used to inform site-specific land use planning decisions. Key hydrologic area, and developed shoreline development policies of the 2017 Growth Plan and Greenbelt Plan as described previously, indicate that subwatershed plans may be required in place of watershed planning for certain development sites. Planning for designated greenfield areas is also required to be informed by a subwatershed plan or equivalent as per policy 4.2.1.3 of the Growth Plan (MMAH, 2017b).

The goals, objectives and targets developed through the subwatershed planning process should form the basis of an implementation plan. The implementation plan is included directly in the subwatershed plan. An Implementation Plan will:

- Develop an implementation schedule for meeting targets;
- Develop monitoring components to track and evaluate progress;
- Identify technical, financial, and human resource requirements;
- Implement management actions developed through each of the seven elements of watershed planning (**Section 2.7**);
- Prepare annual workplans based on the implementation schedule, monitoring components, resources required and management actions; and
- Prepare report of results and adjust implementation plan as necessary.

2.4 Water Resource System

Identification of the water resource system is a key policy requirement within the PPS, Growth Plan, and the Greenbelt Plan. The PPS (MMAH, 2014) states that the identified water resource system is intended to maintain hydrological and ecological linkages and functions between groundwater and surface water components to sustain healthy aquatic and terrestrial ecosystems and human water consumption, and supplying industries including agriculture and agri-food. The water resource system therefore includes areas necessary to protect drinking water supplies, areas of hydrological significance and identification of vulnerable and/or sensitive groundwater and surface water features that should be protected, mitigated or enhanced in land use planning.

Collectively, the Growth Plan (MMAH, 2017b) refers to these as key hydrologic features, key hydrologic areas, and key natural heritage features. Key hydrologic features are also identified as components of the Natural Heritage System. This recognizes the benefit of integrating the water resource and natural heritage systems to sustain ecological function and maintain biodiversity, while supporting the agricultural system.

The Niagara Escarpment Plan refers to the water resource system in the context of natural heritage systems and interconnected hydrological features and functions. In this sense, the water resource system is similar to the natural heritage system in that it provides a systems-based approach to sustain ecological function, maintain biodiversity, supply clean drinking water, manage wastewater and stormwater, and support recreational opportunities, and supply industries including agriculture and agri-food.

The water resource system is a key focus of watershed planning; it informs the development of master plans for water and wastewater which consider effects to water quantity and quality. Understanding of the water resource system also informs land use planning so that important linkages and connections are maintained within the water resource system, and between the water resource and the natural heritage and/or agricultural systems. Identification of core areas, linkages and corridors amongst the various 'systems' is part of the watershed planning process (MOECC and MNRF, 2018).

Once the key hydrological areas and features of the water resource system have been identified, the functions and inter-relationships and water-related dependencies need to be identified. This includes determining existing condition, the stressors contributing to the existing condition and identifying appropriate management strategies. The Draft Watershed Planning in Ontario guidance document (MOECC and MNRF 2018) refers to this as the pressure-state-response framework. Concept mapping is considered to be sufficient at a watershed scale, to determine link between potential stressors and observed conditions.

Further discussion of the water resource system and its components, and standard definitions is provided in the following sub-sections, to support the watershed planning and associated mapping requirements.

2.4.1 Water Resource Components

The 2014 PPS and 2017 Provincial Plans speak to the water resource system and introduce multiple terms and concepts (see **Section 3.0**). The practical implication for what this means with respect to watershed/subwatershed planning, and supportive mapping benefits from further exploration. Based on the policies included within the Provincial plans, the water resource system includes the following components which are necessary to the ecological and hydrological integrity of the watershed (MMAH, 2014):

- Groundwater features and areas
- Surface water features (including shorelines)
- Natural Heritage Features and Areas

Important water resource concepts (e.g., key hydrologic area, key hydrologic feature, hydrologic function) that are included in the Provincial documents are defined in **Appendix 3** and summarized in **Table 2-2**; discussion of mapping and information sources of water resource system components is provided in the Mapping Discussion Paper (North-South Environmental et al., 2019):

The Protected Countryside policies in the Greenbelt Plan (MMAH, 2017a) has identified specific areas of hydrological significance that are relevant to Niagara Region, which include:

- The upper reaches of watersheds draining to Lake Ontario to the west of the Niagara Escarpment;
- Lands around the primary discharge zones along the toe of the Niagara Escarpment;
- The major river valleys that flow from the Niagara Escarpment to Lake Ontario;
- The former Lake Iroquois shoreline in Durham and Niagara Regions.

An important concept in the definition of natural heritage systems is the notion of connectivity. Connectivity is defined as the degree to which key natural heritage features are connected by species movement corridors, hydrological and nutrient cycling, genetic transfer and energy flows through food webs (MOECC and MNRF, 2018). The Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018) indicates that the level of connectivity between key hydrologic features and areas, and key natural heritage features and areas should aim to be maintained or increased through watershed planning.

Niagara Region recognized the importance of mapping its water resource system and initiated a watercourse mapping project jointly with NPCA; many of the mapping layers were released to the area municipalities in 2018. This mapping provides a solid foundation for future work and updates to ensure that the entirety of the water resource system as defined by Provincial documents is available as a basis for watershed planning (See further discussion in **Section 2.5**).

Table 2-2. Overview of water resource system components

WRS Component	Specific features
Key Hydrologic Area	<p>Watershed boundaries</p> <p>Groundwater:</p> <ul style="list-style-type: none"> • Hydrogeologically sensitive areas. • Highly vulnerable aquifers (HVA) • Significant Groundwater Recharge Areas (SGRA) • Well-head protection areas (WHP-A, B, C, D, E) • Sensitive well-head (SWH) • Intake protection zone (IPZ-1, -2, -3) • Aquifers and unsaturated zones that can be defined by surface and subsurface hydrogeological investigations <p>Surface Water:</p> <ul style="list-style-type: none"> • Headwater features • Flood limits <p>Natural Heritage:</p> <ul style="list-style-type: none"> • As per natural heritage mapping <p>Landforms:</p> <ul style="list-style-type: none"> • Niagara escarpment
Hydrologic Features	<p>Groundwater:</p> <ul style="list-style-type: none"> • Recharge areas (aquifer, permeable soils, etc.) • Water Table • Discharge areas (seepage) <p>Surface water:</p> <ul style="list-style-type: none"> ▪ Seepage areas ▪ Springs ▪ Watercourses (permanent, intermittent, ephemeral, headwater); ▪ Watercourses: rivers, creeks, streams, drains ▪ Open bodies of water (ponds, reservoirs and their littoral) ▪ Inland lakes and Great Lakes, and their littoral zones <p>Natural heritage:</p> <ul style="list-style-type: none"> • Riparian vegetation/vegetated buffers • wetland, swamp, coastal wetland etc.) <p>Shoreline:</p> <ul style="list-style-type: none"> • Great Lakes

	<p>Landforms:</p> <ul style="list-style-type: none"> • karst
<p>Hydrologic Functions</p>	<p>Occurrence (different state):</p> <ul style="list-style-type: none"> • Gaseous – atmospheric • Liquid – surface/groundwater • Solid – surface/ground
<p>(Hydrological Cycle)</p>	<p>Circulation (that it moves: infiltrate or recharge, discharge, storage, evaporate) within and between different components of the water resource system and its linkage to the natural system (ecology, landform):</p> <ul style="list-style-type: none"> • Lakes, ponds • Watercourses • Hyporheic zone • Soil • Karst • Aquifer • Evaporation <p>Distribution (where it occurs, and how much):</p> <ul style="list-style-type: none"> • Surface water (lakes, watercourses, ponds) • Groundwater • Karst • Soil • Natural heritage features (wetlands, swamps, coastal wetlands) <p>Chemical properties of water (Water Quality):</p> <ul style="list-style-type: none"> • Surface and groundwater quality (oxygen, suspended solids, temperature, bacteria, nutrients, hazardous contaminants) <p>Physical properties of water:</p> <ul style="list-style-type: none"> • Gas, liquid, solid states • Temperature • Colour <p>Consider water quantity and quality for:</p> <ul style="list-style-type: none"> • Aquatic and Terrestrial ecosystems • Wetlands, swamps • Seepage • Soil moisture • Aquatic habitat • Storage

	<ul style="list-style-type: none"> • Surficial geology, lakes, ponds etc. • Impoundments (dams/barriers)
Hydrologic Linkage	Water quality with <ul style="list-style-type: none"> • Natural heritage system • Aquatic habitat • Recreation
Connectivity	Water resource system Natural heritage system Aquatic habitat
Hydrologic functions that provide ecological assets	<ul style="list-style-type: none"> • Drinking water - municipal and private wells • Industrial use (surface water taking) • Wastewater treatment plant and discharge locations • Wastewater septic systems • Water purification plant • Stormwater management facilities (and type of controls)
Hydrologic Feature Attributes To consider	<ul style="list-style-type: none"> • Water quality • Aquatic system (cool, cold, warm classification for aquatic species) • Flow regime • Stream order <p>Also consider anthropogenic modification:</p> <ul style="list-style-type: none"> • Reservoir • Dams

2.5 Characterization of Existing Conditions

A baseline of existing watershed conditions is considered to be a vital component of watershed planning (MOECC and MNRF, 2018). Future monitoring and review of existing conditions are compared back to the baseline conditions to assess progress towards environmental objectives, to assess effectiveness of management efforts, and success towards goals.

The quality and quantity of water within the water resource system, and the status and locations of features and linkages, needs to be identified to establish baseline conditions. This baseline condition is used to set goals and targets, evaluate land use and management scenarios and develop management approaches. Understanding of the features, functions, and linkages within a watershed or catchment can be useful in monitoring effectiveness of management actions and ecological change.

In brief, MOECC and MNRF (2018) recommend that watershed characterization include:

- Describing the form, function and linkages within the watershed;
- Identifying issues and opportunities, especially regarding the need for protecting, restoring, or enhancing watershed features and function;
- Prioritizing needs; and
- Establishing preliminary goals and objectives which can be refined as the watershed planning process progresses.

Watershed characterization can include a range of elements, depending on local watershed issues (MOECC and MNRF, 2018). The intent of the characterization is to establish existing conditions and also the contributing 'stressors' so that appropriate management recommendations can be made. While the focus is on water quantity and quality, typical data sources beyond the water resource system include: topography, soils, climate, habitat, wildlife, land use and land cover, and existing land management practices.

Establishment of existing conditions may be possible through review of existing reports and data. Additional information may be necessary to re-assess existing conditions and/or to identify emerging issues. This may require establishing a monitoring program which will also be a useful base against which the effectiveness of management decisions can be evaluated. The Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018) recommends that identification of data needs for watershed and subwatershed studies requires a clear understanding of the issues that the watershed plan will address, and the types of recommendations that might come from the plan. That is, information collection should focus on potential management opportunities and solutions, rather than only issues or problems.

The Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018) promotes an efficient and sensible process for establishing existing conditions including:

1. Determine if missing information is essential for preparing the Watershed Plan;
2. Determine if the missing information can be cross-referenced with existing watershed, subwatershed, and subdivision plans;
3. Assess the possibility of coordinating the gathering of information to improve efforts of the watershed planning team;
4. Determine what information is important to a successful plan.

The existing watershed conditions in Niagara Region have been monitored and/or characterized to varying extents. Documentation of existing conditions was led by the NPCA, primarily consisting of subwatershed studies, until around 2011. After this time, the focus of studies completed in Niagara Region has been on specific topics or aspects of the area (e.g., climate change, water strategy, water quality protection, source protection plan and assessment, subwatershed report cards etc., see **Table 4-2**). Monitoring by the Province and NPCA has provided insight into the quality and quantity of surface and groundwater of Niagara Region's watercourses.

The Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018) identifies that Environment and Climate Change Canada (ECCC) provides the following list of sources containing pre-existing baseline data which may be useful in undertaking watershed planning:

- Canadian researchers use **baseline data** from databases developed from **national surveys of water and climate** and maintained by the federal government. In many cases, data collected by provincial agencies are maintained by the provinces or contributed to the federal database, thereby providing research with a solid basis;
- **Water quantity and climate monitoring** are carried out across the country through national programs under the responsibility of ECCC;
- **Water quantity monitoring** is undertaken through ECCC's hydrometric program and carried out under formal agreements with the provinces and territories;
- For **water quality monitoring**, several federal-provincial/territorial agreement-based networks exist, and some provinces have their own networks in place; however, a more coordinated and comprehensive approach is needed. To that end, collective efforts are being made through the **Canadian Council of Ministers of the Environment (CCME)** to revitalize capacities and build a Canada-wide integrated network for water quality monitoring;
- **Groundwater Quality Monitoring** is undertaken through the Provincial Groundwater Monitoring Network (PGMN), which began in 2000 and is

- designed to monitor ambient groundwater level and chemistry conditions across Ontario. There are currently 474 wells in the PGMN program that monitor groundwater levels on an hourly basis. These wells are not used to supply water and are used for monitoring groundwater conditions only; and
- With respect to drinking water quality, Health Canada, provincial/territorial health departments, and their partners are monitoring waterborne disease under the **National Enteric Surveillance Program**. Health Canada and the provinces/territories also collaborate in the development of the Guidelines for Canadian Drinking Water Quality.

Whether the existing reports and studies are sufficient to meet requirements of the Watershed Planning Guidance document (MOECC and MNRF (2018)) is discussed in **Section 2.5**.

2.6 Setting Vision, Goals, Objectives and Targets

The vision, goals, objectives, and targets that are established through the watershed planning process must align with applicable provincial policies and plans, and be appropriate for local conditions. The vision helps to identify priorities, values and issues within a watershed. From these, goals and objectives are developed that form the basis for actions and land-use planning decisions made under the watershed plan. Targets are typically quantitative measures from which progress towards achieving the corresponding objective can be assessed.

The vision, goals, objectives and targets are often set during a watershed planning process. The vision, however, is typically in alignment with the general vision of each stakeholder. Endorsement of the vision, goals, and objectives by the stakeholders is key in ensuring support for implementation and strategy development. Policies of area municipalities would be updated to reflect the vision, goals, and objectives of the watershed or subwatershed plans.

2.7 Watershed Planning Elements and Best Practices

The Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018) outlines the seven components, or elements, that are integral to watershed planning. These elements include the following:

1. Water budgets, conservation plans, and surface and groundwater quantity considerations
 - Water budgets are considered to be a basic tool to fulfill objectives used in support of water supply and land use management.
2. Water quality for surface and ground water, nutrient loading, and assimilative capacity assessments

- This includes identification of point and non-point sources of pollution
- 3. Natural hazards (erosion, flooding, dynamic beach)
 - This includes hazardous lands and hazardous sites.
- 4. Climate change considerations
 - This includes mitigation of greenhouse gases, and adaptations to a changing climate and consideration of green infrastructure that can mitigate effects.
- 5. Interconnections with natural heritage features, areas, and systems, as well as the benefits of green infrastructure
 - This considers the long term health and viability of water resources, biodiversity and ecological integrity
- 6. Consideration of cumulative impacts
 - This refers to accumulating changes in the environment caused by the combined effects of developments, land use changes, permits, licences, climate change and infrastructure over time.
- 7. Analysis of land use and management scenarios.
 - This refers to consideration of alternative measures and methods that may be used to protect, enhance, or rehabilitate the environmental features identified in the watershed issues and goals.

In general, at a high level, watershed planning will involve the steps below and all or some of the components listed:

1. Assessment of existing watershed conditions
 - Delineation and characterization of the watershed of interest
 - Review of existing information for use as equivalency or to build on is recommended
 - Local relevance can influence what information should be collected or what information may not be relevant
2. Setting a direction
 - Setting a vision, objective, goals and targets
 - Identify opportunities for protection, enhancement, rehabilitation, and development
 - assessing cumulative effects
 - assessment of land use and management scenarios
3. Implementing the direction
 - Direction for implementation in municipal official plan policies for informing land use planning and decision-making
 - Water, wastewater and stormwater servicing requirements
 - Best management practices and designs for the management of the quantity and quality of surface water and ground water

4. Monitoring and Evaluation

- Monitoring, reporting and analyzing
- Adaptive management, goal and target revision, evaluation of all areas of the plan

Results of the required analyses and characterization directly support background information necessary to support planning authorities in planning for the ‘protection, restoration, or enhancement of the quality and quantity of water’ as outlined in the PPS. The results are beneficial to development of management plans, provide a watershed scale framework for site scale studies, setting targets.

2.8 Stakeholder Engagement and Indigenous Perspectives

Participation in the watershed planning process by stakeholders that include municipalities, conservation authorities, interested provincial ministries, indigenous communities, stakeholder groups, and the public, develops a sense of ownership of the watershed plan and fosters relationship building and stewardship. Active engagement by stakeholders is considered vital to the successful watershed planning process, and to support the long term, ongoing implementation, monitoring and adaptation of the watershed plan.

Engagement with the public during the watershed planning process provides opportunities for public education and outreach and data collection through citizen science. This increases the likelihood of public understanding and support for the watershed plan and participation in initiatives that result from the watershed plan recommendations. Public support is beneficial to stakeholders to support advancement of the watershed plan, fund plan implementation, and to carry out their mandates/responsibilities in accordance with the plan.

Indigenous community engagement during activity or study related to watershed planning is also strongly encouraged in Provincial guidance to ensure adequate consideration of the relationships, traditional ecological knowledge, and rights communities have within a watershed.

2.9 Monitoring and Adaptive Management

Historically, one of the greatest challenges to subwatershed planning has been the lack of implementation in terms of monitoring, reviewing results, and recommending adaptive management measures. This is largely due to insufficient budgets/funding allocated for these tasks (Conservation Ontario 2003). While governments have fully embraced the concept of subwatershed studies, including the characterization and determination of a preferred management scenario, many have considered this process a onetime project (or expenditure), and have ignored the need for ongoing monitoring and feedback. Monitoring is also important for establishing current conditions, and identifying trends through time; understanding of existing conditions informs the identification of relevant

management actions, through subwatershed planning, that could avoid or minimize negative impacts of land use change. Monitoring of pre-development conditions provides a basis for assessing impact of future land use activities and response to management actions.

There has been a trend towards increased focus on monitoring and adaptive management in watershed management processes. Adaptive management incorporates a project cycle that begins with planning, followed by execution, and then evaluation. The evaluation aspect often incorporates specific monitoring activities that test the outcome of a project against the specific project objectives. The project does not end at the evaluation phase. Instead, the results of the evaluation phase are used to adjust the execution of the work continuously through refinements and enhancements in order to best meet project goals. An illustration showing the adaptive management process is included **Figure 2-6**.

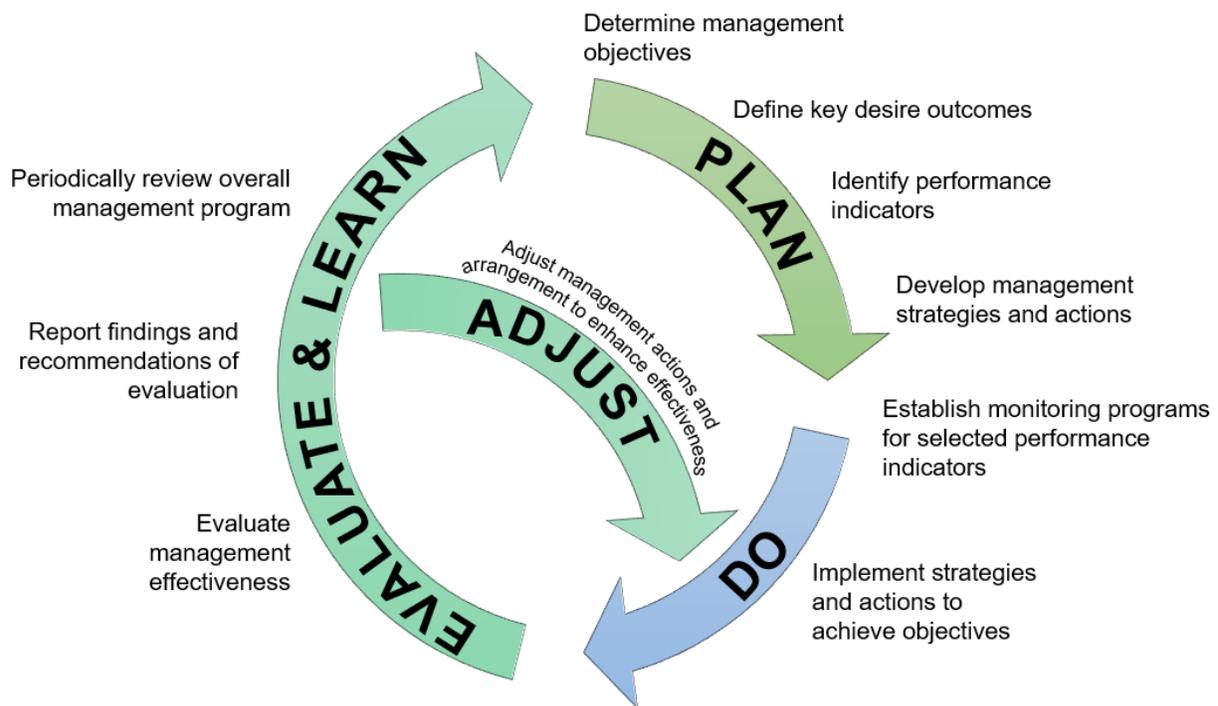


Figure 2-6. The adaptive management cycle

As new technologies emerge and are becoming more accessible and informative (i.e., based on cost, complexity, accuracy) the effectiveness of management actions can be better evaluated. Increasingly, monitoring tools are incorporating internet connectivity which enables watershed managers to see and react to changes in near real-time.

While there is great potential in incorporating an adaptive management and widespread monitoring strategies, there are also associated challenges that should be addressed in the planning process. Some of the challenges include:

- **Cross-jurisdictional challenges:** coordinating an approach with neighbouring jurisdictions.
- **Cumulative impact:** considering cumulative impacts associated with land management, rather than individual components in isolation.
- **Resources:** allocating enough resources (financial and staff) to all aspect of the adaptive management process, especially the evaluation and adjustment phases.

To address these challenges, the creation of partnerships is strongly recommended. This includes partnerships with other stakeholders in the Region in order to share resources and data.

2.10 Provincial Review

The Province has a role in reviewing land use planning and infrastructure decisions to ensure that they are informed by watershed or subwatershed planning. The Province, through the One Window Planning Service will review applicable land use planning decisions (i.e., new Official Plans and Official Plan Amendments where MMAH is the approval authority under the Planning Act)) to ensure that they have been informed by watershed planning in accordance with Provincial direction and guidance. At this time there is no indication that the Province will review or formally approve watershed planning studies

As identified in draft Provincial guidance (MOECC and MNRF, 2018), the Ministry of Environment and Climate Change also has approval and/or review authority over environmental assessments for water-related infrastructure decisions (existing water and wastewater masterplans and stormwater masterplans) under the **Environmental Assessment Act** and approvals for new or expanded infrastructure of this type under the **Environmental Protection Act** and **Ontario Water Resources Act**. During the review and approval process, MOECC may review these decisions to ensure that they have been informed by watershed planning in accordance with Provincial direction and guidance.

3.0 Existing Provincial Direction and Review

With respect to watershed planning in Niagara Region, the PPS, Growth Plan, Greenbelt Plan, and the Niagara Escarpment Plan drive the watershed planning process. Municipalities are required to follow the direction provided in the Provincial plans or policies and incorporate supporting policies into their official plans.

The PPS provides the framework for watershed planning in Ontario. The three provincial land use plans relevant to Niagara Region refine requirements for watershed planning through a series of policy objectives and requirements.

The Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018) summarizes the Provincial policy requirements as follows (note: as the MOECC and MNRF (2018) document is currently in draft, further updates may occur):

PPS policies encourage a coordinated approach to planning, within and across municipalities, on water, ecosystem, shoreline, watershed and Great Lakes matters. The policies require planning authorities to protect, improve or restore the quality and quantity of water by, among other things, using the watershed as the ecologically meaningful scale for integrated and long-term planning. The PPS is an outcome based policy document.

Growth Plan and Greenbelt Plan policies require watershed planning to be undertaken to inform: the protection of water resource systems, decisions related to planning for growth, subwatershed planning for growth, and subwatershed planning to inform site-specific land use planning decisions.

Niagara Escarpment Plan does not reference watershed planning specifically, although approved watershed planning/subwatershed planning can inform land use, infrastructure, and development decision making.

This chapter provides a further overview of the provincial policies and plans as they pertain to watershed planning requirements. An overview of additional provincial strategies and acts relevant to the watershed planning process is also provided.

3.1 Provincial Policy Statement (MMAH, 2014)

The Provincial Policy Statement (PPS) provides policy direction on matters of provincial interest related to land use planning and development. The PPS sets the policy foundation for regulating the development and use of land; it provides for appropriate development while protecting resources of provincial interest, public health and safety, and the quality of the natural and built environment. The PPS provides the minimum standard, and policy foundation, upon which the provincial plans build.

3.1.1 General Planning

Policy 1.2.1 of the PPS recognizes that planning matters may cross **jurisdictional boundaries** and states:

“A coordinated, integrated and comprehensive approach should be used when dealing with planning matters within municipalities, across lower, single and/or upper-tier municipal boundaries, and with other orders of government, agencies and boards including:

- c) managing natural heritage, water, agricultural, mineral, and cultural heritage and archaeological resources;
- e) ecosystem, shoreline, watershed, and Great Lakes related issues;
- f) natural and human-made hazards”

Further, Policy 1.1.1 of the PPS states that “healthy, liveable and safe communities are sustained by:

- a) Promoting efficient development and land use patterns which sustain the financial well-being of the province and municipalities over the long term and
- c) Avoiding development and land use patterns which may cause environmental or public health and safety concerns.

3.1.2 Infrastructure and Development

Efficient development patterns which minimize impacts on natural heritage and water resources are supported by policy direction in the PPS. Consideration for the maintenance of water quality and quantity is a requirement of PPS policy 2.2.2:

“Development and site alteration shall be restricted in or near sensitive surface water features and sensitive ground water features such that these features and their related hydrologic functions will be protected, improved or restored.

Mitigative measures and/or alternative development approaches may be required in order to protect, improve or restore sensitive surface water features, sensitive ground water features, and their hydrologic functions.”

While the provision of infrastructure based on watershed planning as a requirement is not explicitly stated in section 1.6 of the PPS (**Infrastructure and Public Service Facilities**), the policies contained therein provide a basis for water resource planning, which should be considered a fundamental basis and component of watershed planning. Planning for water and wastewater servicing, stormwater management, and development patterns which address water quality and quantity, natural environment protection and promote resilience to climate change encompass considerations which are inherently linked to watershed planning. Policies 1.6.1, 1.6.2, 1.6.6.1, and 1.6.6.7 in the PPS highlight areas where these considerations apply.

3.1.3 Natural Resources

Section 2.0 of the PPS is labelled as: Wise Use and Management of Resources. This is the foundation of integrated watershed and land use planning. Policy 2.0 states:

“Ontario's long-term prosperity, environmental health, and social well-being depend on conserving biodiversity, protecting the health of the Great Lakes, and protecting natural heritage, water, agricultural, mineral and cultural heritage and archaeological resources for their economic, environmental and social benefits.”

Key concepts are introduced in several policies:

Policy 2.1.1 states that natural features and areas shall be protected for the long term.

Policy 2.1.2 states:

“The diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features.”

Specific direction related to development and site alterations with respect to the natural environment, ecological functions, endangered or threatened species, and aquatic habitat are provided in policies 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7.

3.1.4 Water

Policy 2.2.1 of the PPS includes policies which require planning authorities to protect, improve or restore the quality and quantity of water. Quality and quantity of water is defined in the PPS as follows:

“Quality and quantity of water: is measured by indicators associated with hydrologic function such as minimum base flow, depth to water table, aquifer pressure, oxygen levels, suspended solids, temperature, bacteria, nutrients and hazardous contaminants, and hydrologic regime.”

Specifically, policy 2.2.1 directs planning authorities to:

- a) “use the watershed as the ecologically meaningful scale for integrated and long-term planning, which can be a foundation for considering cumulative impacts of development
- b) minimize potential negative impacts, including cross-jurisdictional and cross-watershed impacts

- c) identifying water resource systems consisting of ground water features, hydrologic functions, natural heritage features and areas, and surface water features including shoreline areas, which are necessary for the ecological and hydrological integrity of the watershed
- d) maintaining linkages and related functions among ground water features, hydrologic functions, natural heritage features and areas, and surface water features including shoreline areas;
- e) implementing necessary restrictions on development and site alteration to:
 - 1. Protect all municipal drinking water supplies and designated vulnerable areas; and
 - 2. Protect, improve, and restore vulnerable surface and ground water, sensitive surface water features and sensitive ground water features, and their hydrologic functions;
- f) planning for efficient and sustainable use of water resources, through practices for water conservation and sustaining water quality;
- g) ensuring consideration of environmental lake capacity, where applicable; and
- h) ensuring stormwater management practices minimize stormwater volumes and contaminate loads, and maintain or increase the extent of vegetation and pervious surfaces.”

The PPS does not set out definitions for “key hydrologic features”, or “key hydrologic areas” as is done in the four land use plans.

3.1.5 Agriculture, Mineral, Aggregate and Petroleum Resources

Agriculture is recognized as an important resource and industry by the Province, and is both unique and valued in Niagara Region. Although not explicitly stated, watershed planning requires awareness and consideration of agricultural lands within land use planning (Policies 2.3.1, 2.3.2). Watershed planning also requires identification and planning for the long term protection of natural resources such as Minerals and Petroleum (Policy 2.4) and Mineral Aggregate Resources (Policy 2.5).

3.1.6 Cultural Heritage and Archaeology

Policy 2.6 of the PPS provides direction regarding the conservation of significant built heritage and cultural heritage landscapes. In addition, development and site alternation shall not be permitted on lands containing archaeological resources or areas of archaeological potential unless significant archaeological resources have been conserved. Often water resource systems are inter-linked with cultural heritage landscapes and archaeological resources.

3.1.7 Natural and Human Hazards, Climate Change

Watershed planning is also relevant to protecting public health and safety from natural or human made hazards. Natural hazards such as dynamic beach, erosion, flooding,

and climate change are addressed through Policy 3.1. Human hazards associated with mineral or aggregate operations; oil, gas, and salt; and contaminated lands are addressed through Policy 3.2.

3.2 Provincial Plans (2017)

The Provincial Greenbelt Plan (MMAH, 2017a) and Growth Plan (MMAH, 2017b) released after the Coordinated Land Use Planning Review, exhibit a strengthening of policy and requirements surrounding watershed planning compared to previous versions of the Growth Plan and Greenbelt Plan. These policies underpin support for the PPS direction regarding protection of quality and quantity of water. The Greenbelt Plan specifically addresses the importance of watershed planning at a large scale to ensure the connection of ecological systems (e.g., Greenbelt Natural System, Great Lakes shorelines, Urban River Valleys) and scales (Greenbelt Plan 3.2.6.1 and 3.2.6.2 (MMAH, 2017a)).

Direction for watershed planning is provided in Growth Plan policy 4.2.1 (MMAH, 2017b) and Greenbelt Plan policy 3.2.1.3, 3.2.3.2 (MMAH, 2017a), which state that “upper and single tier municipalities, partnering with conservation authorities as appropriate, will ensure that watershed planning is undertaken to support a comprehensive, integrated, and long-term approach to the protection, enhancement, or restoration of the quality and quantity of water within a watershed.”

This chapter begins with an overview of each of the provincial plans that are relevant to Niagara Region. This is followed a summary of each policy that is relevant to the watershed planning process, and which are relevant to developing the new NOP for Niagara Region.

heritage system and water resource system are mapped can vary, as discussed below.

3.2.1 Overview of Provincial Plans (2017)

While the Growth Plan provides general direction for the Greater Golden Horseshoe (GGH), the Greenbelt and Niagara Escarpment (NEP) plans focus on specific geographic areas/landforms within the GGH.

Growth Plan for the Greater Golden Horseshoe (2017)

The Growth Plan for the Greater Golden Horseshoe (GGH) (MMAH, 2017b) states the following:

“The GGH contains many of Ontario’s most significant ecological and hydrologic natural environments and scenic landscapes, including the Oak Ridges Moraine, the Niagara Escarpment and the other natural areas in the Greenbelt Area and beyond. These natural areas support biodiversity, provide drinking water for the

region's inhabitants, sustain its many resource-based industries, support recreational activities that benefit public health and overall quality of life, and help moderate the impacts of climate change.

The region also has some of Canada's most important and productive farmland. Its fertile soil, moderate climate, abundant water resources, and proximity to markets support agricultural production that cannot be duplicated elsewhere in the country."

The vision for the GGH, as presented in the Growth Plan that is addressed through watershed planning is:

"A healthy natural environment with clean air, land, and water will characterize the GGH. The Greenbelt, including significant natural features, such as the Oak Ridges Moraine and the Niagara Escarpment, will continue to be enhanced and protected in perpetuity. The GGH's rivers and streams, forests and natural areas will be accessible for residents to enjoy their beauty. Our cultural heritage resources and open spaces in our cities, towns, and countryside will provide people with a sense of place.

Natural areas and agricultural lands will provide a significant contribution to the region's resilience and our ability to adapt to a changing climate. Unique and high quality agricultural lands will be protected for the provision of healthy, local food for future generations. Farming will be productive, diverse, and sustainable."

Greenbelt Plan (2017)

The vision for the Greenbelt (MMAH, 2017a) includes permanent protection for the natural heritage and water resource systems so that ecological and human health can be maintained. Protection of these systems form the environmental framework around which major urbanization in south-central Ontario will be organized.

Specific guiding principles or goals that are relevant to watershed planning, presented in the Greenbelt Plan (MMAH, 2017a) and also reflected in the Growth Plan (MMAH, 2017b) include:

- "Protect and enhance natural heritage, hydrologic, and landform systems, features, and functions, including protection of habitat for flora and fauna and particularly species at risk (Greenbelt, Growth Plan)
- Protection and restoration of natural and open space connections between the ... Niagara Escarpment, Lake Ontario... and the major river valley lands while also maintaining connections to the broader natural systems of southern Ontario beyond the GGH, such as the Great Lakes Coast (Greenbelt)

- Protection, improvement or restoration of the quality and quantity of ground and surface water and the hydrological integrity of watersheds (Greenbelt)
- Provision of long-term guidance for the management of natural heritage and water resources when contemplating such matters as watershed/subwatershed and stormwater management planning, water and wastewater servicing, development, infrastructure, open space planning and management, aggregate rehabilitation and private or public stewardship programs.
- Support and enhance the long-term viability and productivity of agriculture by protecting prime agricultural areas and the agri-food network (Growth Plan) including specialty crop (Greenbelt).”

Niagara Escarpment Plan (2017)

The Niagara Escarpment Plan (NEP) (MNRF, 2017) emerged from the Niagara Escarpment Planning and Development Act and serves as a framework of objectives and policies that strike a balance between development, protection and enjoyment of this important landform feature and the resources it supports. The NEP explains:

“Escarpment features that are in a relatively natural state and associated valley lands, wetlands and woodlands that are relatively undisturbed are included within this designation. These areas may contain important cultural heritage resources, in addition to wildlife habitat, geological features and natural features that provide essential ecosystem services, including water storage, water and air filtration, biodiversity, support of pollinators, carbon storage and resilience to climate change. These are the most sensitive natural and scenic resources of the Escarpment. The policies aim to protect and enhance these natural areas.

The natural areas found across the Niagara Escarpment act to clean the air, provide drinking water and support recreational activities that benefit public health and overall quality of life, as well as helping to address and mitigate the effects of climate change.”

The policies in the NEP are intended to protect and enhance natural and hydrologic features of the Escarpment and lands in its vicinity. Watershed planning is relevant with respect to defining the water resource system and also for providing direction to water, wastewater and stormwater planning.

Specific objectives of the Niagara Escarpment Plan include:

- To recognize, protect and where possible enhance the natural heritage and hydrological systems associated with the Niagara Escarpment Plan area;
- To protect the most natural Escarpment features, valley lands, wetlands and related significant natural areas;
- To maintain and enhance the quality and character of natural streams and water supplies in Escarpment Protection Areas;

- To protect hydrologic features and functions;

3.2.2 Watershed Planning

The Growth Plan (MMAH, 2017b) provides the following overview of watershed planning:

“Planning that provides a framework for establishing goals, objectives, and direction for the protection of water resources, the management of human activities, land, water, aquatic life, and resources within a watershed and for the assessment of cumulative, cross-jurisdictional, and cross-watershed impacts.

Watershed planning typically includes: watershed characterization, a water budget, and conservation plan; nutrient loading assessments; consideration of climate change impacts and severe weather events; land and water use management objectives and strategies; scenario modelling to evaluate the impacts of forecasted growth and servicing options, and mitigation measures; an environmental monitoring plan; requirements for the use of environmental best management practices, programs, and performance measures; criteria for evaluating the protection of quality and quantity of water; the identification and protection of hydrologic features, areas, and functions and the inter-relationships between or among them; and targets for the protection and restoration of riparian areas.”

Watershed planning is a process that is intended to inform land use planning (e.g., growth, infrastructure) and therefore, is undertaken at different spatial scales; cross-jurisdictional and cross-watershed impacts are considered in the planning process. The level of analysis and specificity of watershed planning study generally increases for smaller geographic areas such as subwatersheds, tributaries and drainage basins (MMAH, 2017a).

3.2.3 Water Resource System

In alignment with the PPS 2.2.1.c (MMAH, 2014), the Greenbelt Plan (MMAH, 2017a) and the Growth Plan (MMAH, 2017b) require municipalities to identify the water resource system, with the appropriate designations and policies applied in official plans to provide for the long-term protection, enhancement, or restoration of water quality and quantity; key hydrologic features, key hydrologic areas, and their functions (Growth Plan 4.2.1.1, 4.2.1.2, Greenbelt Plan 3.2.3.2, 3.2.3.3). The Greenbelt Plan (policy 3.2.3.1, MMAH, 2017a) further points to a systems approach to the inter-relationships between and/or among the key hydrologic features and key hydrologic areas.

The components of the water resource system as defined in the PPS (MMAH, 2014) would encompass identification of key hydrologic features and areas that considers both

groundwater and surface water. Further detail regarding the water resource system is provided in **Section 2.4**.

The Greenbelt Plan (MMAH, 2017a) defines the Water Resource as “made up of both ground and surface water features and areas and their associated functions, which provide the water resources necessary to sustain healthy aquatic and terrestrial ecosystems and human water consumption. The ORMCP and NEP include very significant elements of, and are fundamental to, the Water Resource System. The areas to which these plans apply contain primary recharge, headwater and discharge areas, together with major drinking water aquifers, within the Greenbelt.”

3.2.4 Natural Heritage System and External Connections

The interconnection of the water resource system with the natural heritage system is recognized in the Provincial Plans and reflected in Growth Plan policy 4.2.2, and 4.2.3 (MMAH, 2017b). Specific reference is made to the hydrological function of the natural heritage features.

Greenbelt Policy 3.2.2 (MMAH, 2017a) address key hydrologic features and functions, connectivity between key natural heritage and key hydrologic features. In particular, policy 3.2.2. 3b) states, “Connectivity along the system and between key natural heritage features and key hydrologic features located within 240 metres of each other will be maintained or, where possible, enhanced for the movement of native plants and animals across the landscape” (MMAH, 2017a).

Greenbelt Policy 3.2.6 (MMAH, 2017a) recognizes that the Natural Heritage system is connected to local, regional, and provincial scale natural heritage, water resource and agricultural systems beyond the boundaries of the Greenbelt. Watershed planning (3.2.6.1, 3.2.6.2, MMAH, 2017a) is required to be undertaken, which integrates supporting ecological systems with those systems in, and beyond, the Greenbelt Plan; this should include consideration of the goals and objectives of protecting, improving, and restoring the Great Lakes.

3.2.5 Natural System

The Greenbelt Plan (MMAH, 2017a) refers to a Natural System that provides a continuous and permanent land base necessary to support human and ecological health in the Greenbelt and beyond. The Natural System policies protect areas of natural heritage, hydrologic and/or landform feature, which are often functionally inter-related, and which collectively provide essential ecosystem services.

The Greenbelt Plan suggests that the Natural System within the protected countryside functions at three scales. Directly relevant to Niagara Region is the “multitude of natural and hydrologic features and functions found within the GGH, but outside of the NEP. In particular, the numerous watersheds, subwatersheds and groundwater resources,

including the network of tributaries that support the major river systems identified in this Plan, are critical to the long-term health and sustainability of water resources, biodiversity and overall ecological integrity. Official plans and related resource management efforts by conservation authorities and others shall continue to assess and plan for these natural and hydrologic features and functions in a comprehensive and integrated manner through the identification and protection of natural systems, building upon and supporting the natural systems identified within the Greenbelt” (MMAH, 2017a).

3.2.6 Planning for Growth and Infrastructure

Decisions on allocation of growth in combination with planning for the infrastructure to support that growth must now be informed by watershed planning (Growth plan 4.2.1.3 (MMAH, 2017b) and Greenbelt Plan 3.2.3.4 (MMAH, 2017a). Planning for designated greenfield areas are to be informed by subwatershed plans or equivalent (Growth Plan 4.2.1.3 (MMAH, 2017b).

The Growth Plan (2017) was updated significantly with regard to infrastructure policies and promoting a coordinated and integrated approach to infrastructure planning. Policies have been put in place to outline how planning for new or expanded infrastructure will occur in an integrated manner, and will be supported by watershed planning and other relevant studies and plans (Growth Plan 3.2.1.2 (MMAH, 2017b)).

There are new requirements, within the policies, for water, wastewater and stormwater planning, and master plans to be informed by watershed or subwatershed planning (Growth Plan 3.2.6.2, 3.2.7.1, 3.2.7.2 (MMAH, 2017b)). This includes protection of water quality and quantity. Coordinated planning for water, wastewater, and stormwater by municipalities sharing inland water sources or receiving bodies in the Greater Golden Horseshoe will be based on a watershed approach, per policy 3.2.6.4 (MMAH, 2017b).

Furthermore, watershed planning must be undertaken to support decisions on the location of and feasibility of settlement area boundary expansions occurring through municipal comprehensive review (Growth Plan 2.2.8.3 (MMAH, 2017b)). Watershed planning must provide information to assist decision-makers in evaluating whether there will be negative impacts to the water resource system as a result of settlement area boundary expansions and associated servicing.

3.2.7 Development

The terms key hydrologic areas, and hydrologic functions are new in the updated Provincial plans; in addition to key hydrologic features, these make up the components of the water resource system (see **Sections 2.2 and 2.4** for further discussions).

Specific policy regarding development adjacent to key hydrologic features and key hydrologic areas has been developed for the Growth Plan 2017 and Greenbelt Plan

2017; the Plans require demonstration that the hydrologic functions, including the quality and quantity of water, of these areas will be protected and, where possible, enhanced or restored. This is accomplished through meeting criteria and direction set out in applicable watershed planning or subwatershed plans. The Provincial requirements are found in Growth Plan policy 4.2.3.2, 4.2.4.2 (MMAH, 2017b) and Greenbelt Plan policy 3.2.4.1 (MMAH, 2017a).

The Growth Plan (MMAH, 2017b), as per policy 4.2.4.5.c, requires, in the case of redevelopment and resort development outside of settlement areas, in developed shoreline areas of inland lakes, that criteria and direction set out in applicable watershed planning and subwatershed plans be met in addition to other requirements described in policy 4.2.4.5.

The NEP (2017) provides specific direction pertaining for development in the context of key hydrological features. This includes ensuring that hydrologic features and functions, particularly the quality, quantity and character of groundwater and surface water, at the local and watershed level, are protected, enhanced or restored with respect to the health, diversity and size of key hydrologic features (Policy 1.6.8.9, 1.7.5.9, 1.8.5.9 (MNRF, 2017)).

NEP policy 2.6 and its sub-policies focus directly on development affecting water resources (MNRF, 2017). NEP policy 2.7 and its sub-policies focus on the natural heritage system and maintaining connectivity with key hydrologic features for the movement of native plants and animals across the landscape (MNRF, 2017).

Various policies refer to the need for land development planning to meet the targets, criteria and recommendations of applicable water, wastewater and stormwater master plans, approved watershed planning and/or subwatershed plans (NEP policy 1.6.8.9, 1.7.5.9, 1.8.5.9 (MNRF, 2017)). Policy 2.4 and 2.6.3 (MNRF, 2017) requires delineation of the key hydrologic features.

3.2.8 Agriculture System

There is an interconnection between the agriculture system and the water resource system. While not explicitly stated in the Provincial Plans, it is clear that the Provincial direction with respect to protecting water quantity and quality is relevant to the Agriculture system. Policy 4.2.6 of the Growth plan pertains to the agriculture system. The Greenbelt Plan Policy 3.1.1 recognizes that many farms within the agricultural system contain important natural heritage features, including areas that support pollinators, and hydrologic features. The stewardship of these farms facilitates both environmental benefits and agricultural protection. Therefore, consideration of the agricultural system in watershed plans and recognizing the role it can play in protecting, enhancing and restoring water resources systems is relevant.

3.2.9 Renewable and Non-Renewable Resource Activities

Activities related to the use of renewable resources in the protected countryside should be undertaken in accordance with the recommendations, standards, or targets of any watershed plan or water budget as per Greenbelt Plan policy 4.3.1.2 (MMAH, 2017a). Watershed plans or equivalent should provide information regarding land use activities related to post-extraction rehabilitation of mineral aggregate operations (Greenbelt Plan policy 4.3.2.11 (MMAH, 2017a)).

The Growth Plan (2017) includes policies regarding mineral aggregate resources in relation to maintaining connectivity between key natural heritage features and key hydrologic features (policy 4.2.8.2 (MMAH, 2017a)). These are considered to be part of the water resource system and therefore based in watershed planning.

The objective of Policy 2.9 of the NEP (MNRF, 2017) is to ensure that mineral aggregate operations and their accessory uses are compatible with the Escarpment environment and to support a variety of approaches to rehabilitate the natural environment. In this regard the sub-policies refer to how the connectivity between key natural heritage features and key hydrologic features will be maintained or enhanced, and how key hydrologic features or functions will be protected and where possible enhanced, including the maintenance of groundwater and surface water quantity and quality (policy 2.9.3, 2.9.11 (MNRF, 2017)). Fulfilment of these policies requires documentation of the water resource system which is a component of watershed planning (See **Section 2.4** for further discussion).

3.2.10 Actions for Climate Change

Climate change adaptation and resilience are key concepts arising from Provincial Climate Change strategies and actions. According to policy 4.2.10 of the Growth Plan (MMAH, 2017b), upper tier and single tier municipalities must develop climate change adaptation goal policies in their official plans that will recognize the importance of watershed planning. Through watershed planning, the potential implication of climate change on watershed conditions can be ascertained, and the effectiveness of management actions for improving watershed conditions and reducing adverse effects of climate change can be evaluated.

3.2.11 Park Zone

Unique to the NEP is the designation of different park zones through Policy 3.1.5 (MNRF, 2017). This includes a Resource Management zone that is intended to provide for sustainable resource management (e.g., forest management, fisheries management, watershed management, wildlife management, and flood control) and the protection of natural heritage and hydrological features and functions. Recognition of these zones through subwatershed planning ensures awareness and appropriate consideration in future land use planning.

3.2.12 Subwatershed Plans

Subwatershed studies and plans often are suitable to refine assessments, targets and objectives of watershed planning for smaller drainage areas within a watershed. Provincial policy directions indicate subwatershed planning should be used to inform site-specific land use planning decisions. Key hydrologic area and developed shoreline development policies of the Growth and Greenbelt Plans as described previously, may need to be based on subwatershed plans which provide additional comprehensive study in comparison to watershed planning for certain development sites. Planning for designated greenfield areas is also required to be informed by a subwatershed plan or equivalent as per policy 4.2.1.3 of the Growth Plan (MMAH, 2017b).

Stormwater management plans under certain development conditions may require subwatershed plans to be used. For example, proposals for large-scale development by way of a secondary plan, plan of subdivision, vacant land plan of condominium or site plan will be supported by a stormwater management plan or equivalent that is informed by a subwatershed plan or equivalent (Growth Plan 3.2.7.2, MMAH, 2017b). Within the Greenbelt area, applications for development and site alteration in the Protected Countryside must be accompanied by a stormwater management plan which demonstrates conformity with applicable recommendations, standards or targets, and water budgets within a subwatershed plan or equivalent (Greenbelt Plan, 4.2.3.4.c, MMAH, 2017a).

3.2.13 Summary

It is clear that the provincial plans and policies support the PPS by strengthening the requirements surrounding watershed planning. They clearly articulate the need for a focus on the water resource system by itself, and also its integration with the natural heritage system. The provincial plans point to the need for Watershed studies to inform land use planning, including water, wastewater and stormwater planning, and master plans, so that the natural environment and water resource system will be protected, restored and/or enhanced. This requires the coordination between municipalities that share inland water resources, and which support natural heritage features that cross political jurisdictional boundaries.

3.3 Other Plans, Policies and Acts

In reviewing the watershed planning elements, a common focus relates to the water resource system; these elements reflect requirements outlined in the Provincial Policy Statement, Provincial Plans released in 2017, and the Clean Water Act (MOE 2006). This section provides an overview of the policies related to key elements of watershed planning (e.g., water budgets).

3.3.1 Water Budgets

Elements such as water budget analysis are promoted and required within various Provincial guidelines and manuals and reflected in many Official Plans. MOECC and MNRF (2018) identify that legislation and policy incorporating water budget assessments include the following:

- **Clean Water Act** is a major driving force for the watershed and subwatershed scale water budgets that have been carried out in the province. Water budgets have been undertaken as part of source protection planning processes across the province, pursuant to the *Clean Water Act*. Conceptual Water Budgets, Tier 2 Water Budgets, and Tier 3 Water Budgets have been undertaken, depending on the characteristics and needs of the watershed.

The Clean Water Act (MOE 2006) requires the delineation and protection of vulnerable groundwater areas for quantity protection (i.e. SGRAs) as well as for quality protection (i.e. HVAs) as mentioned above. Under the Clean Water Act-Ontario Regulation 187/07 a SGRA is defined as “an area within which it is desirable to regulate or monitor drinking water threats that may affect the recharge of an aquifer” (From NPCA 2011, Lower Welland).

- **The Water Budget and Water Quantity Risk Assessment Guidance Module** provide the basic direction to carry out the technical water budget characterization. These water budgets, once incorporated into a provincially approved assessment report, will be used to set policies to manage water uses within local areas to protect sources of municipal drinking water. MNRF’s Water Quantity Geodatabase project developed a water budget model in support of source protection planning. The Water Quantity Geodatabase will be useful for municipalities undertaking watershed planning in southern Ontario.
- **The Provincial Policy Statement, 2014** (MMAH, 2014) states that the diversity and connectivity of natural heritage features in an area should be maintained, restored or, where possible, improved (2.1.2), and the quality and quantity shall be protected, improved or restored (2.2.1). Water budgets are encouraged to meet these requirements.
- **Provincial plans**, such as Growth Plan, Greenbelt Plan, and ORMCP identify water budgets and water conservation plans as some of the typical components of watershed planning.

3.3.2 Source Protection

Important considerations in watershed planning are the key hydrological areas and hydrological functions related to groundwater. Plans that provide groundwater direction for watershed planning include:

- **Source Water Protection** (MOECC, 2014): The key focus is to reduce contamination from activities, existing or future that may be threats to drinking water. The plan provides a process for risk management planning. Municipalities are required to develop risk management plans for chloride and pathogens in vulnerable areas for source protection planning. This requires management of the use of chloride, and promoting salt and water efficient water softeners.
- **Niagara Peninsula Source Protection Plan** (NPCA 2013b): The Minister of the Environment and Climate Change issued a Section 36 order to the Niagara Peninsula Source Protection Authority to update the Niagara Peninsula Source Protection Plan by 2020. The NPCA identified three goals in pursuit of the continuous improvement of the source protection technical framework: required updates (water treatment plans), improving municipal supply protection and groundwater protection.

3.3.3 Other Strategies, Plans and Policies

In addition to water balance and source protection plans, various strategies, plans, and policies have been developed that are relevant to Niagara Region. In addition to those listed below, an overview of additional acts and policies that may be relevant to watershed planning in Niagara Region is provided in **Appendix 1**.

- **Ontario's Great Lakes Strategy (OGLS)** (Government of Ontario, 2014): Several of the Region of Niagara's subwatersheds discharge directly into Lake Ontario. Therefore, the OGLS is relevant to the Region which identifies phosphorus reduction targets.
- **Existing Regional Official Plan** (Niagara Region, 2014): The Region's Natural Environment policies, included in the Region's existing OP as an update completed through ROPA 187 and approved in 2008, are broken out into three sections. The first describes the Healthy Landscape approach the Region is taking to managing the environment, which similar to watershed planning is an ecosystems-based approach. The second section identifies and directs the preservation and conservation of the Region's Core Natural Heritage System. The third section is a policy framework for implementation. The Region environmental protection policy has identified environmental features and corridors within the Region that should be protected. Included in this designation

were a number of stream corridors, including portions of Four Mile Creek that are municipal drains.

- **NPCA Policy Document (2018):** The NPCA identifies watershed plans as proactive documents created cooperatively by government agencies and the community to manage water, land/water interactions aquatic life and aquatic resources within a watershed. The NPCA works collaboratively with municipalities in the development of watershed plans and any municipally led watershed or subwatershed studies.

3.3.4 Cross-Jurisdictional Agreements

There are two main cross-jurisdictional agreements that support the improvement of the receiving waters (Lake Erie, Niagara River, and Lake Ontario) of the tertiary watersheds in Niagara Region. The Government of Canada and the United States work together to protect, restore, and enhance water quality of the Great Lakes through the Canada-U.S. Great Lakes Water Quality Agreement (GLWQA). To fulfill the goals of the GLWQA, Canada works with the Government of Ontario as well as community partners to deliver on the Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health (COA). An overview of key relevant agreements is provided below, and additional cross-jurisdictional plans is provided in **Appendix 1**:

- **Canada-U.S. Great Lakes Water Quality Agreement (2012)** – the purpose of the GLWQA is for both countries to work cooperatively “to restore and maintain the chemical, physical, and biological integrity of the Waters of the Great Lakes.” Through 10 Annexes, the GLWQA focuses on the implementation of remedial action plans, lake-wide action and management plans, chemicals of mutual concern, habitat and species, aquatic invasive species, climate change impacts, and more.
- **Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health (2014)** – this agreement between the governments of Canada and Ontario support the restoration and protection of the Great Lakes basin ecosystem. The agreement has 5 main priorities focused on: protecting waters; improving wetlands, beaches and coastal areas; protecting habitat and species; enhancing understanding and adaptation; and promoting innovation and engaging communities. Through 14 Annexes, the COA helps the province carry out Ontario’s Great Lakes Strategy and assists in fulfilling Canada’s commitments under the GLWQA.

4.0 Equivalency of Watershed Planning Documents

The 2017 Growth Plan and Greenbelt Plans require that land-use and infrastructure planning be ‘informed’ by watershed planning

The term ‘informed by’ means that planning must be guided by the findings and recommendations (objectives, targets, criteria and direction) of the watershed plan; the watershed plan must be used as the basis of planning decisions as it relates to protecting, improving, or restoring water quality and quantity.

The Growth Plan (MMAH, 2017b) indicates that where its policies:

“require the completion of specific types of master plans, assessments, studies, or other plans, including the equivalent, before a decision can be made, including in respect of matters in process, the policy direction in this Plan may be implemented based on, collectively, existing, enhanced, or new assessments, studies, and plans, provided that these achieve or exceed the same objectives” (Policy 5.2.8.1)

The Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018) recognizes that existing information may be considered equivalent to a watershed plan if it fulfills requirements of watershed planning as outlined in the Provincial documents (e.g., Policy 5.2.8.4 in the Growth Plan (2017)). Similarly, documents may be considered equivalent to water, wastewater or stormwater master plans provided that they can be used by municipalities and planning authorities to inform land use and infrastructure planning and decision-making. Equivalent studies are:

“collectively, existing, enhanced or new assessments, studies, and plans provided that they achieve or exceed the same purposes, as required by policies within the plans” (MOECC and MNRF, 2018)

The Watershed Planning in Ontario (MOECC and MNRF, 2018) guidance document strongly recommends that municipalities utilize existing data, assessments, and reports to refine or frame watershed planning or, potentially under the “or equivalent” provision, be used to meet the required components under Provincial plan policy.

Subwatershed plans may be considered partially equivalent to watershed plans if they consider the protection, enhancement or restoration of the water resource system at the broader watershed scale. The refined goals and targets of a subwatershed plan would consider overall watershed objectives.

NPCA initiated a review of the watershed planning documents in 2016 to support development of a watershed planning framework. That review (AECOM, 2016) compared existing watershed plans/studies to typical watershed planning requirements at the time (i.e., MOE and MNR, 1993). With the release of the 2017 Provincial Plans,

and the 2018 Draft Watershed Planning in Ontario guidance document, the 2016 review is no longer current in terms of conformance with Provincial direction.

4.1 Watershed Planning Elements for Equivalency

The Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018) outlines specific elements of watershed planning that need to be included in a watershed study to meet the intent of the 2014 PPS and 2017 Provincial Plans. Equivalency of these elements requires a document, on its own, or in conjunction with other studies, to address one or more of the key elements of watershed planning (MOECC and MNRF, 2018). The watershed elements are identified below and provided in further detail in **Section 2.7**:

- Encompass a watershed scale focus (see **Section 2.2**);
- Identify the water resource system (i.e., key hydrological areas, features, functions and their inter-relationships with the natural heritage and agricultural systems, and intra-relationships within the water resource system) (see **Section 2.4**);
- Characterize existing watershed conditions, processes, and functions (see **Section 2.5**);
- Consider impacts of existing and proposed land uses (see **Section 2.7**);
- Establish goals, objectives, and targets to protect, improve or restore water quality and quantity, and the natural heritage system (see **Section 2.6**);
- Develop an implementation plan for integration into land use and infrastructure planning decisions; and
- Develop a monitoring and evaluation plan to measure progress towards meeting targets.

Also important within a watershed planning study is the consideration of climate change, cumulative impacts of development, and stakeholder consultation. **Table 4-1** lists the watershed planning elements and their corresponding section numbers from within the Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018) (note: it is likely that the draft document will be updated and therefore the proposed framework of elements may be subject to change).

Table 4-1. Watershed planning element as per the Draft Watershed Planning in Ontario guidance document (MOECC and MNR, 2018)

Watershed Planning Element	Description
3.1	Effective Engagement & Committees
3.2	Partnering with Indigenous Communities
4.1	Delineation of Watersheds and Subwatersheds for Land use Planning
4.2	Identification of Water Resource System
4.3	Characterization of Existing Conditions
5.1	Vision, Objectives, Goals & Targets
6.1	Water Quantity, Water Budget & Water Conservation Plans
6.2	Water Quality & Nutrient Load Assessments
6.3	Natural Hazards in Watershed Planning & Subwatershed Plans
6.4	Climate Change & Watershed Management
6.5	Connections to Natural System
6.6	Cumulative Effects Assessment
6.7	Assessment of Land Use & Management Scenarios
7.1	Watershed Plan and Subwatershed Plan Development
7.2	Informing Land Use Planning & Decision Making
7.3	Implementing the Watershed & Subwatershed Plan
8.0	Monitoring and Adaptive Management

4.2 Existing Watershed Planning Related Documents

As noted in **Section 2.2**, Niagara Region is considered to span three (3) tertiary watersheds (Lake Erie, Niagara River, and Lake Ontario) and 9 quaternary watersheds.

The NPCA and Region have, by previously established convention, divided the Region into 17 spatial areas that do not necessarily satisfy the definition of quaternary watershed or subwatershed (See discussion in **Section 2.2**); by convention, these 17 spatial areas have been traditionally referred to as “watershed”. These ‘watershed planning areas’ currently in use were strategically formed through the former Niagara Water Quality Protection Strategy by the amalgamation of its Local Management Areas (LAMs). They were also intentionally designed for ease of engagement and implementation through partnerships with the municipalities. It is noted that these existing ‘watershed planning areas’ are now well entrenched in the business operations of the NPCA.

Section 2.2 of this reports suggests that, for **planning purposes**, the Conservation Ontario (2003) definitions that are based on drainage area, means that in Niagara Region, the tertiary watersheds would be defined as ‘watersheds’ since they are > 1000 km². Most quaternary watersheds would be defined as ‘subwatersheds’ since they are between 50 and 200 km² in area. Tributary planning refers to areas between 2 km² and

10 km² (See discussion in **Section 2.2.1**).

Niagara Region has a comprehensive baseline of Niagara-specific information, reports and data to draw from, for watershed planning. Determining whether existing reports could be considered equivalent to the requirements of the watershed planning process must be considered on a case by case basis.

Various elements of watershed planning, as defined in the Draft Watershed Planning in Ontario guidance document have been undertaken within Niagara Region between 1999 and 2018. A preliminary overview of existing documentation is presented in **Table 4-2**. The table identifies the geographic coverage of the document/information, its general relevance, and potential to address the watershed planning elements (**Table 4-1**) based on a high level review of these documents. Additional comments have been included with respect to the apparent level of detail/comprehensiveness of the document.

Review of **Table 4-2** reveals that existing documents range from focused studies (e.g., climate change, source water protection) that encompass the entire Niagara Region to studies of specific watersheds/subwatershed or environmental management areas.

Table 4-2. Overview of existing watershed planning type documents and reports for Niagara Region

Watershed / Regional Coverage	Documents and Reports	Relevance	Potential Watershed Planning Elements Addressed
Regional Scale Studies			
Region	Niagara Peninsula Source Protection Area Section 36 Workplan Proposal Draft Report (NPCA, 2017)	Climate change, groundwater protection	May partially cover 4.2, 4.3, 6.1, 6.4
Region	Establishing a Framework for Watershed Plans in the NPCA Watershed - AECOM 2016	Current watershed plan status and gap analysis in comparison to 1993 Conservation Ontario guidelines. **NOTE – This document was prepared before the release of the updated Provincial Plans and draft Watershed Planning guidance. Advisory information is heavily reliant on the 1993 MNRF Guidelines**	May partially cover 3.1, 4.3
Region	Investigating Land Use and Climate Change Effects on Small Catchment Water Quality (Harmer, 2015)	Studies the effects land use and climatic variations have on small catchment water chemistry in three (3) Niagara watersheds (i.e., Two Mile, Four Mile and Twelve Mile Creeks)	May partially cover 6.4, 6.7
Region	Niagara Water Strategy, Review and Update. Water Smart Niagara (2014)	Review and update of strategy for managing water resources in Niagara. Comprehensive consultation process and vision/objective/target development.	Includes: 3.1, 4.1, 4.2, 5.1, 7.4, 8
Region	Niagara Water Quality Protection Strategy Update Report (2014)	Climate change impacts and severe weather events, land and water use management objectives and strategies	May partially cover 4.2, 4.3, 5.1, 6.1, 6.2, 6.3, 6.5, 6.7, 7.3, 8
Region	Nature for Niagara’s Future (NPCA, 2013a)	Assessment of the natural features on the landscape for their contribution to overall targets for ecological ecosystem health in Niagara Region	May partially cover 4.3, 6.5
Region	Liquid Assets: Assessing Water’s Contribution to Niagara (Brock University and Niagara Region, 2013)	Climate Change, quantitative water use by sector, water vulnerability. Information is high level.	May partially cover 4.2, 4.3, 6.1, and 6.4
Region	Niagara Source Protection Plan & Assessment Report (2013 update) (NPCA, 2013b)	Characterizations, surface and groundwater quantity and quality overview, human land uses, drinking water system, water budget and stress assessment, HVAs identified, high level climate change estimates. This document may potentially cover a lit of the watershed planning elements.	May partially cover 3.1,4.2, 4.3, 5.1, 6.1, 6.2, 6.3, 6.5, 6.7, 7.3, 8
Region	Adapting to Climate Change: Challenges for Niagara (Penney, 2012)	Climate trends and projections for Niagara, anticipated impacts of climate change in Niagara (water supply, SWM, etc.), climate change adaptation and preparation. Gaps for further research, and potential data sharing, are identified.	May partially cover 6.4, and 8
Region	Watershed Report Card (NPCA, 2012)	Watershed characteristics, existing conditions of surface water quality and forest conditions in relation to targets for southern Ontario.	
Region	Niagara Peninsula Tier 1 Water Budget and Water Quantity Stress Assessment (NPCA 2010d)	Water budget analysis for each watershed planning area, incorporates results from the AquaResource 2009 study.	May cover 6.1 for all watersheds
Region	NPCA Water Quality Monitoring Program Annual Report. Niagara Peninsula Conservation Authority. 2010a.	Review of water quality monitoring data on an annual basis since 2002	May partially cover 4.3, 6.2

Watershed / Regional Coverage	Documents and Reports	Relevance	Potential Watershed Planning Elements Addressed
Region	Water Availability Study (WAS) (AquaResource Inc 2009a – i):	Water balance studies for specific watershed planning areas. Studies are specific to all watershed planning areas except for One Mile Creek.	May partially cover 4.3, 6.1
Region	Natural Areas Inventory (2006-2009) (NPCA, 2009)	Characterization Data, inventory of natural areas within the NPCA watershed. Includes ELC, wetlands, flora and fauna mapping and characterization. Consultation with landowners was undertaken. Collected data was incorporated into a GIS database. This document provides a good foundation for natural heritage related characterization requirements.	May partially cover 3.1, 4.2, 4.3, 6.3, and 6.5
Region	Northeast Area Wastewater Servicing Study (XCG and Hatch Mott MacDonald, 2008)	Master Plan study that provides overview of existing wastewater systems, forecasts for wastewater flow with consideration of future growth, development and evaluation of servicing alternatives, selection of preferred alternative, public consultation. This report builds on Technical Memoranda issued by XCG and Hatch Mott MacDonald (2007) which states that the assimilative capacity of the Queenston Power Canal has yet to be confirmed.	May partially cover 3.1, 4.3,
Region	NPCA Groundwater Study Final Report (Waterloo Hydrogeologic Inc., 2005)	Hydrogeological characterization, including water table elevations, groundwater recharge/discharge areas, groundwater quality problems, groundwater use assessment, PTTW, Regional water balance, potential contaminant sources, public consultation, groundwater protection strategy, recommendations. Good characterization that may meet the requirements of the source water protection planning. A Cross-jurisdictional perspective (Haldimand County, City of Hamilton) has been included.	May partially cover 3.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.7, 7.3, 7.4, 8
Region	Niagara Water Quality Protection Strategy Report Phase 1-4 (NPCA, 2003)	Characterization, Environmental best management practices, programs, and performance measures. Criteria for evaluating the protection of quality and quantity of water. Hydrometeorology, SWM, flooding, erosion, watercourses, fluvial geomorphology, groundwater, terrestrial resources, aquatic resources, shoreline and lake protection, land use planning, infrastructure, pollution sources, water quality, risk assessment, consultation, monitoring.	May partially cover 3.1, 3.2, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 7.3, 7.4, 8 (all watershed planning elements)
Watershed Scale Studies			
Niagara-on-the-Lakes Creeks	Niagara-on-the-Lakes Creeks Watershed Plan (Aquafor Beech, 2008)	Surficial Geology, Stream Morphology and Erosion, Surface Water Flows and Flooding, Shoreline Hazard Mapping, Niagara-on-the-Lake Irrigation System, Groundwater Resources, Water Quality, Aquatic Resources, Terrestrial Resources, Land Use, Summary of Existing Conditions, Issues, Opportunities, Constraints, Goals and Objectives, Preferred Alternatives, Implementation, Monitoring	May partially cover 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.3, 6.5, 6.7, 7.3, 7.4, 8
15-16-18 Mile Creeks	15-16-18 Mile Creeks Watershed Plan (NPCA, 2008)	Characterizations (similar to other subwatershed plans), Conservation plan, Management, restoration strategies, general BMPs.	May partially cover 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.3, 6.5, 6.7, 7.3, 7.4, 8

Watershed / Regional Coverage	Documents and Reports	Relevance	Potential Watershed Planning Elements Addressed
20 Mile Creek	Twenty Mile Creek Watershed Plan (NPCA, 2006)	Characterizations (similar to other subwatershed plans), Restoration Strategies General Management, General overview of climate change effects, Monitoring, general BMPs.	May partially cover 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.3, 6.5, 6.7, 7.3, 7.4, 8
12 Mile Creek	Twelve Mile Creek Watershed Plan (Durley, 2006)	Characterizations (similar to other subwatershed plans), Conservation plan, Management, restoration strategies, general BMPs.	May partially cover 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.3, 6.5, 6.7, 7.3, 7.4, 8
	Twelve Mile Creek Headwaters Important Bird Area (Cheskey, 2003)	SAR birds, habitat, land use issues.	May partially cover 4.3, 6.5, 6.7, 7.3, 8
Beaverdams and Shriners Creek	Beaverdams and Shriners Creek Watershed Plan Phase One (NPCA, 2011)	Phase One Study: Watershed Characterization and Preliminary Issues Identification. General overview of climate change effects; general BMPs for implementation. This document includes good characterization and management information specific to the subwatershed. Vision and objectives are included but no targets. Only Phase One has been completed, therefore no cumulative effects assessment or land use/management scenario assessment completed. Challenges and opportunities have been generalized.	May partially cover 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.3, 6.5, 6.7, 7.3, 7.4, 8
Central Welland River	Central Welland River Watershed Plan (NPCA, 2010)	Characterizations (similar to other subwatershed plans), Conservation plan, Management, Monitoring, General overview of climate change effects; general BMPs for implementation.	May partially cover 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.3, 6.5, 6.7, 7.3, 7.3, 7.4, 8
Lake Erie North Shore	Lake Erie North Shore Watershed Management Plan (NPCA, 2010)	Characterizations (similar to other subwatershed plans), Conservation plan, Management, Monitoring, General overview of climate change effects; general BMPs for implementation.	May partially cover 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.3, 6.5, 6.7, 7.3, 7.4, 8
Lower Welland River	Lower Welland River Characterization Report (May, 2011)	Characterizations (similar to other subwatershed plans), Conservation plan, Management, Monitoring, General overview of climate change effects; general BMPs for implementation. Recommendations focus on natural heritage protection/enhancements	
Lower Welland River	Lake Erie North Shore Watershed Management Plan – Characterization Report (NPCA, 2011)	Characterizations (similar to other subwatershed plans), Conservation plan, Management, Monitoring, General overview of climate change effects; general BMPs for implementation.	May partially cover 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.3, 6.5, 6.7, 7.3, 7.4, 8
One Mile Creek	One Mile Creek Watershed Strategy Final Report (Aquafor Beech, 2005)	Characterizations (similar to other subwatershed plans), Conservation plan, Management, Monitoring, General overview of climate change effects, Targets, general BMPs	May partially cover 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.3, 6.5, 6.7, 7.3, 7.4, 8
Port Robinson West	Port Robinson West Subwatershed Study (TSH, 1999)	Characterizations (similar to other subwatershed plans), Conservation plan, Management, Monitoring, Targets, BMPs.	May partially cover 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.3, 6.5, 6.7, 7.3, 7.4, 8
Port Robinson West	Port Robinson West Scoped Watershed Study Final Reports, Phase 1 – Characterization of Existing Conditions, Phase 2 & 3 – Impact Assessment and Implementation Plan (Aquafor Beech, 2014)	Characterizations (similar to other subwatershed plans), Conservation plan, Management, Monitoring, Targets, BMPs	May partially cover 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.3, 6.5, 6.7, 7.3, 7.4, 8

Watershed / Regional Coverage	Documents and Reports	Relevance	Potential Watershed Planning Elements Addressed
South Niagara Falls	South Niagara Falls Watershed Report (NPCA, 2008)	Characterizations (similar to other subwatershed plans), Conservation plan, Management, Monitoring, General overview of climate change effects; general BMPs for implementation.	May partially cover 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.3, 6.5, 6.7, 7.3, 7.4, 8
Upper Welland River	Upper Welland River Watershed Plan (NPCA, 2011)	Characterizations (similar to other subwatershed plans), Conservation plan, Management, Monitoring, General overview of climate change effects; general BMPs for implementation.	May partially cover 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.3, 6.5, 6.7, 7.3, 7.4, 8
Welland River, Niagara River	The Welland River Eutrophication Study in the Niagara River Area of Concern in Support of the Beneficial Use Impairment: Eutrophication and Undesirable Algae (2011)	Water quality improvement programs, water quality improvement objectives, criteria, recommendations.	May partially cover 4.3, 6.2
Welland River	Welland River Watershed Management Strategy (NPCA, 1999)		
Niagara Region	Niagara Water Strategy Review and Update (Water Smart Niagara, 2014)	Pollution prevention, shoreline management, water conservation. The report is fairly high level.	4.2, 6.1, 6.4, 7.3
Various Watersheds	NPCA Watershed Report Card (2005/06/07 & 2012 & 2018) Individual report cards: 12 Mile Creek, Lake Ontario South Shore, Niagara-on-the-Lake, Upper Welland River, Central Welland River and Big Forks Creek, Lower Welland River and South Niagara Falls, Lake Erie North Shore, Fort Erie	Characterizations (surface water quality, forest conditions, groundwater quality, natural heritage). Report on Programs and monitoring data comparison to Provincial Targets.	May partially cover 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.3, 6.5, 6.7, 7.3, 7.4, 8 (high level)
Ongoing Data Programs			
NPCA/Province	Surface Flow Monitoring Climate data	Characterization Data Water Budget data - Stream flow, - Meteorological information including precipitation, temperature etc.	May partially cover 8
NPCA/Province	Niagara Water Quality Monitoring Program (NPCA) Provincial Groundwater Monitoring Network	Water Quality Monitoring Program - 80 surface/50 groundwater stations	May partially cover 8
Spatial Data			
Niagara Region/NPCA	Niagara Region – Contemporary Mapping of Watercourse Project. 2016	Water Resource System Data - Surface water features and connecting infrastructure - Great Lakes and Niagara River shorelines	Can potentially find a source mapping data related to 4.1, 4.2, 4.3, 6.1, 6.3, 6.5, 6.7, 7.3
NPCA	NPCA	Characterization Data: - Floodplains - Top of Slope - Wetlands - Location of water quality testing stations - Source water protection related data	Can potentially find a source mapping data related to 4.1, 4.2, 4.3, 6.1, 6.3, 6.5, 6.7, 7.3

Watershed / Regional Coverage	Documents and Reports	Relevance	Potential Watershed Planning Elements Addressed
	Other	Characterization Data - Wetlands (Provincial - LIO) - Natural Heritage System (Provincial - LIO)	Can potentially find a source mapping data related to 4.1, 4.2, 4.3, 6.1, 6.3, 6.5, 6.7, 7.3

4.3 Status, Gaps and Deficiencies of Existing Documentation

Existing studies and other documentation in Niagara Region appears to encompass most, if not all, aspects of watershed planning based on a high level review of reports and studies listed in **Table 4-2**. The reports listed in **Table 4-2** were organized by watershed and checked against the watershed planning elements (**Section 4.1**) in **Table 4-5** to better assess watershed planning status. The status, gaps, and deficiencies of each watershed planning element, as reflected in the background reports is summarized by general observation and watershed planning element below. General recommendations are provided in each discussion which will form the basis for the discussions in **Section 4.4** and **4.6**.

4.3.1 General Observations of Existing Documentation

The following provides an overview and brief discussion regarding existing documentation. Specific recommendations to address any gaps or deficiencies have been compiled in **Section 7.0** of this report.

4.3.1.1 Age of Watershed Plan

Existing NPCA authored “watershed” plans and studies were completed and approved from 1999 – 2014; most studies are 10-15 years old. In those watersheds, or areas, for which plans/studies have not yet been completed, watershed relevant information is available, but date back, in some cases, to 2003.

Watershed planning reports must be updated regularly along with municipal Official Plan reviews, to ensure that they satisfy provincial requirements and provide a suitable base to inform land use planning. Watershed study updates are typically required along with the 10 year review cycle of official plans. A 5 year watershed study update cycle is generally considered to be an aggressive timeline given funding constraints. Instead, AECOM (2016) recommends a 5 – 10 year cycle update schedule. The timing for updates should be determined on a watershed basis and reflect the need for updated information to support watershed planning and/or to track progress towards fulfillment of goals, objectives, targets especially when these seek to improve degraded conditions, and for those cases in which a change in management may be beneficial (i.e., adaptive management).

4.3.1.2 Watershed Study Content

Based on a review of the “watershed” study reports that have been completed within Niagara Region, a content comparison has been completed (see **Table 4-3**). Most of the studies includes a discussion on objectives, physiography, current land use, natural heritage resources, aquatic habitat, water quality, groundwater, implementation and monitoring. The reports tended to focus on

characterizing the existing conditions of the watershed. The topics that were most often omitted from the studies included climate change, intake protection zone studies, water quantity, water budget, and geomorphology; modeling of different future land use scenarios, and cumulative impacts. In general, the recent studies (past 5 years) are more likely to include a wider range of watershed study content. Most of the studies followed a similar format/approach.

4.3.1.3 Watershed Coverage

As noted in **Section 2.2**, Niagara Region has been divided, by convention, into 17 spatial units that do not necessarily coincide with quaternary watershed or subwatershed boundary definitions. Plans or studies have been completed for 12 of the 17 “watersheds” or spatial areas (see **Figure 4-1**). Review of the figure demonstrates that two of these “watershed” areas are unnamed and three of the “watershed” areas along the Lake Ontario shoreline are unrepresented (i.e., Grimsby, Lincoln, Unnamed Watershed-1). The five “watersheds” that do not have “watershed” plans/studies (i.e., Big Forks Creek, Grimsby, Lincoln, Unnamed 1 (east of 12 Mile), and Unnamed 2 (East of Beaverdams & Shriners)), are included in regional level studies such as the Niagara Water Quality Protection Strategy Report (NPCA, 2003), and the Niagara Source Protection Plan (NPCA, 2013).

Based on the recommendations provided by AECOM (2016), NPCA had intended to initiate “watershed” plans for those areas that lacked studies.

While Region wide studies have been undertaken (e.g., Source Water Protection Plan, NPCA (2003, 2013)), no studies or characterization appear to have been completed at the tertiary watershed scale. At the tertiary scale, objectives, goals and targets could be developed that would address federal and provincial policy and acts (e.g., Great Lakes Strategy); this would inform quaternary watershed/subwatershed planning and provide for a collation of existing information to assess overall condition status of the tertiary watershed.

4.3.1.4 Region Focus

The regional level studies that have been completed focus on aspects of the water resource system and natural heritage system. Consideration should be given to developing regional visions, objectives and targets that satisfy federal and provincial level policy, strategy and plans for each of the tertiary watersheds. This could be undertaken through an Integrated Watershed Management Plan (Conservation Ontario, 2010) or a Watershed Plan. Likewise, a regional level overview of quaternary watershed conditions and priorities for management to satisfy provincial and/or federal targets (e.g., Ontario Great Lakes Strategy) would help the Region to develop priorities for quaternary watershed and subwatershed studies and funding allocation to fulfill its objectives. Existing documents (e.g., NPCA’s annual water quality reports), along with mapping of the water resource system and identification of key areas of concern from watershed report cards and

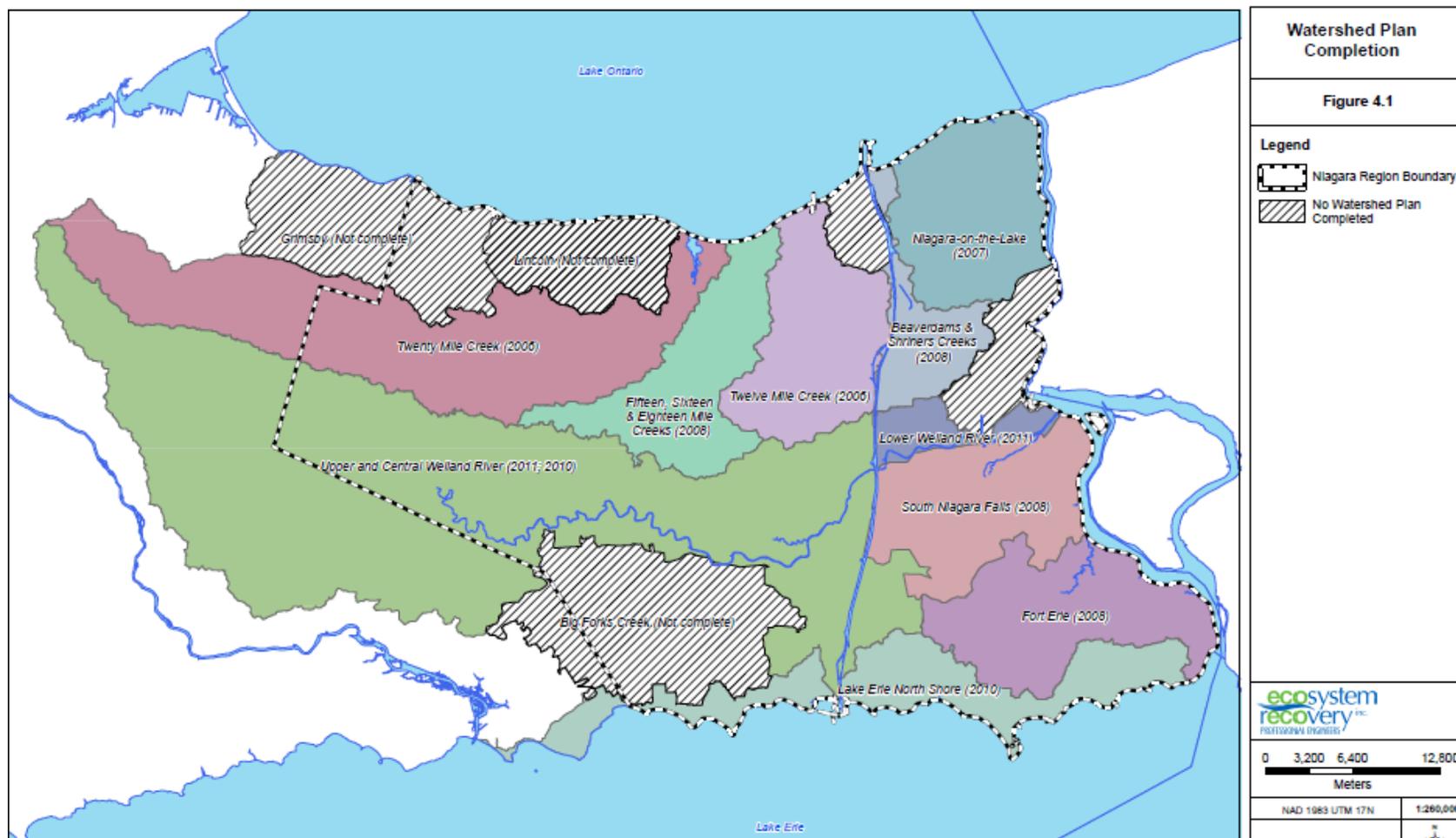


Figure 4-1. Overview of completed NPCA “watershed” plans

Niagara Source Water Protection Plans, can be used to develop the Regional focus and strategy. This would include defining general objectives, goals, and targets for the constituent subwatersheds that would work towards satisfying provincial, federal and bi-national plans (see **Appendix 1**).

4.3.1.5 Monitoring

Within Niagara Region, there are established monitoring networks that record surface and groundwater quality and/or quality, and climatic data. **Table 4-4** provides an overview of publicly available monitoring data.

Regular review of monitoring data can lead to the identification of emerging trends for which management actions could be developed to mitigate potential adverse effects. Monitoring also provides pre-development conditions and can be used as a baseline against which the effect of future land use changes can be assessed. NPCA regularly reviews the water quality data that it collects and reports on parameter exceedances (e.g., phosphorus, bacteria, benthic) in its Watershed Report cards. The Watershed Report cards, which are prepared every 5 years (released in 2013, 2018, 2023 etc.) provide a high level summary of watershed health in the areas of surface water conditions, groundwater conditions, forest conditions and wetland cover; they do not comment on emerging trends. NPCA develops annual Water Quality Reports that provide information about trends in monitored water quality parameters. Both the Watershed Report Cards and Water Quality reports are available from NPCA websites; current information and data are available, by request, from the NPCA. NPCA is working on a website map app as another tool to provide data to the public and NPCA partners.

Results of monitoring data analyses can trigger watershed/subwatershed study updates. Monitoring data should also inform larger Regional watershed programming and, at the watershed and subwatershed scales, can inform land use activities, targets (e.g., SWM), and priorities for restoration.

As part of past watershed studies completed in the Niagara Region, monitoring results from the NPCA monitoring network have been summarized. Ten of the 12 watershed studies reviewed included a summary of surface water and biological monitoring results from the NPCA surface water monitoring program. In addition, three of the studies (Upper Welland River, Niagara-on-the-Lake and Twenty Mile Creek) also included a summary of groundwater monitoring findings from the Provincial Water Quality Monitoring Network. A eutrophication monitoring study has been completed in the Welland River watershed, which included 23 grab samples throughout the Lower Welland, Upper Welland and Central Welland River subwatersheds. Results are summarized briefly in the corresponding studies.

In addition to the existing monitoring programs, 10 of the 12 studies included recommendations for future monitoring efforts. A summary of the list of recommendations from all the studies is included below:

- Continue water quality sampling, benthic studies (BioMAP) and temperature monitoring through the NPCA's Water Quality Monitoring Program.
- Carry out on-going classification of vegetation communities (Ecological Land Classification), including changes in community composition, habitat size and fragmentation. Record the findings in a GIS database.
- Carry out biological life assessments (qualitative and quantitative), including but not limited to insects/pollinators, fish and birds.
- Monitor the performance of BMPs implemented in the watershed including pollutant loading reduction and other information to support the evaluation of design targets.
- Survey watershed landowners (minimum every 5 years) to help identify new watershed issues and evaluate changes in behaviour.
- Install geomorphic control sites to assess change in the monitored area, such as erosion. Sites should be places at key locations to provide results that are spatially representative and indicative of the geomorphic variability within the watershed.
- Carry out a water quality monitoring program to assess the impact of drains on watercourses.
- Undertake a water and sediment quality monitoring program of Virgil Reservoirs.
- Carry out baseflow monitoring.
- Create a photographic log and notes of restoration projects.

Based on a review of **Table 4-4** as well as the 12 "watershed" studies, it is evident that there are gaps in the monitoring programs that should be addressed in regional watershed and subwatershed planning going forward.

Establishment of monitoring programs could be considered to enhance understanding of specific watershed conditions, especially as these relate to the direction provided in Provincial Plans and Policies (See **Section 3**), and to enable feedback into the adaptive management cycle of watershed management and land use planning. The components, frequency, and location of monitoring stations should be determined to enable specific outcomes to be realized. Monitoring programs could include specific data collection, and also the compilation of databases. This could include establishment of databases to document existing conditions within Niagara Region (e.g., location, condition of septic beds).

Table 4-3. Comparison of previous “watershed” study report content

	Lower Welland River Characterization Report	Upper Welland River	Beaver Dans and Shriners Creek Characterization	Central Welland River	Lake Erie North Shore	15-16-18 Mile Creek	Fort Erie Creeks	Niagara-on-the-Lake	South Niagara Falls	Twenty Mile Creek	One Mile Creek Watershed Strategy	Port Robinson West
Date	2011	2011	2011	2010	2010	2008	2008	2008	2008	2006	2005	1999
Author	NPCA	NPCA	NPCA	NPCA	NPCA	NPCA	Philips	Aquafor Beech	NPCA	NPCA	Aquafor Beech	TSH
Objectives	•	•	•	•	•	•	•	•	•	•	•	•
Physiographic characterization	•	•	•	•	•	•	•	•	•	•	•	•
Climate change	•		•	•								
Current land use	•	•	•	•	•	•	•	•	•	•	•	•
Future Land use	•	•	•	•	•				•			•
Natural heritage resources	•	•	•	•	•	•	•		•	•		•
Species at Risk	•	•	•	•	•		•		•			
Aquatic habitat	•	•	•	•	•	•	•	•	•	•	•	•
Water quality	•	•	•	•	•	•	•	•	•	•	•	•
Groundwater resources	•	•	•	•	•	•	•	•	•	•	•	•
Intake protection zone study	•	•	•	•	•				•			
Water quantity	•	•	•	•	•		•	•				•
Water budget	•	•	•	•	•			•				
Geomorphic study	•		•	•		•	•	•	•			
Habitat restoration	•	•		•	•	•			•	•		
Implementation		•		•	•	•	•	•	•	•	•	•
Monitoring		•		•	•	•	•	•	•	•	•	•

Table 4-4. Overview of existing monitoring networks

Agency	Program	Data Types	Notes
NPCA	Surface Water Monitoring	Water chemistry (general chemistry, nutrients, metals, bacteria) and biological assessments (benthic macroinvertebrates)	80 stations
NPCA	Hydrometric Stations	Water level, flow, precipitation, soil moisture (specific data types vary by station)	31 stations (total); 16 stations with partner agencies (i.e., MNRF, MOECC, WSC, Region Water & wastewater)
NPCA	Climate / Meteorological Monitoring	Climate and precipitation	10 precipitation stations; 10 climate and precipitation stations
MECP	Provincial Water Quality Monitoring Network	Groundwater level and chemistry data	15 wells (monitored by NPCA)
MECP	Water Survey Canada	Surface water level and discharge	8 gauging stations
MOECC	Climate monitoring	General climate station	4 stations
EC	Canadian Hydrographic Services	Lake level monitoring	2 stations (Lake Ontario; Lake Erie)

4.3.1.6 Watershed Modelling

Modelling has not played a significant role in the watershed/subwatershed studies completed to date. Most of the modelling completed has been basic and does not adequately consider future land use scenarios. Four of the 12 studies included modelling to support the “watershed” study, including:

- Water quality modelling (mass balance) – 1 study (Fort Erie Creeks);
- Hydrologic modelling – 2 studies (Niagara-on-the-Lake and Port Robinson); and
- Hydraulic Modelling – 3 studies (Niagara-on-the-Lake, Twenty Mile Creek and Port Robinson).

Models have been prepared as part of other studies and have been summarized in several of the 12 “watershed” studies. Specifically, the studies completed since 2010 (Lake Erie North Shore, Central Welland River, Beaverdams and Shriners, Upper Welland River and Lower Welland River) include a summary of regional groundwater modelling completed in HEC-HMS. Climate change modelling has been described in

the Lower Welland River and the Central Welland River studies and consists of a summary of climate change projections for Ontario by the MNRF.

Many of the studies recommend the use of the Agricultural Non-Point Source Pollution (AGNPS) model for modelling land use change in the watershed. This model evaluates how management decisions impact watershed systems, specifically non-point source pollutant loads from agricultural areas.

It is recommended that modelling of future land use changes be completed on a regional scale in order to assess the impact on the water resources system, to better characterize groundwater and surface water interactions, and understand the role of interflow and shallow groundwater, and to support the development of best management recommendations.

Table 4-5. Status of existing watershed study reports compared to watershed planning requirements as defined in MOECC and MNRF (2018). (Note: source in brackets (**bold text**) indicate a high likelihood that the watershed planning element is covered by the document (fully); source in brackets (**regular text**) may include information that could support the watershed planning element, but are unlikely to provide sufficient detail to fully satisfy requirements

Watershed Planning Element Number	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	6.4	6.5	6.6	6.7	7.1	7.2	7.3	8
Watershed Planning Element	Engagement	Indigenous Partners	Watershed Delineation	Water Resources System	Existing Conditions	Vision, Goals, Objectives Targets	Water Quantity, Budget, Conservation	Water Quality and Nutrient	Natural Hazards/ Sub-watershed Plans	Climate Change/ Watershed Management	Connections to Natural Systems	Cum. Effects Assessment	Land Use and Management Scenarios	Watershed Plan and Subwatershed Plan Development	Informing Land Use Planning and Decision Making	Implementing the Watershed/ Sub-watershed Plan	Monitoring and Adaptive Management
Entire Region (all Watersheds)	NPCA, 2003		NPCA, 2003	NPCA, 2013b; Niagara/ NPCA, 2016	NPCA, 2003, 2009, 2013a, 2013b	NPCA, 2003; Water Smart Niagara 2014	Aqua-Resource 2009a-i; NPCA 2013b, 2010a	NPCA, 2003, 2010, 2012	NPCA, 2003	Penney, 2012	NPCA, 2013a, 2013b, 2009, 2003				Water Smart Niagara, 2014	NPCA, 2003; Water Smart Niagara, 2014	NPCA, 2003
Beaverdams & Shriners Creeks	NPCA, 2011a		NPCA, 2011a	NPCA, 2011a	NPCA, 2011a	NPCA, 2011a	NPCA, 2011a	NPCA, 2011a	NPCA, 2011a		NPCA, 2011a		NPCA, 2011a	NPCA, 2011a	NPCA, 2011a	NPCA, 2011a	NPCA, 2011a
Big Forks Creek																	
Central Welland River	NPCA, 2010b		NPCA, 2010b	NPCA, 2010b	NPCA, 2010b	NPCA, 2010b	NPCA, 2010b	NPCA, 2010b	NPCA, 2010b		NPCA, 2010b		NPCA, 2010b	NPCA, 2010b	NPCA, 2010b	NPCA, 2010b	NPCA, 2010b
Fort Erie	Philips, 2007		Philips, 2007	Philips, 2007	Philips, 2007	NPCA, 2003	Philips, 2007	NPCA, 2003	Philips, 2007		Philips, 2007		(NPCA, 2003)	NPCA, 2013	NPCA, 2013	Philips, 2007	Philips, 2007
15-16-18	NPCA, 2008b		NPCA, 2008b	NPCA, 2008b	NPCA, 2008b	NPCA, 2008b		NPCA, 2008b	NPCA, 2008b		NPCA, 2008b		NPCA, 2008b	NPCA, 2008b	NPCA, 2008b	NPCA, 2008b	NPCA, 2008b
Grimsby									NPCA, 2009		NPCA, 2013			NPCA, 2013	NPCA, 2013		
Lake Erie North Shore	NPCA, 2010		NPCA, 2010	NPCA, 2010	NPCA, 2010	NPCA, 2010	NPCA, 2010	NPCA, 2010	NPCA, 2010		NPCA, 2010		NPCA, 2010	NPCA, 2010	NPCA, 2010	NPCA, 2010	NPCA, 2010
Lincoln									NPCA, 2009		(NPCA, 2013)			NPCA, 2013	NPCA, 2013		
Lower Welland River	NPCA, 2011c		NPCA, 2011c	NPCA, 2011c	NPCA, 2011c	NPCA, 2011c	NPCA, 2011c	NPCA, 2011c	NPCA, 2011c		NPCA, 2011c		NPCA, 2011c	NPCA, 2011c	NPCA, 2011c	NPCA, 2011c	NPCA, 2011c
NOTL	Aquafor Beech, 2008		Aquafor Beech, 2008	Aquafor Beech, 2008	Aquafor Beech, 2008	Aquafor Beech, 2008	Aquafor Beech, 2008	Aquafor Beech, 2008	Aquafor Beech, 2008		Aquafor Beech, 2008		Aquafor Beech, 2008	Aquafor Beech, 2008	Aquafor Beech, 2008	Aquafor Beech, 2008	Aquafor Beech, 2008
South Niagara Falls	NPCA, 2008a		NPCA, 2008a	NPCA, 2008a	NPCA, 2008a	NPCA, 2008a	NPCA, 2008a	NPCA, 2008a			NPCA, 2008a		NPCA, 2008a	NPCA, 2008a	NPCA, 2008a	NPCA, 2008a	NPCA, 2008a
12 Mile					Cheskey, 2013												
20 Mile	NPCA, 2006		NPCA, 2006	NPCA, 2006	NPCA, 2006	NPCA, 2006		NPCA, 2006	NPCA, 2006		NPCA, 2006		NPCA, 2006	NPCA, 2006	NPCA, 2006	NPCA, 2006	NPCA, 2006
Upper Welland	NPCA, 2011b		NPCA, 2011b	NPCA, 2011b	NPCA, 2011b	NPCA, 2011b	NPCA, 2011b	NPCA, 2011b	NPCA, 2011b		NPCA, 2011b		NPCA, 2011b	NPCA, 2011b	NPCA, 2011b	NPCA, 2011b	NPCA, 2011b

Watershed Planning Element Number	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	6.4	6.5	6.6	6.7	7.1	7.2	7.3	8
One Mile Creek	Aquafor Beech, 2005		Aquafor Beech, 2005		Aquafor Beech, 2005		Aquafor Beech, 2005										
Unnamed 1 (east of 12 Mile)																	
Unnamed 2 (East of Beaverdams & Shriners)																	

4.3.2 Overview of Watershed Planning Elements

A summary of the existing status, gaps, and deficiencies for each of the watershed planning elements, as numbered in the 2018 document, is provided below.

- 3.1 Effective Engagement and Committees** – effective engagement with stakeholders and the public appears to have been undertaken in regional level studies and the completed “watershed” plans. Engagement with the public may not be necessary for technical studies; involvement of knowledgeable stakeholders within a technical committee is an asset to any study team.
- 3.2 Partnering with Indigenous Communities** – while many of the background studies include details of a documented consultation process, there is a general lack in detail regarding indigenous partnerships. However, in terms partnering with indigenous communities, the definition is loose, and simply states that coordination with indigenous communities is encouraged in the Draft Watershed Planning in Ontario guidance document.
- 4.1 Watershed Delineation** – a discrepancy in the delineation of tertiary drainage basins and quaternary watersheds was identified when comparing data obtained from Land Information Ontario (LIO), existing “watershed” studies led by NPCA.

Inconsistency in the number of quaternary watersheds within Niagara Region has been noted as discussed in **Section 2.2**. The apparent inconsistency is attributable to the convention established in the area under the NPCA’s jurisdiction that uses spatial grouping and applies the term ‘watershed’ when the term ‘subwatershed’ should be applied, or when a geographically based area is defined. Therefore, the existing “watershed studies” reflect ‘watershed planning areas’ (e.g., see AquaResources, 2009) rather than actual watershed boundaries.

An example of this is the division of the Welland River watershed into 3 watersheds. This division is based on a spatial grouping, but could also be considered to be a subwatershed, since these are smaller basins nested within the watershed. Likewise, Port Robinson West was identified as a subwatershed but counted as a watershed (AECOM, 2016); Singers Drain was identified as a separate subwatershed, however, it is a drainage feature located within the Port Robinson West subwatershed. The delineation of watersheds and subwatersheds was likely intended to satisfy specific study needs/ information requirements in the past.

Two quaternary watersheds remain unnamed within the NPCA jurisdiction and are ‘lumped’ as one watershed within AECOM (2016).

Delineation of physiographic watershed boundaries is typically based on digital data (i.e., Digital Elevation Models (DEM)). As the sources of digital data become

updated, refinements in surface water features and watershed boundary refinements can be made. It is recommended that watershed boundary delineations be updated/checked to reflect current data sources.

- 4.2 Water Resource System** – the key components of the water resource system appear to be well represented and available through different studies and initiatives. These include the comprehensive surface water feature mapping completed by Niagara Region and NPCA (i.e., Contemporary Watercourse Mapping Project) and groundwater features identified through studies completed in support of source water protection plans (e.g., NPCA, 2013); natural heritage features that are part of the water resource system (e.g., wetlands) are also mapped. The scale of the mapping would require refinement for specific land use and/or planning level assessments.

Key Hydrological Areas and Key Hydrological Features that relate to surface water, groundwater, ecology, or landforms are currently not represented in an integrated water resource system map. Based on existing information, it is unlikely that all linkages within the water resource system, or between the water resource system and natural heritage system, are well established or represented. Inferences regarding linkages can be made from existing mapping and studies, but should be reviewed/enhanced.

The MOECC issued a Section 36 order to update the Niagara Peninsula Source Protection Plan by 2020. This includes updates to the identification and protection of hydrogeologically sensitive areas; this should be reflected in the water resource system.

- 4.3 Existing Conditions Characterization** – the watershed plan/study content review completed by AECOM (2016) examined the content of existing watershed plans in the context of the 1993 Conservation Ontario watershed planning guidance document. The results of the AECOM (2016) assessment are replicated in **Table 4-6** and demonstrate that characterization of existing conditions generally does not fulfill contemporary practices and/or requirements (e.g., fluvial geomorphology assessment, stream classification (note: this was determined prior to the 2016 Region/NPCA Contemporary Mapping of Watercourses project)) to support watershed planning. This gap is not addressed in other studies available for the Region or its watersheds.

- 5.1 Vision, Objectives, Goals and Targets** – vision, objectives, goals and targets are identified in several of the existing regional scale documents pertaining to water quality (NPCA watershed report card) and groundwater (Source Water Protection Plan, 2013). Each of the watershed planning studies includes goals and targets, although these tend to focus on the protection, enhancement or maintenance of the terrestrial environment. Specific targets are generally not included in the watershed plans.

Table 4-6. Overview of watershed study content – part 1 (adapted from: AECOM, 2016)

Sub-watershed	Watershed/ Subwatershed Study	Date	NHS	Linkages	Stream Class	Fisheries	Fluvial Geomorphology	Municipal Drain	Erosion Sites	Water Quality	Highly Vulnerable Aquifer Identification*	Water Balance* *	Karst	Hazards – Flood, Shore, Slope	Potential Impact Analysis
Grimsby	None	-									✓	✓			
Lincoln	None	-									✓	✓			
Twenty Mile Creek	Watershed	2006	✓	✓	High Level	✓	✓	✓	✓	✓	✓	✓	✓	X	X
15, 16, 18 Mile Creeks	Watershed	2006	✓	✓	High Level	✓	?	✓	✓	✓	✓	✓	✓	X	X
12 Mile Creek	Watershed	2006	✓	✓	High Level	✓	X	X	Partly	✓	✓	✓	X	✓	X
Beaverdam & Shriners	Watershed	2011	✓	✓	High Level	✓	X	✓	X	✓	✓	✓	X	X	X
Niagara-on- the-Lake	Watershed	2005	✓	✓	High Level	✓	✓	✓	Partly	✓	✓	✓	X	✓	X
One Mile Creek	Watershed	2005	✓	✓	High Level	✓	✓	✓	✓	✓	✓	✓	X	✓	X
Upper Welland	Watershed	2012	✓	✓	High Level	✓	X	✓	X	✓	✓	✓	X	X	X
Central Welland	Watershed	2011	✓	✓	High Level	✓	X	✓	X	✓	✓	✓	X	X	X
Lower Welland	Watershed	2011	✓	✓	High Level	✓	X	✓	X	✓	✓	✓	X	X	X
Singers Drain	Subwatershed	1999	✓	✓	High Level	✓	✓	✓	✓	✓	✓	✓	X	✓	✓
Port Robinson West	Subwatershed	2014	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	X	✓	✓
Big Forks Creek	None	-									✓	✓			
Lake Erie/ North Shore	Watershed	2011	✓	✓	High Level	✓	X	✓	X	✓	✓	✓	X	Shoreline	X
South Niagara Falls	Watershed	2008	✓	✓	High Level	✓	X	✓	X	✓	✓	✓	X	X	X
Fort Erie Watersheds	Quasi Subwatershed	2008	✓	✓	High Level	✓	✓	✓	✓	✓	✓	✓	X	✓	✓

Table 4-7. Overview of watershed study content – part 2 (adapted from: AECOM, 2016)

Subwatershed	Watershed/ Subwatershed Study	Date	Public Input	Management Plan	Restoration and Rehab Plan	Further Studies	SWM Recs	Climate Change Consideration
Grimsby	None	-						X
Lincoln	None	-						X
Twenty Mile Creek	Watershed	2006	✓	✓	✓	✓	Generic	X
15, 16, 18 Mile Creeks	Watershed	2006	✓	✓	✓	✓	Generic	X
12 Mile Creek	Watershed	2006	✓	✓	✓	✓	Generic	X
Beaverdam & Shriners	Watershed	2011	✓	✓	✓	✓	Generic	X
Niagara-on-the-Lake	Watershed	2005	✓	✓	Partly	✓	Generic	X
One Mile Creek	Watershed	2005	✓	✓	✓	✓	Generic	X
Upper Welland	Watershed	2012	✓	✓	✓	✓	Generic	X
Central Welland	Watershed	2011	✓	✓	✓	✓	Generic	X
Lower Welland	Watershed	2011	✓	✓	✓	✓	Generic	X
Singers Drain	Subwatershed	1999	✓	✓	✓	✓	✓	X
Port Robinson West	Subwatershed	2014	✓	✓	X	X	✓	X
Big Forks Creek	None	-						
Lake Erie/ North Shore	Watershed	2011	✓	✓	✓	✓	Generic	X
South Niagara Falls	Watershed	2008	✓	✓	✓	✓	Generic	X
Fort Erie Watersheds	Quasi Subwatershed	2008	✓	✓	✓	✓	✓	X

6.1 Water Quantity, Budget & Water Conservation Plans – the 2009 Water Availability Studies completed for the watershed planning areas within Niagara Region include water budget assessments. Reports were not located for the following watershed planning areas through this study: One Mile Creek, Unnamed Tributaries 1 and 2, and Lake Erie North Shore. The NPCA (2013b) Niagara Source Protection Plan & Assessment Report (2013 update) includes a comprehensive water budget assessment. Missing from any of the background documents are Water Conservation Plans.

6.2 Water Quality and Nutrient Load Assessments – assessment of water quality is undertaken by NPCA on an annual basis and is made publicly available on its webpage. A high level overview of surface water quality is provided in the Watershed Report Cards that are published on a 5 year cycle. Sources of nutrient loading and pollutants are generally identified in the watershed plans/studies and source protection reports.

New waste water treatment plants (WWTPs) and existing WWTPs that require expansion to service growth will be subject to a master servicing plan and Municipal Class EA process. The Class EA process typically requires assimilative capacity studies to support approval of new effluents.

6.3 Natural Hazards in Watershed Planning and Subwatershed Plans – the AECOM (2016) review indicated that natural hazards were not identified in most watershed plans and are not the focus of specific studies. Most watershed reports mentioned issues related to erosion or flooding at a high level; details were typically not provided. Shoreline hazards were not discussed in watershed planning documents; this would be relevant for any development that exists, or is proposed, in proximity to the Lake Ontario or Lake Erie shorelines.

Regulatory mapping (i.e., NPCA) would typically include flood hazard delineation and high level delineation of erosion hazards (meander belt). NPCA indicated, in AECOM (2016) that floodline mapping is needed for Lincoln and Grimsby watersheds, the Major Welland River tributaries, Beaverdams and Shriners Creek, Walker's and Beamer Creek, Little Forks Creek and Mill Race Creek.

6.4 Climate Change – the potential implications of climate change in Niagara Region are identified and discussed by Penney (2012); this document provides the basis for more specific studies including cumulative effects and management scenarios. In general, climate change characterization is fairly broad and studies do not include a significant amount of detail in terms of how regionally specific climate change impacts should be addressed. Climate change considerations were not included in existing watershed planning reports (AECOM, 2016). Existing reports also do not appear to consider the effects of existing and proposed land uses and water/wastewater/stormwater management infrastructure on exacerbating climate change impacts.

-
- 6.5 Connections to Natural System** – a comprehensive documentation of natural areas was completed between 2006 and 2009 within Niagara Region. The Natural Areas Inventory (NAI) Report (NPCA, 2010) is also included in the NPCA authored “watershed” plans. Linkage between the natural heritage system and water resource system may be inferred rather than intentionally identified. Goals, objectives, targets, criteria and indicators for natural systems are a predominant focus of watershed plans. The NAI may be becoming ‘dated’ and hence any consideration of the natural system should focus on the current work being undertaken as part of the new OP.
- 6.6 Cumulative Effects Assessment** – cumulative effect assessments appear to have been completed in the 2003 Niagara Water Quality Protection Strategy Report, and do not appear to have not been included in the watershed plans.
- 6.7 Assessment of Land Use & Management Scenarios** – in general, the watershed plans identify concerns pertaining to proposed land use changes, where such changes were anticipated at the time of watershed plan development. The watershed plans do not examine different land use and management scenarios that would guide location for urban growth or transportation infrastructure or identify mitigation measures or targets. The watershed plans do identify strategies for restoration of various deteriorated aspects of the watershed. This includes active restoration measures (e.g., riparian planting) and identification of a range BMPs for stormwater management etc. Specific goals and targets are generally not provided.
- 7.1 Watershed Plan and Subwatershed Plan Development** – each of the 12 reports document the watershed planning process undertaken and provide a summary of all the watershed planning elements that were included in the studies. The documents provide a reference and record of conditions at the time of the study for the watershed, subwatershed, or geographic area included; this provides a basis for future comparison. In the “watershed” plans completed by NPCA, areas for restoration strategies are intended to address identified watershed issues. The “watershed” plans identify potential general policies to be included by municipalities in official plans.
- 7.2 Informing Land Use Planning & Decision Making** – the completed watershed planning studies have generally characterized existing conditions and identified issues within the watershed. Information contained within the watershed plans and similar supporting studies can be used by the municipality to begin to identify settlement area boundary expansion areas, and support infrastructure planning. Lacking in the completed watershed plans are results of different land use and management assessments that would inform planning (e.g., criteria and targets). The reports include recommendations for general policies and BMPs for land use planning (e.g., stormwater management policies, riparian buffer policies, alternative subdivision design, Watershed BMP, Urban BMP etc.).

7.3 Implementing the Watershed & Subwatershed Plan – the existing watershed plans identify general policies and opportunities for education and stewardship to implement restoration strategies. The reports do not typically include an implementation schedule (timing, financial resources) but many do identify programs and initiatives that could effectively implement the watershed plan

8.0 Monitoring and Adaptive Management – there are various monitoring initiatives that occur within Niagara Region, particularly with respect to water quality and natural heritage systems. The data is reviewed as part of NPCA's watershed report cards and the source water protection plan assessment update reports. Additional review of existing documents should be undertaken to identify other monitoring initiatives and whether adaptive management is being undertaken. The watershed plans generally provide recommendations for monitoring, although they often lack specific targets.

4.3.3 Overall Summary

Many reports have been compiled for Niagara Region that document existing conditions, identify issues, develop restoration strategies, and support watershed planning. A high level comparison of the existing documents was completed in the context of the watershed planning elements identified in the Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018). Through this review, it became apparent that none of the existing reports satisfy all of the watershed planning requirements. The content of some background reports may be considered as equivalent to some watershed planning elements (**Table 4-8**), but will require review and comparison to the Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018) confirmation (e.g., as part of a tertiary watershed planning study).

Notable in the watershed plans that have been developed to date is the focus on natural environment restoration through restoration initiatives. This differs from management strategies to mitigate issues caused by land use practices intended in the Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018). In this regard, general management BMPs are typically recommended to address typical issues related to urban land use (e.g., SWM control). Quantitative assessment of land use and/or management alternatives have not been completed; likewise, specific climate change implications for each of the “watersheds” have not been completed.

Table 4-8. Comparison of previous study content to watershed planning element

No.	Watershed Planning Element	% Addressed by Background	Comment
3.1	Effective Engagement and Committees		Public and stakeholder engagement is evident in most studies
4.1	Watershed Delineation		Generally well established, although some clarifications needed
4.2	Water Resource System		Nearly all elements to support water resource system mapping are generally available
4.3	Existing Conditions Characterization		Aquatic, natural environment, physiography, soils, groundwater
5.1	Vision, Objectives, Goals		Generally suitable and relevant; further refinement could occur
6.1	Water Budget Analysis		Completed for most watersheds
6.2	Water Quality		Documentation of water quality conditions occurs regularly and monitoring is active (note: nutrient assessments are limited)

The gaps identified in the watershed plans reflect the general timeframe of study completion (i.e., 10 – 15 years ago) and the relatively lower level of urban growth pressures within each watershed area. Updates to watershed plans are recommended, once scale and logical ecological boundaries, and consideration of cross-jurisdictional and cross-watershed impacts have been determined. The watershed plan updates should be prioritized for those watersheds in which planning for designated greenfield development can be informed by a watershed plan (See **Section 4.4**). Likewise, for those watersheds that continue to exhibit a degraded condition, based on background monitoring reports (e.g., water quality), an updated management strategy may be beneficial to improve conditions and to contribute to meeting Provincial objectives (e.g., phosphorus loading to the Great Lakes). Watershed plan reports should be updated to enable development of suitable stormwater management strategies.

Prior to initiating any watershed study, or update in the Region, it is recommended that an equivalency document be completed at the tertiary level. This would include a comprehensive review of existing reports and studies that includes not only those listed in **Table 4-2**, but also any others that are identified by NPCA, municipalities, and others. Some of the existing NPCA watershed/subwatershed studies have identified specific direction for future study, these should be reviewed to determine relevance and also consider whether these are relevant to other quaternary watersheds/subwatersheds. It is

possible that other planning level documents exist and are available from municipalities that may partially address watershed planning requirements (e.g., Local Management Area summaries, environmental impact study, water and wastewater master plans, assimilative capacity studies, etc.). A tertiary watershed plan will inform subsequent quaternary watershed study requirements.

4.4 Planning for Future Growth

As part of the new Niagara Official Plan a growth management strategy is being completed. The strategy will guide employment and population growth to 2041. Watershed planning, at the tertiary watershed scale will inform growth in the Region. Once areas for growth and intensification have been identified, then those affected watersheds should be prioritized for the quaternary watershed/subwatershed studies. Findings from these studies will inform the secondary plan study process to plan for the anticipated growth and intensification areas.

4.5 Natural Environment Work Program Context

The Natural Environment Work Program is an important component of the new Niagara Official Plan. This includes elements that are relevant to watershed planning. Based on the review of existing documents and the evaluation of equivalency, several data gaps are identified and recommendations for additional work are provided. These work plan items are summarized below, followed by **Table 6-1** which provides a suggested timeline and resources to undertake those work plan components that are not completed as part of the current Natural Environment Work Program. Specific recommendations are provided in **Section 7.2.2**.

4.5.1 Watershed Delineation

Agreement on appropriate scale, accompanied by GIS based modelling to refine boundaries based on updated spatial data, and documentation regarding delineation of watershed and subwatershed areas is required. As the existing delineation and naming conventions are well established in existing NPCA business operations, further dialogue with NPCA will be required.

4.5.2 Water Resource System (WRS) Mapping

The Mapping Discussion Paper (North South Environmental et al., 2019) provides recommendations for use of the Contemporary Mapping of Watercourses dataset. The discussion paper also makes recommendations for the identification of the Water Resource System (e.g., Key Hydrologic Areas, Key Hydrologic Features) as defined in the PPS and Growth Plan, and identifies potential data sources.

The existing mapping and datasets will inform the Natural Environment Work Plan with respect to the identification and evaluation of options for the Regional natural environment systems (e.g. Natural Heritage System), and to ensure conformance with Provincial requirements for mapping the natural environment system.

Mapping of some water resource system features (e.g., karst, seepage etc.) is not practical since feature presence and location can only be confirmed through field investigation and site-specific studies; further, some features are seasonal and therefore may require specific time of year field assessments. Since site specific investigations are not practical at the tertiary watershed scale, mapping zones of likely occurrence (rather than spot features/observations) may be more practical. In such cases, an approach similar to that currently used by the Ontario Geological Survey (OGS) for areas of karst occurrence in Southern Ontario (Brunton and Dodge, 2008) should be considered. The OGS classifies areas as known, inferred, or potential occurrence as described below:

Known: observed, measured field data or data from published reports.

Inferred: regions of carbonate rock units highlighted as most vulnerable or susceptible to karstification, where direct field observations have not been made by OGS staff or other sources. A natural extrapolation of the known karst areas for given rock units.

Potential: areas of carbonate rock units identified as most susceptible to karst processes.

These definitions could be modified as appropriate to document locations of water resource features (e.g., seepage) within the water resource system. Such mapping would be refined based on field study. The intent of mapping features that are inferred and/or have not been field-truthed needs to be clearly conveyed to ensure appropriate interpretation and application for any future study.

Water resource mapping could also include anthropogenic influences such as tile-drains and areas of irrigation (i.e., augmented irrigated ditches, constructed farm irrigation ponds, etc.).

4.5.3 GIS Database

A GIS database, managed by the Region with input from agency partners, would be an effective tool to assist with organization of background data and enable a visual assessment regarding the availability of reports for any watershed or subwatershed area. The GIS database could demonstrate the geographic extent, and rank the equivalency of reports to watershed planning requirements.

4.5.4 Natural Hazards

Inclusion of natural hazards in the Region's natural system should be considered. That is, flood and erosion hazards are typically delineated on the landscape; development in the hazard area is mostly prohibited and a setback is applied that includes an access allowance, and/or accommodates a buffer for erosion and/or flood delineation. The regulatory floodline is based on engineered study. Delineation of erosion hazards pertaining to valley lands is assessed through review of topography. Meander belt corridors within unconfined valley settings are sometimes estimated based on high level assessments as prescribed in MNR (2002); actual meander belt erosion hazards require individual study/assessment and therefore are omitted from regulated mapping in many areas. The areas defined as natural hazards become part of the natural heritage system and provide linkage and connectivity to terrestrial features.

The AECOM (2016) document indicates that floodline mapping is required to be updated in several watersheds. The status of this mapping and supporting hydrologic and hydraulic modeling needs to be determined through consultation with NPCA. If regulatory mapping is not available, then estimated floodline mapping can be produced. Likewise, estimates of the meander belt, based on MNR's technical guidance document would be appropriate at the Regional Scale, for planning purposes (e.g. screening).

4.5.5 Monitoring and Databases

The Region should consider developing mapping to document monitoring locations and corresponding databases to establish information sources to inform watershed studies and planning. Likewise, databases that document location and details of various human land uses (septic, irrigation) may also be beneficial in future studies.

4.6 New Niagara Official Plan Context

There is clear Provincial direction that land-use planning is to be informed by watershed planning or equivalent. As the overarching land-use planning document for the Niagara Region, there is a need to ensure that the new Niagara Official Plan is appropriately informed by watershed planning. Based on the analysis completed above, tertiary-level planning is the appropriate scale to inform a regional official plan.

Recommendations for additional work to inform the new Niagara Official Plan are summarized below, including a preliminary discussion on costs, resources, and timing.

4.6.1 Tertiary-level Planning Study

As summarized in **Section 4.3**, existing studies and other documentation in Niagara Region appear to encompass most, if not all, aspects of watershed planning. The required information is typically spread across numerous reports, and some of the

information is dated, or lacking the detail required under the Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018).

One option that the Region could consider, to establish a watershed planning level of understanding within Niagara Region, is to undertake an Integrated Watershed Management Plan (IWMP) (Conservation Ontario, 2010). Integrated watershed management is defined as:

“ ... the process of managing human activities and natural resources on a watershed basis, taking into account, social, economic, and environmental issues, as well as community interests in order to manage water resources sustainably.... it requires the integration of scientific components and identification of agency and stakeholder responsibilities in the process.... IWM must account for spatial and temporal scales from its initiation and results can therefore be applied at different scales, depending on the question and the need” (Conservation Ontario, 2012).

Developing an IWMP includes the following components (Conservation Ontario, 2012):

- review existing and recent information and data sources to characterize the watershed area and to identify watershed management and ecosystem issues; this, therefore, does not necessarily include a detailed data collection program;
- collaborate with watershed stakeholders to prioritize issues and to develop strategies and plans to address the issues;
- identify specific data/information gaps within the watershed, and prioritization of areas for further study at the quaternary watershed and sub-watershed level; and
- identify future study needs and initiatives.

To satisfy requirements of the Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018), scenario modeling to assess impacts of future growth and development, evaluation and selection of preferred management alternatives should be undertaken to mitigate negative impacts of growth and to provide servicing options in an IWMP.

Although there would be numerous benefits to completing a comprehensive IWMP, there is recognition that provincial direction supports the use of existing equivalent information and documentation, where appropriate. Further, Conservation Ontario (2010) recognizes that IWMP can be applied at different scales, depending on the question and the need. Therefore, a range of options that the Region could consider to ensure that the new Niagara Official Plan is informed by watershed planning, include, but are not limited to:

- a) Relying on existing reports, documentation, and information with scoped summary and analyses, and stakeholder consultation, to fulfill core requirements of the IWMP.

- b) In addition to a), complete additional work to fill in major gaps (e.g., modeling, water resource systems etc.) with a scope of work specifically developed to inform the new Niagara Official Plan.
- c) Preparing a new and comprehensive watershed plan for the Region at the tertiary-level, using an IWMP or similar approach. This could range from a single plan for the geographic range of the Region with specific focus on relevant issues, goals and targets for each tertiary watersheds, to individual plans for each of the three tertiary watersheds in the Region. A comprehensive plan could meet the needs of a range of users and stakeholders in the Region, and support the implementation (and funding applications) for various future initiatives. A comprehensive tertiary watershed plan would benefit from collaboration with, or access to, updated quaternary watershed and subwatershed level studies.

In selecting the preferred option, the Region should consider the quality of existing information and the purpose for which it was developed, including the implications of using this information without any additional review, summary, and analysis. Cost, resources, and need to have the process complete in conjunction with timing of the new Niagara Official Plan are also important considerations.

In preparing a more detailed scope of work, the Region should also consider the need to complete the following:

4.6.1.1 Watershed Delineation and Characterization

As identified previously in the discussion paper, there is a need for consistent delineation and naming of the watersheds within the Region. In addition, an overview of tertiary watershed scale characterization would be beneficial to identify existing conditions and to define overall management goals, objectives and targets that could inform the new Niagara Official Plan. This could likely be based on a review of existing information and concurrent studies, and could be supplemented by scoped cumulative effects and land use and management scenarios, along with climate change scenarios. Any modeling completed should form the basis for further analysis by quaternary watershed plans.

4.6.1.2 Water Resource System

Mapping of the water resources system is required to support the new Niagara Official Plan as outlined in **Section 4.5.2**. It is recognized that the identification of a water resource system is already identified as part of the natural environment work program for the new Niagara Official Plan.

4.6.1.3 Water Resource - Linkages and Enhancements

Existing information should be reviewed to identify appropriate linkages between key hydrologic areas, features or functions and connectivity with the Natural Heritage System. Identification of linkages between the WRS and NHS is important as this may illustrate

opportunities for enhancement of areas and/or constraints for land use planning and/or urban development. This is considered to be in addition to the workplan item outlined in **Section 4.6.1.2** (i.e., Water Resource System) since it requires interpretation and understanding of the interaction of hydrologic and natural features that may not necessarily occupy the same spatial area.

4.6.1.4 Consideration of Equivalency Assessment

The equivalency assessment completed as part of this discussion paper has identified various gaps within existing documentation. Review of background reports to support the tertiary-level watershed planning may result in a change to the equivalency status outlined in **Section 4.0**. Completion of tertiary-level planning will enable identification of specific gaps that should be addressed during quaternary level studies to inform land use planning and quaternary watershed and subwatershed management. This can be used to prioritize future study initiatives (e.g., monitoring, improved application of best management practices) by the Region, area municipalities, the NPCA, or other stakeholders in the region.

4.6.1.5 Growth Management Strategy Coordination

Coordination with the growth management strategy that is being completed as a component of the new Niagara Official Plan is necessary to identify the quaternary watersheds or subwatersheds which are expected to be most impacted by urban development. Once identified, these watersheds should be prioritized for watershed planning so that they can inform suitable locations for urban growth within the watershed and effective strategies for managing impacts from urban growth.

4.6.2 Timing, Costs, and Resources

The cost and resources required to complete the necessary watershed planning to inform the new Niagara Official Plan will range based on the option selected and the associated scope of the work program. The cost will also be dependent on the degree to which work is completed by Region staff vs. retaining a consultant team. The ability for NPCA to partner and provide resources will also be a factor.

For reference – a comprehensive watershed plan following an IWMP approach can be in the range of \$300,000 to \$350,000 or more, depending on the complexity of the terms of reference. The cost for more-detailed scoped watershed plans would be dependent on the level of detail and effort required. For an additional point of reference - Subwatershed plans undertaken to support secondary plans and other major growth areas can cost \$500,000 or more, depending on the extent of data gaps, and the nature of issues to be addressed, as well as the modelling which may be required.

In terms of timing, it is recognized that the work plan for the new Niagara Official Plan is well-underway, with a goal of being complete by the end of 2021. Although the watershed

planning work can be completed, to a degree, concurrent with the remainder of the natural environment work program, ongoing coordination and communication between the work programs will be required to ensure that the findings of the watershed planning work will be available to inform system and policy development. A tertiary-level watershed study can take a year or more to complete. The Region is encouraged to proceed quickly to ensure no delay in finalizing the new Niagara Official Plan.

5.0 Niagara Policy Recommendations

In 2014, the Province updated the PPS as it related to water resources and it now requires that municipalities protect, improve or restore the quality and quantity of water by doing a number of things, one of which is to use the watershed as the ecologically meaningful scale for integrated and long-term planning. In 2017, the Province then updated the four Provincial land use plans that work together to manage growth in the Greater Golden Horseshoe (Growth Plan, Greenbelt Plan, Oak Ridges Moraine Conservation Plan, and Niagara Escarpment Plan). One of the objectives of these updates was to also enhance the Provincial direction to protect natural heritage and water resources systems by further integrating water resources planning with growth management decision-making.

Additional regulatory and policy guidance is also provided in Provincial legislation including the Great Lakes Protection Act and Plan, Ontario Water Resources Act, Ontario Water Opportunities Act and the Clean Water Act. The PPS also requires that upper tier municipalities such as Niagara provide policy direction for the lower tier municipalities for the lower tier municipalities on matters that cross municipal boundaries. One of these matters would be watershed planning, because water resource systems and watersheds do not correspond to municipal boundaries.

Municipalities are responsible for incorporating Provincial direction into Official Plans and providing implementation direction to local municipalities. As a consequence, there is a need to establish a watershed planning policy framework in the new ROP. Given that watershed planning is a foundational element of planning for climate change, some of the recommendations below also impact the development of a climate change policy framework as well.

5.1 Policy Considerations

With respect to watershed planning, the policies of the new Niagara Official Plan should consider the following:

- Provide definitions of tertiary and quaternary watershed and subwatershed as outlined in **Section 5.2**. It will be beneficial to include **Table 2.1** of this report and mapping similar to **Figure 2-4**.
- Define responsibility for watershed and subwatershed studies and adaptive management, for example
 - tertiary watershed = Region responsibility
 - quaternary watershed or subwatershed = Area Municipality responsibility
- Define 'watershed plan' and its components, as per the Growth Plan definition and with reference to contemporary provincial guidelines.
- Establish timeframe for watershed studies and updates (max. 10 years). The updates could be scoped with shorter timelines for aspects such as water quality and meeting of targets and longer timelines for cumulative impact assessments. Priority watersheds for study or comprehensive updates should be considered for

areas that are under development pressure. However, any prescribed timelines would need to be flexible based on updates/introduction of new legislation, policies, or plans.

- Provide direction for quaternary watershed or subwatershed studies to be completed, and updated, to provide a sound basis for land use planning and for managing the natural environment; subwatershed planning is necessary for site-specific land use planning decisions.
- Provide direction for incorporating climate change consideration in watershed planning and management.
- Recommend collaborating/utilizing monitoring programs that are already in place, and managed by others, to enable assessment of management effectiveness regarding natural heritage system and water resource system protection or enhancement.
- Consider initiating a monitoring program(s), where relevant, to augment existing programs in areas of likely future development. Monitoring would establish baseline pre-development conditions against which changes in existing conditions as it relates to the natural heritage and water resource systems can be assessed, in response to development.
- Confirm the need for an adaptive management approach for watershed management and land use impact mitigation.
- Commit to monitoring and adaptive management
- Confirm responsibility for completion of wastewater treatment plan (WWTP) capacity and receiving system assimilative capacity studies to identify and prioritise upgrades.
- Confirm the hierarchy of studies that need to be completed in addition to watershed studies to inform land use planning and management of natural resources)
- Where policies refer to ecological integrity, consideration should be given to also including 'hydrological integrity'.
- Recognize the need for cross-jurisdictional collaboration, and need for consistency of watershed planning studies within the Region. This includes collaboration with the NPCA, as appropriate, who have a strong history of working with the area municipalities and other stakeholders in Niagara Region, and have established understanding of the natural environment through previous watershed planning studies, and current monitoring programs.
- The potential of 'emerging issues' and pro-active management approaches to protect water resource and natural heritage systems.
- An inter-departmental and inter-agency working group for watershed planning in the region in accordance with provincial direction; this could include participation of the NPCA and area municipalities, as appropriate.
- For any natural environment policy:
 - Recognize the water resource system, its features, areas, functions, and inter-connections;
 - Recognize the link between natural heritage and water resource systems; and

- Recognize the link between water resource systems and land use activity (e.g., agriculture).

5.2 Specific Policy Recommendations

Specific policy recommendations for incorporation into the new Niagara Official Plan (NOP) are provided below:

Recommendation 1: It is recommended that the NOP include the following definitions:

- **Watershed** – means an area that is drained by a river and its tributaries.
- **Sub-watershed** – means a smaller nested drainage area within a watershed.
- **Tertiary watershed** – a watershed that drains an area of 1000 km² or more and discharges into a large water body (i.e., Lake Ontario, Lake Erie, Niagara River) (Conservation Ontario, 2003).
- **Quaternary watershed or subwatershed** – an area that drains ~ 200 km² and discharges into a large water body or into a larger branch of a watercourse (Conservation Ontario, 2003).
- **Watershed Planning** – planning that provides a framework for establishing goals, objectives, and direction for the protection of water resources, the management of human activities, land, water, aquatic life, and resources within a watershed and for the assessment of cumulative, cross-jurisdictional, and cross-watershed impacts.

Watershed planning typically includes: watershed characterization, a water budget, and conservation plan; nutrient loading assessments; consideration of climate change impacts and severe weather events; land and water use management objectives and strategies; scenario modelling to evaluate the impacts of forecasted growth and servicing options, and mitigation measures; an environmental monitoring plan; requirements for the use of environmental best management practices, programs, and performance measures; criteria for evaluating the protection of quality and quantity of water; the identification and protection of hydrologic features, areas, and functions and the inter-relationships between or among them; and targets for the protection and restoration of riparian areas.

Watershed planning is undertaken at many scales, and considers cross-jurisdictional and cross-watershed impacts. The level of analysis and specificity generally increases for smaller geographic areas such as subwatersheds and tributaries.

- **Subwatershed Plan** – a plan that reflects and refines the goals, objectives, targets, and assessments of watershed planning for smaller drainage areas, is tailored to subwatershed needs and addresses local issues.

A subwatershed plan should: consider existing development and evaluate impacts of any potential or proposed land uses and development; identify hydrologic features, areas, linkages, and functions; identify natural features, areas, and related hydrologic functions; and provide for protecting, improving, or restoring the quality and quantity of water within a subwatershed.

A subwatershed plan is based on pre-development monitoring and evaluation; is integrated with natural heritage protection; and identifies specific criteria, objectives, actions, thresholds, targets, and best management practices for development, for water and wastewater servicing, for stormwater management, for managing and minimizing impacts related to severe weather events, and to support ecological needs.

Recommendation 2: It is recommended that the NOP indicate that the Region is responsible for preparing watershed plans and that the Area Municipalities are responsible for subwatershed plans. The NOP should also identify, if possible, priority watershed and subwatershed plans, based on where growth is expected.

Recommendation 3: The NOP should include a map that clearly defines the tertiary watershed and quaternary watersheds/subwatersheds to assist in the implementation of the policy framework.

Recommendation 4: Section 2.2.8.3 of the Growth Plan (MMAH, 2017b) indicates that once, and if, the need for a settlement area expansion has been justified,

"the feasibility of the proposed expansion will be determined and the most appropriate location for the proposed expansion will be identified based on the comprehensive application of all of the policies in this Plan."

Included in the consideration of these policies is the following in sub-section d):

"the proposed expansion, including the associated water, wastewater and stormwater servicing, would be planned and demonstrated to avoid, or if avoidance is not possible, minimize and mitigate any potential negative impacts on watershed conditions and the water resource system, including the quality and quantity of water."

On the basis of the above, it is recommended that the settlement area expansion policies in the NOP reflect the above requirement.

Related to the above, Section 4.2.1.3 of the Growth Plan (MMAH, 2017b) indicates the following as it relates in particular to the allocation of growth:

"Watershed planning or equivalent will inform:

- a) The identification of water resource systems;
- b) The protection, enhancement, or restoration of the quality and quantity of water;
- c) Decisions on allocation of growth; and
- d) Planning for water, wastewater, and stormwater infrastructure."

On the basis of the above, decisions on the allocation of growth, which will occur as a component of the current update to the NOP are required to be supported by watershed planning or its equivalent.

Recommendation 5: Section 3.1 of the Growth Plan (MMAH, 2017b) indicates the following as it relates to water infrastructure planning:

"A clean and sustainable supply of water is essential to the long-term health and prosperity of the region. There is a need to co-ordinate investment in water, wastewater, and stormwater infrastructure to service future growth in ways that are fiscally sustainable and linked to decisions about how these systems are paid for and administered. Water infrastructure planning will be informed by watershed planning to ensure that the quality and quantity of water is maintained."

On the basis of the above, it is recommended that the infrastructure policies in the NOP indicate that appropriate watershed planning be completed to support water infrastructure planning.

Recommendation 6: Section 3.1 of the Growth Plan (MMAH, 2017b) also indicates the following with respect to the Great Lakes:

"The importance of the Great Lakes is reflected in many provincial initiatives, including the Great Lakes Protection Act, 2015 and Ontario's Great Lakes Strategy. This Plan supports these initiatives by providing direction on watershed-based, integrated water, wastewater, and stormwater master planning and by restricting future extensions of water and wastewater servicing from the Great Lakes."

The purpose of the Great Lakes Protection Act, 2015 (GLPA) is to protect and restore water quality, hydrologic functions, watersheds, wetlands, beaches, shorelines and coastal areas of the Great Lakes-St. Lawrence River Basin. The Ontario Great Lakes Strategy, 2012 aids in the implementation of the GLPA by describing the vision, goals, and principles that are intended to guide decisions under the GLPA and actions taken to achieve the purposes of the GLPA.

On the basis of the above, it is recommended that the NOP highlight the importance of Lake Erie and Lake Ontario as integral elements of the water resource system in

accordance with Section 2.2.1 c) of the PPS. In addition, there should be policies in the NOP that strongly support the maintenance of linkages and related functions among ground water features, hydrologic functions, natural heritage features and areas, and surface water features including shoreline areas in accordance with Section 2.2.1 d) of the PPS as well. Section 4.2.1.5 of the Growth Plan (MMAH, 2017b) also indicates that municipalities are required to consider the Great Lakes Strategy and the GLPA.

According to the State of the Great Lakes, 2017 report, run-off from land is a major source of non-point source pollutants to the Great Lakes. As a consequence, it is recommended that the NOP include stormwater management policies in accordance with Section 1.6.6.7 of the PPS, which states the following:

"Planning for stormwater management shall:

- a) Minimize, or, where possible, prevent increases in contaminant loads;
- b) Minimize changes in water balance and erosion;
- c) Not increase risks to human health and safety and property damage;
- d) Maximize the extent and function of vegetative and pervious surfaces; and
- e) Promote stormwater management best practices, including stormwater attenuation and re-use, and low impact development."

The policies in the NOP on stormwater management should indicate that except in extenuating circumstances, proposals for development or redevelopment should provide for a low impact development approach to stormwater management which may include techniques such as rainwater harvesting, phosphorus reduction, constructed wetlands, bio-retention swales, green roofs, permeable surfaces, clean water collection systems, and the preservation and enhancement of native vegetation cover.

Recommendation 7: Section 3.2.7.1 of the Growth Plan (MMAH, 2017b) also contains extensive policies on stormwater management. In particular, Section 3.2.7.1 a) requires the following:

"Municipalities will develop stormwater master plans or equivalent for serviced settlement areas that: are informed by watershed planning or equivalent."

On this basis, the NOP will need to identify when stormwater management master plans are required for existing settlement areas and what the form of the supporting watershed plan or its 'equivalent' plan should be.

Recommendation 8: Section 3.2.7.2 of the Growth Plan (MMAH, 2017b) deals with stormwater management and proposals for large-scale development. In particular, Section 3.2.7.2 a) requires the following:

"Proposals for large-scale development proceeding by way of a secondary plan, plan of subdivision, vacant land plan of condominium or site plan will be supported

by a stormwater management plan or equivalent, that is informed by a subwatershed plan or equivalent".

Notwithstanding the use of the word 'equivalent' twice, the NOP will need to identify what is exactly required to support large-scale development proposals in accordance with this policy. It is noted that Section 4.2.1.4 of the Growth Plan (MMAH, 2017b) also contains a similar requirement. In addition to the above, it is recommended that the NOP include policies that establish the basis for the monitoring of the impacts of development on the water resource system.

Recommendation 9: Section 4.2.2.2 of the Growth Plan (MMAH, 2017b) deals with stormwater management and proposals for large scale development outside of settlement areas and states the following:

"Outside of settlement areas, proposals for large-scale development proceeding by way of plan of subdivision, vacant land plan of condominium or site plan may be permitted within a key hydrologic area where it is demonstrated that the hydrologic functions, including the quality and quantity of water, of these areas will be protected and, where possible, enhanced or restored through:

- a) The identification of planning, design, and construction practices and techniques;
- b) Meeting other criteria and direction set out in the applicable watershed planning or subwatershed plans; and
- c) Meeting any applicable provincial standards, guidelines, and procedures."

On the basis of the above, the NOP is required to include policies that set out what is required to support large-scale development proposals outside of settlement areas. In addition to the above, it is recommended that the NOP include policies that establish the basis for the monitoring of the impacts of development on the water resource system.

Recommendation 10: Section 3.1 of the Growth Plan (MMAH, 2017b) also indicates the following with respect to climate change:

"Climate change poses a serious challenge for maintaining existing infrastructure and planning for new infrastructure, however, vulnerability assessments can help to identify risks and options for enhancing resilience. Similarly, comprehensive stormwater management planning, including the use of appropriate low impact development and green infrastructure, can increase the resiliency of our communities".

Section 4.2.10.1 e) of the Growth Plan (MMAH, 2017b) also requires that upper tier municipalities develop policies:

"in their official plans to identify actions that will reduce greenhouse gas emissions and address climate change adaptation goals, aligned with other provincial plans

and policies for environmental protection - recognizing the importance of watershed planning for the protection of the quality and quantity of water and the identification and protection of hydrologic features and areas."

On the basis of the above, it is recommended that consideration be given to establishing a 'climate change lens' in the NOP as the approval authority on Planning Act applications and as a commenting agency to maximize resiliency of ecosystems and communities, manage the risks associated with climate change and provide sustainable natural environmental services for future generations of residents and visitors to the Region. In addition, the climate change lens should also be applied to the preparation of watershed and subwatershed plans.

Policy considerations include but are not limited to:

- a) Reduction of greenhouse gas emissions;
- b) Improvement of air quality;
- c) Promotion of compact form;
- d) Efforts to limit the dispersal of the population and travel times between housing, employment, and amenities and services;
- e) Use of green infrastructure;
- f) Promotion of design to maximize energy efficiency and conservation including consideration of the mitigating effects of vegetation, and maximize opportunities for the use of renewable and alternative energy sources and systems;
- g) Identification and mitigation of existing hazards which may be compounded or aggravated by climate change, including flood prone areas and wildland fire areas; and
- e) Identification of natural heritage features that have become more sensitive to development pressures due to climate change.

The implementation of the climate change lens may result in requiring resiliency measures such as:

- a) Improved floodplain mapping and increased restrictions for redevelopment of existing structures;
- b) Increased setbacks for development adjacent to wetlands, lakes, rivers, headwater areas and groundwater recharge areas;
- c) Retention of natural vegetation;
- d) Establishment of monitoring plans as a condition of development;
- e) More stringent requirements for stormwater management and flood abatement; and
- f) Provisions to increase the resilience of power and data grids.

Recommendation 11: Section 3.2.6.2 c) of the Growth Plan (MMAH, 2017b) states the following with respect to planning for sewage and water services:

"Municipal water and wastewater systems and private communal water and wastewater systems will be planned, designed, constructed, or expanded in accordance with the following: comprehensive water or wastewater master plan or equivalent, informed by watershed planning or equivalent has been prepared to:

- i. Demonstrate that the effluent discharges and water takings associated with the system will not negatively impact the quality and quantity of water;
- ii. Identify the preferred option for servicing growth and development, subject to the hierarchy of services provided in policies 1.6.6.2, 1.6.6.3, 1.6.6.4 and 1.6.6.5 of the PPS, 2014, which must not exceed the assimilative capacity of the effluent receivers and sustainable water supply for servicing, ecological, and other needs; and
- iii. Identify the full life cycle costs of the system and develop options to pay for these costs over the long-term."

On the basis of the above, policies will be required in the NOP that indicate that watershed planning or its equivalent is a foundational element supporting the development of master servicing plans. Given that public works are required to conform to an Official Plan in accordance with the Planning Act, this will be a key element of the Region's policy framework.

6.0 Watershed Planning Framework for Niagara Region

In support of the new Niagara Official Plan a watershed planning framework is required. This framework is intended to satisfy Provincial requirements and provide a practical outline of the scale of studies that should be completed as well as the roles and responsibilities of the Region, area municipalities, NPCA, and landowners.

The following framework, that includes three tertiary watershed (Lake Erie, Niagara River, Lake Ontario) and 9 quaternary watersheds is proposed for consideration by the Region and partner agencies. The quaternary watersheds can be further delineated into subwatersheds or management areas similar to those already established in previous 'watershed' type studies completed by NPCA or others. This is consistent with the MOECC and MNR (2018) definitions and approach.

Watershed planning is a multi-step, or phased, approach that is intended to inform land use planning and the preparation of management plans to assist in the protection of water quantity and quality. Several phases that achieve different goals of the overall framework can be accomplished as stand alone documents and plans or as part of an overall comprehensive plan. Recent provincial direction has made it clear that watershed planning is to inform land use planning, including the identification of areas for urban growth and development of master plans for water and wastewater infrastructure and corresponding stormwater management plans.

6.1 Considerations

Specific considerations for Niagara Region with respect to watershed planning framework are summarized below:

Tertiary Watersheds

Niagara Region encompasses three tertiary watershed planning areas. While there are commonalities across these watersheds, consideration should be given to developing separate watershed plans that will suitably inform land use planning based on the unique conditions within each tertiary watershed, and in consideration of provincial objectives for each of the water bodies into which the watersheds drain.

Quaternary Watersheds

Nine quaternary watersheds have been identified in Niagara Region, as defined by Provincial mapping (Figure 2-5); these meet the definition of subwatershed as defined by Conservation Ontario (2003). Quaternary watersheds should be prioritized for study and/or updates based on development pressures, and anticipated growth, since watershed planning is intended to inform land use planning.

To ensure that the quaternary watershed/subwatershed studies are completed in accordance with Provincial direction, and are of high quality, the Region should consider

developing a working group, including NPCA and Area Municipalities, as appropriate. This group would identify efficiencies and enable information sharing while also providing direction to the subwatershed study process. The working group would also oversee the implementation of recommendations from the subwatershed studies, and encourage an adaptive management process in response to review of monitoring results.

A sustainable cycle for watershed study updates should be determined, that considers the need for informed land use planning and the reality of budgetary constraints. Completion of several watershed plans/updates at once could result in an economy of effort. While there is cross-over and commonality between watersheds, cumulative effects and land use scenario assessments will need to reflect unique attributes and land uses of the watershed.

Cross-jurisdiction

Some quaternary watersheds within the Niagara cross into Haldimand County and City of Hamilton. Coordination with these municipalities is necessary for undertaking the watershed studies and in developing management strategies. It is recommended that proactive communication with the neighbouring municipalities be undertaken to ensure a coordinated timeline for completing any watershed plan studies or updates will occur.

Cross-jurisdiction watershed planning also occurs within Niagara Region in those cases where watersheds cross into multiple area municipalities. Coordination between area municipalities should be facilitated by the Region to ensure that watershed planning studies are undertaken in a timely manner to inform land use planning.

Cross-jurisdiction watershed planning also occurs related to Canada-Ontario agreements and Canada – U.S. agreements when considering targets and objectives for the Great Lakes and Niagara River (e.g., phosphorus reductions). This requires provincial and federal level of support and coordination.

6.2 Hierarchy of Responsibility

The 2014 PPS is clear in the direction it provides to upper tier municipalities. This includes a coordinated, integrated and comprehensive approach should be used when dealing with planning matters within municipalities, across lower, single and/or upper-tier municipal boundaries, and with other orders of government, agencies and boards.

Watershed Plans

Conservation Ontario (2003) suggests that watershed plans:

“typically cover large areas (1,000 km² or more) and correspond to the drainage basins of major rivers such as the Thames, Credit, Grand or Humber. They contain goals, objectives and targets for the entire watershed and document both

environmental resources and environmental problems. They also provide watershed-wide policy and direction for protecting surface and groundwater, natural features, fisheries, open space systems, terrestrial and aquatic habitats and other factors. Where resources are degraded, watershed plans address restoration needs. Watershed plans typically include both implementation plans (specifying who will do what by when) and monitoring plans (describing how monitoring of the watershed and reporting is to take place).”

Using this definition, it is clear that the Region would be responsible for completing Tertiary Watershed studies (Lake Ontario, Lake Erie, Niagara River) (See **Table 2-1**). The Welland River (993 km²) also meets the definition and is the dominant watercourse in the Niagara River tertiary watershed; coordination with Hamilton Region is necessary since the Welland River originates in that region.

Although there may be similarity in land use and physiography within the region, the tertiary watersheds discharge into different water bodies; each of these water bodies differs in provincial or federal management strategy.

Subwatershed Plans

Subwatershed studies and plans often are suitable to refine assessments, targets and objectives of watershed planning for smaller drainage areas within a watershed (see definition in **Section 2.2**). Conservation Ontario (2003) suggest that:

“The area covered by a subwatershed is typically in the range of 50 to 200 km². At this smaller scale, there is enhanced detail that allows local environmental issues to be addressed. Subwatershed Plans contain goals, objectives and targets for management of the subwatershed. They also:

- identify the form, function and linkages of the natural system (including surface and groundwater, aquatic and terrestrial habitats, fisheries and wildlife communities, soils and stream morphology);
- identify environmentally sensitive or hazard lands;
- identify existing and proposed land uses;
- identify areas where development may be permitted;
- provide direction for Best Management Practices (e.g., for agriculture, aggregate extraction, development servicing, woodlots, etc.);
- provide direction and consistency for approval of development for municipalities;
- address cumulative impacts of changes on the natural environment; and
- include both implementation and monitoring plans.

Subwatershed plans are tailored to address specific subwatershed issues and local municipal concerns. The plan for a highly urbanized subwatershed may differ markedly from that for a rural area, reflecting the different environmental conditions and stresses between the two.

Recommendations contained in subwatershed plans may be included in official plans, secondary plans, growth management strategies, or other municipal planning mechanisms.”

Based on the Conservation Ontario (2003) definition, the size of most of the quaternary watersheds in the Region that drain directly into Lake Ontario or Lake Erie (see **Table 2-1**) would meet the subwatershed definition and should be considered as such, for planning purposes and therefore also meets the recommended responsibility designation to area municipalities. That is, unlike most areas in Southern Ontario, Niagara Region straddles multiple tertiary watersheds each of which include multiple quaternary watersheds, by definition (i.e., that drain directly into a larger waterbody). Given the, potential to undertake both quaternary watershed and subwatershed planning concurrently, area municipalities, rather than the Region, should be responsible for study initiation.

Roles and Responsibilities

The roles and responsibilities are based on new provincial direction, best practices, and the agency best suited to complete the work. In general, watershed planning responsibilities are as follows and outlined in **Figure 6-1**. :

Niagara Region – overall watershed planning to identify potential areas for urban growth and to identify management strategies that protect and/or enhance the natural heritage system and water resource system, while managing natural resources to support human population and economic growth. Coordination with City of Hamilton will need to occur for any tertiary watersheds that originate outside of Niagara Region. The region may also assist area municipalities with coordination of any quaternary watershed or subwatershed planning studies that originates outside of Niagara Region (e.g., Red Hill and 40 Mile Creek, Twenty Mile Creek) or are.

Area Municipality – for every quaternary watershed or subwatershed whose streams originate within the municipality’s area of jurisdiction, the municipality will be responsible for subwatershed planning and geographically scoped studies; this will define issues, constraints and opportunities, establish goals, objectives and targets, and undertake technical studies to accommodate existing and future development while protecting and/or enhancing the natural heritage system and water resource system, to manage natural resources that support human population and economic growth. Niagara Region should be a participant in all quaternary watershed/subwatershed studies and provide high level oversight to ensure that the studies fulfill all requirements and meet a common standard within the Region. Coordination with all municipalities that have jurisdiction within the same quaternary watershed should occur. Coordination with City of Hamilton will

need to occur for those watersheds that originate outside of Niagara Region (e.g., Red Hill and 40 Mile Creek, Twenty Mile Creek)

Niagara Peninsula Conservation Authority – The mandate of the NPCA as prescribed by the Conservation Authorities Act and referenced in its most recent strategic plan is to “establish and undertake programs and services, on a watershed basis, to further the conservation, restoration, development, and management of natural resources”. NPCA has historically led most of the watershed planning initiatives, has established various monitoring programs, and has developed an understanding of watershed health as documented in Watershed Report Cards and annual Water Quality reports. Furthermore, NPCA has a strong tradition of successfully partnering with the Region and Area Municipalities on water management issues. It is anticipated that the NPCA will continue to provide resources and technical expertise to the watershed planning process at both the watershed and subwatershed scale, as appropriate.

Landowner – site specific studies or plans for proposed development

It is relevant to keep in mind that while there may be a hierarchy of responsibility, the various studies require multi-stakeholder collaboration. This is necessary to support full integration of studies and provincial interests into overall watershed management plans and to fulfill stakeholder and public engagement requirements of the watershed planning process.

6.3 Sequence of Implementation

The ideal logical sequence of watershed planning is reflected in **Figure 6-1**. The trigger for study initiation is most often related to urban growth (i.e., to inform land use planning). In this regard, the type of study that is initiated should be appropriate for the scale of planning. For example, determining location of designated greenfield development should be informed by results of quaternary watershed/subwatershed planning studies. Once designated, geographically scoped studies are undertaken for the greenfield development areas, to develop general constraints/opportunities for development (e.g., subwatershed studies, secondary plans, water and wastewater plans, etc.) or specific constraints/opportunities for sites (e.g., EIS, stormwater management plan, etc.).

Although subwatershed studies should inform secondary plan studies, they often occur concurrently in some municipalities due to the aggressive timeline required to meet growth targets; development of a water and wastewater master plan may likewise occur concurrently. When concurrent studies are undertaken, integration of the relevant study teams is necessary.

A timeline for initiating watershed studies/updates should be informed by projections of future growth and prioritize those watersheds which are anticipated to experience the most greenfield development. Likewise, watershed prioritization should consider the timeline of

growth and thus the timeline for watershed planning information to be available for land use planning. There may be some economy of effort by completing studies for adjacent watersheds.

For those watersheds in which a watershed study has not been completed, or is outdated, even when minimal urban growth is anticipated, a watershed study is still warranted. In these situations, a watershed or subwatershed study provides an overview of existing conditions and enables identification of management actions that could be implemented to enhance existing (i.e., deteriorated) conditions, especially if these compromise the health of the watershed or any matters of provincial interest (e.g., aquatic habitat, Species at Risk habitat, etc.). Once the watershed or subwatershed studies are completed, then updates to Official Plans are undertaken to advance the implementation of best management practices and environmental restoration.

The general triggers and the potential for concurrent studies is provided in **Figure 6-1** and **Table 6-2**. The timeline for implementation is provided in **Figure 6-2**.

Given the status of watershed planning and the timeline for the new Niagara Official Plan, it is recommended that the Region initiate tertiary watershed plans or equivalent. This plan would draw on existing information that is available that would lead to the identification and prioritization for quaternary watershed/subwatershed studies, with consideration of the Region's growth plans. This would also identify watersheds and subwatersheds for priority restoration through various initiatives to be undertaken at both regional and municipal levels (e.g., phosphorus reduction in surface water). Findings from the tertiary watershed plan would inform the new Niagara Official Plan.

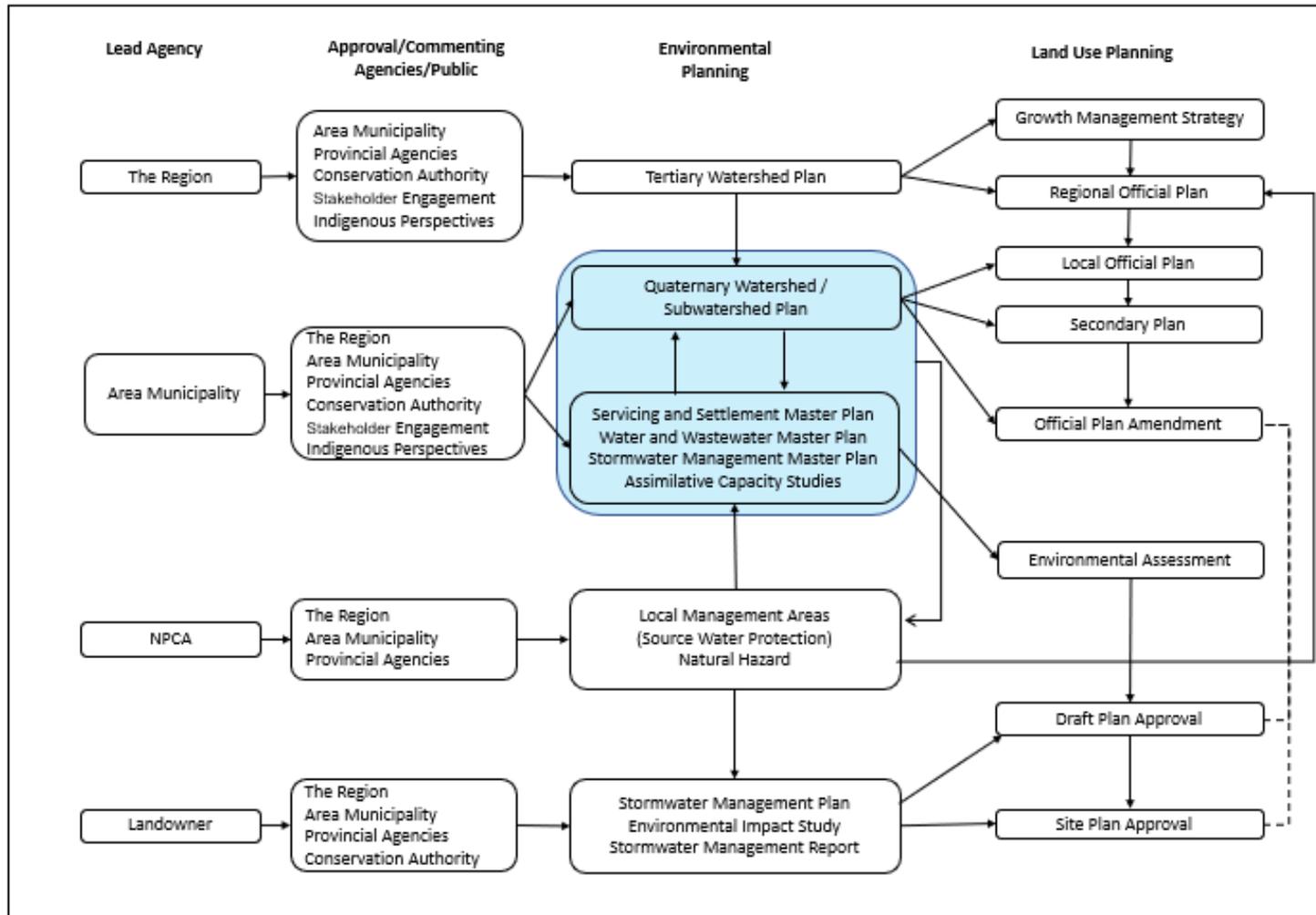
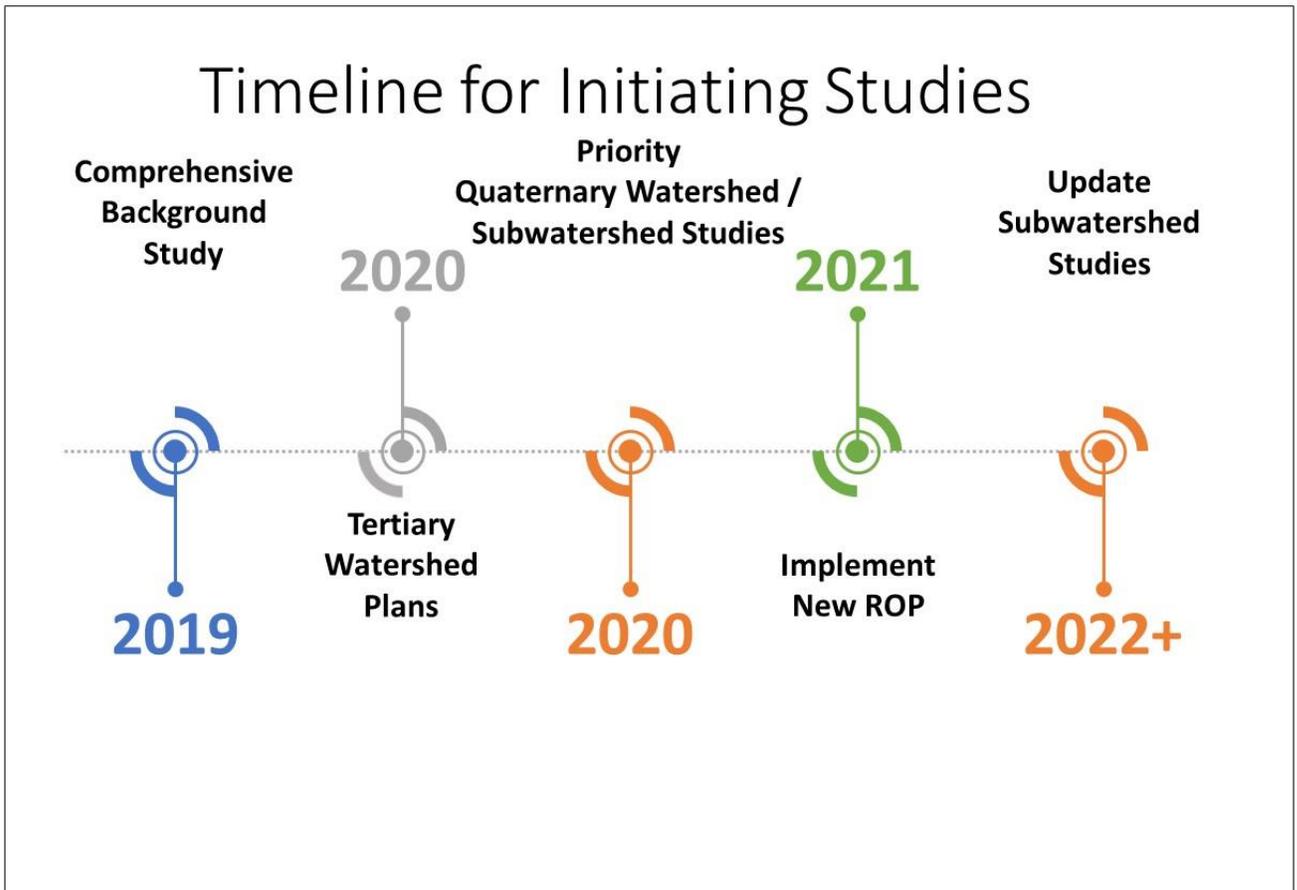


Figure 6-1. Watershed and municipal planning sequence (adapted from OMOE, 2003)

Table 6-1. Implementation schedule and study triggers

Reports / Studies	Lead Agency	Trigger for Study Initiation	Time to Complete	Notes
Tertiary Watershed	Region	<ul style="list-style-type: none"> • Regional Official Plan Review • Urban growth • Watershed condition assessment and development of restoration strategies 	2 years	
Quaternary Watershed/ Subwatershed Studies/Update	Area Municipality	<ul style="list-style-type: none"> • Local Official Plan Review • Urban growth • Typically after tertiary watershed plan completion • Most recent quaternary watershed/subwatershed studies are more than 10 years old • Watershed condition assessment and development of restoration strategies to enhance existing conditions and/or ecological services (e.g., assimilative capacity of receiving water bodies/courses). 	2 – 10 years	<p>This suite of studies could be undertaken as part of the same planning process to inform planning for designated greenfield development and future growth areas.</p> <p>Studies to assess infrastructure capacity and servicing potential should be undertaken to identify deficiencies and to plan for enhancements to accommodate future growth.</p>
Servicing and Settlement Master Plan	Area Municipality	<ul style="list-style-type: none"> • Urban Growth • concurrent with, or in lieu of, a subwatershed study 	3 years	
Assimilative Capacity Study	Region/ Area Municipality	<ul style="list-style-type: none"> • Urban Growth – assessment of capacity to accommodate growth at existing WWTP and/or identify constraints for new WWTP • Assessment of existing WWTP effluent effects and prioritization of WWTP upgrades along degraded watercourses 	2 years	
Technical Reports for Natural Hazard Identification	NPCA	<ul style="list-style-type: none"> • Urban Growth, in support of Secondary Plan and Site Plan 	2 years	

Reports / Studies	Lead Agency	Trigger for Study Initiation	Time to Complete	Notes
Regional Master Servicing Plans	Region	<ul style="list-style-type: none"> Upon completion of watershed plan and identification of growth area. 	2 years	
Water and Wastewater Management Plan	Area Municipality	<ul style="list-style-type: none"> Concurrent with, or after, secondary plan study 	2 years	
Stormwater Management Plan	Area Municipality	<ul style="list-style-type: none"> Concurrent with, or after secondary plan 	1 year	



Adapted from OMOE, 2003

Figure 6-2. Suggested implementation timeline

7.0 Conclusions and Summary of Recommendations

Niagara Region is developing a new Niagara Official Plan. The Province has provided clear direction that land use planning needs to be informed by watershed planning. The Province has provided direction for undertaking watershed planning through a Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018). The guideline document provides an overview of the elements necessary to complete watershed plans, including modeling of different land use and climate change scenarios to inform land use planning and watershed management that maintains or enhances existing natural environment and water resource systems.

Recognizing that documentation exists in many areas that address some, or all, of the required watershed planning elements, existing documents may satisfy the ‘equivalency’ provision of the Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018). Review and analyses of existing documents was completed to assess their equivalency to the watershed planning requirements outlined in the Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018) results generally indicated the following:

- Watershed plans do not exist for six (6) NPCA “watershed” areas.
- Most existing watershed plans are 10-15 years old and do not fulfill contemporary watershed planning requirements.
- The focus of existing watershed plans has been on natural environment restoration through restoration initiatives. This differs from management strategies to mitigate issues caused by land use practices as outlined in the Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018).
- Effective engagement is generally represented in all studies completed within Niagara Region.
- Existing conditions characterization is generally complete for all watersheds, delineation of natural hazards (e.g., flooding, erosion, shoreline) is available from NPCA.
- Water balance studies have been completed for nearly all watersheds; water conservation plans have not been developed.
- Assessment of cumulative effects or impacts of land use scenarios and management strategies have not been completed.
- Climate change impacts have been identified on a regional basis; implications for land use scenarios and management strategies has generally not been completed.
- Studies pertaining to source water protection provide watershed planning level insight into each of the watersheds.

While it is clear that some elements of watershed planning are addressed in existing documentation, there are gaps that will need to be addressed in future studies.

A framework for watershed planning has been provided that considers the range of watershed planning studies and documentation that is necessary to support land use planning in Niagara Region. This includes identification of the implementation lead and general recommendations for implementation.

7.1 Recommendations to Address Gaps in Existing Documentation

No.	Recommendation	Supporting Justification
1.	Develop framework for watershed study initiation and/or updates (See Section 6.4 for further discussion)	4.3.1.3 Watershed Coverage
2.	Assign name to the unnamed tributary watershed areas. Consider whether a public consultation process is necessary	2.2 Watershed Delineation and Characterization
3.	<p>Establish a working group, led by the Region and including, but not limited to, NPCA and Area Municipalities, to coordinate and resource watershed and subwatershed study updates as well as the monitoring programs that feed into them. The working group would prioritize watershed and subwatersheds for study/updates, undertake multi-stakeholder coordination, cross-jurisdictional coordination, and financial resourcing of studies (e.g., funding applications, developing funding mechanisms within region).</p> <p>The group could establish standards for subwatershed studies, and follow up regarding recommendation implementation, monitoring outcomes, and adaptive management.</p> <p>The working group should ensure that study findings are used in an adaptive management manner to enhance watershed management strategies to fulfill watershed planning objectives.</p>	<p>2.8 Monitoring and Adaptive Management</p> <p>4.3.1.1 Age of Watershed Plan</p> <p>4.3.2 Overview of Watershed Planning Elements: Planning element 8.0 (Monitoring and Adaptive Management)</p> <p>4.4 Planning for Future Growth</p> <p>See Recommendation 4 below</p>
4.	Priority assignment for each new/update study should be based on anticipated development pressure to inform land use planning and associated studies, on watershed conditions that would benefit from environmental management actions, and on age of previous study (if present; studies older than 10 years should be updated).	<p>4.3.1.1 Age of Watershed Plan</p> <p>4.3.1.3 Watershed Coverage</p> <p>4.3.2 Overview of Watershed Planning Elements: Planning</p>

	<p>Maintain a list of new watersheds or subwatershed studies that are required, and existing “watershed” studies that should be updated (e.g., studies that are more than 10 years old).</p> <p>Identification of the priority watersheds could occur as part of an equivalency study and should consider what is necessary to inform the new OP, and what needs to be done to inform subsequent growth and infrastructure decisions (e.g., secondary planning etc.).</p> <p>As funding becomes available, then the priority watershed/subwatershed studies would be initiated.</p>	<p>element 7.2 (Informing Land Use Planning & Decision Making)</p> <p>4.4 Planning for Future Growth</p> <p>See Recommendations in Section 7. 3</p>
5.	<p>Establish an engagement process for any watershed plan updates. This would include stakeholder groups, technical experts, and provide opportunity for public input. Transparency of the watershed planning process will provide certainty to the public and provide efficiencies for those updating watershed studies.</p>	<p>4.1 Watershed Planning Elements</p> <p>4.3.2 Overview of Watershed Planning Elements: Planning element 3.1 and 3.2 (Effective Engagement Committees, Partnering with Indigenous Communities)</p>
6.	<p>Complete watershed study updates to review progress towards achieving targets and objectives outlined in relevant reports.</p>	<p>4.3.2 Overview of Watershed Planning Elements: Planning element 8.0 (Monitoring and Adaptive Management)</p>
7.	<p>Include implementation schedule and estimated financial resources in future subwatershed plans or updates.</p>	<p>4.3.2 Overview of Watershed Planning Elements: Planning element 7.3 (Implementing the Watershed & Subwatershed Plan)</p>
8.	<p>Complete a tertiary scale watershed characterization study to identify overall conditions and enable development of management strategies to address federal and provincial policies, acts, and agreements, especially as these relate to international considerations (e.g., Niagara River, Great Lakes). This could be undertaken as part of an equivalency study to inform the new Niagara Official Plan.</p>	<p>4.3.1.2 Watershed Study Content</p> <p>4.3.1.4 Region Focus</p> <p>6.2 Hierarchy of Responsibility</p>

		See Recommendations in Section 7.3
9.	Carry out supplemental studies to address gaps in existing (tertiary) watershed understanding.	4.3.1.2 Watershed Study Content 4.3.2 Overview of Watershed Planning Elements
10.	Consider developing a repository for studies and mapping that support watershed planning. Such a repository, at the Region, could facilitate cross-jurisdictional planning and management, especially of the natural heritage and water resource systems	2.9 Monitoring and Adaptive Management 4.3.1.5 Monitoring 4.5.3 GIS database
11.	Establish mapping of all monitoring station locations, and a database that provides background of parameters measures, years of operation etc. This could be undertaken at the tertiary planning level.	4.5.1.2 water resource mapping 4.5.1.5 Monitoring and Databases
12.	Complete modelling of future land use changes on a regional scale in order to assess the impact on the water resources system and to support the development of best management recommendations.	4.3.1.6 Watershed Modelling
13.	Ensure full integration of any updated studies into the Water Resource System mapping to support land use planning and the protection of water supply and quality, and to support monitoring and adaptive management. Likewise, integration with the agricultural system is recommended.	2.9 Monitoring and Adaptive Management 4.3.1.5 Monitoring 6.2 Hierarchy of Responsibility
14.	For any future subwatershed study, gaps in existing condition characterization should be addressed to inform land use planning and could be undertaken through smaller scale studies (e.g., secondary plans) to assist with defining settlement boundary expansion areas.	4.3.2 Overview of Watershed Planning Elements: Planning element 4.3 (Existing Conditions Characterization)
15.	Review/update/develop vision, objectives, goals, and targets in tertiary watershed plans to ensure that they capture Provincial requirements regarding the water resource system. Additional objectives and goals would	4.3.2 Overview of Watershed Planning Elements: Planning element 5.1 (Vision,

	be identified through completion of other watershed planning elements. Refinement of the vision, goals and targets would occur on a quaternary watershed/ subwatershed basis, to address unique conditions and land use that is characteristic of the quaternary watershed.	Objectives, Goals and Targets)
16.	Complete water budget assessment of unrepresented watershed planning areas. Water conservation plans should be developed, in collaboration with municipalities, to support land use planning and promote a reduction in water resource; such plans could be included in water and wastewater master plans or stormwater management plans.	4.3.2 Overview of Watershed Planning Elements: Planning element 6.1 (Water Quantity, Budget & Water Conservation Plans)
17.	Complete assimilative capacity studies to support WWTP planning	4.3.2 Overview of Watershed Planning Elements: Planning element 6.2 (Water Quality and Nutrient Load Assessments)
18.	Assessment of natural hazards should be included in watershed update studies (e.g., include review of number of buildings in flood hazard areas etc.). This would include NPCA floodline mapping and erosion hazard delineation; both could be considered for inclusion in the water resource system mapping. Delineation of natural hazard areas is necessary to inform land use planning and is typically confirmed/refined during secondary plans. Natural hazard delineation must consider future implications of climate change and develop management strategies (e.g., flood forecast warning etc.).	4.3.2 Overview of Watershed Planning Elements: Planning element 6.3 (Natural Hazards in Watershed Planning and Subwatershed Plans)
19.	Climate change impacts should be considered in watershed plan updates, when considering different land use scenarios. Results will provide insight into potential management and/or mitigative measures that should be considered in future land use planning. Specifically, the impacts should be considered in terms how climate change will affect watershed systems. Climate change adaptation planning relies on development of local climate projections that can be used as inputs to local hydrological and ecological	4.3.2 Overview of Watershed Planning Elements: Planning element 6.4 (Climate Change)

	<p>models to examine watershed responses. The hydrologic and ecological models enable assessments of cumulative impacts from stressors such as climate change coupled with urbanization, water taking activities, dam and reservoir operations and point and non-point source pollution. This information also assists in developing an understanding of watershed vulnerabilities to flooding, erosion, heat stress and ecosystem degradation.</p> <p>Information necessary for climate change planning could include climate projections (precipitation, temperature, evaporation, ice cover/snow melt, extreme weather) to assess flood and drought response of surface water, and groundwater. A climate change study could also advance the understanding of agricultural-based sensitivity to climate variability and longer term change in water quantity. That is, the capacity of the agricultural systems to adapt to changing climate and weather conditions has implications for the economic and social conditions within the watershed.</p> <p>In Phase 2 of watershed planning (See Section 2.0), the extreme and average conditions can be modeled with the land use planning scenarios to assess effects and identify potential management and mitigation scenarios. Those results would enable a better understanding of vulnerabilities and risk.</p>	
20.	Awareness of connections and linkage between the natural heritage system and water resource system should be identified in watershed updates to identify appropriate land use planning constraints.	4.3.2 Overview of Watershed Planning Elements: Planning element 6.5 (Connections to Natural System)
21.	Review of targets, especially in the context of ecological services provided by the natural system, and their potential to mitigate climate change, should be undertaken in watershed plans. Such review could be considered at the Regional level.	4.3.2 Overview of Watershed Planning Elements: Planning element 6.5 (Connections to Natural System)
22.	Cumulative effects assessments should be completed at the watershed and subwatershed scale to support land use planning. Cumulative impacts can be assessed by simulating various land use scenarios and evaluating their respective impact and the benefits of	2.9 Monitoring and Adaptive Management 4.3.2 Overview of Watershed Planning Elements:

	various mitigation measures. As part of adaptive management, any land development that is approved, should be fed back into the model to assist with measuring cumulative effects.	Planning element 6.6 (Cumulative Effects Assessment)
23.	Assessment of different land use and management scenarios may be beneficial to identify suitable areas of growth. This is most relevant to identifying impacts of future growth and servicing options and mitigation measures (modeling of land use and management scenarios should examine effect on water quality, surface water quantity).	4.3.2 Overview of Watershed Planning Elements: Planning element 6.7 (Assessment of Land Use & Management Scenarios) 4.4 Planning for Future Growth
24.	<p>Regularly assess the coverage of the existing/ongoing water quality monitoring programs (NPCA, Provincial, other) in terms of their ability to characterize water quality conditions in the watershed against watershed management plan objectives. If gaps exist between existing/ongoing monitoring efforts and the ability of monitoring data to evaluate watershed management plan objectives, then new/additional monitoring initiatives should be implemented.</p> <p>Any new monitoring initiatives should build upon existing monitoring program</p> <p>Results of monitoring activity needs to be reviewed and used to assess the effectiveness of management strategies in achieving watershed/subwatershed objectives. This review is a necessary part of the adaptive management cycle; findings will enable assessment of the effectiveness of management strategies and inform future management strategies.</p>	2.9 Monitoring and Adaptive Management 4.3.1.5 Monitoring
25.	Monitoring efforts should be carried out to quantify the impact of all future management decisions on the water resources system. Monitoring programs should evaluate how the water resources system is functioning against specific, measurable, achievable, relevant and time-bound targets developed at a Regional scale.	2.9 Monitoring and Adaptive Management 4.3.1.5 Watershed Monitoring
26.	Review, document and evaluate (ongoing, emerging) trends in monitored water quality parameters reported annually by NPCA (as part of their Water Quality	2.9 Monitoring and Adaptive Management

	Reports) and at any other monitoring stations. Review existing water quality monitoring program results periodically to determine ongoing or emerging trends in water quality characteristics. Results should be compared against watershed management plan objectives, and incorporated into adaptive management strategies. The adaptive management program should be prepared/refined to best ensure that the objectives of the watershed management plans are fulfilled.	4.3.1.5 Monitoring
27.	Consider establishing databases and/or monitoring programs to document conditions in the Region for future reference. This could include septic beds (locations and conditions), stormwater management ponds (locations and conditions).	2.9 Monitoring and Adaptive Management 4.3.1.5 Monitoring 4.5.1.2 requirements for natural environment work program
28.	Develop an implementation plan, as part of the watershed plan (see Section 2.7), that will: <ul style="list-style-type: none"> • Develop an implementation schedule for meeting targets; • Develop monitoring components to track and evaluate progress; • Identify technical, financial, and human resource requirements; • Implement management actions developed through each of the seven elements of watershed planning (Section 2.7); • Prepare annual workplans based on the implementation schedule, monitoring components, resources required and management actions; and • Prepare report of results and adjust implementation plan as necessary 	6.2.2. Subwatershed Plan

7.2 Recommendations for Natural Environment Work Plan

The following are recommendations related to watershed planning that that have been integrated into the Natural Environment Work Program that is being undertaken in support of the new Niagara Official Plan, or that can be included in future tertiary planning studies.

No.	Recommendation	Supporting Justification
29.	Develop integrated water resource system mapping (e.g., including Key Hydrologic Areas, Key Hydrologic	4.3.2 Overview of Watershed Planning

	Features) on a regional scale that includes all elements necessary to addresses Provincial requirements to create a sound basis for watershed planning (See Section 2.4 and 2.4.1). This can be based on existing information available in background reports; options for the identification of the water resource system will be proposed in the next phase of the Natural Environment Work Program.	Elements: Planning element 4.2 (Water Resource System)
30.	Expand the Contemporary Mapping of Watercourses to include all aspects of the Water Resources System identified in Section 2.4 as appropriate	4.5.2 Water Resources System (WRS) Mapping
31.	Create new mapping to identify Key Hydrological Areas and Key Hydrological Features (Options for mapping these components will be determined through the next phase of the Natural Environment Work Program)	4.5.2 Water Resource System (WRS) Mapping
32.	All existing mapping available and reviewed as part of the background phase of the Natural Environment Work Program should support the identification and evaluation of options of the Regional natural systems and conform to Provincial requirements.	4.5.2 Water Resource System (WRS) Mapping
33.	Seasonal water resource features should be included in mapping efforts. Since occurrence of some water resource system components (e.g., seepage, karst) requires field observations to confirm presence, consideration should be given, instead, to mapping zones by likely occurrence; future field assessments would confirm occurrence and identify specific locations of observation.	4.5.2 Water Resource System (WRS) Mapping
34.	When features that have been inferred are mapped, or zones of likely occurrence are illustrated, then the mapping must include clear explanation of the intended use of clear definition of the intended use of the mapping should be stated to ensure appropriate use and application of the data.	4.5.2 Water Resource System (WRS) Mapping
35.	Consider mapping of anthropogenic influences such as tile drains and irrigation ponds, as these affect the water resource system and should be considered in watershed planning and assessment of cumulative impacts.	4.5.2 Water Resource System (WRS) Mapping

		2.0 Watershed Planning Overview 6.2 Hierarchy of Responsibility
36.	Develop a GIS database, to be managed by the Region (with input from agency partners) to assist with the compilation and organization of background mapping data. The database would identify data sources and include assessment scale to ensure appropriate application of data. The database could include a portal/website link to relevant documents.	4.5.3 GIS Database
37.	Comprehensive floodplain mapping within the Region is required in order to determine the extent of natural hazards due to flooding. Existing floodplain mapping is available from the NPCA in many watersheds. Where floodplain mapping is unavailable/outdated, then a request should be made to the NPCA to develop/update floodplain mapping.	4.5.4 Natural Hazards
38.	Comprehensive channel corridor/erosion hazard mapping is required within the Region in order to determine the extent of natural hazards due to erosion. Mapping of slope hazards is typically available from NPCA or can be produced through GIS analyses. The limits of erosion hazard mapping, from NPCA, reflected at the regional scale would require refinement based updated site specific study.	4.5.4 Natural Hazards

7.3 Recommendations for New Niagara Official Plan

Recommendations have been identified for consideration to inform the new Niagara Official Plan. These are outlined in the table below.

No.	Recommendation	Supporting Justification
39.	Develop clear definition, and consistency with respect to terminology, delineation and designation of watershed and subwatershed areas. This will require consultation between the Region, Area Municipalities, and NPCA. Where geographical areas rather than drainage divides are used, then appropriate terminology should be assigned to avoid confusion.	4.3.2 Overview of Watershed Planning Elements: Planning element 4.1 (Watershed Delineation)

		4.5.1 Watershed Delineation See Recommendation in 7.2
40.	An overview of tertiary watershed scale characterization should be carried out to identify existing conditions and to define overall management objectives and targets that could inform the new NOP. The tertiary watershed scale study would satisfy Provincial plans and policies and include a scoped cumulative effects assessment, land use and management considerations, and climate change scenarios).	4.6.1.1 Watershed Delineation and Characterization
41.	Complete a high level assessment to identify if there are key hydrologic areas, features or functions which support the Natural Heritage System that could result in the identification of Linkages, potential enhancement opportunities, or potential additional constraints for land use planning and/or urban development.	4.6.1.3
42.	Ensure that quaternary watershed plans are prioritized based on anticipated future growth areas, and are completed in a timely manner to inform land use planning within them.	4.4 Planning for Future Growth 4.6.1.5
43.	An update to the equivalency assessment completed in this discussion paper may occur as a result of the work completed for a tertiary watershed level study, to inform the new Niagara Official Plan. Identified gaps may need to be addressed at the quaternary watershed and subwatershed level.	4.6.1.4 Consideration of Equivalency Assessment 4.3.3 Overall Summary
44.	Establishment of an inter-departmental regional working group to identify priorities and coordinate watershed planning studies/updates should be considered. This would allow integration of different disciplines and could facilitate a streamlined approach and conformity to watershed studies within the region. The working group would ensure that regional information necessary to inform growth planning and infrastructure development remains current.	See Recommendation in 7.1

8.0 References

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Appendix 1: Overview of Relevant Acts, Policies, and Guidelines

Appendix 1: Overview of Relevant Acts, Policies, and Guidelines

1. Clean Water Act, 2006 & Source Protection Plans

- The Act safeguards human health and the environment through a multi-barrier approach to protection of drinking water at the source. Source protection plans are a requirement under the Act, and identify areas where an activity is or would be significant drinking water threat, through assessment reports, and then provide policies and approaches to protect against significant drinking water threats.

2. Niagara River Remedial Action Plan (RAP), 1993

- The Niagara River was identified as an Area of Concern in the Great Lakes Basin due to degraded water quality which impairs complete use of the river's resources. In response to these concerns, the RAP was developed by scientists from Ontario and Canada environment and resource agencies with the assistance of a Public Advisory Committee. The RAP includes current conditions and concerns, remedial activities and goals, and evaluation of these measures.

3. Niagara River Toxics Management Plan

- The NRTMP outlines a series of actions to be undertaken by the Four Parties (Environment and Climate Change Canada (ECCC), United States Environmental Protection Agency (USEPA), Ontario Ministry of Environment, Conservation, and Parks (MECP), and New York Department of Environmental Conservation (NYSDEC)), including reduce toxic loadings from direct and indirect discharges, conduct research and monitoring to learn more about the water quality of the river, coordinate methodologies for identifying, quantifying and assessing toxic loadings, and communicate progress to the public.

4. Lake Ontario Lakewide Action and Management Plan (LAMP)

- The Lake Ontario LAMP is a binational ecosystem-based management strategy for protecting and restoring the water quality of Lake Ontario including the connecting Niagara River and St. Lawrence River to the international boundary. The LAMP is developed and implemented by the Lake Ontario Partnership, which is led by the U.S. Environmental Protection Agency and Environment and Climate Change Canada, and which facilitates information sharing, sets priorities, and assists in coordinating binational environmental protection and restoration activities.

5. Lake Erie Lakewide Action and Management Plan (LAMP)

- The Lake Erie LAMP is a binational ecosystem-based management strategy for protecting and restoring the water quality of Lake Erie, the St. Clair River, Lake St. Clair, and the Detroit River. The LAMP is developed and implemented by the Lake Erie Partnership, which is led by the U.S. Environmental Protection Agency and Environment and Climate Change Canada, and which facilitates information sharing, sets priorities, and assists in coordinating binational environmental protection and restoration activities

- 6. Canada-United States Great Lakes Water Quality Agreement, 2012**
 - a. Commits Canada and the United States to coordination of actions to restore the chemical, physical, and biological integrity of the waters of the Greta Lakes basin.
- 7. Canada-Ontario Agreement on Great Lakes Water Quality & Ecosystem Health, 2014**
 - a. Agreement between the governments of Canada and Ontario to support the restoration and protection of the Great Lakes basin ecosystem. The 2014 Agreement builds on previous COAs and helps the province in meeting commitments under the Great Lakes Water Quality Agreement.
- 8. Proposed Canada-Ontario Action Plan for Lake Erie**
 - a. Supports goals between the Canada and the Unites States to reduce phosphorus loadings and improve water quality and ecosystem health in Lake Erie.
- 9. Great Lakes Protection Act, 2015 (Bill 66) & Ontario's Great Lakes Strategy**
 - a. The Act provides a framework to protect and restore the health of the Great Lakes-St. Lawrence River basin. The Act provides for establishment of the Great Lakes Guardians' Council and maintenance of Ontario's Great Lakes Strategy. The Strategy provides direction on actions to restore Great Lakes water, beaches, and coastal areas through strategies to conserve biodiversity, deal with invasive species, and address climate change.
- 10. Water Opportunities Act, 2010**
 - a. The Act enables the Minister of Environment & Climate Change to establish aspirational targets with respect to the conservation of water.
- 11. Ontario's Climate Change Strategy (2015) & Action Plan (2016)**
 - a. Building on MOECC's *Climate Ready: Adaptation Strategy and Action Plan 2011-2014*, which outlines actions to mitigate climate change and reduce greenhouse gas emissions, the Strategy has a goal to reduce greenhouse gas emissions to 80% below 1990 levels by 2050, and build a prosperous low-carbon economy. The Strategy was followed by *Ontario's five-year Climate Change Action Plan*, which aims to fight climate change, reduce greenhouse gas pollution and transition to a low-carbon economy over the long term.
- 12. Biodiversity: It's in Our Nature 2012-2020**
 - a. The strategy is the provincial government's action plan for conserving biodiversity.
- 13. Ontario's Biodiversity Strategy**
 - a. Provides the framework for coordinating conservation of the province's biological diversity over 10 years.
- 14. Municipal Class Environmental Assessment Process**
 - a. The *Ontario Environmental Assessment Act* provides for protection, conservation, and wise use and management of the environment by setting out a decision-making process to address potential effects of municipal infrastructure projects. The Process enables the planning of

municipal infrastructure to be undertaken in accordance with an approved procedure designed to protect the environment.

15. Environmental Bill of Rights

- a. Proclaimed in 1994, the Bill aims to protect, conserve, and restore the natural environment and to protect the rights of the people of Ontario to a healthful environment through means provided in the Act.

16. Stormwater Pollution Prevention Handbook

- a. Provides practical assistance to municipalities in implementing pollution prevention and flow reduction programs related to stormwater runoff and combined sewer overflow.

17. Stormwater Management Planning & Design Manual (MOECC, 2003)

- a. Provides direction with regard to environmental planning, environmental design criteria, stormwater management plan design infill development, operations, and capital costs.

18. Green Book & Blue Book

- a. The Green Book (MOECC, 1994a) provides guidance with regard to deriving effluent requirements and deriving receiving water based effluent requirements. The Blue Book (MOECC, 1994b) provides direction with regard to managing the quality and quantity of both surface and ground waters, and provides Provincial Water Quality Objectives.

19. Permit to Take Water Manual

- a. Provides an introduction outlining common instances of water taking, highlights the principles of the PTTW program, and provides classifications and considerations for permits.

20. Far North Act, Land Use Planning Initiative & Strategy

- a. Provides a framework for joint land use planning between the province and First Nations.

21. How Much Habitat is Enough? (Environment Canada, 2013)

- a. Provides 21 science-based habitat guidelines to assist planners and conservation practitioners in protecting and restoring habitat for migratory birds, species at risk, and other wildlife species in the lower Great Lakes and mixedwood plains.

22. Lakeshore Capacity Assessment Handbook

- a. Published in May 2010 by MOECC, MNRF, and MMAH to assess lakeshore capacity and develop water quality objectives for phosphorus in inland lakes in Ontario's Precambrian Shield.

23. Wetland Conservation Strategy for Ontario 2017-2030 (DRAFT)

- a. Identifies priorities for wetland conservation in Ontario now and in the future.

24. Natural Heritage Reference Manual

- a. The manual represents the Province's recommended technical criteria and approaches for being consistent with the PPS in protecting natural heritage features and areas and natural heritage systems in Ontario. The recommended technical criteria and approaches are to be considered by

planning authorities for land use planning and review of *Planning Act* applications.

25. Significant Wildlife Habitat Technical Guide (MNRF)

- a. The Guide describes a landscape approach to conserving significant wildlife habitat, which will allow for consideration of wildlife habitat at more than one scale.

26. Great Lakes-St. Lawrence River System and Large Inland Lakes: Technical Guides for Flooding, Erosion, and Dynamic Beaches

- a. Developed by MNRF to assist with understanding the natural hazard policies of the PPS, 1997, and assist municipalities with identification of areas prone to natural hazards, and development of management approaches.

27. River & Stream Systems: Flooding Hazard Limit Technical Guide (MNRF, 2002)

- a. Addresses the policy direction of the PPS, 1997 by describing the hydrologic and hydraulic work needed to conduct floodplain analysis.

Appendix 2: Overview of Requirements outlined in Draft Watershed Planning in Ontario guidance document

Watershed Planning Component - Growth/Greenbelt Plan	Factors/Considerations (Provincial Guidance -Version 1)
Watershed Characterization	<ul style="list-style-type: none"> • Quality and quantity of water (minimum base flow, depth to water table, aquifer pressure; oxygen levels; suspended solids; temperature; bacteria; and nutrients and hazardous contaminants, hydrologic regime) • Identifying aquatic and terrestrial habitats • Identifying the quantity of surface and groundwater resources, relationships, and water related dependencies (<i>part of water budget</i>) • Quantifying precipitation, groundwater, surface water (<i>part of water budget</i>) • Identifying existing flow regimes (peak flow volume and rates) • Identifying existing water balance (recharge areas, rates and sensitivity) • Identifying features and functions of the natural heritage system (interconnections between and among aquatic, terrestrial and groundwater systems, buffers and linkages) • Identifying constraints (floodplains, steep slopes, erosion areas, wetlands, forests, habitat, corridors, buffers, wellheads).

Watershed Planning Component - Growth/Greenbelt Plan	Factors/Considerations (Provincial Guidance -Version 1)
Water Budget	<ul style="list-style-type: none"> • Measured inputs (precipitation, runoff, surface water inflow, groundwater inflow, water diversions) vs. outputs (evaporation, transpiration, surface water outflow, groundwater outflow, water diversions, industrial uses, and residential uses) on an annual average basis.
Conservation Plan	<ul style="list-style-type: none"> • Develop Water Use Profile and Forecast • Identify Water Conservation Goals - Link to Water Budget Analysis • Identify and Evaluate Water Conservation Measures and Incentives • Analyze Relative Benefits and Costs of Measures and Incentives • Select Conservation Measures and Incentives • Illustration of anticipated effects of conservation measures and incentives on water demand and supply capacity • An implementation plan • A plan for monitoring and evaluating effectiveness
Nutrient Loading Assessment	<p>Provincial Guidance does not put forth specific considerations for this process but does indicate that a range of nutrients causing issues in the watershed should be considered</p>

Watershed Planning Component - Growth/Greenbelt Plan	Factors/Considerations (Provincial Guidance -Version 1)
Consideration of Climate Change Impacts and Severe Weather Events	<ul style="list-style-type: none"> • Consider the Potential Effects of Climate Change on Existing and Proposed Land Uses, Infrastructure, and Developments (effects include drought, periods of extreme heat or cold, flooding, changes to water supply, water quality) • Consider the Effects of Existing and Proposed Land Uses and Water/ Wastewater/ Stormwater Management Infrastructure on Exacerbating Climate Change Impacts • Determine Impacts of Alternative Land Use and Management Scenarios Under Various Climate Models • Document Climate Effects on Water Use and Management
Land and Water Use Management Objectives and Strategies	<p>Management actions should be sufficient enough to meet stated watershed targets, as well as applicable provincial and federal standards</p> <ul style="list-style-type: none"> • Management approaches will: <ul style="list-style-type: none"> - Use the best available information - Address the needs of the ecosystem as well as human needs; - Involve all stakeholders and interested parties; - Recognize and account for uncertainties; - Recognize cumulative effects; - Use an adaptive management approach; and - Be realistic for the watershed conditions and capacities of implementing authorities. • Concept mapping within a pressure-state-response framework (describes the current condition (state), describes the stressors likely leading to the current condition (pressure), and recommends management responses in the context of the current management framework (response))

Watershed Planning Component - Growth/Greenbelt Plan	Factors/Considerations (Provincial Guidance -Version 1)
Scenario Modelling (to evaluate the impacts of forecasted growth and servicing options, and mitigation measures)	<ul style="list-style-type: none"> • From simple desktop analyses with existing information to complex computer models, scenarios can be developed through a range of approaches depending on the development pressures on the watershed, geographic scale, and complexity of contributing factors. • Typically, land use and management scenarios consider the state of the watershed: <ul style="list-style-type: none"> - under current conditions - under pressures and impacts associated with future land use - under management scenarios and actions
Environmental Monitoring Plan	<ul style="list-style-type: none"> • Monitoring plans should be designed to evaluate the success of the watershed plan’s land and water use and management strategies in achieving watershed goals and objectives • Water Measurement Monitoring <ul style="list-style-type: none"> - Water measurements can include the components of the hydrologic cycle, including hydrologic features and functions. Water measurement includes climatological measurements as well as water quantity and quality measurements. It can also include groundwater quantities, surface water quantities, flow rates, and the withdrawal and discharge of water for human uses • Performance Monitoring <ul style="list-style-type: none"> - Can include developing indicators to be used to measure the success of the implementation plan, the target values, and knowing the variability of these indicators • Feedback from the monitoring should be used to <ul style="list-style-type: none"> - Assess progress with respect to meeting the targets established for protecting water quality and quantity, hydrologic features, and hydrologic functions - Trigger corrective responses or additional management actions - Identify if any revisions to the management goals, objectives, or targets are necessary.

Watershed Planning Component - Growth/Greenbelt Plan	Factors/Considerations (Provincial Guidance -Version 1)
Requirements for the Use of Environmental Best Management Practices, Programs, and Performance Measures	<ul style="list-style-type: none"> • Best management practices for the management of the quantity and quality of surface water and groundwater • Performance monitoring can include developing indicators to be used to measure the success of the implementation plan, the target values, and knowing the variability of these indicators.
Criteria for Evaluating the Protection of <i>Quality and Quantity of Water</i>	Components are outlined in Provincial Guidance as part of the environmental monitoring plan
Identification and Protection of Hydrologic Features, Areas, and Functions and the Inter-Relationships between or among them	Components for the identification of features is outlined in Provincial Guidance as part of the watershed characterization <ul style="list-style-type: none"> • Connectivity is the degree to which key natural heritage features are connected by species movement corridors, hydrological and nutrient cycling, genetic transfer, and energy flows through food webs • Geospatial analysis of core features and supporting features can provide a means of assessing connectivity
Targets for the Protection and Restoration of Riparian Areas	Provincial Guidance defers to the document <i>How much habitat is Enough?</i> section 2.2 -Riparian and Watershed Habitat Guidelines, for targets and rationale

Appendix 3. Definitions

The definitions were extracted directly from Provincial documents including the Provincial Policy Statement (PPS), Niagara Escarpment Plan (NEP) (MNRF, 2017), Greenbelt Plan (MMAH, 2017a), Draft Watershed Planning in Ontario guidance document (MOECC and MNRF, 2018), and Growth Plan (MMAH, 2017b).

Area of Natural and Scientific Interest (ANSI): An area of land and water containing natural landscapes or features that have been identified as having life science or earth science values related to protection, scientific study, or education (Provincial Policy Statement, MMAH, 2014).

Assimilative Capacity: The relationship between water quality and quantity, land use, and the capability of a watercourse or lake to resist the effects of landscape disturbance without impairment of water quality. An assimilative capacity study develops modelling to support and assist in predicting the impacts of land use.

Connectivity: Means the degree to which key natural heritage features or key hydrologic features are connected to one another by links such as plant and animal movement corridors, hydrologic and nutrient cycling, genetic transfer and energy flow through food webs (Greenbelt Plan, MMAH, 2017a).

Corridor: In natural heritage and watershed planning, broader areas and connections can be identified as 'linkages' or 'corridors' (MOECC and MNRF, 2018).

Core Area: In natural heritage and watershed planning, areas with high concentration of key features (MOECC and MNRF, 2018).

Ecological function: Means the natural processes, products or services that living and non-living environments provide or perform within or between species, ecosystems and landscapes, including hydrologic functions and biological, physical, chemical and socio-economic interactions (Greenbelt Plan, MMAH, 2017a).

Ecological integrity: Which includes hydrological integrity, means the condition of ecosystems in which:

- a) the structure, composition and function of the ecosystems are unimpaired by the stresses from human activity,
 - b) natural ecological processes are intact and self-sustaining, and
 - c) the ecosystems evolve naturally
- (Greenbelt Plan, MMAH, 2017a).

Green infrastructure: Natural and human-made elements that provide ecological and hydrologic functions and processes. Green infrastructure can include components such as natural heritage features and systems, parklands, stormwater management systems, street trees, urban forests, natural channels, permeable surfaces, and green roofs (PPS, MMAH, 2014).

Ground water feature: Means water-related features in the earth’s subsurface, including recharge/discharge areas, water tables, aquifers and unsaturated zones that can be defined by surface and subsurface hydrogeologic investigations (PPS, MMAH, 2014).

Highly Vulnerable Aquifer: Aquifers, including lands above the aquifers, on which external sources have or are likely to have a significant adverse effect. (Greenbelt Plan, MMAH, 2017a).

Hydrologic function: Means the functions of the hydrological cycle that include the occurrence, circulation, distribution and chemical and physical properties of water on the surface of the land, in the soil and underlying rocks, and in the atmosphere, and water’s interaction with the environment including its relation to living things (PPS, MMAH, 2014). This generally includes recharge, storage and discharge of water.

Intake protection zone: An area surrounding a surface water intake and within which it is desirable to regulate or monitor drinking water threats (Source Protection Plan, NPCA 2013).

Key Hydrologic Areas: Significant groundwater recharge areas, highly vulnerable aquifers, and significant surface water contribution areas that are necessary for the ecological and hydrologic integrity of a watershed (MMAH, 2017a).

“Key hydrologic areas are areas which contribute to the hydrologic functions of the Water Resource System. These areas maintain ground and surface water quantity and quality by collecting, storing and filtering rainwater and overland flow, recharge aquifers and feed downstream tributaries, lakes, wetlands and discharge areas. These areas are also sensitive to contamination and feed key hydrologic features and drinking water sources. Key hydrologic areas include: significant groundwater recharge areas, highly vulnerable aquifers; and significant surface water contribution areas (Greenbelt 3.2.4).

Hydrogeologically sensitive areas are “karstic areas, areas of fractured bedrock exposed at surface, areas of thin soil cover, or areas of highly permeable soils (MOE, 1996) and may be within Highly Vulnerable Aquifers.”

Key Hydrologic Features: Permanent streams, intermittent streams, inland lakes and their littoral zones, seepage areas and springs, and wetlands (MMAH, 2017a).

Linkage: In natural heritage and watershed planning, broader areas and connections between them are referred to as ‘linkage’ or ‘corridors’ (MOECC and MNRF, 2018).

River, stream and small inland lake systems: Means all watercourses, rivers, streams, and small inland lakes or waterbodies that have a measurable or predictable response to a single runoff event (PPS, MMAH, 2014).

Seepage Areas and Springs: Sites of emergence of groundwater where the water table is present at the ground surface (Greenbelt Plan, MMAH, 2017a).

Sensitive: In regard to surface water features and ground water features, means areas that are particularly susceptible to impacts from activities or events including, but not limited to, water withdrawals, and additions of pollutants (PPS, MMAH, 2014).

Significant Groundwater Recharge Area: An area that has been identified:

- a) as a significant groundwater recharge area by any public body for the purposes of implementing the PPS, 2014;
- b) as a significant groundwater recharge area in the assessment report required under the Clean Water Act, 2006; or
- c) as an ecologically significant groundwater recharge area delineated in a subwatershed plan or equivalent in accordance with provincial guidelines.

For the purposes of this definition, ecologically significant groundwater recharge areas are areas of land that are responsible for replenishing groundwater systems that directly support sensitive areas like cold water streams and wetlands (Greenbelt Plan, MMAH, 2017a).

Significant Surface Water Contribution Areas: Areas, generally associated with headwater catchments, that contribute to baseflow volumes which are significant to the overall surface water flow volumes within a watershed (Greenbelt Plan, MMAH, 2017a).

Source Protection Region: Means a drinking water source protection region established by the regulations of the Clean Water Act (Source Protection Plan, NPCA 2013).

Stormwater Master Plan: A long-range plan that assesses existing and planned stormwater facilities and systems and outlines stormwater infrastructure requirements for new and existing development within a settlement area. Stormwater master plans are informed by watershed planning and are completed in accordance with the Municipal Class Environmental Assessment (MMAH, 2017b).

Stormwater Management Plan: A plan that provides direction to avoid or minimize and mitigate stormwater volume, contaminant loads, and impacts on receiving water courses to: maintain groundwater quality and flow and stream baseflow; protect water quality; minimize the disruption of pre-existing (natural) drainage patterns wherever possible; prevent increases in stream channel erosion; prevent any increase in flood risk; and protect aquatic species and their habitat (MMAH, 2017b).

Stream or watercourse: A feature having defined bed and banks, through which water flows at least part of the year (NEP, NEC 2017).

Subwatershed: Means a smaller nested drainage area within a watershed.

Subwatershed plan: Means a plan that reflects and refines the goals, objectives, targets and assessments of watershed planning for smaller drainage areas, is tailored to subwatershed needs and addresses local issues.

A subwatershed plan should: consider existing development and evaluate impacts of any potential or proposed land uses and development; identify hydrologic features, areas, linkages and functions; identify natural features, areas and related hydrologic functions; and provide approaches for protecting, improving or restoring the quality and quantity of water within a subwatershed.

A subwatershed plan is based on pre-development monitoring and evaluation; is integrated with natural heritage protection; and identifies specific criteria, objectives, actions, thresholds, targets and best management practices for development, for water and wastewater servicing, for stormwater management, for managing and minimizing impacts related to severe weather events, and to support ecological needs (MMAH, 2017b).

Surface water feature: Means water-related features on the earth's surface, including headwaters, rivers, stream channels, inland lakes, seepage areas, recharge/discharge areas, springs, wetlands, and associated riparian lands that can be defined by their soil moisture, soil type, vegetation or topographic characteristics (PPS, MMAH, 2014).

Vulnerable: Means surface and/or ground water that can be easily changed or impacted (PPS, MMAH, 2014).

Water Resource System: A system consisting of ground water features and areas and surface water features (including shoreline areas), and hydrologic functions, which provide the water resources necessary to sustain healthy aquatic and terrestrial ecosystems and human water consumption. The water resource system will comprise key hydrologic features and key hydrologic areas (PPS, MMAH, 2014).

Water source: An aquifer or surface water body being used to supply drinking water (Source Protection Plan, NPCA 2013);

Watershed: Means an area that is drained by a river and its tributaries (MMAH, 2014).

Watershed management: The analysis, protection, development, operation and maintenance of the land, vegetation and water resources of a drainage basin (MNRF 2017).

Watershed Planning: Planning that provides a framework for establishing goals, objectives, and direction for the protection of water resources, the management of human activities, land, water, aquatic life, and resources within a *watershed* and for the assessment of cumulative, cross-jurisdictional, and cross-*watershed* impacts.

Watershed planning typically includes:

- watershed characterization, a water budget, and conservation plan;
- identification of the water resource system
- nutrient loading assessments;
- consideration of climate change impacts and severe weather events;
- land and water use management objectives and strategies;
- scenario modelling to evaluate the impacts of forecasted growth and servicing options, and mitigation measures;
- an environmental monitoring plan;
- requirements for the use of environmental best management practices, programs, and performance measures;
- criteria for evaluating the protection of quality and quantity of water;
- the identification and protection of hydrologic features, areas, and functions and the inter-relationships between or among them; and
- targets for the protection and restoration of riparian areas.

Watershed planning is undertaken at many scales and considers cross-jurisdictional and cross-watershed impacts. The level of analysis and specificity generally increases for smaller geographic areas such as subwatersheds and tributaries (MMAH, 2017a).

Wetlands: Means 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 abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic plants or water tolerant plants. The four major types of wetlands are swamps, marshes, bogs and fens.

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 (MMAH, 2017a).