

# Niagara Watershed Plan (Equivalency) – Volume 3: Growth Analysis

Niagara Official Plan Niagara Region, Ontario Project # WW 20101001

Prepared for:

**Regional Municipality of Niagara** 1815 Sir Isaac Brock Way, Thorold, ON L2V 4T7

5/16/2022



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# Table of contents

| 1.0 | INTR | ODUCTION AND STUDY PURPOSE                                       | 1  |
|-----|------|--|----|
|     | 1.1  | Introduction   | 1  |
|     | 1.2  | Tertiary Watershed Context                                       | 3  |
|     | 1.3  | Work Plan  | 9  |
|     | 1.4  | NWP (E) Report Structure   | 12 |
| 2.0 | GRO  | WTH SCENARIOS  | 14 |
|     | 2.1  | Integration with Growth Management                               | 14 |
|     |      | 2.1.1 Assessment of Total Growth Areas by Watershed/Subwatershed | 15 |
|     | 2.2  | Cumulative Impacts – Potential Growth                            | 16 |
| 3.0 | PRIO | RITY WATERSHED SYSTEMS & GROWTH AREAS                            | 22 |
|     | 3.1  | Watershed Plans & Legacy Studies                                 | 23 |
|     |      | 3.1.1 Review Criteria  | 26 |
|     |      | 3.1.2 Primary Findings & Study Gaps                              | 27 |
|     |      | 3.1.3 Existing Monitoring Network within Potential Growth Areas  | 36 |
|     |      | 3.1.4 NHS & WRS within Potential Growth Areas                    | 42 |
| 4.0 | GRO  | WTH AREA SCREENING MATRIX  | 51 |
|     | 4.1  | Methodology & Purpose  | 51 |
|     |      | 4.1.1 Natural Heritage Considerations                            | 54 |
|     | 4.2  | Screening Matrix Results & Outcomes                              | 57 |
| 5.0 | CON  | CLUSIONS   | 60 |

# List of figures

| Figure 1-1: Provincial Mapping – Watershed Delineation Scales | 4 |
|---|---|
| Figure 1-2. Niagara Region – Tertiary Watershed Areas         | 6 |
| Figure 1-3. Niagara Region – Quaternary Watershed Areas       | 7 |
| Figure 1-4. Niagara Region Subwatershed Areas                 | 8 |

# List of tables

| Table 2-5: Cumulative Impact Assessment - Land Use Categories by Quaternary        |     |
|--|-----|
| Watershed  | 19  |
| Table 3-1: Potential Areas of Growth and Greenfield Area by Quaternary Watershed . | 22  |
| Table 3-2: Watershed Plans per Quaternary Watershed                                | 23  |
| Table 3-3: Water Quantity Stress Levels by Old Watershed (ref. AquaResource, 2010  | )   |
|  | 32  |
| Table 3-4: Niagara Region Existing Monitoring Network Inventory – Total Proposed   |     |
| Growth   | 38  |
| Table 3-5: Niagara Region Existing Monitoring Network Inventory – Potential Growth |     |
| Areas  | 39  |
| Table 3-6: Summary of Natural Heritage System Features within Potential Growth Are | eas |
| , , , , , , , , , , , , , , , , , , ,  | 44  |
| Table 3-7: Summary of Water Resource System Features and Areas within Potential    |     |
| Growth Areas   | 46  |
| Table 3-8: Potential Interaction and Interdependencies by Potential Growth Areas   | 49  |
| Table 4-1: Growth Area Screening Matrix Outcomes                                   | 58  |
|  | -   |

# List of Attached Drawings

Drawing 2-1: Total Proposed Growth Summary Drawing 3-1: Potential Growth & Greenfield Areas GA-WR1-(1-3): Soil Drainage Classes GA-WR2-(1-3): Topography & Constructed Drains GA-WR3-(1-3): Groundwater System & Source Water Protection GA-WR4-(1-3): Natural Hazards GA-NH-(1-20): Natural Heritage System GA-WRS-(1-20): Water Resource System

#### Appendices

Appendix A-3 – Total Potential Growth Statistics Appendix B-3 – Watershed Plan & Legacy Study Review Appendix C-3 – Growth Area Screening Matrix

# 1.0 INTRODUCTION AND STUDY PURPOSE

# 1.1 Introduction

Niagara Region (Region) is preparing a new Niagara Official Plan (NOP) which will achieve conformity with provincial plans and provide relevant guidance to local area municipalities. As part of this work, a Natural Environment Work Program (NEWP) is being undertaken, which is focusing on establishing a regional-scale natural heritage system (NHS) and water resource system (WRS), including policies and mapping, which will be implemented through the new NOP. As part of the NEWP, a Watershed Planning Discussion Paper (WPDP, October 3, 2019) was prepared to better understand the Provincial requirement that watershed planning must inform land use planning. The Discussion Paper was largely based on the Draft, Provincial Watershed Planning guidance document "Watershed Planning in Ontario – Guidance for Land-use Planning Authorities" (MOECC, MNRF 2018) highlighting its influence on how best to inform growth and infrastructure planning through the Official Plan process.

The Draft Provincial Watershed Planning guidance document, as well as the Growth Plan (2019) and Greenbelt Plan (2017), acknowledge the concept of leveraging equivalent information from existing documents.

The Discussion Paper also discussed the possibility of preparing an "equivalency" document at a tertiary level, informed by a review of existing reports available from the Niagara Peninsula Conservation Authority (NPCA), Region of Niagara, local area municipalities (LAMs) and other organizations. Notably, based on the terminology in the Provincial Guidance, the "tertiary" level of watersheds refers to those lands draining to Lake Ontario, Lake Erie and the Niagara River for Niagara Region.

The Niagara Watershed Plan Equivalency document (NWP (E)) is being prepared as a watershed planning equivalency document in accordance with provincial direction in the Growth Plan which allows for the use of legacy data in watershed planning. The document builds on the guidance from the previously completed Watershed Planning Discussion Paper (WPDP); notably the WPDP outlined the status of watershed-oriented data across Niagara, specific to mapping, data and reporting. The WPDP also outlined the status of the available data/information and associated gaps. As noted, the NWP (E) builds on this understanding and further mines the available information, in order to better characterize the resources in the areas being planned for growth, and to inform the new NOP on constraints and opportunities, where the information is sufficient. Where there are information gaps, the NWP (E) has outlined those gaps and provided high-level scope for execution at the subsequent planning stages (i.e., Quaternary Watershed Plan or local OP). The NWP (E) has not filled any data gaps, through confirmatory field work, nor has it involved any analytical modelling of water systems (hydrology, hydraulics, hydrogeology); again, this effort is considered more appropriate at the subsequent planning stages.

Further, the Region is supported by the NPCA through an existing partnership, as well as emerging opportunities to collaborate and advance the watershed and sub watershed planning framework for Niagara conceptualized through the NWP (E). Notably, the NPCA is positioned to support the Region with a watershed based natural resource management framework fundamental to Integrated Watershed Management (IWM). In accordance with sections 20 and 21 of the *Conservation Authorities Act*, Conservation Authorities are local watershed-based natural resource management agencies that develop programs that reflect local resource management needs within their jurisdiction. These programs and/or policies are approved by the conservation authority board. The NPCA uses the Integrated Watershed Management (IWM) as the local approach to natural resources management. IWM is the process of managing human activities and natural resources on a watershed basis, considering social, economic, and environmental issues, as well as local community interests to manage water resources sustainably.

As noted, a core element of the NWP (E) study has involved gathering and reviewing existing information (GIS-based mapping and data) which has been mined from the legacy studies, as well as the NEWP, to support the area characterization (without field work and modelling analysis) and the establishment of growth scenarios to 2051 while also providing management guidance at the tertiary scale. Key data sources have included:

- Legacy Reports
  - Watershed Plans
  - Subwatershed Plans
  - Master Drainage Plans
  - Source Protection Plan
- Data
  - Natural systems
  - Water quality and quantity
- Mapping
  - Hazards
  - Resources

The following graphic presents the high-level relationship between the respective initiatives supporting the new NOP, including the key information flow amongst the initiatives.



Relationship of the Niagara Watershed Plan (E) to New Niagara Official Plan

In addition, the Niagara Watershed Plan (E) has summarized stakeholder-driven issues, particularly in potential growth areas defined by the Region. Niagara Region staff has provided an initial outline of issues which has been further expanded as part of subsequent study tasks and consultation activities.

# 1.2 Tertiary Watershed Context

The Draft Provincial guidance for Watershed Planning (MNRF, MECP 2018) advocates for the use of existing data available from Provincial, Municipal, and Conservation Authorities, to establish the limits of watersheds and subwatersheds. Provincial mapping delineates watersheds at the primary, secondary, tertiary, and quaternary levels, representing nested levels of drainage areas, from largest (primary) to smallest (quaternary) (ref. Figure 1-1). Current watershed and subwatershed information in Niagara, available from legacy documents and the NPCA do not explicitly align with the common industry understanding of "watersheds" or "subwatersheds".



Figure 1-1: Provincial Mapping – Watershed Delineation Scales

The WPDP states that Niagara Region is comprised of two secondary watersheds: Lake Ontario and Niagara Peninsula, and Northern Lake Erie. Also, while the majority of land in Niagara Region, and portions of Hamilton and Haldimand County, drain northerly into Lake Ontario, the southern part of the Region drains into the Lake Erie watershed. Further, Niagara Region drains into three (3) tertiary watersheds, where the subject lands drain either into Lake Ontario, Lake Erie, or the Niagara River. This delineation reflects the unique hydrologic and ecological functions of the receivers, specific to the Lakes verses the Niagara River. Based on this approach, the NWP (E) has been structured to report at a tertiary watershed scale, where the lands in Niagara have been characterized and discussed based upon the three (3) tertiary receivers, including Lake Ontario, Lake Erie and the Niagara River.

Moreover, Provincial mapping cited in the WPDP identifies ten (10) quaternary watersheds within Niagara Region (Note: Table/Mapping has 10 however text refers to 9). At issue is that while these quaternary watersheds largely follow drainage divides, many of the quaternary watersheds which border the Lake Ontario or Lake Erie shorelines, or the Niagara River, include smaller drainage basins or hydrologic units which do not drain to a watercourse or river by way of a tributary, but rather outlet directly to the associated receiving waterbody. In the Provincial nomenclature cited above, this would make these drainage basins, by definition, individual watersheds.

The Province released an updated watershed boundary dataset on May 8<sup>th</sup>, 2020, which is collectively called the Ontario Watershed Boundary (OWB). The boundaries relevant to Niagara Region were based on the recent Ontario Integrated Hydrology (OIH) data produced in the spring/fall of 2019 for areas within Ontario. Refinements to these OWB boundaries have been made by the Niagara Region, in consultation with the NWP (E) team, based upon more detailed knowledge of drainage systems and

catchment boundaries for the quaternary watersheds and tertiary watershed systems. Further discussion regarding these data sets and the delineation process applied for the drainage systems within the Niagara Region, which have been carried throughout the NWP (E) study and reporting, can be found in the NWP (E) Volume 1: Characterization.

For ease of reference purposes in the current Volume 3, the figures depicting the tertiary watersheds, quaternary watersheds and subwatershed systems within the Niagara Region, documented in Volume 1, have been repeated in the following **Figure 1-2**, **Figure 1-3**, **Figure 1-4**.



Figure 1-2. Niagara Region – Tertiary Watershed Areas







Figure 1-4. Niagara Region Subwatershed Areas

# 1.3 Work Plan

The NWP (E) has been completed through five (5) primary tasks:

# Task 1 Confirm Boundaries & Establish Priorities

- Task 1-1 Confirm & Collect Available Data & Reports | The Natural Environment Work Program (NEWP) collected, considered and summarized an extensive range of datasets (geospatial) and reports that have informed or been used in analyses of the current Niagara Watershed Plan Equivalency study. The Wood Team has worked with the Region to confirm that the list of available data and reports represents the most current and 'best available' data and information for use in the Niagara Watershed Plan Equivalency document.
- Task 1-2 Watershed and Sub-watershed Delineation | The NWP (E) Team has worked with the Region to confirm or refine watershed and subwatershed mapping for the Region based upon available sources. Substantive mapping and modelling have been undertaken as part of separate studies and as such, has required consolidation of existing mapping and rationalizing any minor mapping discrepancies to produce appropriate and supportable watershed and sub-watershed delineations for the purpose of the NWP (E) document.
- *Task 1-3 Establish Priority Areas* | While the Watershed Plan Equivalency document broadly characterizes the tertiary watersheds in their entirety, identification of more localized priority areas within Niagara's watersheds has allowed for an opportunity to focus guidance and direction for the subsequent tasks and work effort of the Wood Team. Priority watershed areas and subwatersheds include those which have been informed by the new NOP work being completed by the Region (e.g., known or potential settlement expansion areas), known areas experiencing higher levels of development or resource pressure, or are known to have functional concerns related to management of water quality or quantity.

# Task 2Characterization of Existing Conditions

- Task 2-1 Data Mining & Gap Analysis | Existing legacy datasets and reports (as outlined in the WPDP and others) have been mined, pulling from the various formats, geospatially referenced datasets and information that can be used to characterize existing conditions across the tertiary watersheds. Focus has been given to priority areas identified through Tasks 1-1 to 1-3 to refine the level of understanding within these critical areas for land use planning within the Region. Through this data mining and review exercise, the NWP (E) Team has identified gaps or deficiencies including age, quality / accuracy and/or availability, for its use in prioritizing recommendations for future work.
- Task 2-2 Stakeholder Consultation #1 | Issues & Opportunities Workshop | Extensive stakeholder engagement was undertaken as part of the NEWP and continued through the new NOP process. This engagement has identified that protection of the environment, and water specifically, are amongst the community's top priorities.

# Task 3Set Watershed Plan Equivalency Goals & Objectives

- Task 3-1 Policy Review & Identification of Key Conformity Support | The key purpose
  of the NWP (E) study is to provide tertiary watershed planning direction to inform
  the new NOP. In support of this, the NWP (E) Team has reviewed applicable
  provincial policies, plans and guidance documents (i.e., specifically the "Watershed
  Planning in Ontario Guidance for Land-use Planning Authorities", 2018) related to
  watershed planning, natural heritage and water resource systems to identify key
  areas of conformity. This review has directly informed the goals and objectives of the
  NWP (E) document.
- *Task 3-2 Watershed Equivalency Goals & Objectives* | Drawing on work completed through primary Tasks 1, 2 and 3-1, the NWP (E) Team has worked with the Region's Project Team to establish goals and objectives for the NWP (E) document. This effort has provided key direction on scope and prioritization of outcomes for the report to ensure that it meets the needs of the Region and Stakeholders.

# Task 4Integrate the Natural Heritage System & Inform the Water Resource<br/>System

This task has built on the work completed through the NEWP to support the NWP (E) document and also has drawn upon data mined through Task 2-1, to refine and inform the WRS within priority areas. Through this task, key elements of the systems supporting the tertiary watersheds of the Niagara Region have been confirmed to inform the development of recommendations and implementation priorities.

- Task 4-1 Integrating the Preferred Natural Heritage System | A key input to watershed planning is the natural heritage system prepared as part of the NEWP. The interrelationship between natural heritage system (NHS) and water resource system (WRS) is recognized in the PPS and is an essential component informing watershed planning. A preliminary preferred option and associated system mapping was completed and follow-on consultation resulted in the preferred system.
- Task 4-2 Informing the Water Resource System | Through the NEWP, initial options for a WRS have been identified based on sources of information to inform the WRS through watershed planning (per the WPDP). This task has used data 'mined' from existing sources (Task 2-1) to further inform and refine the preliminary WRS discussed through the NEWP. This task has focused on informing the WRS within priority areas identified through Tasks 1-3 to maximize the utility of project resources and ensure effective input and direction for land use planning for the new NOP.

# Task 5Watershed Plan Elements & Best Practices

Drawing on work completed through the preceding tasks, the NWP (E) Team has identified and developed recommendations for prioritizing gap filling in the future and establishing implementation priorities. In their development, the NWP (E) Team has explored best practices associated with those key elements that influence land use planning at a tertiary watershed planning scale to inform the new NOP. Section 6 of the "Watershed Planning in Ontario – Guidance for Land-use Planning Authorities", 2018, outlines the expectations and scope associated with defining those elements which typically constitute a Watershed Plan. Given the scope of the current project, an "equivalency" approach has been advocated to optimize the use of existing desktop resources to address the respective items to the extent possible and thereby develop informed tertiary guidance for the new NOP. A brief summary of key watershed plan elements is provided in the tasks which follow:

- *Task 5-1 Water Management Guidance (Quantity / Quality)* | The Source Protection Plan and available watershed and subwatershed plans have been used to establish a tertiary understanding of conceptual water budgets and water quality for the respective systems (no modelling was conducted). This information has been used to prioritize locations where land use change and supporting growth would be anticipated to have low, medium and high impacts.
- *Task 5-2 Climate Change Guidance* | Numerous municipalities, including Niagara Region, are actively involved in considering the potential impacts due to climate change on infrastructure and growth. The NWP (E) Team has used "lessons learned" from Ontario-based initiatives, as well as other local examples, to provide guidance on best practices to consider climate change influences in the new NOP.
- *Task 5-3 Natural Hazards* | Earlier tasks (ref. Task 2.1) have collected mapping and background to NPCA's hazard delineation in its watersheds. These data are understood to be contemporary and reflect the best available information. As part of this task the information has been checked against other on-going and future initiatives to ensure the information is current and consistent, with acknowledgement of future updates and/or refinements to come through other studies.
- *Task 5-4 Cumulative Impact Guidance* | For a study of this scale (tertiary watersheds) and scope, a fulsome cumulative effects study was not feasible. Rather, in order to provide direction/guidance related to cumulative impacts, the characterization established earlier (ref. Task 2.1) has been used to identify sensitivities through which, existing development and potential growth, have been overlain to define areas anticipated to potentially be under the greatest impact due to past, current and potential development, in the form of a screening lens. Future studies will be required to conduct more detailed and analytical cumulative impact assessments (i.e., Quaternary Watershed Plans).
- *Task 5-5 Land Use Impact Management* | Best practices for managing impacts due to urbanization are well documented. Current trends and approaches, particularly those in Niagara, have been reviewed to provide appropriate insights for the new NOP. Balanced consideration of grey/green infrastructure is considered important to inform the new NOP, building from acceptable local area municipal approaches. The

categories of management include: NHS, watercourses and water (surface and ground).

- Task 5-6 Future Studies / Priorities | The NWP (E) Team has mined the available desktop resources of information related to the NHS, WRS and associated resource/water-focused data. As is clearly understood and outlined in the WPDP, numerous gaps exist. Furthermore, numerous future studies will be required to support growth (notably Quaternary Watershed plans and/or Subwatershed Studies); strategies and experiences from these types of studies have been outlined to appropriately inform the new NOP.
- Task 5-7 Monitoring / Adaptive Management | As part of this task, it was required to determine those aspects of the NHS and WRS, and associated natural and waterbased resources, which should be monitored as part of broad-scale growth plans. The NWP (E) Team has outlined a framework and requirements for developing both local and holistic monitoring strategies for large scale development over extended periods (10 years +/-) for the Niagara Region.

Each of these tasks represented an important milestone in the background review, consultation, data collection, analysis and developing the framework for the resulting NWP (E); each task has been completed individually and submitted to the Region under separate cover (through Technical Memoranda) for review and approval, prior to the compilation of the current final NWP (E) presented as three (3) volumes (ref. Section 1.4).

# 1.4 NWP (E) Report Structure

The NWP (E) has been structured as an overall framework which provides an overview of existing data sets and has developed an outline for subsequent quaternary watershed plans. The findings from each project task outlined in the previous section have been integrated into the following report volumes which represent the contents of the three (3) NWP (E) documents, which together constitute the NWP (E):

- Volume 1: Characterization
  - Niagara Watersheds Characterization (Lake Ontario, Niagara River, Lake Erie)
    - Drainage Systems
    - Surficial Soils
    - Slopes / Topography
    - Groundwater System & Source Water Protection
    - Natural Hazards
    - Natural Heritage (Fish & Terrestrial)
    - Land Uses (Urban & Agricultural)
    - Watershed Monitoring (Climate, Streamflow, Water Quality and Groundwater)

# • Volume 2: Niagara Watershed Management

- Goals & Objectives
- Integrating the Natural Heritage System (NHS) & Water Resource System (WRS)
- Watershed Plan (Equivalency) Guidance
  - Water Management Guidance (Quantity/Quality)
  - Climate Change Guidance

- Natural Hazards
- Cumulative Impacts
- Land Use Impact Management & Preliminary Guidance
- Future Studies & Monitoring
- Volume 3: Growth Analysis
  - Growth Scenarios / Priority Areas
    - Total Potential Growth
    - Priority Watershed Systems & Growth Areas
    - Growth Area Screening Matrix

The contents of the current report pertain to **Volume 3: Growth Analysis**, which provides a review of the potential growth scenarios across the Niagara Region, and documents the analysis conducted for the potential growth areas identified by the Region, with respect to the natural environment and water based systems. The contents of this volume build upon Volume 1, which outlined the existing data sources as part of the existing conditions characterization of the three (3) tertiary watershed systems present within the Niagara Region, as well as the preliminary guidance and management recommendations identified for natural systems through Volume 2.

These report volumes, encompassing the final NWP(E), have been compiled to improve the understanding of the natural and water-based systems present within the Niagara Region. The information also helps inform the new NOP and provides direction for the subsequent studies, which will be required to support future quaternary watershed planning and local subwatershed planning initiatives in the Niagara Region.

# 2.0 GROWTH SCENARIOS

The NWP (E) is intended to broadly characterize the tertiary watersheds, however, the identification of more localized priority areas (framed specifically around potential growth areas) within Niagara's watersheds provides an opportunity to focus guidance and direction for the other components of the NWP (E) and the new NOP. Priority watershed areas and priority subwatersheds have become identifiable through the new NOP work being completed by the Region, more specifically land needs assessment (e.g., potential for settlement area boundary expansions), and areas known to be experiencing higher levels of development or resource pressure. These areas may also share known functional concerns related to management of water quality or quantity. The objective is to provide a contextual lens to both the potential growth areas and sensitive areas, as a means to help inform planning decisions related to growth management. Other NWP (E) components related to the characterization of Niagara's watersheds (ref. Volume 1: Characterization & Volume 2: Niagara Watershed Management), have been completed and provide input on high sensitivity areas and features, which provides an additional element to offer focus for this assessment and the need and scope of future studies.

# 2.1 Integration with Growth Management

Niagara Region staff initially considered forecasted growth to the year 2041. The Province, as of June 30, 2020 released its proposed changes to the Land Needs Assessment methodology and provided draft forecasts to 2051. As such, the Region of Niagara will now be required to plan to 2051 in the new Regional Official Plan. Over the course of the NWP (E), the Province approved Amendment 1 to Growth Plan that extends the planning horizon to 2051 and subsequently provided additional forecasted minimum growth that must be planned and allocated. The purpose of this NWP (E) remains the same and the result of Growth Plan Amendment 1 furthers the significance of this study work to evaluate the potential growth areas and provide a summary of potential constraints to support the Region in advancing watershed planning objectives. This review and identification of potential constraints to the currently identified potential growth areas have been a collaborative and iterative effort with the Region's Land Use Planning Team.

The mapping information identifying the potential growth areas across the Niagara Region (bulleted below) has been provided by the Region (ref. Drawing 2-1). The following provides a description of the layers included in the mapping, some of which is static while others remain active:

- **Urban Growth Centre** [Downtown St. Catharines] Growth Area provided to Niagara by the Province through the Growth Plan.
- **Major Transit Station Areas** These are the areas around the 4 proposed GO Stations in Niagara. A secondary plan has already been completed for each. Grimsby, St. Catharines and Niagara Falls are confirmed station locations. Lincoln is considered a future potential station location.
- **District Plan & Secondary Plan Areas** District Plans represent Regionally initiated detailed planning exercises that focus on strategic growth and development of complete communities. District Plans are Council endorsed and implemented

through new or updated Secondary Plans at the local level. Currently the Niagara Region has two approved District Plans being the Brock District Plan and the Glendale District Plan. Secondary Plans have or will be initiated by the respective local municipalities in the near term.

- Local municipalities may also prepare Secondary Plans to assist in detailed planning that meets local objectives in land use planning. Niagara Region supports local interest and activity in Secondary Planning as a principle of good planning practice.
- **Delineated Built-Up Area** The Growth Plan requires the existing built boundary to take in a minimum of 50% of future housing growth through intensification. Niagara Region has chosen to go beyond the minimum provincial requirements, and local municipalities were allocated varied percentages, but a 60% intensification rate is proposed region-wide.
- **Designated Greenfield Areas** These are undeveloped areas within the existing urban boundaries that currently have minimum targets of 50 people and jobs per hectare.
- **Draft Employment Areas** As part of the new Official Plan, Niagara Region will illustrate employment areas in the Region. The areas represent Niagara's existing traditional employment clusters located within the urban area boundaries and consist entirely of designated employment lands. Although none currently exist, the Region may request Provincially Significant Employment Zones be identified in the future, which may include several of these draft employment areas.
- Potential Areas of Growth These locations generally represent areas where there has been interest expressed for consideration during review and analysis for urban boundary expansion. Consideration of these requests is a function of completing the Land Needs Assessment before considering expansion potential, as well as other evaluation criteria. Expansion considerations are not strictly limited to the areas shown on the mapping. The Region has considered the full extent of the urban boundaries to ensure the most appropriate locations have been considered for urban boundary expansions.
  - From Niagara Region Staff's perspective, it will be explicitly beneficial to understand the environmental limitations (i.e., constraints and opportunities) in these areas for the purpose of informed decision making and how any potential future growth planned for these areas may impact the associated watershed/subwatershed and their functions. To reiterate, these generalized areas are illustrated on the mapping as a result of expressed interest (submissions made to local and regional staff) or active planning study work initiated by the local municipalities as part of their own growth management exercises to either supply information to the Region or advance expansion interest under the provisions of the current Growth Plan.

# 2.1.1 Assessment of Total Growth Areas by Watershed/Subwatershed

As noted previously, the objective of this GIS-based assessment has been to align the planned growth areas to the watersheds and subwatersheds, so as to establish priority areas for more detailed and integrated assessments to be completed as part of the NWP (E) and subsequent quaternary and subwatershed level studies.

A table has been compiled of all categories of proposed growth as provided by the Region (as listed in Section 2.1) and has been used to report the overall proposed growth in the watersheds and subwatersheds within the Niagara Region (ref. Appendix A-3). The categories included in the proposed growth summary are presented on the attached Drawing 2-1 and includes the following land use designations:

- Urban Growth Centers
- Major Transit Areas
- District Plan Areas

- Draft Employment Areas
- Greenfield Areas (Land Supply)
- Potential Areas of Growth

It should be noted that the above categories have been included as they represent future areas of growth and/or expansion; notably this summary does not include any existing "built-up area", as these have been assumed to be subject to growth through infill / intensification, which depending on the scale of development, may not require the same level of study at the quaternary watershed or subwatershed level. Nonetheless, these "built-up areas" representing the existing urban areas are expected to generate approximately 60% of future urban growth region-wide; furthermore, these existing built-up areas can provide a unique opportunity for retroactive stormwater management (SWM) practices to provide SWM benefit to existing urban areas. Further discussion regarding these areas and best management practices can be found in Volume 2: Niagara Watershed Management.

The mapping data provided for use in this study have been used to report the proposed growth as a percentage of the quaternary watershed / subwatershed areas, to provide a comparative means to determine key priority areas at the regional scale. While absolute information is also presented in terms of actual growth areas in hectares, the percentage metric is considered useful to guide the subsequent assessments and provide comparative context.

It should be noted that the potential growth area summary has been completed on the basis of the quaternary watershed delineations discussed in Volume 1: Characterization; however, the summary of potential growth areas on a subwatershed basis is in reference to the "old watershed" names, as these boundaries have not been refined as part of the current study, and as such references the previous watershed naming system as per the NPCA methodology.

# 2.2 Cumulative Impacts – Potential Growth

As documented in Volume 2: Niagara Watershed Management, the *Draft Watershed Planning Guidance, 2018* defines cumulative environmental effects as accumulated changes in the environment occurring over time, as a result of land use changes, urban developments, infrastructure, climate change etc. The assessment of these cumulative effects is typically completed at a watershed and/or subwatershed scale, so as to provide logical boundaries for assessment of the environmental, social and economic impacts of proposed land use changes within a system. This type of assessment provides an indication of how much change the watershed system has undergone due to past and present influences and can allow for a prediction of future stresses to inform decision-making, including growth and watershed planning. For the current study, a framework for the cumulative impact assessment has been completed using available land use mapping provided by the Region used in the *Characterization of Existing Conditions* (ref. Volume 1: Characterization), in order to identify, at the scale of the quaternary watersheds, the most potentially impacted areas. It should be noted that the current assessment has been completed at a high-level using area-based mapping only and does not reflect the density of features or their respective sensitivity to change, however this work provides an overall summary of the land use changes which have occurred and are currently proposed, across the quaternary watersheds. Future studies will be required to conduct more detailed and analytical cumulative impact assessments to further identify the potential impacts to watershed systems associated with proposed growth (i.e., conducted as part of future Quaternary Watershed Plans).

The available mapping provided for use in this study has been used to generate the following categories and measures for this assessment:

- Existing Land Use Cover:
  - Existing Natural Feature Area: Ecological Land Classification (ELC) mapping for woodlands and wetlands (sourced from the 2020 ELC mapping for areas within the Niagara Region, and the NAI project (NPCA, 2011) and MNRF datasets for areas outside the Niagara Region).
    - Note: Natural cover mapping is distributed throughout the Niagara Region, including overlapping areas within the higher level "built-up" areas and "agricultural land base" areas. As such, the resulting urban and agricultural cover has been adjusted to accurately reflect the natural cover.
  - **Existing Urban Area:** Sourced from the "Built-up" Area mapping minus the "Natural Feature Areas".
  - **Existing Agricultural Area**: Sourced from the "Agricultural Land Base" mapping minus the "Natural Feature Areas".
    - Includes all agricultural land designations (prime agriculture, specialty crop and candidate area lands); further discussion on these categories can be found in Volume 1: Characterization.
    - It should be noted that different types of farming practices will have different levels of impact within a watershed system, and as such, different management needs.
  - Other (N/A): Land which does not qualify as either natural, urban or agricultural.
- Future Land Use Changes:
  - Total Potential Growth (Outside Existing Urban Built-Up Boundary): This assessment category is intended to summarize potential growth, including all identified potential growth areas provided by the Region through the NOP, including the following land use designations:
    - Urban Growth Centre, Major Transit Station Areas, District Plan & Secondary Plan Areas, Greenfield Areas, Draft Employment Areas, Potential Areas of Growth.

- It is understood that the potential growth areas included in this category do not all represent absolute and/or confirmed areas of growth or expansion. These areas have been identified for consideration as part of the NOP, and as such have been evaluated as total "potential" for growth considerations to meet the Region's 2051 growth targets and are expected to be refined further as part of subsequent land use planning processes.
- Note: some of the above areas overlap with regards to growth type/designation; in order to limit duplication of land cover, all potential growth mapping files have been combined to generate a summary of total potential growth land coverage. Additionally, some of the identified growth lands overlap with the existing urban "built-up" boundary mapping; as such, the total proposed growth has been reported only for areas outside of the built-up boundary, demonstrating the potential expansions to the urban built boundaries, and thus limits the duplication of land cover estimates.
- It is assumed that the addition of potential growth and expansion of urban areas will occur within lands designated for agricultural uses and/or arid lands, under the assumption that natural feature areas are to be maintained and protected through future land use planning. While this may not be the case in all systems and areas, for the current assessment, this has been considered a reasonable assumption which can be further verified at subsequent planning stages.
- Change in Potential Proposed Land Conversions:
  - The total change in potential proposed land use conversions has been reported in terms of both:
    - Urban Land Use Changes demonstrating the proposed rate of urbanization (existing plus future urban areas) in comparison to the existing urban land cover.
    - Agricultural / Other Land Use Changes demonstrating the proportion of agricultural / other lands lost and/or converted to accommodate proposed growth.

The analysis of these various land use changes overtime allows for the total proposed and/or potential land use changes to be quantified at a high level which can help to identify the respective stress levels for the quaternary watershed systems, and thereby bring perspective to the potential cumulative impacts spatially. Each of these land categories have been summarized on a quaternary watershed basis (absolute potential area and as a percentage of total drainage area) and are presented in Table 2-1.

| Tertiary         | Quaternary<br>Watershed               | Drainage<br>Area<br>(km²) | Existing<br>Land<br>Use<br>Cover<br>Natural<br>Features<br>km <sup>2</sup> | Existing<br>Land<br>Use<br>Cover<br>Natural<br>Features<br>% of QW | Existing<br>Land<br>Use<br>Cover<br>Urban<br>km <sup>2</sup> | Existing<br>Land<br>Use<br>Cover<br>Urban<br>% of QW | Existing<br>Land Use<br>Cover<br>Agricultural<br>km <sup>2</sup> | Existing<br>Land Use<br>Cover<br>Agricultural<br>% of QW | Existing<br>Land Use<br>Cover<br>Other<br>(N/A)<br>km <sup>2</sup> | Existing<br>Land Use<br>Cover<br>Other<br>(N/A)<br>% of QW | Total<br>Potential<br>Growth<br>(Outside<br>Built-Up)<br>km <sup>2</sup> * | Total<br>Potential<br>Growth<br>(Outside<br>Built-Up)<br>% of QW | Change in<br>Potential<br>Land<br>Conversion<br>(%)<br>Urban | Change in<br>Potential<br>Land<br>Conversion<br>(%)<br>Agriculture<br>+ Other |
|------------------|---------------------------------------|---------------------------|--|--|--|--|--|--|--|--|--|--|--|---|
| Lake<br>Ontario  | Fifteen and<br>Sixteen Mile<br>Creeks | 136.5                     | 29.9   | 22%  | 2.0  | 1%   | 103.7  | 76%  | 0.9  | 1%   | 0.2  | 0.1%   | 9%   | -0.2%   |
| Lake<br>Ontario  | Four Mile Creek<br>and NOTL           | 126.4                     | 17.3   | 14%  | 12.6   | 10%  | 95.6   | 76%  | 0.9  | 1%   | 0.3  | 0.2%   | 2%   | -0.3%   |
| Lake<br>Ontario  | Jordan Harbour -<br>Twenty Mile Creek | 303.5                     | 62.3   | 21%  | 6.1  | 2%   | 217.1  | 72%  | 18.0   | 6%   | 10.4   | 3.4%   | 169%   | -4%   |
| Lake<br>Ontario  | Twelve Mile Creek                     | 148.4                     | 36.8   | 25%  | 58.3   | 39%  | 50.6   | 34%  | 2.7  | 2%   | 0.1  | 0.0%   | 0%   | 0%  |
| Lake<br>Ontario  | Welland Canal<br>North                | 92.4                      | 20.6   | 22%  | 38.3   | 42%  | 27.8   | 30%  | 5.6  | 6%   | 12.9   | 14.0%  | 34%  | -39%  |
| Lake<br>Ontario  | Welland Canal<br>South                | 77.4                      | 32.5   | 42%  | 22.1   | 29%  | 17.1   | 22%  | 5.7  | 7%   | 0.2  | 0.2%   | 1%   | -0.7%   |
| Lake<br>Ontario  | West Lake Ontario<br>Shoreline        | 300.1                     | 43.5   | 14%  | 19.6   | 7%   | 135.9  | 45%  | 101.1  | 34%  | 1.8  | 0.6%   | 9%   | -1%   |
| Niagara<br>River | Niagara River<br>North                | 62.2                      | 11.8   | 19%  | 33.7   | 54%  | 9.3  | 15%  | 7.4  | 12%  | 0.2  | 0.3%   | 1%   | -1%   |
| Niagara<br>River | Niagara River<br>South                | 185.4                     | 70.2   | 38%  | 20.2   | 11%  | 87.6   | 47%  | 7.4  | 4%   | 12.5   | 6.7%   | 62%  | -13%  |
| Niagara<br>River | Welland River<br>East                 | 136.6                     | 57.4   | 42%  | 21.2   | 16%  | 56.5   | 41%  | 1.4  | 1%   | 10.0   | 7.3%   | 47%  | -17%  |
| Niagara<br>River | Welland River<br>West                 | 868.5                     | 209.3  | 24%  | 15.8   | 2%   | 615.4  | 71%  | 28.0   | 3%   | 0.2  | 0.02%  | 1%   | -0.03%  |
| Lake Erie        | Northeast Lake<br>Erie Shoreline      | 137.0                     | 46.5   | 34%  | 22.8   | 17%  | 40.7   | 30%  | 27.0   | 20%  | 2.2  | 1.6%   | 10%  | -3%   |
| Total for        | Niagara Region                        | 2574.4                    | 638.0  | 25%  | 272.9  | 11%  | 1457.5   | 57%  | 206.0  | 8%   | 50.8   | 2.0%   | 19%  | -3.1%   |

Table 2-1: Cumulative Impact Assessment - Land Use Categories by Quaternary Watershed

Note: \* Total Potential Growth is calculated outside of the existing built-up boundary and excludes designated natural feature area under the assumption that these lands would remain protected as part of future growth (where possible); this is to be confirmed as part of subsequent planning and future study phases.

# Niagara Watershed Plan (Equivalency) – Volume 3: Growth Analysis Niagara Official Plan

As demonstrated in Table 2-1, the existing land use distribution across the Niagara Region is represented by most lands being designated for agricultural use (57%), followed by natural feature area (25%), existing urban built-up areas (11%) and other lands (8%). As expected, this demonstrates that the most significant past land use change has related to the conversion of natural and/or open lands to agricultural land designations, which now dominates the existing land base across the Region.

Looking to the future potential land use changes, Table 2-1 demonstrates that the opportunities for which potential growth may be considered represent up to 50.8 km<sup>2</sup> (+/-) of area outside of the current built-up boundary; these areas represent potential opportunities for growth consideration equating to up to 2% of the total Niagara Region, and represent potential expansions into and/or conversions of lands of other designations, should any of this area be considered/advanced for potential growth. Clearly, the potential growth areas outlined in this assessment identify the total potential area being considered for select areas of urban growth (if required), whereby the land needs assessment currently being completed by the Region as part of the NOP will identify how much land area is required to achieve regional growth targets and which of the potential growth areas are most suitable for development.

The total potential growth categories used in this high-level assessment generate a rate of change in urban area of approximately 19% across the Niagara Region, with some quaternary watersheds demonstrating significant rates of relative potential expansion, including Jordan Harbour – Twenty Mile Creek, Niagara River South and Welland River East, all of which have a potential for growth of over 47% as a measure of the existing urban land area; although, as noted previously, these areas are only under consideration for growth, and it is not expected that all of these areas will experience the total rate of potential growth noted herein.

Under the assumption that future development will aim to maintain and protect natural feature areas where possible, it is assumed that urban development will occur in lands designated as agricultural and/or other (no designation). The average total potential loss/conversion of agricultural and other lands across the region is approximately -3.1% but varies greatly across the quaternary watershed systems; most notably for the Welland Canal North, Niagara River South and Welland River East, as they all demonstrate a potential loss of greater than -10% of their existing agricultural and other lands, should all potential growth and expansion areas be approved within these drainage systems.

These proposed and potential cumulative changes through land conversions and the additional impacts of climate change will result in watershed scale implications, if not managed appropriately. The environmental response indicators are noted to be represented by the natural features and watershed functions themselves, which respond to environmental stressors, demonstrating the impacts of urbanization and climate change through functions such as increased flooding, erosion, water quality deterioration, habitat loss, etc. Future studies will be required to conduct more detailed and analytical cumulative impact assessments (i.e., Quaternary Watershed Plans).

In order to mitigate and manage the impacts of these environmental stressors, sensitive and/or critical areas are to be identified as those with sensitive and/or critical features and watershed functions (i.e., feature habitat, source water, vulnerable systems, etc.), in conjunction with those proposed to have the greatest potential future change in land use through urbanization. As part of future growth planning, monitoring of the natural features through the various stages of development can allow for adaptive management opportunities to minimize the impacts of land use changes, and climate change, as a function of future growth objectives. Further discussion regarding monitoring and adaptive management practices is provided in Volume 2: Niagara Watershed Management.

# 3.0 PRIORITY WATERSHED SYSTEMS & GROWTH AREAS

As part of the watershed characterization and management strategies (ref. Volume 1: Characterization and Volume 2: Niagara Watershed Management), areas with an approved or in process Secondary Plan have not been included in the future "growth area" designation for use in the current NWP (E).For the most part, these areas are noted to be guided by established policy and requirements set out by the local municipality and regulatory agencies in their Secondary Plans, which have been supported by the studies required to establish these growth areas. As such, depending upon the timing and stage of study, these areas will inherently not be explicitly guided by the recommendations of the current NWP (E), although there may be opportunities to implement Best Management Practices (BMPs) and associated recommendations throughout the planning process, as detailed in the NWP (E). Further discussion regarding the management of these established planned growth areas can be found in Volume 2: Niagara Watershed Management.

To support the analysis of the potential growth areas across the Region, a detailed Watershed Plan review of legacy studies has been completed with focus placed upon watershed systems with identified areas consisting of the following two (2) land use designations:

- Potential Areas of Growth
- Greenfield Areas (without Secondary Plan status)

The locations of these Potential Areas of Growth and Greenfield Areas are presented on Drawing 3-1, and a summary by quaternary watersheds is provided in Table 3-1.

# Table 3-1: Potential Areas of Growth and Greenfield Area by QuaternaryWatershed

| Tertiary<br>Watershed | Quaternary Watershed                  | Total Potential<br>Areas of Growth<br>& Greenfield<br>Areas (ha) | % of<br>Watershed |
|-----------------------|---------------------------------------|--|-------------------|
| Lake Ontario          | Fifteen and Sixteen Mile<br>Creeks    | 6.1  | 0.04%             |
| Lake Ontario          | Four Mile Creek and NOTL              | 185.5  | 1.5%              |
| Lake Ontario          | Jordan Harbour - Twenty Mile<br>Creek | 1345.9   | 4.4%              |
| Lake Ontario          | Twelve Mile Creek                     | 70.4   | 0.5%              |
| Lake Ontario          | Welland Canal North                   | 1625.6   | 17.6%             |
| Lake Ontario          | Welland Canal South                   | 291.4  | 3.8%              |
| Lake Ontario          | West Lake Ontario Shoreline           | 70.1   | 0.2%              |
| Niagara River         | Niagara River North                   | 75.2   | 1.2%              |
| Niagara River         | Niagara River South                   | 2092.8   | 11.3%             |
| Niagara River         | Welland River East                    | 1823.7   | 13.4%             |
| Niagara River         | Welland River West                    | 123.0  | 0.14%             |
| Lake Erie             | Northeast Lake Erie Shoreline         | 402.6  | 2.9%              |

As outlined previously, this excludes any areas within the designated "built-up" area, as these are primarily existing urban areas, and would be subject to infill/intensification, as opposed to larger greenfield development. As such, these existing urban areas have not been included in the Watershed Plan review, however, are expected to generate approximately 60% of future urban growth. Further as noted earlier, these areas can provide a unique opportunity for retroactive stormwater management (SWM) practices, to provide SWM benefit to existing urban areas, some of which have been found to be largely uncontrolled for both quantity and quality of urban stormwater (ref. NWQPS, 2003). Further discussion regarding these areas and the associated best management practices and preliminary management guidance can be found in Volume 2: Niagara Watershed Management.

# 3.1 Watershed Plans & Legacy Studies

A variety of background data sources including existing legacy datasets and reports have been reviewed in order to characterize the existing level of study, mapping, tools, guidance and associated recommendations across the Niagara Region tertiary watershed systems. This information has been incorporated as part of the future study requirements and growth management strategies outlined in Volume 2: Niagara Watershed Management, whereas the following sections provide further detail as to the information collected relative to the priority watershed systems and potential growth areas. The focus for this data review has been placed upon subwatersheds for which potential growth areas have been identified, according to the 2051 growth scenario provided by Niagara Region (ref. Section 2.1); the land use types and quaternary watershed and subwatershed systems of focus for this review are presented on Drawing 3-1.

The primary data sources for this review have included the current Watershed Plans, as applicable for the quaternary watersheds within the Niagara Region, as well as available mapping data provided by both the Niagara Region and NPCA. These data sources build upon the data inventory collected and outlined as part of the Watershed Planning Discussion Paper (WPDP) completed by Ecosystem Recovery Inc., North-South Environmental, Meridian Planning Consultants Inc. and Glenn Pothier Consulting (the WPDP Study Team) in 2019.

The available Watershed Plans used in this review are summarized in Table 3-2.

| Tertiary<br>Watershed | New<br>Quaternary<br>Watershed        | Old Watershed                                 | Primary Study / Watershed Plan                                       |
|-----------------------|---------------------------------------|---|--|
| Lake<br>Ontario       | Fifteen and<br>Sixteen Mile<br>Creeks | Fifteen, Sixteen<br>& Eighteen Mile<br>Creeks | Fifteen-Sixteen-Eighteen Mile<br>Creek Watershed Plan, NPCA,<br>2008 |
| Lake<br>Ontario       | Four Mile<br>Creek and<br>NOTL        | Niagara-on-the-<br>Lake                       | Niagara-on-the-Lake Watershed<br>Study, Aquafor Beech Ltd, 2008      |

## Table 3-2: Watershed Plans per Quaternary Watershed

| Tertiary<br>Watershed | New<br>Quaternary<br>Watershed              | Old Watershed                    | Primary Study / Watershed Plan   |  |
|-----------------------|---|----------------------------------|--|--|
| Lake<br>Ontario       | Jordan<br>Harbour -<br>Twenty Mile<br>Creek | Twenty Mile<br>Creek             | Twenty Mile Creek Watershed<br>Plan, NPCA, 2006                            |  |
| Lake                  | Twelve Mile                                 | Twelve Mile                      | Twelve Mile Creek Watershed Plan,  |  |
| Ontario               | Creek                                       | Creek                            | NPCA, 2006   |  |
| Lake                  | Twelve Mile                                 | St. Catharines                   | N/A - Regional Level Studies <sup>1</sup>                                  |  |
| Ontario               | Creek                                       | Urban                            |  |  |
| Lake<br>Ontario       | Welland Canal<br>North                      | Beaverdams and<br>Shriners Creek | Beaverdams and Shriners Creek<br>Watershed Plan - Phase One,<br>NPCA, 2011 |  |
| Lake                  | Welland Canal                               | Central Welland                  | Central Welland River Watershed  |  |
| Ontario               | North                                       | River (partial)                  | Plan, NPCA, 2010   |  |
| Lake                  | Welland Canal                               | Central Welland                  | Central Welland River Watershed  |  |
| Ontario               | South                                       | River (partial)                  | Plan, NPCA, 2010   |  |
| Lake                  | Welland Canal                               | Lake Erie North                  | Lake Erie North Shore Watershed  |  |
| Ontario               | South                                       | Shore (partial)                  | Plan, NPCA, 2010   |  |
| Lake<br>Ontario       | West Lake<br>Ontario<br>Shoreline           | Lincoln                          | N/A - Regional Level Studies <sup>1</sup>                                  |  |
| Lake<br>Ontario       | West Lake<br>Ontario<br>Shoreline           | Grimbsy                          | N/A - Regional Level Studies <sup>1</sup>                                  |  |
| Lake<br>Ontario       | West Lake<br>Ontario<br>Shoreline           | Miscellaneous                    | N/A - Regional Level Studies <sup>1</sup>                                  |  |
| Niagara               | Niagara River                               | Niagara-on-the-                  | Niagara-on-the-Lake Watershed  |  |
| River                 | North                                       | Lake (partial)                   | Study, Aquafor Beech Ltd, 2008   |  |
| Niagara               | Niagara River                               | Niagara Falls                    | N/A - Regional Level Studies <sup>1</sup>                                  |  |
| River                 | North                                       | Urban                            |  |  |
| Niagara               | Niagara River                               | South Niagara                    | South Niagara Falls Watershed  |  |
| River                 | South                                       | Falls (partial)                  | Report, NPCA, 2008   |  |
| Niagara               | Niagara River                               | Fort Erie (partial)              | Fort Erie Creeks - Watershed Plan,   |  |
| River                 | South                                       |                                  | Phillips Engineering, 2008   |  |
| Niagara               | Welland River                               | Upper Welland                    | Upper Welland River Watershed  |  |
| River                 | West  | River                            | Plan, NPCA, 2011   |  |
| Niagara               | Welland River                               | Central Welland                  | Central Welland River Watershed  |  |
| River                 | West  | River (partial)                  | Plan, NPCA, 2010   |  |
| Niagara<br>River      | Welland River<br>West                       | Big Forks Creek                  | N/A - Regional Level Studies <sup>1</sup>                                  |  |
| Niagara<br>River      | Welland River<br>East                       | Lower Welland<br>River           | Lower Welland River<br>Characterization Report, NPCA,<br>2011              |  |

| Tertiary<br>Watershed | New<br>Quaternary<br>Watershed      | Old Watershed            | Primary Study / Watershed Plan                                  |  |
|-----------------------|-------------------------------------|--------------------------|---|--|
| Niagara               | Welland River                       | South Niagara            | South Niagara Falls Watershed                                   |  |
| River East            |                                     | Falls (partial)          | Report, NPCA, 2008  |  |
| Lake Erie             | Northeast<br>Lake Erie<br>Shoreline | Lake Erie North<br>Shore | Lake Erie North Shore Watershed<br>Plan, NPCA, 2010             |  |
| Lake Erie             | Northeast<br>Lake Erie<br>Shoreline | Fort Erie (partial)      | Fort Erie Creeks - Watershed Plan,<br>Philips Engineering, 2008 |  |

Note: <sup>1</sup> "Regional Level Studies" refers to studies completed beyond the watershed scale (i.e., at a higher level, such as Niagara Region wide), which have been reviewed in order to collect any relevant and/or pertinent information regarding environmental sensitivities and/or watershed guidance which may supplement the lack of watershed scale studies for the system.

As shown in Table 3-2, the majority of the quaternary watersheds have had a watershed scale study completed either by NPCA directly, or through consultants on-behalf of NPCA. These studies were completed over the course of 5 years, beginning in 2006 and the most recent being completed in 2011, prior to the Watershed Plan program cancellation.

As indicated in the WPDP, there are three (3) watersheds for which there is no watershed plan or large-scale study completed. These include the Grimsby and Lincoln quaternary watersheds (now part of West Lake Ontario Shoreline quaternary watershed) which are a part of the Lake Ontario tertiary watershed, as well as the Big Forks Creek watershed, which is part of the Welland River West quaternary watershed, contributing to the Niagara River.

Notably, the Town of Grimsby completed hydrologic and hydraulic studies for its numbered watercourses in the late 1980's and has been largely maintaining these since their initial development, with updates associated with the widening of the QEW in the mid-1990s. NPCA is currently working on developing new flood line mapping for many of the regulated watercourses in Grimsby. This will be a source of new hydrology and hydraulics information which will be of potential utility for future studies. The Town of Lincoln previously prepared Master Drainage Plans for the Konkle, Bartlett and Prudommes systems, in the late 1980's, which have similarly been updated over time to capture land use changes. The Tufford and Haun systems were modelled in the early 1990's. These databases serve as a useful base from which to establish future analytical modelling. In addition, the Township of West Lincoln developed hydrologic modelling for several of its smaller urban watersheds in the early 1990s and has similarly updated this over time. Notably, some of these are currently being updated as part of the Smithville Subwatershed Studies; this work is anticipated to be completed in 2022.

Additionally, there are miscellaneous areas which drain directly to Lake Ontario that have not been captured or included in studies of proximate (i.e., Subwatersheds Lake Ontario 22, 36, 37, 40, 41, 42, 43). The urban development centres for St. Catharines

Urban and Niagara Falls Urban areas are also excluded from the local watershed studies.

For areas which are lacking local and specific watershed-scale studies, a review of regional-level studies has been completed in order to collect any relevant or pertinent information for these areas relative to environmental sensitivities, urban expansion and potential growth. The regional-level studies included in this review include the following:

- Niagara Water Quality Protection Study, (MacViro, Philips, CH2MHill), NPCA, 2003
- Groundwater Study, Waterloo Hydrogeologic Inc. (WHI), 2005
- Water Availability Study, AquaResource Inc, 2009
- Water Budget and Water Quantity Stress Assessment Final Report, AquaResource Inc, 2009
- Source Protection Plan for Niagara Peninsula Source Protection Area, NPCA, 2013
- Climate Change Discussion Paper, Niagara Region, 2019

The methods and results of the background review and data gathering has been summarized and presented in the subsequent sections.

# 3.1.1 Review Criteria

The various studies completed for the Niagara Region have been reviewed in order to extract any relevant criteria, recommendations or pertinent findings related to water management; this review has helped to characterize and summarize the legacy guidance and identify any gaps which would need to be addressed as part of future (Sub)Watershed Planning at a more resolute scale. The results of this background review and data inventory have been incorporated as part of the recommendations for future studies and growth management strategies, as documented in Volume 2: Niagara Watershed Management.

The review and summary have been focused on a variety of different analysis or management components related to water management, further building upon the inventory completed by the WPDP Study Team as part of the WPDP; these include the following:

- **Hydrologic Modelling** Hydrologic model development (i.e., HSPF, VO, PCSWMM, etc.), the type of assessment (design storms, continuous, duration, etc.), the date of completion, etc.
- **Hydraulic Modelling** Hydraulic model development (i.e., HEC-RAS, etc.), the extent of the modelling effort (inclusive of all reaches), the date of completion, etc.
- **Floodline Mapping** Resulting from hydraulic modelling, the regulatory storm event (i.e., 100 year), the date of completion, etc.
- Stormwater Management Criteria & Important Study Findings Outlining specific strategies or above and beyond typical SWM Best Management Practices (BMPs) involving the following:
  - *Water Quality* any noted water quality parameter exceedances (monitoring) or specific management requirements.

- Erosion Control any noted extended detention requirements (sizing).
- Flood Control any specific SWM sizing criteria (unitary release rates, etc.), SWM facility recommendations, flood sensitive locations, etc.
- Water Balance / Budget any specific criteria related to infiltration or on-site retention targets, or water quantity sensitivities.
- **Groundwater Management** Special considerations for the area including susceptible or at-risk areas, recharge areas, specific policies, etc.
- Watercourse Management & Watercourse Works In-watercourse erosion protection, riparian buffer zone management, etc., and any noted erosion prone locations which may require monitoring or capital works, etc.
- Aquatic Species at Risk (SAR) & Fishery Management Any designations, special consideration and/or discussions regarding known SAR and/or fishery habitat management that should be considered as part of management strategies.
- Wetlands Any direction for management of wetlands as part of a water resource system that should be considered as part of management strategies.
- Headwater Drainage Features (HDFs) Non-designated "watercourses" under the conservation authority; any HDF identification, classification and management details.
- **Climate Change –** Discussion of implications of climate change on watershed systems, and associated plans for adaptation, resiliency and management actions.

These management elements have been summarized based upon the available and applicable watershed planning studies for each of the subwatersheds which contain identified potential growth areas. The findings of this review have been summarized based upon quaternary watershed, with responsible municipalities identified for each subwatershed with identified growth, since it is assumed that each municipality will advance the future study needs relative to growth within their jurisdiction. The summary of findings and recommendations for the WRS can be found in the Table WR1 located in Appendix B-3.

# 3.1.2 Primary Findings & Study Gaps

The purpose of the Watershed plan review has been to summarize and extract important conclusions and/or characterization of natural systems in relation to a variety of engineering analyses, SWM criteria, and management of natural resources. The results of this review have also been used to identify the extent of gaps in each of the categories based upon the current available studies; this has been completed using three (3) categories of gaps:

- Major Gap tools/models missing, lack of specific discussion or SWM criteria to the watershed (only general/watershed wide best management practices), missing level of detail for specific watershed & subwatershed systems.
- Partial Gap partial information and/or lacking specific detail/next step in terms of developing management strategies (i.e., identification of issues, no management/mitigation plan).

 No Significant Gap – main information available/outlined, management plans defined – may require further refinement as part of future study, however, provides a sufficient level of detail for planning.

The results of this gap analysis and screening have been summarized based on a quaternary watershed basis in the Table WR2, located in Appendix B-3, with the applicable color coding of gap extent for each of the categories included in the review. A high-level summary of the region-wide findings are discussed in the subsequent sections. This information helps to identify specific requirements for future (sub)watershed studies relating to potential growth areas within the Niagara Region (further discussion regarding future studies can be found in Volume 2: Niagara Watershed Management).

# Hydrologic Modelling

As outlined in the WPDP, the majority of the existing watershed plans did not include a hydrologic model in which land use changes were assessed. Of the watershed plans reviewed, only two (2) studies included a hydrologic assessment and summary of peak flow results, these included:

- Fort Erie Creeks Watershed Plan, Philips Engineering, 2008
  - SWMHYMO model developed to assess land use changes and quantify hydrologic impacts.
- Niagara-on-the-Lake Watershed Study, Aquafor Beech Ltd, 2008
  - Flows estimated using the Index Flood Method for use in hydraulic modelling update.

This suggests "Major Gaps" in the remaining watershed planning areas, which currently have no existing hydrologic modelling completed for the surface water systems (as outlined in the watershed plans). Hydrologic modelling is the primary input for hydraulic modelling/floodplain mapping, therefore further information may be required from NPCA to identify the sources of the hydrologic inputs which were utilized for floodplain mapping studies, which may not be discussed in the respective watershed plans.

It should be noted that as part of the Water Availability Study (WAS) completed for the Region (ref. AquaResource Inc, 2009), HEC-HMS models were developed for all major watershed planning areas in order to quantify and characterize the groundwater system including the interaction and relationships with surface water. This can be an important data source moving forward, however does not incorporate the required analyses of land use changes and hydrologic responses within the receiving surface water systems.

# Hydraulic Modelling & Floodplain Mapping

Hydraulic modelling (i.e., HEC-RAS) and floodplain mapping are an important consideration when identifying lands safe and applicable for future development, specific to flood hazards. The majority of the watershed plans reviewed did not discuss hydraulic modelling and/or floodplain mapping explicitly as part of the watershed plan process; those that did outline the hydraulic modelling and results include the following:

- Fort Erie Creeks Watershed Plan, Philips Engineering, 2008
- Niagara-on-the-Lake Watershed Study, Aquafor Beech Ltd, 2008
- Twenty Mile Creek Watershed Plan, NPCA, 2006

However, it is understood that hydraulic studies have been completed as part of separate studies at smaller scales (i.e., not full watershed plans), which have occurred prior or subsequent to the published watershed plans. As such, the regulatory floodplain mapping (GIS format) has been reviewed as provided by the NPCA in order to flag subwatershed areas identified for potential growth, which do not currently have floodplain mapping delineated. The NPCA has also provided information regarding planned floodplain mapping studies for future consideration, which has been outlined in Volume 2: Niagara Watershed Management.

For those areas with published regulatory mapping available (GIS format), the source (author) and date of study completion would need to be reviewed in order to assess the vintage and the methods used. As hydrologic models become available and refined as part of future studies, there is a possibility that floodplain mapping will need to be updated to incorporate the most recent hydrologic results for the appropriate land use scenarios, particularly in areas where flood hazards may need to be identified with respect to future growth.

#### **Stormwater Management Criteria**

The watershed plans reviewed primarily consisted of a wide range of best management practices, with minimal discussion identifying specific goals and/or targets. This finding is consistent with the WPDP, by which the completed watershed plans generally characterize existing conditions and identify issues within the watershed; detailed analyses regarding land use changes and evaluation of management strategies/performance is lacking in the currently completed studies. Further details regarding the four (4) primary criteria for SWM outlined as part of the existing and legacy watershed plans are discussed in the subsequent sections. Details regarding the recommended strategies and opportunities for SWM related to the future growth as part of the NWP (E) can be found in Volume 2: Niagara Watershed Management.

## Water Quality

As demonstrated in the water quality monitoring summary (ref. Volume 1: Characterization), NPCA operates an extensive surface water quality monitoring network throughout the Niagara Region, with monitoring summaries published on an annual basis, and condensed summaries prepared as part of regional Watershed Report Cards. This allows for a high-level characterization of existing conditions, and identification of potential water quality issues in reference to the existing land uses present within the watershed systems. These reported exceedances can identify existing sensitivities which may be incorporated into future development management plans.

For water quality SWM sizing, watercourse habitat designation has historically been required in order to determine the level of quantity control required (i.e., enhanced, normal, basic). Some of the watershed plans discuss the habitat designation for the receiving watercourses, but not all include this detail in the characterization. The "major

watercourse" mapping (GIS) layer provided for use in this study has an attribute for fish habitat designation by the MNRF, which identifies features as either Type 1 – Critical, Type 2 – Important, Type 3 – Marginal, or "Other" (for non-classified watercourses); although it should be noted that there are concerns regarding the accuracy and intended use of these designations with respect to protection and/or remediation potential. This information can be used in future studies to determine the level of control for volumetric sizing criteria required for water quality management based on the level of sensitivity for the receiving systems as well as required setbacks for adjacent development.

However, it should be noted that the completed watershed plans are lacking an assessment of future land uses and analyses of the resulting impacts on surface water quality to develop measurable water quality SWM criteria. It is expected that this level of study would be warranted in future quaternary and subwatershed plans, as proposed land uses, and planning objectives become further refined.

## **Erosion Control**

Of the watershed plans reviewed, approximately half of the completed studies make reference to a separate stream morphology / geomorphology study, in which the focus was to characterize the physical stream systems, identify problem areas (erosion/stability) and recommend capital works and/or further monitoring programs. This information can be useful to identify erosion prone receivers which may be more sensitive to urbanization, thus requiring more extensive erosion control criteria.

However, majority of these studies lack the determination of erosion thresholds (measurable stream flows), which would be required in order to determine appropriate erosion control and extended detention volumetric sizing for erosion prone receivers. The majority of the watershed plans included general BMPs (structural and non-structural), which included mention of extended detention of 25 mm for 24-48 hours. This current level of guidance is considered to be inadequate to inform future management needs, and as such would be required to be advanced as part of future watershed and subwatershed plans, as proposed land uses, and planning objectives become further refined.

# Flood Control

Similar to the findings of the status of hydrologic modelling, flood control SWM criteria are largely missing from the completed watershed plans. Given that there was minimal assessment of future land uses, there is a corresponding lack of discussion regarding the quantifiable impacts to surface water peak flows and the resulting flood risks. As such, the completed watershed plans do not provide any indication regarding unitary release rates or volumetric sizing which can inform the management requirements for mitigating the impacts from proposed land uses.

The completed watershed plans outline general BMPs (related to watershed management), which includes the discussion of maintaining pre-development conditions, with minimal direction or measurable criteria for implementation or management planning. Some of the watershed plans and separate studies such as the Niagara Water Quality Protection Strategy (NWQPS, 2003), outline flood sensitive

locations as well as local management areas (LMAs) which are currently lacking SWM facilities for quality and flood control; these areas could serve as good opportunities for retroactive SWM should infill/intensification be expected in those areas.

## Groundwater Management

The Niagara Region has had several studies completed to date in order to characterize the groundwater system, water quantity and identify the required protection of sensitive features. All watershed plans reviewed made mention to the 2005 Groundwater Study, which is followed by the Source Water Protection Plan (ref. NPCA, 2013) and associated studies, such as the Water Availability Studies (WAS), Water Budget and Water Quantity Stress Assessment, as well as the resulting delineation of sensitive groundwater areas (i.e., Highly Vulnerable Aquifers (HVAs), Significant Groundwater Recharge Areas (SGRAs)). Further study will be required to assess the future land uses of potential growth areas and develop specific management criteria once planning objectives are refined.

#### Water Balance / Budget

The maintenance of a water balance / budget post-development is a vital component of the hydrologic system, involving both surface water and groundwater systems, and their interactions. A water budget is a general accounting for the amount of rainfall/snowmelt which becomes runoff, is infiltrated, or is lost through evapotranspiration for a subject area. The primary water quantity studies which consider the water budget completed for Niagara Region include the Water Availability Studies (WAS), completed in 2009, which included HEC-HMS modelling and existing water balance/budget characterization, and the Tier 1 Water Budget and Water Quantity Stress Assessment, completed in 2010, which identified the water quantity stress level of both the surface water and groundwater systems relative to demand and supply. As such, depending on the year of completion for the local watershed plans, there is no explicit discussion regarding the current water balance / budget characterization for the plans completed prior to 2010.

These water quantity studies provide a detailed characterization of Niagara's water budget and available water quantity under existing land uses and can thereby provide targets and/or identify sensitive areas currently under hydrologic stress. Through these studies, stress levels were assigned to each of the watershed planning areas for both the surface water and groundwater systems to identify "significant", "moderate" or "low" stress levels, based upon monthly demand and supply. These classifications can help identify both at-risk areas, and those areas considered less sensitive to impacts associated with urban development. Although, it should be noted that the growth areas are all proposed to be serviced with municipal water (urban) and are therefore not expected to contribute to annual/seasonal water demand through local wells, permits to take water or irrigation needs.

The impacts of the potential growth areas are primarily associated with the local hydrologic cycle which would influence water availability in the respective systems (surface runoff and infiltration / groundwater recharge). A summary of the surface water and groundwater quantity stress levels with reference to Niagara's quaternary watersheds with potential growth areas, is presented in Table 3-3.

Table 3-3: Water Quantity Stress Levels by Old Watershed (ref. AquaResource,2010)

| Old Watershed Name <sup>1</sup>           | Potential<br>Growth Area                                  | Surface Water<br>Stress Level | Groundwater<br>Stress Level |
|---|---|-------------------------------|-----------------------------|
| Beaverdams and<br>Shriners Creeks         | PEL-1*,<br>NF-1*, NF-2,<br>NF-3*                          | Significant                   | Low                         |
| Big Forks Creek                           | -   | Significant                   | Low                         |
| Central Welland River                     | WEL-1,<br>PEL-1*  | Moderate                      | Low                         |
| Fifteen, Sixteen,<br>Eighteen Mile Creeks | -   | Significant                   | Moderate                    |
| Fort Erie                                 | FE-1*, FE-2*,<br>FE-3, FE-4,<br>FE-5, FE-6,<br>FE-7, FE-8 | Moderate                      | Moderate                    |
| Grimsby                                   | GR-1  | Significant                   | Low                         |
| Lake Erie North Shore                     | FE-2*   | Moderate                      | Significant                 |
| Lincoln                                   | -   | Significant                   | Low                         |
| Lower Welland River                       | NF-3*, NF-4*  | Moderate                      | Low                         |
| Miscellaneous                             | -   | -                             | -                           |
| Niagara Falls Urban                       | -   | Low                           | Low                         |
| Niagara-on-the-Lake                       | NF-1*   | Significant                   | Low                         |
| South Niagara Falls                       | FE-1*, NF-4*,<br>NF-5, NF-6,<br>NF-7                      | Moderate                      | Low                         |
| St. Catharines Urban                      | -   | Low                           | Low                         |
| Twelve Mile Creek                         | -   | Low                           | Low                         |
| Twenty Mile Creek                         | WL-1, WL-2  | Significant                   | Low                         |
| Upper Welland River                       | -   | Moderate                      | Low                         |

Note: <sup>1</sup> Currently summarized by old watershed naming convention as per the mapping/reporting available as part of the Tier 1 Water Budget and Water Quantity Stress Assessment, AquaResource, 2010.

\* Potential Growth Area crosses old watershed boundary.

Based upon the currently proposed potential growth area locations (ref. Drawing 3-1), the groundwater stress level was identified as primarily "Low", with some occurrences of "Moderate" or "Significant" which is limited to the Fort Erie growth areas. The surface water stress levels vary across all watershed systems, with "Moderate" or "Significant" being the dominant classification with respect to the identified growth areas.

The water budgets resulting from the WAS and water quantity assessments should be reviewed further as part of future quaternary and/or subwatershed studies to establish the specific management needs for these systems. Notably lands identified as either Highly Vulnerable Aquifers (HVAs) or Significant Groundwater Recharge Areas
(SGRAs), or other drinking water threats (i.e., IPZ, ECA, IBA, etc.) identified through the Source Water Protection Plan (NPCA, 2013) will require management in accordance with policies laid out by the Niagara Peninsula Source Protection Plan, which includes consideration for both water budget (i.e. recharge or infiltration through on-site controls) as well as contaminant management plans in accordance with the Conservation Authorities Moraine Colaition (CAMC) (ref. (Ogilvie, Ogilvie & Company and Anthony Usher Planning Consultant, 2005) and the Nutrient Management Act, 2002. Inclusion of both water quantity and water quality management for vulnerable lands as part of the development approval process, will thereby minimize the impacts of development on the local water budget and source water protection.

#### Watercourse Management / Works

As discussed in the previous Erosion Control section, a number of the watershed plans contained text and/or referenced separate stream morphology / geomorphology studies for the watershed systems. These provide an indication of the "current" status (being at the time of publication) of the natural features, and identification of erosion prone/at risk areas; majority of these studies contained recommendations for localized capital works and future monitoring needs. Based upon information from NPCA, the fluvial geomorphology assessment program was cancelled at the time of the watershed planning program cancellation in 2011. As such, there are no recent watershed scale studies, however further information may be available and/or included as part of recent subwatershed scale plans. Any planned or proposed work related to stream morphology / geomorphology studies are to be addressed as part of subsequent quaternary and (sub)watershed plans.

The majority of the watershed plans included discussion and recommendations for riparian buffer planting programs to improve existing water quality and sediment conditions, particularly in agricultural areas with little to no existing buffers. Discussions of the watercourse management was found to be primarily focused on improving existing conditions, as opposed to inferring management needs as part of future development. As such, it is expected that the current state of the watercourses be included as part of future study requirements and identify any sensitivities to land use changes (i.e., re-alignment).

#### Aquatic Species at Risk (SAR) & Fishery Management

All watershed plans reviewed contained a high-level review of fish and fish habitat. Some watershed studies included and documented sampling or in-field survey efforts, others do not speak to collection methods, and it is generally understood that monitoring information and existing information (secondary source, air photo) was used for these characterizations. Some important or uncommon characteristics were identified (e.g., cold water, naturally occurring brook trout population – Twelve Mile Creek). Many, but not all watershed plans included discussion and lists of aquatic Species at Risk. Generally, objectives and general direction for management is focused on protecting, and where possible enhancing or restoring habitat and native species populations. Specific actions and management provide basic direction on restoration, including:

- **Riparian habitat creation, restoration, and protection**. This objective is common across most watershed studies reviewed. Increasing riparian habitat supports improvements to water quality and to fish habitat through providing cover / habitat and supporting thermal mitigation. Some watershed studies provide refinement to cover objectives based on reaches / portions of subwatersheds. Program for funding support and education on the value of riparian areas are identified.
- Restoration of areas to support Species at Risk and Provincially Rare Species. Some general direction to seek opportunities to benefit SAR and provincially Rare Species is provided in watershed plans. Targeted efforts are not identified, but references to reaches / portions of subwatersheds based on SAR records at the time of report preparation is provided.
- **Thermal Impact Mitigation**. Twelve Mile Creek has the only coldwater system supporting a naturally occurring Brook Trout population. Specific direction for mitigating or improving thermal conditions (e.g., removing stressors) is identified in this watershed plan. Some reference to thermal mitigation / benefits occurs in other watershed studies, but no other targeted efforts were identified.
- **Removing Barriers to Fish Movement**. Several watershed studies identify existing or recommend an assessment of barriers to fish movement. Some barriers are natural / semi-natural (e.g., debris jams), while others (e.g., weirs, control structures) are manmade. Where structures are in place to manage flood levels / flows, removal may not be feasible; alternative mitigation measures may be appropriate.

It should be noted that the timing of study preparation will result in outdated information on Species at Risk and, to a lesser extent, provincially rare species occurrence and designations. Other characterization data collected for the NWP (E) provide updated information (ref. Volume 1: Characterization), however it is important that a refined review of SAR be completed to support any future works.

The Healthy Twelve Mile Creek Project, led by Trout Unlimited Canada, has assessed and provides recommendations as well as existing and proposed mitigation and restoration recommendations across the Twelve Mile Creek Watershed (ref. <u>https://www.healthytwelvemilecreek.ca/</u>). Restoration and mitigation opportunities include forestation / reforestation, implementation of Low Impact Design strategies within existing urban areas, addressing areas of acute sedimentation and erosion, identifying and addressing location of thermal pollution / impact, education and communication to support the protection of native species – with a focus on Brook Trout. Direction provided by this project will be very informative for the preparation of management strategies within the watershed.

#### Wetlands

Wetlands have a direct relationship with water management throughout a watershed. They can slow the movement of water to receiving streams, support baseflow conditions, provide infiltration / recharge and support improved water quality. Wetlands were a key metric used to assess health of the watersheds across all watershed studies reviewed. Management of wetlands focused on:

- Protection and Enhancement of Existing Wetlands. Wetland cover across watersheds is variable. Some fall below the 10% target for wetland cover in a watershed (Environment Canada's "How Much Habitat is Enough" 3<sup>rd</sup> Edition, 2013), and some achieve or exceed this target. Higher wetland cover supports a healthy water resource system and as such protection and enhancement of existing wetland cover is important to the health of the watershed. Opportunities to enhance wetlands can improve their form and function across a range of services (terrestrial and aquatic).
- Restore or Create Wetlands Where Suitable Conditions Exist. Restoration and creation of wetlands was another common, generalized management objective. Some watershed plans provide additional geographic direction for areas of potential action / implementation (e.g., restoration around an existing PSW to improve quality and size). Others are more general with focus on increasing cover. More recent watershed studies include an assessment of suitability criteria to identify areas of higher potential for restoration; in restoration summaries, these reports also provide a higher level of specificity in location.

Programs for funding support and education on the value of wetlands are identified in the reviewed plans. Refinement or prioritization of opportunities tied to other water management objectives may assist in targeting efforts. All watershed plans provided direction for protection and enhancement or creation of wetland areas across the watershed(s).

#### **Headwater Drainage Features**

There was no mention of headwater drainage features (HDF) as part of the completed watershed plans. As part of the "major watercourse" shapefile provided for use in this study, there is a "feature type" attribute which does identify some of the watercourse lines as "headwaters". However, it is unclear of the status and protection level for these features; from the current work being completed as part of the Smithville Subwatershed Studies, it is understood that the application of the CVC/TRCA HDF protocols has not been formally adopted or required by Niagara Region, although the NPCA is seeking to standardize the application of the protocols within its jurisdiction. Therefore, this will require further confirmation and/or study to identify the existence and management of such features (ref. Volume 2: Niagara Watershed Management).

#### Climate Change

As outlined in the WPDP, the potential implications of climate change in Niagara Region are identified and discussed by Penney (ref. Adapting to Climate Change: Challenges for Niagara, 2012), which provides the basis for more specific studies including cumulative effects and management scenarios. Based upon the watershed plans reviewed, climate change considerations were very minimally discussed, and did not consider the effects of existing and proposed land uses and water/wastewater/ stormwater management infrastructure on exacerbating climate change impacts. This identifies a need for inclusion as part of future studies to develop appropriate climate change mitigation, adaptation and management plans for the watershed systems and future development.

As part of the Niagara Official Plan, the Niagara Region's Planning and Development Services division has completed a Climate Change Discussion Paper (CCDP) in November 2019, in order to identify past work, future trends and policy conformity requirements. The notable impacts of climate change within the Niagara Region include increasing flood risks (severe storms, winter storms, ice storms), extreme temperatures and drought, deteriorating water quality and increasing occurrence of vector borne diseases.

As outlined in Volume 2: Niagara Watershed Management, the next phase of this work program will be the development of draft policies for the new Official Plan. Additionally, this work program will be undertaking a climate modeling and projections project in conjunction with the Ontario Climate Consortium, providing the Region with historical and future data on how the climate is changing. This data will be instrumental in informing watershed and subwatershed plans. Upon Council endorsement this data will be accessible to NPCA and local area municipalities as well.

Land use planning provides an opportunity to minimize climate change risks to communities through mitigation and adaptation, in order to increase resiliency to climate change. The following have been identified as a subset of possible opportunities, related to SWM and natural systems, to achieve mitigation and adaptation through future planning initiatives in Niagara Region (ref. Climate Change Discussion Paper (CCDP), 2019):

- Encouraging the use of green infrastructure and low impact development;
- Incorporating urban heat island mitigation strategies;
- Prohibiting development in hazardous lands and natural areas;
- Stormwater management plans that assess extreme weather and encourage or require low-impact development and green infrastructure;
- Watershed and subwatershed planning that considers climate change scenarios (e.g. how extreme storm events may impact/change floodplains).

The recommendations presented as part of the CCDP, future policy development, and climate change modeling and projections (if available) have been evaluated and incorporated into the requirements and recommendations for future studies, as part of subsequent study tasks of the NWP (E) (ref. Volume 2: Niagara Watershed Management).

### 3.1.3 Existing Monitoring Network within Potential Growth Areas

As outlined in Volume 1: Characterization, a review of information from NPCA has been completed to inventory the existing hydrometeorological datasets available for Niagara Region, which include climate stations, streamflow monitoring, water quality monitoring and groundwater monitoring across the various watersheds under NPCA jurisdiction. This summary of monitoring locations has allowed for the identification of potential information gaps or data deficiencies which may need to be addressed as part of future studies, particularly the quaternary-level watershed plans to be conducted by Niagara Region, following the current NWP (E). Further discussion regarding the monitoring program details and monitoring station specifics (data type, status, time steps, period of

record) can be found in the respective tertiary watershed characterization of Volume 1: Characterization.

As documented in Volume 2: Niagara Watershed Management, the existing monitoring network was summarized on a regional scale, to demonstrate the four (4) monitoring networks into a single high-level summary, in order to identify any key gaps with respect to coverage. The following summary has taken the regional-scale summary provided in Volume 2 and re-presented the inventory with respect to the proposed growth across the Niagara Region. The current monitoring inventory has been completed at two (2) different scales, including at the quaternary watershed scale, and the proposed growth area (subwatershed) scale.

The first summary includes an inventory of the existing/established monitoring network across all quaternary watersheds, in conjunction with the total future potential growth (all growth designations), as documented in the *Cumulative Impacts* assessment (ref. Section 2.2). The purpose of summarizing the established monitoring networks at this scale is to demonstrate the monitoring data available in connection to the watershed systems with the largest amount and/or proportion of total future potential growth (i.e. stressed watersheds). This summary provides a basis for prioritizing action and can identify gaps related to the data needs for long-term monitoring, in order to characterize the impacts of future development and provide an opportunity for adaptive management; further discussion regarding opportunities for adaptive management are provided in Volume 2: Niagara Watershed Management. This quaternary scale summary is presented in Table 3-4.

The second summary includes an inventory of the existing/established monitoring networks within the subwatershed areas identified with potential growth areas. This summary provides a smaller scale inventory to inform the required monitoring coverage for future growth planning and potential settlement boundary expansions. This is intended to help provide direction for the Region and local municipalities on their data collection needs for use in future land use and subwatershed planning initiatives. This potential growth area scale summary is presented in Table 3-5.

|                    |                                    |                           | <b>.</b> .           | •  | •  |  |  |   |   |   |
|--------------------|------------------------------------|---------------------------|----------------------|--|--|--|--|---|---|---|
| Tertiary Watershed | Quaternary Watershed (QWS)         | Drainage<br>Area<br>(km²) | Subwatersheds<br>(#) | Total<br>Potential<br>Growth<br>(Outside<br>Built-Up)<br>km <sup>2</sup> | Total<br>Potential<br>Growth<br>(Outside<br>Built-Up)<br>% of WS | Potential<br>Growth<br>Area (ID)   | Existing<br>Monitoring<br>Station<br>Established<br>(Count #)<br>Climate | Existing<br>Monitoring<br>Station<br>Established<br>(Count #)<br>Streamflow | Existing<br>Monitoring<br>Station<br>Established<br>(Count #)<br>Water<br>Quality | Existing<br>Monitoring<br>Station<br>Established<br>(Count #)<br>Groundwater <sup>1</sup> |
| Lake Ontario       | Fifteen and Sixteen Mile Creeks    | 136.5                     | 10                   | 0.2  | 0.1%   |  | 0  | 0   | 3   | 2   |
| Lake Ontario       | Four Mile Creek and NOTL           | 126.4                     | 15                   | 0.3  | 0.2%   | NF-1*  | 1  | 1   | 6   | 1   |
| Lake Ontario       | Jordan Harbour - Twenty Mile Creek | 303.5                     | 6                    | 10.4   | 3.4%   | WL-1, WL2  | 3  | 4   | 10  | 1   |
| Lake Ontario       | Twelve Mile Creek                  | 148.4                     | 9                    | 0.1  | 0.0%   |  | 2  | 4   | 13  | 5   |
| Lake Ontario       | Welland Canal North                | 92.4                      | 5                    | 12.9   | 14.0%  | NF-1*, NF-<br>2, NF-3*,<br>PEL-1*  | 1  | 0   | 2   | 3   |
| Lake Ontario       | Welland Canal South                | 77.4                      | 4                    | 0.2  | 0.2%   | WEL-1  | 1  | 0   | 1   | 2   |
| Lake Ontario       | West Lake Ontario Shoreline        | 300.1                     | 38                   | 1.8  | 0.6%   | GR-1   | 1  | 0   | 4   | 2   |
| Niagara River      | Niagara River North                | 62.2                      | 8                    | 0.2  | 0.3%   |  | 0  | 0   | 1   | 1   |
| Niagara River      | Niagara River South                | 185.4                     | 22                   | 12.5   | 6.7%   | FE-1, FE-<br>2*, FE-3,<br>FE-4*, FE-<br>5, FE-6,<br>FE-7, FE-8,<br>NF-6*, NF-7 | 1  | 1   | 7   | 4   |
| Niagara River      | Welland River East                 | 136.6                     | 7                    | 10.0   | 7.3%   | NF-3*, NF-<br>4, NF-5,<br>NF-6*  | 2  | 1   | 7   | 3   |
| Niagara River      | Welland River West                 | 868.5                     | 38                   | 0.2  | 0.02%  | PEL-1*   | 8  | 8   | 13  | 15  |
| Lake Erie          | Northeast Lake Erie Shoreline      | 137.0                     | 38                   | 2.2  | 1.6%   | FE-2*, FE-<br>4*   | 2  | 0   | 8   | 0   |

#### Table 3-4: Niagara Region Existing Monitoring Network Inventory – Total Proposed Growth

Note: \* Potential Growth Area crosses quaternary watershed boundaries.

<sup>1</sup> The groundwater monitoring network is comprised of both the PGMN and OGS program networks (further discussion in Volume 1: Characterization). The OGS program has several wells/stations in the same geographic location (i.e., recording at varying depths); as such, the count applied in this summary is based upon the different monitoring station IDs, and does not account for additional depth recordings.

|                   |              |               |                         | • •                                    | •                                     |   |  |   |   |
|-------------------|--------------|---------------|-------------------------|--|---------------------------------------|---|--|---|---|
| Growth<br>Area ID | Area<br>(ha) | Municipality  | Tertiary<br>Watershed   | Quaternary Watershed                   | Subwatershed                          | Existing<br>Monitoring<br>Station<br>Established?<br>(Y/N)<br>Climate | Existing<br>Monitoring<br>Station<br>Established?<br>(Y/N)<br>Streamflow | Existing<br>Monitoring<br>Station<br>Established?<br>(Y/N)<br>Water Quality | Existing<br>Monitoring<br>Station<br>Established?<br>(Y/N)<br>Groundwater |
| FE-1              | 437          | Fort Erie     | Niagara River<br>(100%) | Niagara River South<br>(100%)          | FEC Black Creek (96%)                 | Y   | Y  | Y   | Y   |
| FE-1              | 437          | Fort Erie     | Niagara River<br>(100%) | Niagara River South<br>(100%)          | SNF Bayers Creek (4%)                 | Ν   | N  | Y   | N   |
| FE-2              | 34           | Fort Erie     | Niagara River<br>(69%)  | Niagara River South<br>(69%)           | FEC Beaver Creek (69%)                | Ν   | N  | N   | Y   |
| FE-2              | 34           | Fort Erie     | Lake Erie<br>(31%)      | Northeast Lake Erie<br>Shoreline (31%) | FEC Six Mile Creek Lake<br>Erie (11%) | Ν   | N  | N   | N   |
| FE-2              | 34           | Fort Erie     | Lake Erie<br>(31%)      | Northeast Lake Erie<br>Shoreline (31%) | LENS Bay Beach Area<br>Drain (18%)    | Ν   | N  | N   | N   |
| FE-2              | 34           | Fort Erie     | Lake Erie<br>(31%)      | Northeast Lake Erie<br>Shoreline (31%) | LENS Lake Erie 2B (2%)                | Ν   | N  | N   | N   |
| FE-3              | 544          | Fort Erie     | Niagara River<br>(100%) | Niagara River South<br>(100%)          | FEC Beaver Creek (34%)                | Ν   | N  | N   | Y   |
| FE-3              | 544          | Fort Erie     | Niagara River<br>(100%) | Niagara River South<br>(100%)          | FEC Frenchmans Creek<br>(34%)         | Ν   | N  | Y   | Ν   |
| FE-3              | 544          | Fort Erie     | Niagara River<br>(100%) | Niagara River South<br>(100%)          | FEC Miller Creek (32%)                | Ν   | N  | N   | Y   |
| FE-4              | 143          | Fort Erie     | Niagara River<br>(33%)  | Niagara River South<br>(33%)           | FEC Frenchmans Creek<br>(33%)         | Ν   | N  | Y   | N   |
| FE-4              | 143          | Fort Erie     | Lake Erie<br>(67%)      | Northeast Lake Erie<br>Shoreline (67%) | FEC Niagara River 18F<br>(21%)        | Ν   | N  | N   | N   |
| FE-4              | 143          | Fort Erie     | Lake Erie<br>(67%)      | Northeast Lake Erie<br>Shoreline (67%) | FEC Six Mile Creek Lake<br>Erie (45%) | Ν   | N  | N   | N   |
| FE-4              | 143          | Fort Erie     | Lake Erie<br>(67%)      | Northeast Lake Erie<br>Shoreline (67%) | FEC Bertie Bay Drain Area<br>2A (1%)  | Ν   | N  | N   | N   |
| FE-5              | 350          | Fort Erie     | Niagara River<br>(100%) | Niagara River South<br>(100%)          | FEC Beaver Creek (40%)                | Ν   | N  | N   | Y   |
| FE-5              | 350          | Fort Erie     | Niagara River<br>(100%) | Niagara River South<br>(100%)          | FEC Black Creek (60%)                 | Y   | Y  | Y   | Y   |
| FE-6              | 98           | Fort Erie     | Niagara River<br>(100%) | Niagara River South<br>(100%)          | FEC Black Creek (100%)                | Y   | Y  | Y   | Y   |
| FE-7              | 81           | Fort Erie     | Niagara River<br>(100%) | Niagara River South<br>(100%)          | FEC Black Creek (100%)                | Y   | Y  | Y   | Y   |
| FE-8              | 20           | Fort Erie     | Niagara River<br>(100%) | Niagara River South<br>(100%)          | FEC Black Creek (100%)                | Y   | Y  | Y   | Y   |
| GR-1              | 12           | Grimbsy       | Lake Ontario<br>(100%)  | West Lake Ontario<br>Shoreline (100%)  | GR Lake Ontario 44A<br>(0.01%)        | Ν   | N  | N   | N   |
| NF-1              | 329          | Niagara Falls | Lake Ontario<br>(100%)  | Welland Canal North<br>(92%)           | BDSC Shriners Creek<br>(30%)          | Y   | N  | Y   | N   |
| NF-1              | 329          | Niagara Falls | Lake Ontario<br>(100%)  | Welland Canal North<br>(92%)           | BDSC Ten Mile Creek<br>(62%)          | lile Creek N  |  | N   | N   |

### Table 3-5: Niagara Region Existing Monitoring Network Inventory – Potential Growth Areas

| Growth<br>Area ID | Area<br>(ha) | Municipality              | Tertiary<br>Watershed   | Quaternary Watershed             | Subwatershed                      | Existing<br>Monitoring<br>Station<br>Established?<br>(Y/N)<br>Climate | Existing<br>Monitoring<br>Station<br>Established?<br>(Y/N)<br>Streamflow | Existing<br>Monitoring<br>Station<br>Established?<br>(Y/N)<br>Water Quality | Existing<br>Monitoring<br>Station<br>Established?<br>(Y/N)<br>Groundwater |
|-------------------|--------------|---------------------------|-------------------------|----------------------------------|-----------------------------------|---|--|---|---|
| NF-1              | 329          | Niagara Falls             | Lake Ontario<br>(100%)  | Four Mile Creek and<br>NOTL (8%) | NOTL Six Mile Creek (8%)          | Ν   | N  | Y   | N   |
| NF-2              | 537          | Niagara Falls             | Lake Ontario<br>(100%)  | Welland Canal North<br>(100%)    | BDSC Beaver Dams Creek<br>(53%)   | Ν   | N  | Y   | N   |
| NF-2              | 537          | Niagara Falls             | Lake Ontario<br>(100%)  | Welland Canal North<br>(100%)    | BDSC Shriners Creek<br>(47%)      | Y   | N  | Y   | N   |
| NF-3              | 373          | Niagara Falls             | Lake Ontario<br>(61%)   | Welland Canal North<br>(61%)     | BDSC Beaver Dams Creek<br>(61%)   | Ν   | N  | Y   | N   |
| NF-3              | 373          | Niagara Falls             | Niagara River<br>(39%)  | Niagara River North<br>(4%)      | Chippawa Power Canal<br>(4%)      | Ν   | N  | Y   | N   |
| NF-3              | 373          | Niagara Falls             | Niagara River<br>(39%)  | Welland River East<br>(34%)      | LWR Thompson Creek<br>(34%)       | Ν   | N  | Y   | N   |
| NF-4              | 467          | Niagara Falls             | Niagara River<br>(100%) | Welland River East<br>(100%)     | LWR Welland River (11%)           | Ν   | N  | Y   | N   |
| NF-4              | 467          | Niagara Falls             | Niagara River<br>(100%) | Welland River East<br>(100%)     | SNF Lyons Creek (52%)             | Ν   | N  | Y   | Y   |
| NF-4              | 467          | Niagara Falls             | Niagara River<br>(100%) | Welland River East<br>(100%)     | SNF Grassy Brook (37%)            | Ν   | N  | Y   | Y   |
| NF-5              | 311          | Niagara Falls             | Niagara River<br>(100%) | Welland River East<br>(100%)     | SNF Lyons Creek (91%)             | Ν   | N  | Y   | Y   |
| NF-5              | 311          | Niagara Falls             | Niagara River<br>(100%) | Welland River East<br>(100%)     | SNF Tee Creek (9%)                | Ν   | N  | Y   | N   |
| NF-6              | 656          | Niagara Falls             | Niagara River<br>(100%) | Welland River East<br>(78%)      | SNF Hunters Drain (34%)           | Ν   | N  | N   | N   |
| NF-6              | 656          | Niagara Falls             | Niagara River<br>(100%) | Welland River East<br>(78%)      | SNF Lyons Creek (42%)             | Ν   | N  | Y   | Y   |
| NF-6              | 656          | Niagara Falls             | Niagara River<br>(100%) | Welland River East<br>(78%)      | SNF Tee Creek (2%)                | Ν   | N  | Y   | N   |
| NF-6              | 656          | Niagara Falls             | Niagara River<br>(100%) | Niagara River South<br>(22%)     | SNF Usshers Creek (22%)           | Ν   | N  | Y   | Y   |
| NF-7              | 246          | Niagara Falls             | Niagara River<br>(100%) | Niagara River South<br>(100%)    | SNF Niagara River 11C<br>(40%)    | Ν   | N  | N   | N   |
| NF-7              | 246          | Niagara Falls             | Niagara River<br>(100%) | Niagara River South<br>(100%)    | SNF Usshers Creek (60%)           | Ν   | N  | Y   | Y   |
| PEL-1             | 91           | Pelham                    | Lake Ontario<br>(23%)   | Welland Canal North<br>(23%)     | BDSC Welland Canal<br>North (20%) | Ν   | N  | N   | Y   |
| PEL-1             | 91           | Pelham                    | Lake Ontario<br>(23%)   | Welland Canal North<br>(23%)     | CWR Tow Path Drain (3%)           | Ν   | N  | N   | N   |
| PEL-1             | 91           | Pelham                    | Niagara River<br>(77%)  | Welland River West<br>(77%)      | CWR Draper Creek (77%)            | Ν   | N  | Y   | N   |
| WEL-1             | 45           | Welland, Port<br>Colborne | Lake Ontario<br>(100%)  | Welland Canal South<br>(100%)    | CWR Welland Canal<br>South (100%) | Y   | N  | N   | N   |

| Growth<br>Area ID | Area<br>(ha) | Municipality | Tertiary<br>Watershed  | Quaternary Watershed                            | Subwatershed                    | Existing<br>Monitoring<br>Station<br>Established?<br>(Y/N)<br>Climate | Existing<br>Monitoring<br>Station<br>Established?<br>(Y/N)<br>Streamflow | Existing<br>Monitoring<br>Station<br>Established?<br>(Y/N)<br>Water Quality | Existing<br>Monitoring<br>Station<br>Established?<br>(Y/N)<br>Groundwater |
|-------------------|--------------|--------------|------------------------|---|---------------------------------|---|--|---|---|
| WL-1              | 556          | West Lincoln | Lake Ontario<br>(100%) | Jordan Harbour -<br>Twenty Mile Creek<br>(100%) | TWEN Spring Creek (54%)         | Ν   | N  | Y   | N   |
| WL-1              | 556          | West Lincoln | Lake Ontario<br>(100%) | Jordan Harbour -<br>Twenty Mile Creek<br>(100%) | TWEN Twenty Mile Creek<br>(46%) | Y   | Y  | Y   | Y   |
| WL-2              | 687          | West Lincoln | Lake Ontario<br>(100%) | Jordan Harbour -<br>Twenty Mile Creek<br>(100%) | TWEN North Creek (62%)          | Υ   | Y  | Y   | N   |
| WL-2              | 687          | West Lincoln | Lake Ontario<br>(100%) | Jordan Harbour -<br>Twenty Mile Creek<br>(100%) | TWEN Twenty Mile Creek<br>(38%) | Y   | Y  | Y   | Y   |

#### 3.1.3.1 Summary

In summary, the tertiary and quaternary watershed systems consist of a wide variety of natural and water-based resources which will influence future land use planning initiatives in Niagara Region. The information presented as part of the characterization and legacy study review has been used in other study elements (ref. Section 4.0 and Volume 2: Niagara Watershed Management) to determine any constraints or unfavorable conditions to development and identify gaps for future study. This data inventory assists in identifying the state of available information to inform decision making for preferred growth/expansion areas, as well as provide recommendations for additional study and monitoring, which may be required to support future growth planning, as part of subsequent study needs at the quaternary and subwatershed level (ref. Volume 2: Niagara Watershed Management).

#### 3.1.4 NHS & WRS within Potential Growth Areas

Volume 1 of the NWP(E) characterizes the watersheds within Niagara and provides an overview of known constraints and opportunities (e.g., restoration or enhancement). Volume 2 introduces existing directions for management of the natural environment resources across Niagara's watersheds, including the NHS and WRS being developed through the new NOP process, considers interactions between these systems and the role they play in maintaining the composite Natural Environment System and provides guidance and best practices for watershed management developed and informed by the data presented in Volume 1.

To further refine the information and guidance provided, the following sections provide a summary of features and areas which comprise the NHS and WRS that occur within each of the Potential Growth Areas and summarizes the potential system interactions and interdependencies that are to be considered, confirmed, and addressed through more refined scales of study to inform land use planning (e.g., a detailed subwatershed study).

#### 3.1.4.1 Natural Heritage System Features within Potential Growth Areas

Most features which comprise the NHS are **required** and as such are confirmed components of the NHS. While the components are generally known, criteria and definitions are being developed as part of the new NOP process to inform the identification of these features on the landscape. As such, while the composition of the NHS is generally known, they cannot at this time be identified (i.e., mapped or confirmed) within the Potential Growth Areas. For example, significant woodlands are a known component but the criteria and definition by which they are identified in Niagara Region are in final stages of development. However, available datasets provide the opportunity to summarize existing features and areas which occur within the Potential Growth Areas to generally characterize existing natural land cover and inform the review of potential interactions between the NHS and WRS that may occur in these areas (ref. Volume 2, Section 3.4). While this summary provides a snapshot of landcover, readers are referred to Volume 1: Characterization of the NWP(E) for a comprehensive summary of existing conditions by tertiary and quaternary watershed. Preparation of future study plans should consider the context for the potential growth

areas within their respective watersheds, to ensure that potential presence of significant features, land cover, etc. is considered.

To facilitate use of this information through preparation of recommendations associated with the current NWP (E) and subsequent stages of study and planning, summary information is provided for potential growth / urbanized areas as follows:

- **Growth Areas** | A summary of features present within each of the Potential Growth Areas. Additional details have been included in the evaluation matrix for the Potential Growth Areas (Section 4.0. Growth Areas include lands not currently within the settlement boundaries for Cities / Towns within the Region (e.g., St. Catharines, Lincoln, etc.) which may (pending assessment) be brought into the urban boundary to accommodate future growth. Some, none, or all may be required (see additional information in Section 4.0).
- **Greenfield Areas** | A summary of features present in Greenfield Areas (cumulative). Greenfield Areas include lands currently within settlement boundaries but are not yet 'built-out' (i.e., fully developed) and will accommodate growth within the existing settlement boundary.
- Settlement / Existing Built-Up Areas | A summary of features present in existing built-up areas (cumulative). Settlement / Existing Built-Up Areas are those lands which have been developed and include residential, commercial, etc. land uses within the Region's Cities / Towns.

A summary of NHS features based on currently identified components of the system is presented in Table 3-6.. Detailed information on natural heritage conditions is presented through Volume 1: Characterization of the NWP (E) and a detailed overview of natural features within each Potential Growth Area is presented in the Growth Area Evaluation Matrix. The summary presented here is intended to identify presence / absence to inform guidance in subsequent sections of this report.

As noted above the definition and criteria for identifying some NHS features are noted to be 'in development' at the time of preparation of the NWP (E), and will be finalized through the NEWP. These are noted as 'to be determined' (TBD) in the table to reflect their pending status. Numerous feature types require additional study to identify their presence/absence on the landscape, they are noted as 'additional study required' (ASR).

| Feature / Area  | FE-1 | FE-2 | FE-3 | FE-4 | FE-5 | FE-6 | FE-7 | FE-8 | GR-1 | NF-1 | NF-2 | NF-3 | NF-4 | NF-5 | NF-6 | NF-7 | PEL-1 | WEL-1 | WL-1 | WL-2 | Greenfield<br>Areas | Settlement<br>Areas |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|------|------|---------------------|---------------------|
| Provincially<br>Significant Wetland   | •    |      | •    | •    | •    | •    | •    |      |      |      |      | •    | •    | •    | •    | •    | •     | •     | •    | •    | •                   | •                   |
| Areas of Natural<br>and Scientific<br>Interest (ANSI) -<br>Life Science, Earth<br>Science |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |       |       | •    |      | •                   | •                   |
| Significant<br>Woodlands*   | TBD  |      | TBD  | TBD  | TBD  | TBD  | TBD  | TBD  |      | TBD   | TBD   | TBD  | TBD  | TBD                 | TBD                 |
| Fish Habitat  | •    |      | •    |      | •    |      | •    |      |      | •    | •    | •    | •    | •    | •    | •    | •     |       | •    | •    | •                   | •                   |
| Significant<br>Valleylands  | ASR  |      | ASR  | ASR  | ASR  |      | ASR  |      |      | ASR   |       | ASR  | ASR  | ASR                 | ASR                 |
| Habitat for<br>Endangered and<br>Threatened<br>Species                                    | ASR   | ASR   | ASR  | ASR  | ASR                 | ASR                 |
| Significant Wildlife<br>Habitat (SWH)   | ASR   | ASR   | ASR  | ASR  | ASR                 | ASR                 |
| Linkages  | ASR   | ASR   | ASR  | ASR  | ASR                 | ASR                 |
| Enhancement<br>Areas  | ASR   | ASR   | ASR  | ASR  | ASR                 | ASR                 |
| Woodlands*  | •    |      | •    | •    | •    | •    | •    | •    |      | •    | •    | •    | •    | •    | •    | •    | •     | •     | •    | •    | •                   | •                   |
| Grasslands /<br>Meadows /<br>Thickets   | •    | •    | •    | •    | •    |      | •    |      |      | •    | •    | •    | •    | •    | •    | •    | •     |       | •    | •    | •                   | •                   |

Table 3-6: Summary of Natural Heritage System Features within Potential Growth Areas

\*Definition and criteria for identifying significant woodlands is in preparation through the NEWP. 'Woodlands' includes all woodlands; it does not distinguish between significant and other.

#### 3.1.4.2 WRS Features & Areas within Potential Growth Areas

As discussed in Section 3.3 of Volume 2, some component features and areas of the WRS are mapped while others require further information to be identified. This additional information is obtained through site-specific study (e.g., a subwatershed study). Using this more detailed information, features that cannot be mapped at the current scale can be identified on the landscape and the limits or presence of other features and areas, including those currently mapped, of the WRS can be confirmed and/or refined, as appropriate.

A summary of mapped features for the WRS is provided for Potential Growth Areas as a snapshot of current information and to inform the review of potential interactions between the NHS and WRS. As outlined previously, readers are referred to Volume 1: Characterization of the NWP (E) for a comprehensive summary of existing conditions and available information by tertiary and quaternary watershed and to Section 3.4 of Volume 2, for a description of interactions and interdependencies between the NHS and WRS. Preparation of future study plans should consider the context for selected growth areas within their respective watersheds to ensure that potential presence of features and areas which, per the new NOP, are to be identified as part of the WRS.

A summary of WRS components within the three (3) area categories related to potential growth and urbanization, as identified in the previous section (ref. Section 3.1.4.1), is presented in Table 3-7. More detailed information on water resource features and areas is presented through Volume 1: Characterization of the NWP (E) and a detailed overview of water resource features, areas and functions within each Potential Growth Area is presented in the Growth Area Evaluation Matrix. The summary presented here is intended to identify presence / absence to inform guidance for recommendations contained in the Watershed Plan (Equivalency) Report.

As discussed in Volume 2, Section 3.3.1, optional components of the WRS (e.g., other recharge or discharge areas) are to be considered for inclusion in the WRS as informed by detailed studies in which function in the context of the system as well as interactions and interdependencies with the NHS can be assessed. The NWP (E) informs the WRS through a much-expanded review of existing conditions, available studies and their recommendations. Based on this information, the NWP (E) provides guidance for the management of the WRS and sets out direction for detailed studies in which features and areas are to be confirmed and refined. Where detailed site-specific information is required to confirm feature or area presence, function within the system, etc. they are identified as 'additional study required' (ASR). This ensures that they are carried forward into future planning and study stages (e.g., quaternary watershed studies, or local subwatershed studies).

| Feature / Area  | FE-1 | FE-2 | FE-3 | FE-4 | FE-5 | FE-6 | FE-7 | FE-8 | GR-1 | NF-1 | NF-2 | NF-3 | NF-4 | NF-5 | NF-6 | NF-7 | PEL-1 | WEL-1 | WL-1 | WL-2 | Greenfield<br>Areas | Settlement<br>Areas |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|------|------|---------------------|---------------------|
| Key Hydrologic Features<br>(KHF): Permanent and<br>intermittent streams                               | •    |      | •    |      | •    | •    | •    |      | ٠    | •    | •    | •    | •    | •    | •    | ٠    | •     |       | •    | •    | •                   | •                   |
| Key Hydrologic Features<br>(KHF): Inland lakes and<br>their littoral zones                            |      |      | •    |      | •    |      |      |      |      |      | •    | •    |      |      | •    | •    | •     |       |      | ●1   |                     |                     |
| Key Hydrologic Features<br>(KHF): Seepage areas<br>and springs  | ASR   | ASR   | ASR  | ASR  | ASR                 | ASR                 |
| Key Hydrologic Features<br>(KHF): Wetlands  | •    | •    | •    | •    | •    | •    | •    |      |      | •    | •    | •    | •    | •    | •    | •    | •     | •     | •    | •    | •                   | •                   |
| Key Hydrologic Areas<br>(KHA): Significant<br>groundwater recharge<br>areas                           | •    | •    | •    | •    | •    | •    | •    | •    |      |      |      |      | •    | •    |      |      | •     |       |      |      | •                   | •                   |
| Key Hydrologic Areas<br>(KHA): Highly vulnerable<br>aquifers  | •    | •    | •    | •    | •    | •    | •    | •    |      | •    | •    | •    | •    | •    | •    | •    | •     | •     | •    | •    | •                   | •                   |
| Key Hydrologic Areas<br>(KHA): Significant surface<br>water contribution areas                        | ASR   | ASR   | ASR  | ASR  | ASR                 | n/a                 |
| Ground Water Features<br>and Areas: Other recharge<br>/ discharge areas                               | ASR   | ASR   | ASR  | ASR  | ASR                 | ASR                 |
| Ground Water Features<br>and Areas: Ecologically<br>Significant Groundwater<br>Recharge Areas (ESGRA) | ASR   | ASR   | ASR  | ASR  | ASR                 | ASR                 |
| Ground Water Features<br>and Areas: Water tables  | ASR   | ASR   | ASR  | ASR  | ASR                 | ASR                 |
| Ground Water Features<br>and Areas: Aquifers and<br>unsaturated zones                                 | ASR   | ASR   | ASR  | ASR  | ASR                 | ASR                 |
| Ground Water Features and Areas: Karst  |      | ASR  | •    | ASR  | ASR  |      | •    |      |      | ASR  | ASR  | ASR  | ASR  |      |      |      | ASR   |       | ASR  | ASR  | ASR                 | ASR                 |
| Surface Water Features and Areas: Floodplain,   | •    | •    | •    |      | •    |      | •    |      |      | •    | •    | •    | •    | •    | •    | •    | •     |       | •    | •    | •                   | •                   |

 Table 3-7: Summary of Water Resource System Features and Areas within Potential Growth Areas

<sup>1</sup> Three 'ponds' are captured as inland lakes in available mapping. These appear to be sewage lagoons or similar infrastructure.

| Feature / Area   | FE-1 | FE-2 | FE-3 | FE-4 | FE-5 | FE-6 | FE-7 | FE-8 | GR-1 | NF-1 | NF-2 | NF-3 | NF-4 | NF-5 | NF-6 | NF-7 | PEL-1 | WEL-1 | WL-1 | WL-2 | Greenfield<br>Areas | Settlement<br>Areas |
|--|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|------|------|---------------------|---------------------|
| flood hazards and<br>floodways   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |       |       |      |      |                     |                     |
| Surface Water Features<br>and Areas: Headwaters  | ASR   | ASR   | ASR  | ASR  | ASR                 | ASR                 |
| Surface Water Features<br>and Areas: Other recharge<br>/ discharge areas   | ASR   | ASR   | ASR  | ASR  | ASR                 | ASR                 |
| Surface Water Features<br>and Areas: Associated<br>riparian land that can be<br>defined by their soil<br>moisture, soil type,<br>vegetation or topographic<br>characteristics  | ASR   | ASR   | ASR  | ASR  | ASR                 | ASR                 |
| Hydrologic Functions   | ASR   | ASR   | ASR  | ASR  | ASR                 | ASR                 |
| Shoreline Areas:<br>Recommended to be 30m<br>from the limits of the<br>shoreline flood hazard  | TBD   | TBD   | TBD  | TBD  | TBD                 | TBD                 |
| Vegetation Protection Zone<br>(VPZ): For key hydrologic<br>features, a VPZ of no less<br>than 30m measures from<br>the outside boundary of the<br>key hydrologic feature is<br>required outside of<br>settlement areas | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •     | •     | •    | •    | •                   | •                   |

#### 3.1.4.3 Interactions and Interdependencies

The WRS and NHS interact across the landscape. Many of the features and functions which comprise these systems are interdependent when viewed at different scales from highly localized site scales (e.g., catchment and water balance for a small discrete wetland) to the landscape scale (e.g., downstream flooding due to a loss of wetlands and landscape permeability in headwater areas). To recognize these connections, the Region considered these two systems as comprising a single Natural Environment System (NES). Volume 2, Section 3.4.1 discusses the nature of system interactions in terms of scale (local vs. landscape) and their potential complexity in supporting key functions of one or both systems. More specifically, the various types of interdependencies (e.g., groundwater recharge, flow attenuation, specialized habitats, etc.) are described, and indicators used to consider potential presence / occurrence are provided. Attention is also given to the identification and assessment of these potential interactions and interdependencies that should be considered through detailed watershed or subwatershed studies. This summary and direction are provided in Table 3-2 in Volume 2. This information is carried forward and was used to inform watershed plan (equivalency) quidance (Volume 2, Section 4).

In this Volume, the potential presence or occurrence of interactions within the identified potential growth areas and within greenfield and settlement areas, is considererd with a summary presented in Table 3-8. In the preceding sections, feature presence is based on occurrence within the limit of the Potential Growth Area; interactions and interdependencies between features, functions and areas will extend beyond the limits of the Potential Growth Areas, as such, consideration has been given to the presence and potential relationship between features both within the Potential Growth Area and lands within 120m of the Potential Growth Area boundary.

| Interaction /<br>Interdependencies                            | FE-1 | FE-2 | FE-3 | FE-4 | FE-5 | FE-6 | FE-7 | FE-8 | GR-1 | NF-1 | NF-2 | NF-3 | NF-4 | NF-5 | NF-6 | NF-7 | PEL-1 | WEL-1 | WL-1 | WL-2 | Greenfield<br>Areas | Settlement<br>Areas |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|------|------|---------------------|---------------------|
| Water Quality & Quantity:<br>Groundwater Recharge             | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    |      |      | •    | •    |      |      | •     |       |      |      | •                   | •                   |
| Water Quality & Quantity:<br>Groundwater discharge            | ASR  |      | ASR  |      | ASR  | ASR  | ASR  |      | ASR  |      | ASR   | ASR   | ASR  |      | ASR                 | ASR                 |
| Water Quality & Quantity:<br>Flow attenuation                 | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •     | •     | •    | •    | •                   | •                   |
| Water Quality & Quantity:<br>Thermal Effects                  | •    | •    | •    | •    | •    | •    | •    | •    |      | •    | •    | •    | •    | •    | •    | •    | •     | •     | •    | •    | •                   | •                   |
| Vegetation Communities/<br>Structure: Wetlands                | •    | •    | •    |      | •    | •    | •    | •    |      | •    | •    | •    | •    | •    | •    | •    | •     | •     | •    | •    | •                   | •                   |
| Vegetation Communities/<br>Structure: Woodlands               | •    |      | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •     | •     | •    | •    | •                   | •                   |
| Vegetation Communities/<br>Structure: Open County<br>Habitats | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •     | •     | •    | •    | •                   | •                   |
| Specialized Wildlife Habitat                                  | ASR   | ASR   | ASR  | ASR  | ASR                 | ASR                 |
| Significant Wildlife Habitat                                  | ASR   | ASR   | ASR  | ASR  | ASR                 | ASR                 |
| Aquatic Habitat: Thermal Regime                               | ASR  |      | ASR  |      | ASR  | ASR  | ASR  |      | ASR  |      | ASR   | ASR   | ASR  |      | •                   | •                   |
| Aquatic Habitat: Riparian<br>Habitat                          | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •     | •     | •    | •    | •                   | •                   |
| Aquatic Habitat: Benthic invertebrates                        | •    | •    | •    |      | •    | •    | •    |      | •    | •    | •    | •    | •    | •    | •    | •    | •     |       | •    | •    | •                   | •                   |
| Terrestrial and Aquatic<br>Biodiversity                       | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •    | •     | •     | •    | •    | •                   | •                   |

#### 3.1.4.4 Process Outcomes

As evident, interactions and interdependencies occur across the Niagara landscape and within the Potential Growth Areas. This is reflective of the nature of these systems and the integrated manner in which they function on the landscape. The NWP (E) provides a preliminary identification of potential or anticipated interactions to inform planning and management direction at the scale of the Region. As with refinements to the NHS and WRS, interactions between these systems will be confirmed, refined and identified through subsequent studies. It is expected that this refined level of assessment will occur through detailed watershed or subwatershed studies. Assessment of interactions will require data gap filling and / or detailed studies or analyses. These may include:

- **Data development** may be required to facilitate additional study. This may include further compilation or analysis of existing datasets, detailed field study, etc. Datasets may range in scale from landscape level (e.g., water table elevations) to site specific (e.g., identification of specialized wildlife habitats with high hydrologic dependencies).
- **Geospatial analyses and modelling** to identify areas of potential interaction using available or newly developed data sets to assess interactions and interdependencies at watershed or subwatershed study scales. This may include point-source and non-point source modelling, and systematic conservation planning tools amongst others.

Generally, it is anticipated that identification and confirmation of interactions and interdependencies will be developed at increasingly refined scales, as land use planning proceeds from broad scale (e.g., quaternary watershed studies) to site scale (e.g., an EIS). It is imperative that the understanding be developed at appropriate points in the planning processes, to ensure the form and function of these systems can be adequately planned for and managed. To be achieved, this will require the support and involvement of local area municipalities and the NPCA. Local area municipality conformity and implementation of Regional policies (e.g., through zoning, by-laws, etc.) will be required. The NPCA can act as a resource for identifying functional dependencies between the systems. and will act as regulator for some components of the WRS (e.g., wetlands, watercourses). This integrated approach to land use planning is to be informed by un-biased science, balanced and driven and supported by planning (e.g., policy direction and drivers). This approach will ensure that the policies and direction provided through provincial planning documents is met.

### 4.0 GROWTH AREA SCREENING MATRIX

#### 4.1 Methodology & Purpose

As part of the NWP (E), an integrated constraint assessment has been completed for the twenty (20) "Potential Areas of Growth", herein referred to as Growth Areas (or GAs), as provided by Niagara Region, and discussed in previous sections. These potential GAs are located in several different quaternary watersheds across the Niagara Region, some of which cross multiple subwatershed, quaternary and tertiary watershed boundaries. The potential GAs are located within the municipalities of Fort Erie, Grimsby, Niagara Falls, Pelham, Welland, Port Colborne and West Lincoln (ref. Drawing 3-1).

The purpose of the constraint assessment is to provide insights to the Regional Planning Team as to potential environmental constraints (based on the natural and water systems) within and around the potential GAs, in order to help inform the Region's growth plan and decision making. This assessment has been completed using the various data sources outlined in Volume 1: Characterization and Volume 2: Niagara Watershed Management, to establish the presence, coverage, density, sensitivity, etc. of various environmental constraints related to the GAs; these include the following:

#### • Category #1: Physical Conditions

- Soils Based upon the OMAFRA Soil Complex Survey mapping, drainage classes within the GA boundaries have been summarized into four (4) designations based upon their potential response to urbanization, including: Unknown (this represents a potential information gap), High (this relates to the soils of highest permeability), Medium (soils of moderate permeability) and Low (least permeable soils). The soil distribution among these four (4) sensitivity designations have been summarized for each of the GAs to indicate the relative sensitivity to development, with the highest permeability aligned with highest sensitivity.
- Slopes / Topography Ground slopes within the GA boundaries have been summarized based upon the provincial DEM which has been processed and classified in order to characterize the land surface areas based upon specified thresholds, demonstrating, mild (0-2%), medium (2-10%) and steep slopes (>10%), which can indicate a measure related to suitability for development. Steeper lands are considered less suitable to development.

#### • Category #2: Groundwater System & Source Water Protection

- IPZs Mapping of Surface Water Intake Protection Zones (IPZs) has been used to identify if IPZ designations exist within the potential GAs, as well as within the respective subwatershed system and quaternary watershed system, seeing as all upstream and connected surface water ways may have an impact on the local IPZs. The presence of IPZs may introduce special consideration and management policy implications of the respective drainage lands, hence areas with direct IPZs would be most constrained.
- SGRAs Mapping of Significant Groundwater Recharge Areas (SGRAs) has been sourced from NPCA and used to identify at-risk areas within the GA

boundaries, which may be more susceptible to contamination and/or impacts associated with development, as a result of the highly permeable nature and recharge capabilities. These areas may require special consideration and management should development advance.

 HVAs – Mapping of Highly Vulnerable Aquifers (HVAs) has been sourced from the Region and has been used to identify at-risk areas within the GA boundaries which may be more susceptible to contamination and/or impacts associated with development, as a result of the designated vulnerability. These areas may require special consideration and management should development advance.

#### • Category #3: Natural Hazards

- Regulated Floodplain Floodplain delineation, typically based upon hydraulic modelling analyses to determine the flood inundation limits associated with the Regulatory event, has been sourced from the NPCA, in order to identify the presence of these regulated lands within the GA areas plus a 30 m buffer. Regulated floodplains represent formal hazards of watercourses due to their associated flood risk, and as such would not typically be suitable for development and/or would require specific approval and management (i.e. strategic cut/fills, realignment where supportable).
- Regulated Shorelines Similar to regulated floodplains, regulated shoreline mapping has been sourced from NPCA, in order to identify the presence of these regulated lands within the GA limits plus a 30 m buffer. Regulated shorelines represent the associated natural hazards through the application of the greatest of either the shoreline erosion (100-year erosion rate, dynamic beach) or shoreline flood (100-year flood level, wave uprush) hazards. These regulated lands are limited to the Lake Ontario and Lake Erie shorelines, and would not apply to the majority of the inland areas identified as potential GAs.
- Top of Slope Allowances In the absence of a meander belt delineation, the top
  of slope allowances mapping has been sourced from NPCA to provide an
  indication of the natural erosion hazard limits associated with river and valley
  systems within the GA areas plus a 30 m buffer; planning around such hazards
  allows for natural stream form and function to continue, while avoiding erosion
  risk to property or infrastructure. Clearly at the next stages of planning more
  detailed morphological assessments will be required.
- Karst Topography Karst mapping has been sourced from the Ontario Geological Survey (OGS) which establishes three (3) main karst classifications, including Known, Inferred and Potential Karst. The presence of these landforms provides further indication of potentially vulnerable areas which may result in constraints to future development and is a known concern for parts of the Niagara Region.
  - As noted in Volume 2: Niagara Watershed Management, there are updates proposed to the provincial karst mapping by the OGS, as well as more detailed information currently in development as part of separate studies (i.e. Smithville Subwatershed Study). Given that this information is pending and currently in development/under review, the 2008 karst mapping has been used as the basis for this assessment (ref. Volume 1: Characterization for

further details regarding sources of data). Natural hazard mapping associated with karst topography is to be refined and updated as part of subsequent quaternary and subwatershed planning initiatives, as new information is made available.

#### • Category #4: Water Resource System

- Watercourses (Length & Sensitivities) Niagara Region watercourse mapping has been analyzed to determine the length of watercourses within the GA limits plus a 30 m buffer (normalized and reported as m/ha); this provides an indication of the length of designated watercourses relative to the overall potential development area. Watercourse sensitivity has also been summarized based upon three subfactors, including: Channel Type (Constructed or Natural), Permanency (Permanent, Intermittent, Ephemeral flow or a combination) and the MNRF Fish Habitat Designation (Type 1 – Critical, Type 2 – Important, Type 3 – Marginal or Other); each of these sensitivity subfactors provide additional insight into the potential sensitivity and impacts from and/or constraints to development.
- Constructed Drains (Length & Class/Review Process) Due to the agricultural nature of the Niagara Region, constructed drains (i.e. including formal Municipal Drains) are important drainage features for both agricultural practices, as well as the ecosystem and habitat they provide. Constructed Drain mapping has been sourced from OMAFRA and analyzed to determine the constructed drain length within the GA limits plus a 30 m buffer (normalized and reported as m/ha). Based upon the drain sensitivity (including fish presence and flow periods), there are several resulting classifications, which have been further grouped into the three (3) authorization processes for maintenance of the drainage features; this categorization provides a reasonable proxy for level of drain sensitivity included in the current constraint analysis.

#### • Category #5: Natural Heritage System

- *Natural Features & Areas and Impact Risk* – Further discussion provided in a subsequent section (ref. Section 4.1.1).

In order to incorporate the relative importance of the various constraint categories, an additional "Weighting" factor has been applied to each category in order to establish the hierarchy of the constraints with respect to future development (ref. the "Weighting" column). These have been applied so that larger constraints are given a higher weighting (max. up to 2) and lower constraints are given a lower weighting (min. down to 0.5); this ensures that the constraints are appropriately represented across all categories and the analysis does not overweight constraint categories which may overlap (i.e. SGRAs and HVAs). This weighting has allowed for a more even distribution between the WRS (total score of 22) and the NHS (total score of 20) categories.

This constraint / screening analysis has applied a rating structure for each of the constraint categories cited above, where higher ratings demonstrate more favourable conditions for development, and lower ratings demonstrate higher potential constraints. Ratings have been applied to each of the subcategories, as outlined and detailed in the table provided in Appendix C-3 (ref. the "Rating" column). Categories 1 through 4 have

applied a rating scale of 0 to 3 depending upon the data, and category 5 (NHS) has applied a rating scale of 0 to 5; further details regarding the NHS assessment have been provided in the following section.

#### 4.1.1 Natural Heritage Considerations

The following provides a brief outline of the approach for the evaluation of potential Growth Areas for Natural Heritage Considerations.

#### **Context for the Evaluation**

The evaluation of potential Growth Areas has proceeded on the basis of using available natural heritage information and designations which are defined external to the N.H.S. process (e.g., Provincially Significant Wetlands). This approach ensures that natural features and areas are appropriately considered in the evaluation process and can inform the selection of preferred Growth Area alternatives. Confirmation of an N.H.S. can then be addressed through future planning stages, as more refined information becomes available to confirm feature presence or significance in accordance with the new NOP.

#### **Evaluation Approach**

#### **Factors and Sub-Factors**

Growth Area evaluation has considered two primary factors: presence and extent of natural features and areas within the Growth Areas, and a preliminary assessment of impact risk to natural heritage associated with each Growth Area. Each of these broad factors is comprised of several sub-factors. Each factor and the measures applied herein are discussed below.

#### Natural Features and Areas

Using 2020 ELC data for the Region, presence and extent of natural cover were used to evaluate the potential Growth Areas. Total area (ha) has been used for most sub-factors. As the amount of natural cover within a GA increases, the greater the potential for impact to natural heritage features and, upon its confirmation, the Natural Heritage System. A relative comparison using % cover for known *significant* features (i.e., Provincially Significant Wetlands, Areas of Natural and Scientific Interest) and natural cover within the GA boundaries are also provided.

- Wetland subfactors included an assessment by wetland classification Provincially Significant, Unevaluated and Evaluated-Other. Provincially significant wetlands are protected under the PPS; development is prohibited within them. Unevaluated wetlands have yet to be assessed for significance and are to be treated as Provincially Significant until such time as an assessment is completed. Evaluated-Other wetlands are not afforded explicit protection under section 2.1 (Natural Heritage) of the PPS. Wetlands may be separately protected under policies and direction associated with the Water Resource System (W.R.S.). All wetlands are regulated by the NPCA.
  - Measure(s): Total cover [ha] in the Growth Area.
- **Woodlands** are considered under two subfactors woodland cover and woodlands with interior habitat. Significant woodlands, in accordance with criteria for the New

NHS have not been confirmed; as such, total woodland cover has been used for the evaluation process. To facilitate some consideration of significance or function, woodlands with interior habitat are included as a second sub-factor.

- Measure(s): Total cover [ha] (woodlands) and Count of woodlands with interior habitat in the Growth Area.
- **Successional Habitat** has potential to provide habitat for grassland and other open country bird species, including Species at Risk. Inclusion as a sub-factor does not evaluate significance or function; it flags this as a potential habitat to be assessed through land planning processes.
  - Measure(s): Total cover [ha] in Growth Area.
- Areas of Natural and Scientific Interest [Provincial] include both Earth Science and Life Science areas. These are provincially significant and protected under the PPS.
  - Measure(s): Total cover [ha] in Growth Area.
- **Rare / Uncommon Vegetation Communities** may be more sensitive to changes in the landscape (e.g., hydrologic). Consideration of presence was included as it was available through the updated ELC for the Region.
  - Measure(s): Total cover [ha] in Growth Area.
- **Relative Cover** is assessed for known *significant* features (i.e., Provincially Significant Wetlands, Areas of Natural and Scientific Interest) and all natural cover to provided a relative comparison across the GA's on the proportion which is comprised of natural features.
  - Measure(s): Percent (%) cover in the Growth Area.

#### Impact Risk

Presence and amount (area) of features within the GA, captured through the preceding section, provides an indication of how much natural cover may be influenced or impacted directly or indirectly as a result of development. Sub-factors under 'Impact Risk' consider additional measures and considerations beyond feature presence which may influence potential for impacts to occur. They consider basic parameters to inform where risk of, or potential extent of impacts, may be greater or smaller. Proposed land use(s) (e.g., development type, orientation, stormwater management, etc.) is required to complete an impact assessment.

- **Proximity to Significant Features** considers potential impacts on adjacent features, but identifying how many confirmed *significant* features (per the PPS) occur within 120 m of the potential Growth Area. For the purposes of the evaluation, this includes Provincially Significant Wetlands and Areas of Natural and Scientific Interest.
  - Measure(s): Count of features within 120 m of the Growth Area.
- Edge to Area Ratio provides a preliminary consideration of feature shape and the influence this has on land use change and occupancy related impacts. Impacts are generally realized most acutely at feature edges (i.e., in the outer portion of the feature, closest to the area of development / land use change). Degree of impact decreases as distance from the edge increases. Depth of impact will vary based on species, nature of the impact, and other factors. Use of the Edge to Area Ratio

provides a preliminary screening at impact potential. It is important to note that for the purpose of this evaluation it considers all natural cover.

- Measure(s): Ratio, which identifies the how many units of edge (m) there are for each measure of area (ha).
- **Fragmentation** is a qualitative, visual assessment of potential fragmentation of features and areas on the landscape which could result from land use conversion from an existing permeable land cover (e.g., agriculture) to an urban form. The assessment included two elements: *risk* of fragmentation, which examined feature orientation and the potential need to cross or bisect features (e.g., watercourse corridors) and/or for development to occur between features proximal to one another, thus potentially removing connectivity; *magnitude* of fragmentation was qualitatively assessed based on the landscape context size of features being disconnected, potential alternative points of connection, etc. As a qualitative assessment, this has considered *potential* impacts to connectivity only; it does not take into consideration linkages that may be established on the landscape through land use planning, etc.
  - Measure(s): qualitative assignment of risk and magnitude as 0 (none), 1 (low), 2 (moderate), 3 (high). A value is assigned to both, so that a total score may range from 0-6.

#### Rating

Ratings were applied using quartile, min, max approach so that a consistent rating system could be applied across all sub-factors. Rating values were developed based upon measure outcomes, so that each sub-factor is assessed against itself. Using outcomes from the measured analyses, the option that best achieves the objective for the criteria receives a rating of 5; based on how other options compare, they receive decreasing ratings on the following scale:

- 5 = minimum value (best achieves the criteria)
- 4 = minimum value  $< 25^{\text{th}}$  quartile value
- $3 = 25^{\text{th}}$  quartile <  $50^{\text{th}}$  quartile
- $2 = 50^{\text{th}}$  quartile <  $75^{\text{th}}$  quartile
- 1 = 75<sup>th</sup> quartile < maximum value
- 0 = maximum value

This approach was applied consistently across each natural heritage sub-factor.

#### Subfactor Weighting

Weighting factors may be used to increase the relative impact of a sub-factor in the evaluation matrix. Based on the data available for use at the time of preparation, the following general weighting has been applied:

- **Higher weighting** should be applied to features of *known* or increased likelihood of significance, constraint to development, etc. For the purposes of this evaluation, this would include: Provincially Significant Wetlands, Woodlands with Interior Habitat, Areas of Natural and Scientific Interest, Rare / Uncommon Vegetation Communities.
- **Moderate weighting** should be applied to features of increased potential to be constraints to development, but are not confirmed as *significant* and further

assessment may result in either their confirmation as *significant* or not significant, which will ultimately influence retention on the landscape and/or management. For the purposes of this evaluation, this would include: Unevaluated and Evaluated-Other wetlands, and woodlands.

• Lower weighting may be applied to those features with unknown or lower likelihood of being constraint to development based on policy-based protections. For the purpose of this evaluation, this would include successional habitats. It is important to note that successional habitats may be important for a range of species, including Species at Risk and assessment of these habitat areas should be completed to determine whether it meets criteria for being Significant Wildlife Habitat or is habitat for Species at Risk.

#### 4.2 Screening Matrix Results & Outcomes

The presence of the natural and water-based systems and features and their relative sensitivity and/or potential constraints to development have been identified for each of the potential twenty (20) GAs, either within the GA boundaries only or extending beyond via specified buffers and/or within the subwatershed; the results of this data analysis have been summarized in the screening matrix attached in Appendix C-3.

The total resulting scores for each of the GAs have been determined by summing the product of the Weight x Rating for each of the factor categories, which results in a score out of a total possible 42.0. The outcomes of this analysis for the WRS, NHS and Combined categories have been used to inform the Settlement Area Boundary Review (SABR) Analysis regarding the Topic Area of "Environmental Protection and Natural Resources" (ref. Appendix 18.2 of MCR Assessment Criteria: Settlement Area Boundary Review for Urban Areas, Draft May 2021); in particular, the Environmental Question #3 which is:

"With respect to Watershed Planning and the overall health of the respective Watershed, what is the impact should the parcel or collection of parcels be added to the urban area and be developed for urban use?"

Based upon the resulting total score for the Combined categories (including both WRS and NHS categories), each GA has been assigned one (1) of five (5) anticipated impact ratings, should the GA be advanced for urban development. Based upon the associated Combined scores out of a total possible score of 42.0, the impact ratings range from neglible to critical impacts, as follows:

- Negligible Impact (Combined Score = 35 42)
- Minimal Impact (Combined Score = 30 34.9)
- Modest Impact (Combined Score = 25 29.9)
- High Impact (Combined Score = 20 24.9)
- Critical Impact (Combined Score = < 20)

The results of this analysis are presented in the screening matrix and associated Drawings which have been prepared as a visual representation of each of the constraint categories included in the assessment (ref. Appendix C-3). The drawings for each category can be found attached to this report, and have been grouped into the following categories:

- GA-WR1-(1-3): Soil Drainage Classes
- GA-WR2-(1-3): Topography & Constructed Drains
- GA-WR3-(1-3): Groundwater System & Source Water Protection
- GA-WR4-(1-3): Natural Hazards
- GA-NH-(1-20): Natural Heritage System (ref. Section 3.1.4)
- GA-WRS-(1-20): Water Resource System (ref. Section 3.1.4)

The results of this screening matrix and impact analysis are summarized in Table 4-1.

| Growth<br>Area ID# | Constraint<br>Weighting<br>Results<br>WRS<br>Score | Constraint<br>Weighting<br>Results<br>NHS<br>Score | Constraint<br>Weighting<br>Results<br>Combined<br>Score | SABR Analysis<br>Environmental<br>Question #3 |
|--------------------|--|--|---|---|
| FE-1               | 16.3   | 12.9   | 29.2  | Modest Impact                                 |
| FE-2               | 14.6   | 14.0   | 28.6  | Modest Impact                                 |
| FE-3               | 13.4   | 9.4  | 22.8  | High Impact                                   |
| FE-4               | 16.6   | 13.9   | 30.4  | Minimal Impact                                |
| FE-5               | 14.5   | 10.1   | 24.6  | High Impact                                   |
| FE-6               | 18.7   | 15.2   | 33.9  | Minimal Impact                                |
| FE-7               | 13.7   | 13.0   | 26.8  | Modest Impact                                 |
| FE-8               | 19.2   | 15.0   | 34.2  | Minimal Impact                                |
| GR-1               | 17.7   | 16.5   | 34.2  | Minimal Impact                                |
| NF-1               | 18.1   | 13.5   | 31.6  | Minimal Impact                                |
| NF-2               | 16.2   | 13.3   | 29.6  | Modest Impact                                 |
| NF-3               | 17.5   | 10.4   | 27.9  | Modest Impact                                 |
| NF-4               | 15.8   | 8.2  | 24.0  | High Impact                                   |
| NF-5               | 15.1   | 9.5  | 24.6  | High Impact                                   |
| NF-6               | 15.1   | 7.9  | 23.0  | High Impact                                   |
| NF-7               | 13.8   | 12.6   | 26.3  | Modest Impact                                 |
| PEL-1              | 15.8   | 11.9   | 27.7  | Modest Impact                                 |
| WEL-1              | 21.2   | 15.9   | 37.1  | Negligible<br>Impact                          |
| WL-1               | 18.7   | 11.0   | 29.6  | Modest Impact                                 |
| WL-2               | 16.1   | 9.3  | 25.3  | Modest Impact                                 |

#### Table 4-1: Growth Area Screening Matrix Outcomes

As demonstrated in Table 4-1, the twenty (20) potential GAs have been assigned an associated potential impact rating according to the resulting score for the WRS categories (1 through 4), and the NHS category (5), representing the combined total score. Based upon the total combined scores, the potential GAs have been assigned associated impact ratings ranging in four (4) out of the five (5) possible impact categories associated with SABR Environmental Question #3; these include, one (1) GA with Negligible Impact, five (5) GAs with Minimal Impact, nine (9) GAs with Moderate Impact, and five (5) GAs with High Impact. The information presented in Table 4-1 can be used by Niagara Region to help inform the sensitivity and/or potential constraints to development, as well as the required management strategies (ref. Volume 2) as part of the regional land use and growth planning process.

## 5.0 CONCLUSIONS

**Volume 3: Growth Analysis** has analyzed a range of potential growth areas in the Region from the perspective of the potential for impacts on natural heritage and waterbased resources. This analysis has been completed as input to Niagara Region's growth management work being completed in support of the new Niagara Official Plan, in accordance with Provincial direction which requires the allocation of growth to be informed by watershed planning (or equivalent). It is expected that Niagara Region staff will consider the analysis presented in this volume as one of the many inputs into the overall evaluation process of potential growth areas in the Region.

The contents of this volume build upon Volume 1: Characterization, which outlined the existing data sources as part of the existing conditions characterization of the three (3) tertiary watershed systems within the Niagara Region, namely Lake Ontario, Lake Erie and Niagara River. The findings presented in Volume 3 should be taken into consideration with the management, guidance and future study requirements outlined in Volume 2: Niagara Watershed Management. The core contents of Volumes 1 and 2 have been outlined below for reference.

#### • Volume 1: Characterization

- Niagara Watersheds Characterization (Lake Ontario, Niagara River, Lake Erie)
  - Drainage Systems
  - Surficial Soils
  - Slopes / Topography
  - Groundwater System & Source Water Protection
  - Natural Hazards
  - Natural Heritage (Fish & Terrestrial)
  - Land Uses (Urban & Agricultural)
  - Watershed Monitoring (Climate, Streamflow, Water Quality and Groundwater)

#### • Volume 2: Niagara Watershed Management

- Goals & Objectives
- Integrating the Natural Heritage System (NHS) & Water Resource System (WRS)
- Watershed Plan (Equivalency) Guidance
  - Water Management Guidance (Quantity/Quality)
  - Climate Change Guidance
  - Natural Hazards
  - Cumulative Impacts
  - Land Use Impact Management & Preliminary Guidance
- Future Studies & Monitoring

These report volumes, encompassing the final NWP (E), have been compiled to improve the understanding of the natural and water-based systems present within the Niagara Region. The NWP (E) will help inform the new NOP, provide direction for the management of water resources and other natural features in the Region, and provide direction for future watershed planning in the Region – including quaternary watershed planning by the Region and subwatershed planning by the Local Municipalities.






























While every effort has been made to accurately depict the information, this map should not be relied on as being a precise indicator of locations, features, or roads, nor as a guide to navigation. MNRF data provided by Queen's Printer of Ontario. Use ement by the



DRAWN BY: J.Sauder



Hyman Ave Jewell Ave **Riselay** Ave

Bernard Ave

Poplar Ave Thunder Bay

Nicholas Rd

Young Ave

Bernard Avenue Beach

GA-NH-2: Potential Growth Area FE-2 Niagara Watershed Plan (Equivalency) Potential Growth Area <sup>1</sup> Adjacent Lands (120m) ANSI <sup>2</sup> Land Cover<sup>1</sup> 🥏 Wetland Wetland/Woodland Woodland Successional **Other Natural** Wetland Significance<sup>1</sup> Evaluated-Provincial // Evaluated-Other Not evaluated per OWES

Sources: 1) Niagara Region, 2021 2) MNRF, 2021

Basemap: Earthstar Geographics, Esri Community Maps Contributors, Province of Ontario Niagara Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, nd County Esri Canada Esri HERE Garmin FAO METI/NASA USGS EPA NPS NRCan, Parks Canad

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# GA-NH-3: Potential Growth Area FE-3 Niagara Watershed Plan (Equivalency) Potential Growth Area<sup>1</sup> Adjacent Lands (120m) ANSI <sup>2</sup> Land Cover<sup>1</sup> 🥏 Wetland Wetland/Woodland Woodland Successional **Other Natural** Wetland Significance<sup>1</sup> Evaluated-Provincial // Evaluated-Other Not evaluated per OWES St Catharines Niagara Falls Welland



Sources: 1) Niagara Region, 2021 2) MNRF, 2021

Basemap: Earthstar Geographics, Esri Community Maps Contributors, Province of Ontario Niagara Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, d County Esri Canada Esri HERE Garmin FAO METI/NASA LISGS EPA NPS NRCan, Parks Canad







Greecent



# GA-NH-4: Potential Growth Area FE-4 Niagara Watershed Plan (Equivalency) Potential Growth Area <sup>1</sup> Adjacent Lands (120m) ANSI <sup>2</sup> Land Cover<sup>1</sup> 🥏 Wetland Wetland/Woodland Woodland Successional **Other Natural** Wetland Significance<sup>1</sup> Evaluated-Provincial // Evaluated-Other Not evaluated per OWES



Sources: 1) Niagara Region, 2021 2) MNRF, 2021

Basemap: Earthstar Geographics, Esri Community Maps Contributors, Province of Ontario Niagara Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, d County Esri Canada Esri HERE Garmin FAO METI/NASA LISGS EPA NPS NRCan, Parks Canad



### Disclaimer:





GA-NH-5: Potential Growth Area FE-5 Niagara Watershed Plan (Equivalency) Potential Growth Area<sup>1</sup> Adjacent Lands (120m) ANSI <sup>2</sup> Land Cover<sup>1</sup> 🥏 Wetland Wetland/Woodland Woodland Successional Other Natural Wetland Significance<sup>1</sup> Evaluated-Provincial // Evaluated-Other Not evaluated per OWES



Sources: 1) Niagara Region, 2021 2) MNRF, 2021

Basemap: Earthstar Geographics, Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCRENKENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EFA, NPS, NRCan, Parks Canada







# GA-NH-6: Potential Growth Area FE-6 Niagara Watershed Plan (Equivalency) Potential Growth Area <sup>1</sup> Adjacent Lands (120m) ANSI <sup>2</sup> Land Cover<sup>1</sup> 🥏 Wetland Wetland/Woodland Woodland Successional Other Natural Wetland Significance<sup>1</sup> Evaluated-Provincial // Evaluated-Other Not evaluated per OWES



Sources: 1) Niagara Region, 2021 2) MNRF, 2021

Basemap: Earthstar Geographics, Esri Community Maps Contributors, Province of Ontario Niagara Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, nd County Esri Canada Esri HERE Garmin FAO METI/NASA LISGS EPA NPS NRCan, Parks Cana







PROJECT: DA20-014-01





# GA-NH-7: Potential Growth Area FE-7 Niagara Watershed Plan (Equivalency) Potential Growth Area<sup>1</sup> Adjacent Lands (120m) ANSI <sup>2</sup> Land Cover<sup>1</sup> 🥏 Wetland Wetland/Woodland Woodland Successional Other Natural Wetland Significance <sup>1</sup> Evaluated-Provincial // Evaluated-Other Not evaluated per OWES



Sources: 1) Niagara Region, 2021 2) MNRF, 2021

Basemap: Earthstar Geographics, Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCRENKENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada









GA-NH-8: Potential Growth Area FE-8 Niagara Watershed Plan (Equivalency) Potential Growth Area<sup>1</sup> Adjacent Lands (120m) ANSI <sup>2</sup> Land Cover<sup>1</sup> 🥏 Wetland Wetland/Woodland Woodland Successional Other Natural Wetland Significance<sup>1</sup> Evaluated-Provincial // Evaluated-Other Not evaluated per OWES



Sources: 1) Niagara Region, 2021 2) MNRF, 2021

Basemap: Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, JMxa



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**Disher St** 

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Bertie Pl

S MIII S

Highland Dr

All Saft Anglice Churc

# Old Ridgeway Cemetery

Fatt Ave



# GA-NH-9: Potential Growth Area GR-1 Niagara Watershed Plan (Equivalency) Potential Growth Area<sup>1</sup> Adjacent Lands (120m) ANSI <sup>2</sup> Land Cover<sup>1</sup> 🥏 Wetland Wetland/Woodland Woodland Successional Other Natural Wetland Significance<sup>1</sup> Evaluated-Provincial // Evaluated-Other Not evaluated per OWES



Sources: 1) Niagara Region, 2021 2) MNRF, 2021

Basemap: Esri Community Maps Contributors, City of Hamilton, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada









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nber 2021

DATE: 08, Sept



Sources: 1) Niagara Region, 2021 2) MNRF, 2021

Basemap: Earthstar Geographics, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, INCREMENT P METI/NASA LISGS EPA NPS LIS Census Bureau LISDA NRCan Parks Canad



### Disclaimer:









# GA-NH-12: Potential Growth Area NF-3 Niagara Watershed Plan (Equivalency) Potential Growth Area<sup>1</sup> Adjacent Lands (120m) ANSI <sup>2</sup> Land Cover<sup>1</sup> 🥏 Wetland Wetland/Woodland Woodland Successional Other Natural Wetland Significance<sup>1</sup> Evaluated-Provincial

// Evaluated-Other

Not evaluated per OWES



Sources: 1) Niagara Region, 2021 2) MNRF, 2021

Basemap: Earthstar Geographics, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada









Misener Rd

**Grand Niagara** Resort



Carl Rd



GA-NH-13: Potential Growth

Area NF-4

Niagara Watershed Plan (Equivalency)

Potential Growth Area <sup>1</sup>

Adjacent Lands (120m)

Wetland/Woodland

ANSI <sup>2</sup>

Land Cover<sup>1</sup>

🥏 Wetland

Woodland

Successional

**Other Natural** Wetland Significance<sup>1</sup>

Sources: 1) Niagara Region, 2021 2) MNRF, 2021

Basemap: Earthstar Geographics, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NNCan, Parks Canada

Buffal







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Fraser



Rexinger Rd

Lyons Creek Rd

redle R





# GA-NH-14: Potential Growth Area NF-5 Niagara Watershed Plan (Equivalency) Potential Growth Area<sup>1</sup> Adjacent Lands (120m) ANSI <sup>2</sup> Land Cover<sup>1</sup> 🥏 Wetland Wetland/Woodland Woodland Successional Other Natural Wetland Significance<sup>1</sup> Evaluated-Provincial // Evaluated-Other Not evaluated per OWES



Sources: 1) Niagara Region, 2021 2) MNRF, 2021

Basemap: Earthstar Geographics, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, INCan, Parks Canada











# GA-NH-15: Potential Growth Area NF-6 Niagara Watershed Plan (Equivalency) Potential Growth Area<sup>1</sup> Adjacent Lands (120m) ANSI <sup>2</sup> Land Cover<sup>1</sup> 🥏 Wetland Wetland/Woodland Woodland Successional **Other Natural** Wetland Significance<sup>1</sup> K Evaluated-Provincial // Evaluated-Other Not evaluated per OWES St Catharines

Sources: 1) Niagara Region, 2021 2) MNRF, 2021

Basemap: Earthstar Geographics, Esri Community Maps Contributors, Province of Ontario Niagara Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, d County Esri Canada Esri HERE Garmin FAO METI/NASA LISGS EPA NPS NRCan, Parks Cana

Welland

Niagara

Falls 4

Buffal









Sources: 1) Niagara Region, 2021 2) MNRF, 2021

Basemap: Earthstar Geographics, Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCRENKENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EFA, NPS, NRCan, Parks Canada



Megene Rher







# GA-NH-17: Potential Growth Area PEL-1 Niagara Watershed Plan (Equivalency) Potential Growth Area<sup>1</sup> Adjacent Lands (120m) ANSI <sup>2</sup> Land Cover<sup>1</sup> 🥏 Wetland Wetland/Woodland Woodland Successional Other Natural Wetland Significance<sup>1</sup> Evaluated-Provincial // Evaluated-Other Not evaluated per OWES



Sources: 1) Niagara Region, 2021 2) MNRF, 2021

Basemap: Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, City of Welland, Earthstar Geographics, Esri Community Maps Contributors, City of Welland, Province of Ontario, Niagara Region, Esri Canada Esri HERE Garmin INCREMENT P METI/NASA LISGS EPA NPS LIS Cel u, USDA, NRCan, Parks Canada N







PROJECT: DA20-014-01



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DRAWN BY: J.Sauder

DATE: 08, September 2021



# GA-NH-19: Potential Growth Area WL-1 Niagara Watershed Plan (Equivalency) Potential Growth Area<sup>1</sup> Adjacent Lands (120m) ANSI <sup>2</sup> Land Cover<sup>1</sup> 🥏 Wetland Wetland/Woodland Woodland Successional **Other Natural** Wetland Significance<sup>1</sup> Evaluated-Provincial // Evaluated-Other Not evaluated per OWES



Sources: 1) Niagara Region, 2021 2) MNRF, 2021

Basemap: City of Hamilton, Province of Ontario, Haldimand County, Niagara Region, Esri Canada, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Earthstar Geographics, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks











# GA-NH-20: Potential Growth Area WL-2 Niagara Watershed Plan (Equivalency) Potential Growth Area<sup>1</sup> Adjacent Lands (120m) ANSI <sup>2</sup> Land Cover<sup>1</sup> 🥏 Wetland Wetland/Woodland Woodland Successional **Other Natural** Wetland Significance<sup>1</sup> Evaluated-Provincial // Evaluated-Other Not evaluated per OWES



Sources: 1) Niagara Region, 2021 2) MNRF, 2021

Basemap: Earthstar Geographics, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Esri Community Maps Contributors, City of Hamilton, Province of Ontario, Haldimand County, Niagara Region, Esri Canada, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS, EPA, NPS, US au, USDA, NRCan, Parks Canada







# GA-WRS-1: Potential Growth Area FE-1 Niagara Watershed Plan (Equivalency)

- └ Adjacent Lands (120m)
- Potential Growth Area<sup>2</sup>
- Regulated Floodplains<sup>1</sup>

# **Key Hydrologic Features**

- Permanent and Intermittent Streams<sup>2</sup>
- Wetlands <sup>3</sup>
- Inland Lakes and their littoral zones<sup>2</sup>

# **Key Hydrologic Areas**

- Highly Vulnerable Aquifers<sup>2</sup>
- Significant Groundwater Recharge Areas<sup>2</sup>

## Karst Features<sup>4</sup>

- Known Karst
- Inferred Karst
- Potential Karst



Sources: 1) NPCA, 2020 2) Niagara Region, 2021 3) Consolidation of datasets. Niagara Region and MNRF, 2021 (MNRF data used to fill gaps outside Niagara Region) 4) Ontario Geologic Survey, 2008

Basemap: Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Maxar



Sider Rd





# GA-WRS-2: Potential Growth Area FE-2

Niagara Watershed Plan (Equivalency)

- └ Adjacent Lands (120m)
- Potential Growth Area<sup>2</sup>
- Regulated Floodplains<sup>1</sup>

# **Key Hydrologic Features**

- Permanent and Intermittent Streams<sup>2</sup>
- Wetlands <sup>3</sup>
- Inland Lakes and their littoral zones<sup>2</sup>

# **Key Hydrologic Areas**

- Highly Vulnerable Aquifers<sup>2</sup>
- Significant Groundwater Recharge Areas<sup>2</sup>

## Karst Features<sup>4</sup>

- Known Karst
- Inferred Karst
- Potential Karst



Sources: 1) NPCA, 2020 2) Niagara Region, 2021 3) Consolidation of datasets. Niagara Region and MNRF, 2021 (MNRF data used to fill gaps outside Niagara Region) 4) Ontario Geologic Survey, 2008

Basemap: Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Maxa



### Disclaimer:





# GA-WRS-3: Potential Growth Area FE-3

Niagara Watershed Plan (Equivalency)

- □ ¬ Adjacent Lands (120m)
- Potential Growth Area<sup>2</sup>
- Regulated Floodplains<sup>1</sup>

# **Key Hydrologic Features**

- Permanent and Intermittent Streams<sup>2</sup>
- Wetlands <sup>3</sup>
- Inland Lakes and their littoral zones<sup>2</sup>

# **Key Hydrologic Areas**

- Highly Vulnerable Aquifers<sup>2</sup>
- Significant Groundwater Recharge Areas<sup>2</sup>

# Karst Features<sup>4</sup>

- Known Karst
- Inferred Karst
- Potential Karst



Sources: 1) NPCA, 2020 2) Niagara Region, 2021 3) Consolidation of datasets. Niagara Region and MNRF, 2021 (MNRF data used to fill gaps outside Niagara Region) 4) Ontario Geologic Survey, 2008

Basemap: Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Maxa



Disclaimer:





# GA-WRS-4: Potential Growth Area FE-4

Niagara Watershed Plan (Equivalency)

- └ Adjacent Lands (120m)
- Potential Growth Area<sup>2</sup>
- Regulated Floodplains <sup>1</sup>

### **Key Hydrologic Features**

- Permanent and Intermittent Streams<sup>2</sup>
- Wetlands <sup>3</sup>
- Inland Lakes and their littoral zones<sup>2</sup>

## **Key Hydrologic Areas**

- Highly Vulnerable Aquifers<sup>2</sup>
- Significant Groundwater Recharge Areas<sup>2</sup>

## Karst Features <sup>4</sup>

- Known Karst
- Inferred Karst
- Potential Karst



Sources: 1) NPCA, 2020 2) Niagara Region, 2021 3) Consolidation of datasets. Niagara Region and MNRF, 2021 (MNRF data used to fill gaps outside Niagara Region) 4) Ontario Geologic Survey, 2008

Basemap: Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Maxar



### Disclaimer:





PROJECT: DA20-014-01

DATE: 13, September 2021

DRAWN BY: J.Sauder

# GA-WRS-5: Potential Growth Area FE-5 Niagara Watershed Plan (Equivalency)

- └ Adjacent Lands (120m)
- Potential Growth Area<sup>2</sup>
- Regulated Floodplains<sup>1</sup>

# **Key Hydrologic Features**

- Permanent and Intermittent Streams<sup>2</sup>
- Wetlands <sup>3</sup>
- Inland Lakes and their littoral zones<sup>2</sup>

# **Key Hydrologic Areas**

- Highly Vulnerable Aquifers<sup>2</sup>
- Significant Groundwater Recharge Areas<sup>2</sup>

# Karst Features<sup>4</sup>

- Known Karst
- Inferred Karst
- Potential Karst



Sources: 1) NPCA, 2020 2) Niagara Region, 2021 3) Consolidation of datasets. Niagara Region and MNRF, 2021 (MNRF data used to fill gaps outside Niagara Region) 4) Ontario Geologic Survey, 2008

Basemap: Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Maxar







# GA-WRS-6: Potential Growth Area FE-6 Niagara Watershed Plan (Equivalency)

- └ djacent Lands (120m)
- Potential Growth Area<sup>2</sup>
- Regulated Floodplains<sup>1</sup>

# **Key Hydrologic Features**

- Permanent and Intermittent Streams<sup>2</sup>
- Wetlands <sup>3</sup>
- Inland Lakes and their littoral zones<sup>2</sup>

# **Key Hydrologic Areas**

- Highly Vulnerable Aquifers<sup>2</sup>
- Significant Groundwater Recharge Areas<sup>2</sup>

### Karst Features<sup>4</sup>

- Known Karst
- Inferred Karst
- 🝋 Potential Karst



Sources: 1) NPCA, 2020 2) Niagara Region, 2021 3) Consolidation of datasets. Niagara Region and MNRF, 2021 (MNRF data used to fill gaps outside Niagara Region) 4) Ontario Geologic Survey, 2008

Basemap: Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Maxa







All Nations **Mission Centre** 

Gar

# GA-WRS-7: Potential Growth Area FE-7

Niagara Watershed Plan (Equivalency)

- └ djacent Lands (120m)
- Potential Growth Area<sup>2</sup>
- Regulated Floodplains<sup>1</sup>

## **Key Hydrologic Features**

- Permanent and Intermittent Streams<sup>2</sup>
- Wetlands <sup>3</sup>
- Inland Lakes and their littoral zones<sup>2</sup>

# **Key Hydrologic Areas**

- Highly Vulnerable Aquifers<sup>2</sup> 2
- Significant Groundwater Recharge Areas<sup>2</sup>

## Karst Features <sup>4</sup>

- Known Karst
- Inferred Karst
- 🝋 Potential Karst



Sources: 1) NPCA, 2020 2) Niagara Region, 2021 3) Consolidation of datasets. Niagara Region and MNRF, 2021 (MNRF data used to fill gaps outside Niagara Region) 4) Ontario Geologic Survey, 2008

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All Sett Anglice Churc

Old Ridgeway

# GA-WRS-8: Potential Growth Area FE-8 Niagara Watershed Plan (Equivalency)

- □ ¬ Adjacent Lands (120m)
- Potential Growth Area<sup>2</sup>
- Regulated Floodplains<sup>1</sup>

# **Key Hydrologic Features**

- Permanent and Intermittent Streams<sup>2</sup>
- Wetlands <sup>3</sup>

MIM S

Inland Lakes and their littoral zones<sup>2</sup>

# **Key Hydrologic Areas**

- Highly Vulnerable Aquifers<sup>2</sup>
- Significant Groundwater Recharge Areas<sup>2</sup>

## Karst Features <sup>4</sup>

- Known Karst
- Inferred Karst
- Potential Karst



Sources: 1) NPCA, 2020 2) Niagara Region, 2021 3) Consolidation of datasets. Niagara Region and MNRF, 2021 (MNRF data used to fill gaps outside Niagara Region) 4) Ontario Geologic Survey, 2008

Basemap: Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Maxar











- └ djacent Lands (120m)
- Potential Growth Area<sup>2</sup>
- Regulated Floodplains<sup>1</sup>

# **Key Hydrologic Features**

- Permanent and Intermittent Streams<sup>2</sup>
- Wetlands <sup>3</sup>
- Inland Lakes and their littoral zones<sup>2</sup>

# **Key Hydrologic Areas**

- Highly Vulnerable Aquifers<sup>2</sup>
- Significant Groundwater Recharge Areas<sup>2</sup>

## Karst Features<sup>4</sup>

- Known Karst
- Inferred Karst
- Potential Karst



Sources: 1) NPCA, 2020 2) Niagara Region, 2021 3) Consolidation of datasets. Niagara Region and MNRF, 2021 (MNRF data used to fill gaps outside Niagara Region) 4) Ontario Geologic Survey, 2008

Basemap: Esri Community Maps Contributors, City of Hamilton, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada,







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## GA-WRS-12: Potential Growth Area NF-3

Niagara Watershed Plan (Equivalency)

- └ djacent Lands (120m)
- Potential Growth Area<sup>2</sup>
- Regulated Floodplains<sup>1</sup>

#### **Key Hydrologic Features**

- Permanent and Intermittent Streams<sup>2</sup>
- Wetlands <sup>3</sup>
- Inland Lakes and their littoral zones<sup>2</sup>

### **Key Hydrologic Areas**

- Highly Vulnerable Aquifers<sup>2</sup>
- Significant Groundwater Recharge Areas<sup>2</sup>

### Karst Features<sup>4</sup>

- Known Karst
- Inferred Karst
- 🝋 Potential Karst



Sources: 1) NPCA, 2020 2) Niagara Region, 2021 3) Consolidation of datasets. Niagara Region and MNRF, 2021 (MNRF data used to fill gaps outside Niagara Region) 4) Ontario Geologic Survey, 2008

Basemap: Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, INCREMENT P, METI/ NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Maxar



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## GA-WRS-13: Potential Growth Area NF-4

Niagara Watershed Plan (Equivalency)

- └ Adjacent Lands (120m)
- Potential Growth Area<sup>2</sup>
- Regulated Floodplains<sup>1</sup>

#### **Key Hydrologic Features**

- Permanent and Intermittent Streams<sup>2</sup>
- Wetlands <sup>3</sup>
- Inland Lakes and their littoral zones<sup>2</sup>

### **Key Hydrologic Areas**

- Highly Vulnerable Aquifers<sup>2</sup>
- Significant Groundwater Recharge Areas<sup>2</sup>

### Karst Features<sup>4</sup>

- Known Karst
- Inferred Karst
- Potential Karst



Sources: 1) NPCA, 2020 2) Niagara Region, 2021 3) Consolidation of datasets. Niagara Region and MNRF, 2021 (MNRF data used to fill gaps outside Niagara Region) 4) Ontario Geologic Survey, 2008

Basemap: Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, INCREMENT P, METI/ NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Maxar



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PROJECT: DA20-014-01



## GA-WRS-14: Potential Growth Area NF-5

Niagara Watershed Plan (Equivalency)

- └ djacent Lands (120m)
- Potential Growth Area<sup>2</sup>
- Regulated Floodplains<sup>1</sup>

### **Key Hydrologic Features**

- <sup>2</sup> Permanent and Intermittent Streams<sup>2</sup>
- Wetlands <sup>3</sup>
- Inland Lakes and their littoral zones<sup>2</sup>

### **Key Hydrologic Areas**

- Highly Vulnerable Aquifers<sup>2</sup>
- Significant Groundwater Recharge Areas<sup>2</sup>

### Karst Features<sup>4</sup>

- Known Karst
- Inferred Karst
- Potential Karst



Sources: 1) NPCA, 2020 2) Niagara Region, 2021 3) Consolidation of datasets. Niagara Region and MNRF, 2021 (MNRF data used to fill gaps outside Niagara Region) 4) Ontario Geologic Survey, 2008

Basemap: Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, INCREMENT P, METI/ NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Maxar



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## GA-WRS-15: Potential Growth Area NF-6

Niagara Watershed Plan (Equivalency)

- └ Adjacent Lands (120m)
- Potential Growth Area<sup>2</sup>
- Regulated Floodplains<sup>1</sup>

### **Key Hydrologic Features**

- Permanent and Intermittent Streams<sup>2</sup>
- Wetlands <sup>3</sup>
- Inland Lakes and their littoral zones<sup>2</sup>

### **Key Hydrologic Areas**

- Highly Vulnerable Aquifers<sup>2</sup>
- Significant Groundwater Recharge Areas<sup>2</sup>

### Karst Features <sup>4</sup>

- Known Karst
- Inferred Karst
- Potential Karst



Sources: 1) NPCA, 2020 2) Niagara Region, 2021 3) Consolidation of datasets. Niagara Region and MNRF, 2021 (MNRF data used to fill gaps outside Niagara Region) 4) Ontario Geologic Survey, 2008

Basemap: Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Maxa



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## GA-WRS-16: Potential Growth Area NF-7

Niagara Watershed Plan (Equivalency)

- └ djacent Lands (120m)
- Potential Growth Area<sup>2</sup>
- Regulated Floodplains<sup>1</sup>

#### **Key Hydrologic Features**

- Permanent and Intermittent Streams<sup>2</sup>
- Wetlands <sup>3</sup>
- Inland Lakes and their littoral zones<sup>2</sup>

### **Key Hydrologic Areas**

- Highly Vulnerable Aquifers<sup>2</sup> 25
- Significant Groundwater Recharge Areas<sup>2</sup>

#### Karst Features<sup>4</sup>

- Known Karst
- Inferred Karst

🝋 Potential Karst



Sources: 1) NPCA, 2020 2) Niagara Region, 2021 3) Consolidation of datasets. Niagara Region and MNRF, 2021 (MNRF data used to fill gaps outside Niagara Region) 4) Ontario Geologic Survey, 2008

Basemap: Esri Community Maps Contributors, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Maxar



Mecere River

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CLIENT: Niagara Region

DRAWN BY: J.Sauder



## GA-WRS-17: Potential Growth Area PEL-1

Niagara Watershed Plan (Equivalency)

- └ Adjacent Lands (120m)
- Potential Growth Area<sup>2</sup>
- Regulated Floodplains<sup>1</sup>

### **Key Hydrologic Features**

- Permanent and Intermittent Streams<sup>2</sup>
- Wetlands <sup>3</sup>
- Inland Lakes and their littoral zones<sup>2</sup>

### **Key Hydrologic Areas**

- Highly Vulnerable Aquifers<sup>2</sup>
- Significant Groundwater Recharge Areas<sup>2</sup>

### Karst Features<sup>4</sup>

- Known Karst
- Inferred Karst
- Potential Karst



Sources: 1) NPCA, 2020 2) Niagara Region, 2021 3) Consolidation of datasets. Niagara Region and MNRF, 2021 (MNRF data used to fill gaps outside Niagara Region) 4) Ontario Geologic Survey, 2008

Basemap: City of Welland, Maxar, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Esri Community Maps Contributors, City of Welland, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA,



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Quaker Rd



Nlagara College-Welland





## GA-WRS-18: Potential Growth Area WEL-1

Niagara Watershed Plan (Equivalency)

- └ djacent Lands (120m)
- Potential Growth Area<sup>2</sup>
- Regulated Floodplains<sup>1</sup>

#### **Key Hydrologic Features**

- Permanent and Intermittent Streams<sup>2</sup>
- Wetlands <sup>3</sup>
- Inland Lakes and their littoral zones<sup>2</sup>

### Key Hydrologic Areas

- Highly Vulnerable Aquifers<sup>2</sup> 051
- Significant Groundwater Recharge Areas<sup>2</sup>

#### Karst Features<sup>4</sup>

- Known Karst
- Inferred Karst
- Potential Karst



Sources: 1) NPCA, 2020 2) Niagara Region, 2021 3) Consolidation of datasets. Niagara Region and MNRF, 2021 (MNRF data used to fill gaps outside Niagara Region) 4) Ontario Geologic Survey, 2008

Basemap: City of Welland, Maxar, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Esri Community Maps Contributors, City of Welland, Province of Ontario, Niagara Region, Esri Canada, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA,



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## GA-WRS-19: Potential Growth Area WL-1

Niagara Watershed Plan (Equivalency)

- └ djacent Lands (120m)
- Potential Growth Area<sup>2</sup>
- Regulated Floodplains<sup>1</sup>

#### **Key Hydrologic Features**

- Permanent and Intermittent Streams<sup>2</sup>
- Wetlands <sup>3</sup>
- Inland Lakes and their littoral zones<sup>2</sup>

#### **Key Hydrologic Areas**

- Highly Vulnerable Aquifers<sup>2</sup>
- Significant Groundwater Recharge Areas<sup>2</sup>

### Karst Features<sup>4</sup>

- Known Karst
- Inferred Karst
- Potential Karst



Sources: 1) NPCA, 2020 2) Niagara Region, 2021 3) Consolidation of datasets. Niagara Region and MNRF, 2021 (MNRF data used to fill gaps outside Niagara Region) 4) Ontario Geologic Survey, 2008

Basemap: City of Hamilton, Province of Ontario, Haldimand County, Niagara Region, Esri Canada, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Maxar



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Yonge St

Bennett Rd

Twenty Mile Rd





## GA-WRS-20: Potential Growth Area WL-2

Niagara Watershed Plan (Equivalency)

- □ ¬ Adjacent Lands (120m)
- Potential Growth Area<sup>2</sup>
- Regulated Floodplains<sup>1</sup>

#### **Key Hydrologic Features**

- Permanent and Intermittent Streams<sup>2</sup>
- Wetlands <sup>3</sup>
- Inland Lakes and their littoral zones<sup>2</sup>

#### **Key Hydrologic Areas**

- Highly Vulnerable Aquifers<sup>2</sup>
- Significant Groundwater Recharge Areas<sup>2</sup>

#### Karst Features<sup>4</sup>

- Known Karst
- Inferred Karst
- Potential Karst



Sources: 1) NPCA, 2020 2) Niagara Region, 2021 3) Consolidation of datasets. Niagara Region and MNRF, 2021 (MNRF data used to fill gaps outside Niagara Region) 4) Ontario Geologic Survey, 2008

Basemap: Province of Ontario, Haldimand County, Esri Canada, Esri, HERE, Garmin, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Maxar, Esri Community Maps Contributors, City of Hamilton, Province of Ontario, Haldimand County, Niagara Region, Esri Canada, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census



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## **APPENDIX A-3:**

## TOTAL POTENTIAL GROWTH STATISTICS

| TABLE $\Delta_3_1$ NIAGARA REGION POTENTIAL | GROWTH - OUATERNARY WATERSHEDS (KM2 | n  |
|---|-------------------------------------|----|
| TABLE A-3-1. NIAGARA REGION FUTENTIAL       | GROWIN - QUATERNART WATERSHEDS (NW2 | .) |

| Tertiary<br>Watershed | Quaternary Watershed               | Total<br>Area<br>(km2) | Urban<br>Growth<br>Centre | Major<br>Transit<br>Area | District /<br>Secondary<br>Plan Area | Draft<br>Employment<br>Areas | Greenfield<br>Areas | Potential<br>Growth<br>Area | Potential<br>Growth +<br>Greenfield<br>(no SP) | PGA+GR<br>Area as %<br>of Quat WS | Total<br>Potential<br>Growth<br>(km2) | Total<br>Potential<br>Growth with<br>SP (km2) | Total Potential<br>Growth as % of<br>Quaternary<br>Watershed | Built Up<br>Area |
|-----------------------|------------------------------------|------------------------|---------------------------|--------------------------|--------------------------------------|------------------------------|---------------------|-----------------------------|--|-----------------------------------|---------------------------------------|---|--|------------------|
| LO                    | Fifteen and Sixteen Mile Creeks    | 136.5                  |                           |                          | 0.23                                 |                              | 0.07                |                             | 0.06   | 0.04                              | 0.06                                  | 0.27  | 0.0%   | 2.09             |
| LO                    | Four Mile Creek and NOTL           | 126.4                  |                           |                          | 3.45                                 | 1.96                         | 1.77                | 0.25                        | 1.86   | 1.5                               | 4.99                                  | 4.99  | 3.9%   | 14.66            |
| LO                    | Jordan Harbour - Twenty Mile Creek | 303.5                  |                           |                          | 2.13                                 | 1.49                         | 1.14                | 12.43                       | 13.46  | 4.4                               | 14.6                                  | 15.84   | 4.8%   | 7.11             |
| LO                    | Twelve Mile Creek                  | 148.4                  | 1.18                      | 1.72                     | 8.72                                 | 3.91                         | 0.78                |                             | 0.70   | 0.5                               | 10.2                                  | 12.40   | 6.9%   | 66.75            |
| LO                    | Welland Canal North                | 92.4                   |                           |                          | 14.13                                | 6.13                         | 5.93                | 10.89                       | 16.26  | 17.6                              | 21.7                                  | 30.78   | 24%  | 45.50            |
| LO                    | Welland Canal South                | 77.4                   |                           |                          | 0.03                                 | 7.71                         | 2.72                | 0.45                        | 2.91   | 3.8                               | 8.72                                  | 8.74  | 11.3%  | 31.20            |
| LO                    | West Lake Ontario Shoreline        | 300.1                  |                           | 1.72                     | 6.85                                 | 2.64                         | 0.64                | 0.12                        | 0.70   | 0.2                               | 4.13                                  | 9.11  | 1.4%   | 21.51            |
| NR                    | Niagara River North                | 62.2                   |                           | 1.19                     | 5.41                                 | 3.84                         | 0.65                | 0.16                        | 0.75   | 1.2                               | 5.27                                  | 8.55  | 8%   | 40.50            |
| NR                    | Niagara River South                | 185.4                  |                           |                          | 10.27                                | 6.75                         | 1.19                | 19.91                       | 20.93  | 11.3                              | 26.6                                  | 35.98   | 14%  | 28.42            |
| NR                    | Welland River East                 | 136.6                  |                           |                          | 3.64                                 | 7.72                         | 4.49                | 14.18                       | 18.24  | 13.4                              | 24.6                                  | 27.18   | 18%  | 36.74            |
| NR                    | Welland River West                 | 868.5                  |                           |                          | 0.85                                 | 0.64                         | 0.59                | 0.70                        | 1.23   | 0.14                              | 1.74                                  | 2.40  | 0.2%   | 18.68            |
| LE                    | Northeast Lake Erie Shoreline      | 137                    |                           |                          | 12.26                                | 0.02                         | 3.26                | 1.07                        | 4.03   | 2.9                               | 4.04                                  | 15.74   | 3%   | 30.29            |

Note: LO = Lake Ontario, NR = Niagara River, LE = Lake Erie

| TABLE A-3-2: NIAGARA REGION POTENTIAL | GROWTH - SUBWATERSHED AREAS (KM2 | 2) |
|---------------------------------------|----------------------------------|----|
|                                       |                                  | •, |

| Teritiary Outlet               | Quaternary<br>Watershed   | Old Watershed                     | Total Old WS<br>Area (km2) | Subwatershed                 | Total Area<br>(km2) | Urban<br>Growth<br>Centre | Major<br>Transit<br>Area | District<br>Plan Area | Draft<br>Employment<br>Areas | Greenfield<br>Areas (Land<br>Supply) | Potential<br>Expansion<br>Area | Total<br>Potential<br>Growth | Total Potential<br>Growth as % of<br>Subwatershed | Built Up<br>Area |
|--------------------------------|---|-----------------------------------|----------------------------|------------------------------|---------------------|---------------------------|--------------------------|-----------------------|------------------------------|--------------------------------------|--------------------------------|------------------------------|---|------------------|
| Lake Ontario                   | Welland Canal North   | Beaverdams and<br>Shriners Creeks | 76.74                      | BDSC BEAVER DAMS CREEK       | 15.42               |                           |                          |                       | 0.74                         | 1.03                                 | 5.15                           | 6.93                         | 45%   | 4.43             |
|                                |   | 1                                 |                            | BDSC SHRINERS CREEK          | 15.33               |                           |                          |                       | 0.51                         | 0.00                                 | 3.50                           | 4.01                         | 26%   | 7.80             |
|                                |   | 1                                 |                            | BDSC TEN MILE CREEK          | 6.57                |                           |                          |                       |                              | 0.00                                 | 2.03                           | 2.03                         | 31%   | 0.45             |
|                                |   | 1                                 |                            | BDSC WELLAND CANAL NORTH     | 39.43               |                           |                          | 0.26                  | 3.05                         | 3.46                                 | 0.18                           | 7.67                         | 19%   | 7.29             |
|                                |   | 1                                 |                            | TOTAL                        | 76.74               |                           |                          | 0.3                   | 4.3                          | 4.5                                  | 10.9                           | 20.63                        | 27%   | 20.0             |
| Niagara River                  | Welland River West  | Big Forks Creek                   | 171.95                     | BFC Beezor Drain             | 12.07               |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |   | 1                                 |                            | BFC East Kelly Drain         | 15.03               |                           |                          |                       |                              |                                      |                                |                              | 0%  | Í                |
|                                |   | 1                                 |                            | BFC Ellsworth Drain          | 5.50                |                           |                          |                       |                              |                                      |                                |                              | 0%  | Í                |
|                                |   | 1                                 |                            | BFC Mill Race Creek          | 82.20               |                           |                          |                       |                              |                                      |                                |                              | 0%  | Í                |
|                                |   | 1                                 |                            | BFC North Forks Drain        | 8.84                |                           |                          |                       |                              |                                      |                                |                              | 0%  | Í                |
|                                |   | 1                                 |                            | BFC Wolf Creek Drain West    | 6.50                |                           |                          |                       |                              |                                      |                                |                              | 0%  | Í                |
|                                |   | 1                                 |                            | BFC Big Forks Creek          | 36.55               |                           |                          |                       |                              |                                      |                                |                              | 0%  | Í                |
|                                |   | 1                                 |                            | WOLF CREEK DRAIN EAST        | 5.25                |                           |                          |                       |                              |                                      |                                |                              | 0%  | Í                |
|                                |   |                                   |                            | TOTAL                        | 171.95              |                           |                          |                       |                              |                                      |                                | 0.00                         | 0%  | í l              |
| Niagara River,<br>Lake Ontario | Welland River West,<br>Welland Canal<br>North, Welland<br>Canal South | Central Welland<br>River          | 285.02                     | CWR BIEDERMAN DRAIN          | 18.21               |                           |                          |                       | 0.78                         | 0.532                                |                                | 1.11                         | 6%  | 0.71             |
|                                |   | 1                                 |                            | CWR Beaver Creek             | 24.66               |                           |                          |                       |                              | -                                    |                                |                              | 0%  | í                |
|                                |   | 1                                 |                            | CWR Black Ash Creek          | 12.09               |                           |                          |                       |                              | -                                    |                                |                              | 0%  |                  |
|                                |   | 1                                 |                            | CWR Coyle Creek              | 40.57               |                           |                          |                       |                              | 0.263                                |                                | 0.26                         | 1%  | 2.16             |
|                                |   | 1                                 |                            | CWR Draper Creek             | 8.65                |                           |                          |                       |                              | 0.090                                | 0.699163                       | 0.79                         | 9%  | 5.52             |
|                                |   | 1                                 |                            | CWR INDIAN CREEK             | 13.70               |                           |                          |                       | 1.13                         | 0.539                                |                                | 1.13                         | 8%  | [                |
|                                |   | 1                                 |                            | CWR LYONS CREEK DRAIN        | 8.24                |                           |                          |                       |                              | -                                    |                                |                              | 0%  | [                |
|                                |   | 1                                 |                            | CWR Little Forks Creek       | 13.48               |                           |                          |                       |                              | -                                    |                                |                              | 0%  | [                |
|                                |   | 1                                 |                            | CWR Parker Creek             | 8.29                |                           |                          |                       |                              | -                                    |                                |                              | 0%  | [                |
|                                |   | 1                                 |                            | CWR Sucker Creek             | 10.36               |                           |                          |                       |                              | -                                    |                                |                              | 0%  | [                |
|                                |   | 1                                 |                            | CWR TOW PATH DRAIN           | 5.24                |                           |                          |                       |                              | 0.388                                | 0.028                          | 0.42                         | 8%  | 1.62             |
|                                |   | 1                                 |                            | CWR Unnamed Creek            | 27.74               |                           |                          |                       |                              | -                                    |                                |                              | 0%  | [                |
|                                |   | 1                                 |                            | CWR WELLAND CANAL SOUTH      | 44.88               |                           |                          |                       | 5.47                         | 2.197                                | 0.452                          | 7.11                         | 16%   | 25.53            |
|                                |   | 1                                 |                            | CWR WELLAND RIVER BETWEEN    | 5.92                |                           |                          |                       | 1.21                         | -                                    |                                | 1.77                         | 30%   | 5.05             |
|                                |   | 1                                 |                            | CWR Welland River            | 61.23               |                           |                          |                       | 0.55                         | 0.181                                | 0.000                          | 0.69                         | 1%  | 6.73             |
|                                |   | L                                 |                            | TOTAL                        | 285.02              |                           |                          | 0.0                   | 9.1                          | 4.2                                  | 1.2                            | 13.28                        | 5%  | 47.3             |
| Niagara River,<br>Lake Erie    | Niagara River South,<br>Lake Erie                                     | Fort Erie                         | 171.35                     | FEC Baker Creek              | 4.50                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |   | 1                                 |                            | FEC Beaver Creek             | 37.53               |                           |                          |                       |                              | 0.038                                | 4.52                           | 4.59                         | 12%   | 1.34             |
|                                |   | 1                                 |                            | FEC Bertie Bay Drain Area 2A | 2.64                |                           |                          |                       |                              |                                      | 0.01                           | 0.01                         | 0%  |                  |
|                                |   | 1                                 |                            | FEC Black Creek              | 66.69               |                           |                          |                       | 0.57                         |                                      | 7.28                           | 7.85                         | 12%   | 3.86             |
|                                |   | 1                                 |                            | FEC Frenchmans Creek         | 17.45               |                           |                          |                       | 3.47                         | 0.119                                | 2.32                           | 5.81                         | 33%   | 4.71             |
|                                |   | 1                                 |                            | FEC Kraft Drain              | 6.90                |                           |                          |                       |                              | 0.381                                | 0.00                           | 0.43                         | 6%  | 4.22             |
|                                |   |                                   |                            | FEC Miller Creek             | 7.93                |                           |                          |                       | 1.65                         | 0.402                                | 1.72                           | 3.35                         | 42%   | 0.24             |
|                                |   |                                   |                            | FEC Niagara River 15         | 1.29                |                           |                          |                       | 0.17                         |                                      |                                | 0.17                         | 14%   |                  |
|                                |   |                                   |                            | FEC Niagara River 17         | 0.59                |                           |                          |                       | 0.19                         |                                      |                                | 0.19                         | 33%   | 0.59             |
|                                |   |                                   |                            | FEC Niagara River 18         | 0.56                |                           |                          |                       |                              |                                      |                                |                              | 0%  | 0.56             |
|                                |   |                                   |                            | FEC Niagara River 18A        | 0.47                |                           |                          |                       |                              |                                      |                                |                              | 0%  | 0.47             |
|                                |   |                                   |                            | FEC Niagara River 18B        | 0.66                |                           |                          |                       |                              |                                      |                                |                              | 0%  | 0.66             |
|                                |   |                                   |                            | FEC Niagara River 18C        | 1.38                |                           |                          |                       |                              | 0.036                                |                                | 0.00                         | 0%  | 1.08             |
|                                |   | 1                                 |                            | FEC Niagara River 18D        | 0.56                |                           |                          |                       |                              | 0.001                                |                                | 0.00                         | 0%  | 0.15             |

| TABLE A-3-2' NIAGARA REGION POTENTIAL | GROWTH - SUBWATERSHED AREAS (KM2) |  |
|---------------------------------------|-----------------------------------|--|
|                                       |                                   |  |

| Torition Outlet             | Quaternary                         | Old Watershed                                | Total Old WS | Subwatarabad                 | Total Area | Urban  | Major | District  | Draft | Greenfield | Potential | Total  | Total Potential | Built Up |
|-----------------------------|------------------------------------|--|--------------|------------------------------|------------|--------|-------|-----------|-------|------------|-----------|--------|-----------------|----------|
| Teritlary Outlet            | Watershed                          | Old watershed                                | Area (km2)   | Subwatersned                 | (km2)      | Centre | Area  | Plan Area | Areas | Supply)    | Area      | Growth | Subwatershed    | Area     |
|                             |                                    |  |              | FEC Niagara River 18E        | 0.39       |        |       | 1         |       |            |           |        | 0%              | 0.35     |
|                             |                                    |  |              | FEC Niagara River 18F        | 2.00       |        |       |           |       | 0.036      | 0.30      | 0.34   | 17%             | 0.99     |
|                             |                                    |  |              | FEC Niagara River 18G        | 0.89       |        |       |           |       |            |           |        | 0%              |          |
|                             |                                    |  |              | FEC Niagara River 18H        | 0.94       |        |       |           |       | 0.023      |           | 0.02   | 2%              | 0.66     |
|                             |                                    |  |              | FEC Six Mile Creek Lake Erie | 18.00      |        |       |           |       | 0.108      | 0.69      | 0.79   | 4%              | 2.30     |
|                             |                                    |  |              | TOTAL                        | 171.35     |        |       | 0.0       | 6.1   | 1.1        | 16.8      | 23.58  | 14%             | 22.2     |
| Lake Ontario                | Fifteen and Sixteen<br>Mile Creeks | Fifteen, Sixteen,<br>Eighteen Mile<br>Creeks | 133.45       | FSEM Eighteen Mile Creek     | 17.67      |        |       |           |       |            |           |        | 0%              | 0.01     |
|                             |                                    |  |              | FSEM Fifteen Mile Creek      | 64.20      |        |       |           |       | 0.057      |           | 0.06   | 0%              | 0.71     |
|                             |                                    |  |              | FSEM Jordan Harbour East     | 1.95       |        |       |           |       |            |           |        | 0%              | 0.12     |
|                             |                                    |  |              | FSEM Lake Ontario 11         | 0.70       |        |       |           |       |            |           |        | 0%              |          |
|                             |                                    |  |              | FSEM Lake Ontario 14         | 3.10       |        |       |           |       |            |           |        | 0%              |          |
|                             |                                    |  |              | FSEM Lake Ontario 14A        | 0.56       |        |       |           |       |            |           |        | 0%              |          |
|                             |                                    |  |              | FSEM Lake Ontario 15         | 2.39       |        |       |           |       |            |           |        | 0%              |          |
|                             |                                    |  |              | FSEM Sixteen Mile Creek      | 42.88      |        |       |           |       |            |           |        | 0%              |          |
|                             |                                    |  |              | TOTAL                        | 133.45     |        |       | 0.0       |       | 0.1        |           | 0.06   | 0%              | 0.8      |
| Lake Ontario                | West Lake Ontario<br>Shoreline     | Grimsby                                      | 74.87        | GR Forty Mile Creek          | 65.10      |        |       |           | 0.02  |            |           | 0.02   | 0%              | 1.04     |
|                             |                                    |  |              | GR Lake Ontario 33           | 1.31       |        |       |           |       |            |           |        | 0%              | 0.84     |
|                             |                                    |  |              | GR Lake Ontario 35           | 1.42       |        |       |           | 0.24  |            |           | 0.24   | 17%             | 1.10     |
|                             |                                    |  |              | GR Lake Ontario 37           | 0.85       |        | 0.16  |           | 0.09  |            |           | 0.16   | 19%             | 0.69     |
|                             |                                    |  |              | GR Lake Ontario 38           | 0.85       |        | 0.12  |           |       |            |           | 0.12   | 15%             | 0.38     |
|                             |                                    |  |              | GR Lake Ontario 39           | 2.99       |        | 0.21  |           | 0.02  |            |           | 0.21   | 7%              | 0.34     |
|                             |                                    |  |              | GR Lake Ontario 44           | 1.09       |        |       |           | 0.19  | 0.027      |           | 0.19   | 18%             | 0.12     |
|                             |                                    |  |              | GR Lake Ontario 44A          | 1.26       |        |       |           | 0.13  |            | 1.822E-05 | 0.13   | 11%             | 0.13     |
|                             | Nouthoast Laks Evia                |  |              | IOIAL                        | 74.87      |        | 0.5   | 0.0       | 0.7   | 0.0        | 0.0       | 1.08   | 1%              | 4.6      |
| Lake Erie,<br>Niagara River | Shoreline, Welland<br>River West   | Lake Erie North<br>Shore                     | 93.46        | LENS Bay Beach Area Drain    | 1.51       |        |       |           |       | 0.055      | 0.063     | 0.09   | 6%              | 1.32     |
|                             |                                    |  |              | LENS Bearss Drain            | 10.09      |        |       |           |       |            |           |        | 0%              |          |
|                             |                                    |  |              | LENS Beaver Dam Drain        | 11.97      |        |       |           |       |            |           |        | 0%              |          |
|                             |                                    |  |              | LENS Casey Drain             | 7.33       |        |       |           |       |            |           |        | 0%              |          |
|                             |                                    |  |              | LENS Eagle Marsh Drain       | 10.74      |        |       |           |       | 1.188      |           | 1.33   | 12%             | 3.23     |
|                             |                                    |  |              |                              | 0.84       |        | -     |           |       |            |           |        | 0%              | -        |
|                             |                                    |  |              | LENS Lake Erie 10            | 0.27       |        |       |           |       |            |           |        | 0%              |          |
|                             |                                    |  |              |                              | 0.46       |        |       |           |       | 0.000      |           | 0.00   | 0%              | 0.00     |
|                             |                                    |  |              | LENS Lake Erie 2             | 0.13       |        |       |           |       | 0.003      |           | 0.00   | 2%              | 0.09     |
|                             |                                    |  |              |                              | 0.01       |        |       |           |       |            | 0.0059157 | 0.01   | 0%              | 0.82     |
|                             |                                    |  |              | LEINS Lake Erie 20           | 1.90       |        |       |           |       |            | 0.0056157 | 0.01   | 0%              | 0.10     |
|                             |                                    |  |              | LENS Lake Erie 3             | 0.22       |        | +     |           |       |            |           |        | 0%              |          |
|                             |                                    |  |              | I ENS I ake Frie 1           | 2.12       |        |       |           |       | 0.007      |           | 0.01   | 0 %             | 1/2      |
|                             |                                    |  |              | I ENS Lake Frie 5            | 1 70       |        |       |           |       | 0.007      |           | 0.01   | 0%              | 1.40     |
|                             |                                    |  |              | I ENS Lake Frie 50           | 0.50       |        |       |           |       |            |           |        | 0%              |          |
|                             |                                    |  |              | I ENS Lake Frie 6            | 0.00       |        |       |           |       |            |           |        | 0%              |          |
|                             |                                    |  |              | I ENS Lake Frie 6A           | 0.23       |        |       |           |       |            |           |        | 0%              |          |
|                             |                                    |  |              | LENS Lake Frie 6B            | 0.33       |        | +     | 1         |       |            |           |        | 0%              |          |
|                             |                                    |  |              | LENS Lake Erie 6C            | 0.23       |        |       |           |       |            |           |        | 0%              |          |
|                             |                                    |  |              | LENS Lake Erie 6D            | 0.63       |        | 1     | 1         |       |            |           |        | 0%              |          |

| TABLE A-3-2: NIAGARA REGION POTENTIAL | . GROWTH - SUBWATERSHED AREAS (KM2) |  |
|---------------------------------------|-------------------------------------|--|
|                                       |                                     |  |

| Teritiary Outlet               | Quaternary<br>Watershed      | Old Watershed       | Total Old WS<br>Area (km2) | Subwatershed                     | Total Area<br>(km2) | Urban<br>Growth<br>Centre | Major<br>Transit<br>Area | District<br>Plan Area | Draft<br>Employment<br>Areas | Greenfield<br>Areas (Land<br>Supply) | Potential<br>Expansion<br>Area | Total<br>Potential<br>Growth | Total Potential<br>Growth as % of<br>Subwatershed | Built Up<br>Area |
|--------------------------------|------------------------------|---------------------|----------------------------|----------------------------------|---------------------|---------------------------|--------------------------|-----------------------|------------------------------|--------------------------------------|--------------------------------|------------------------------|---|------------------|
|                                |                              |                     |                            | LENS Lake Erie 6E                | 0.10                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |                              |                     |                            | LENS Lake Erie 6F                | 0.31                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |                              |                     |                            | LENS Lake Erie 6G                | 1.18                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |                              |                     |                            | LENS Lake Erie 7                 | 0.29                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |                              |                     |                            | LENS Lake Erie 8                 | 1.44                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |                              |                     |                            | LENS Lake Erie 8A                | 0.04                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |                              |                     |                            | LENS Lake Erie 9                 | 0.03                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |                              |                     |                            | LENS Lake Erie 9A                | 0.12                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |                              |                     |                            | LENS Low Banks Drain             | 12.48               |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |                              |                     |                            | LENS Oil Mill Creek              | 2.94                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |                              |                     |                            | LENS Point Abino Drain           | 8.99                |                           |                          |                       |                              |                                      |                                |                              | 0%  | 0.13             |
|                                |                              |                     |                            | LENS Wainfleet Marsh Drain       | 0.28                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |                              |                     |                            | LENS Wignell Drain               | 11.89               |                           |                          |                       |                              | 0.969                                |                                | 1.00                         | 8%  | 0.15             |
|                                | Maat Laka Ontaria            |                     |                            | TOTAL                            | 93.46               |                           |                          | 0.0                   |                              | 2.2                                  | 0.1                            | 2.43                         | 3%  | 7.3              |
| Lake Ontario                   | Shoreline                    | Lincoln             | 74.22                      | LIN Bartlett                     | 12.09               |                           | 0.01                     |                       | 0.40                         | 0.281                                |                                | 0.64                         | 5%  | 2.29             |
|                                |                              |                     |                            | LIN Beamsville Creek/KonkleCreek | 8.05                |                           | 0.55                     |                       |                              | 0.210                                |                                | 0.57                         | 7%  | 1.27             |
|                                |                              |                     |                            | LIN Campden Creek                | 4.53                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |                              |                     |                            | LIN Jordan Harbour West          | 2.23                |                           |                          |                       |                              |                                      |                                |                              | 0%  | 0.04             |
|                                |                              |                     |                            | LIN Lake Ontario 15A             | 1.09                |                           |                          |                       |                              |                                      |                                |                              | 0%  | 0.12             |
|                                |                              |                     |                            | LIN Lake Ontario 20              | 4.25                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |                              |                     |                            | LIN Lake Ontario 23              | 1.45                |                           | 0.42                     |                       | 0.27                         | 0.040                                |                                | 0.69                         | 47%   | 1.15             |
|                                |                              |                     |                            | LIN Lake Ontario 24              | 2.71                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |                              |                     |                            | LIN Lake Ontario 25              | 2.92                |                           |                          |                       | 0.00                         |                                      |                                |                              | 0%  | 0.00             |
|                                |                              |                     |                            | LIN Lake Ontario 26              | 0.92                |                           |                          |                       | 0.06                         |                                      |                                | 0.06                         | 6%<br>0%  | 0.22             |
|                                |                              |                     |                            | LIN Lake Ontario 29              | 2.48                |                           |                          |                       |                              |                                      |                                |                              | 0%  | 0.97             |
|                                |                              |                     |                            | LIN Lake Ontario 30              | 0.70                |                           |                          |                       |                              |                                      |                                |                              | 0%  | 0.09             |
|                                |                              |                     |                            | LIN Lake Ontario 31              | 2.44                |                           |                          |                       |                              |                                      |                                |                              | 0%  | 1.50             |
|                                |                              |                     |                            | LIN Lake Offiano 52              | 2.40                |                           |                          |                       |                              |                                      |                                |                              | 0%  | 0.10             |
|                                |                              |                     |                            | LIN Fluctionine Cleek            | 0.91                |                           |                          |                       |                              |                                      |                                |                              | 0%  | 0.10             |
|                                |                              |                     |                            |                                  | 9.13                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |                              |                     |                            |                                  | 74.22               |                           | 10                       | 0.0                   | 0.7                          | 0.5                                  |                                | 1 95                         | 3%  | 9.6              |
| Niagara River                  | Welland River East           | Lower Welland River | 33.63                      | LWR Thompson Creek               | 14.14               |                           | 1.0                      | 0.0                   | 0.22                         | 1.72                                 | 1.29                           | 2.96                         | 21%   | 0.01             |
|                                |                              |                     |                            | I WR Welland River               | 10/0                |                           |                          |                       | 2 20                         | 0.32                                 | 0.52                           | 3.08                         | 16%   | 9.96             |
|                                |                              |                     |                            |                                  | 33.63               |                           |                          | 0.0                   | 2.20                         | 20                                   | 1.8                            | 6.03                         | 18%   | 10.0             |
| Niagara River                  | Niagara River North          | Niagara Falls Urban | 36.77                      | CHIPPAWA POWER CANAL             | 36.77               |                           |                          | 0.0                   | 2.71                         | 0.42                                 | 0.16                           | 3.59                         | 10%   | 22.93            |
| 0                              |                              | 5                   |                            | ΤΟΤΑΙ                            | 36 77               |                           |                          | 0.0                   | 27                           | 0.4                                  | 0.2                            | 3 59                         | 10%   | 22.9             |
|                                | Four Mile Creek and          |                     |                            | ICIAL                            | 30.77               |                           |                          | 0.0                   | 2.1                          | 0.4                                  | 0.2                            | 0.00                         | 1070  | 22.5             |
| Lake Ontario,<br>Niagara River | NOTL, Niagara River<br>North | Niagara-on-the-Lake | 130.35                     | NOTL Andre's Drain               | 1.41                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |                              |                     |                            | NOTL Eight Mile Creek            | 13.88               |                           |                          | 0.92                  |                              | 0.289                                |                                | 0.92                         | 7%  |                  |
|                                |                              |                     |                            | NOTL Epp Drain                   | 5.98                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                                |                              |                     |                            | NOTL Four Mile Creek             | 45.82               |                           |                          |                       | 0.25                         | 0.337                                |                                | 0.45                         | 1%  | 4.35             |
|                                |                              |                     |                            | NOIL Four Mile Pond              | 6.70                |                           |                          |                       |                              | 0.011                                |                                | 0.01                         | 0%  | 0.25             |
|                                |                              |                     |                            | NOT Lake Ontario 1               | 1.05                |                           |                          | 0.00                  | 0.00                         | 0.400                                |                                |                              | 0%  | 0.00             |
|                                |                              |                     |                            | NOTE Lake Ontario 10             | 1.08                |                           |                          | 0.00                  | 0.26                         | 0.139                                |                                | 0.44                         | 41%   | 0.26             |
|                                |                              |                     | 1                          | NOTE Lake Ontario 1A             | 0.65                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |

| TABLE A-3-2: NIAGARA REGION POTENTIAL | . GROWTH - SUBWATERSHED AREAS (KM2 | 2) |
|---------------------------------------|------------------------------------|----|
|                                       |                                    | -, |

| Teritiary Outlet | Quaternary<br>Watershed                    | Old Watershed        | Total Old WS<br>Area (km2) | Subwatershed                  | Total Area<br>(km2) | Urban<br>Growth<br>Centre | Major<br>Transit<br>Area | District<br>Plan Area | Draft<br>Employment<br>Areas | Greenfield<br>Areas (Land<br>Supply) | Potential<br>Expansion<br>Area | Total<br>Potential<br>Growth | Total Potential<br>Growth as % of<br>Subwatershed | Built Up<br>Area    |
|------------------|--|----------------------|----------------------------|-------------------------------|---------------------|---------------------------|--------------------------|-----------------------|------------------------------|--------------------------------------|--------------------------------|------------------------------|---|---------------------|
|                  |  |                      |                            | NOTL Lake Ontario 2           | 0.54                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                     |
|                  |  |                      |                            | NOTL Lake Ontario 4           | 0.79                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                     |
|                  |  |                      |                            | NOTL Lake Ontario 5           | 0.73                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                     |
|                  |  |                      |                            | NOTL Lake Ontario 6A          | 0.55                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                     |
|                  |  |                      |                            | NOTL Lake Ontario 8           | 1.63                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                     |
|                  |  |                      |                            | NOTL Lake Ontario 9           | 1.55                |                           |                          |                       | 0.35                         | 0.048                                |                                | 0.35                         | 23%   | 0.29                |
|                  |  |                      |                            | NOTL Niagara River 1          | 0.49                |                           |                          |                       |                              |                                      |                                |                              | 0%  | 0.23                |
|                  |  |                      |                            | NOTL Niagara River 3          | 0.61                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                     |
|                  |  |                      |                            | NOTL Niagara River 4          | 0.87                |                           |                          |                       |                              |                                      |                                |                              | 0%  | 0.02                |
|                  |  |                      |                            | NOTL One Mile Creek           | 2.89                |                           |                          |                       |                              | 0.000                                |                                | 0.00                         | 0%  | 1.85                |
|                  |  |                      |                            | NOTL Routh Drain              | 0.00                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                     |
|                  |  |                      |                            | NOTL Six Mile Creek           | 18.13               |                           |                          | 2.53                  | 0.79                         | 0.756                                | 0.254                          | 2.79                         | 15%   | 0.01                |
|                  |  |                      |                            | NOTL Two Mile Creek           | 25.01               |                           |                          |                       |                              | 0.009                                |                                | 0.01                         | 0%  | 2.04                |
|                  |  |                      |                            | TOTAL                         | 130.35              |                           |                          | 3.4                   | 1.7                          | 1.6                                  | 0.3                            | 4.97                         | 4%  | 9.3                 |
| Lake Ontario     | Twelve Mile Creek                          | St. Catharines Urban | 16.01                      | BEAMER CREEK                  | 5.83                | 0.16                      |                          |                       | 2.40                         |                                      |                                | 1.20                         | 21%   | 8.94                |
|                  |  |                      |                            | WALKER CREEK                  | 6.38                |                           |                          |                       | 0.10                         |                                      |                                | 0.10                         | 1%  | 6.38                |
|                  |  |                      |                            | SPRING GARDEN CREEK           | 3.79                |                           |                          |                       |                              |                                      |                                |                              | 0%  | 3.79                |
|                  |  |                      |                            | TOTAL                         | 16.01               | 0.2                       |                          |                       | 2.5                          |                                      |                                | 1.30                         | 8%  | 19.1                |
| Niagara River    | Niagara River South,<br>Welland River East | South Niagara Falls  | 136.65                     | SNF Bayers Creek              | 12.03               |                           |                          |                       |                              |                                      | 0.16                           | 0.16                         | 1%  |                     |
|                  |  |                      |                            | SNF Grassy Brook              | 13.16               |                           |                          |                       | 0.23                         | 0.363                                | 1.70                           | 2.30                         | 17%   | 0.89                |
|                  |  |                      |                            | SNF Hunters Drain             | 3.30                |                           |                          |                       |                              | 0.055                                | 2.26                           | 2.29                         | 69%   | 0.06                |
|                  |  |                      |                            | SNF Lyons Creek               | 44.31               |                           |                          |                       | 2.80                         | 1.726                                | 8.04                           | 11.86                        | 27%   | 2.81                |
|                  |  |                      |                            | SNF Niagara River 10          | 0.62                |                           |                          |                       |                              |                                      |                                |                              | 0%  | 0.62                |
|                  |  |                      |                            | SNF Niagara River 11          | 0.67                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                     |
|                  |  |                      |                            | SNF Niagara River 11A         | 1.20                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                     |
|                  |  |                      |                            | SNF Niagara River 11B         | 0.13                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                     |
|                  |  |                      |                            | SNF Niagara River 11C         | 1.31                |                           |                          |                       |                              |                                      | 0.99                           | 0.99                         | 75%   |                     |
|                  |  |                      |                            | SNF Niagara River 12          | 1.01                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                     |
|                  |  |                      |                            | SNF Niagara River 13          | 0.45                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                     |
|                  |  |                      |                            | SNF Niagara River 14          | 0.85                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                     |
|                  |  |                      |                            | SNF Niagara River 9           | 2.39                |                           |                          |                       |                              | 0.442                                | 0.02                           | 0.44                         | 19%   | 1.77                |
|                  |  |                      |                            | SNF Tee Creek                 | 36.27               |                           |                          |                       |                              |                                      | 0.38                           | 0.38                         | 1%  |                     |
|                  |  |                      |                            | SNF Usshers Creek             | 18.97               |                           |                          |                       |                              | 0.010                                | 2.89                           | 2.89                         | 15%   | 0.79                |
|                  |  |                      | 100.11                     | TOTAL                         | 136.65              |                           |                          | 0.0                   | 3.0                          | 2.6                                  | 16.4                           | 21.30                        | 16%   | 6.9                 |
| Lake Ontario     | I welve Mile Creek                         | I welve Mile Creek   | 132.44                     | TWEL Dicks Creek              | 20.63               | 0.39                      | 0.07                     | 2.45                  | 0.41                         | 0.105                                |                                | 3.39                         | 16%   | 20.03               |
|                  |  |                      |                            | TWEL Francis Creek            | 6.80                |                           | 0.87                     | 4.04                  | 1.02                         | 0.320                                |                                | 1.36                         | 20%   | 4.76                |
|                  |  |                      |                            | TWEL Lake Gibson System       | 16.63               | 0.54                      | 0.00                     | 1.64                  | 0.53                         | 0.054                                |                                | 1.93                         | 12%   | 3.23                |
|                  |  |                      |                            | TWEL LOWER I WEIVE MILE Creek | 18.88               | 0.51                      | 0.69                     | 0.28                  | 0.32                         | 0.003                                |                                | 1.73                         | 9%  | 15.66               |
|                  |  |                      |                            | TWEL KICHARDSON GREEK         | 18.82               |                           |                          | 0.00                  | 0.18                         | 0.117                                |                                | 0.30                         | 2%  | 1.35                |
|                  |  |                      |                            |                               | 00.08               | 0.0                       | 1.6                      | 0.23                  | 2 5                          | 0.030                                |                                | 0.20                         | 1 %0  | 0.98                |
| Lake Ontario     | Jordan Harbour -                           | Twenty Mile Creek    | 303 18                     | TWEN Gavora Ditch             | 17 22               | 0.9                       | 1.6                      | 4.0                   | 2.0                          | 0.0                                  |                                | 0.97                         | 0%  | <b>40.0</b><br>0.48 |
|                  | Twenty Mile Creek                          |                      | 000.10                     |                               | 00.00               |                           |                          |                       |                              | 0.010                                | 4.00                           | 4.00                         | 440/  | 0.10                |
|                  |  |                      |                            |                               | 38.22               |                           |                          |                       |                              | 0.012                                | 4.29                           | 4.30                         | 11%   | 0.12                |
|                  |  |                      |                            | I WEN SINKNOIE Creek          | 18.29               |                           |                          |                       | 0.70                         | 0.040                                | 0.00                           | 0.70                         | 0%  | 0.05                |
|                  |  |                      |                            | TWEN Spring Creek             | 43.36               |                           |                          |                       | 0.76                         | 0.213                                | 3.00                           | 3.78                         | 9%  | 0.35                |
|                  | 1  | 1                    |                            |                               | 7.96                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                     |

| <b>TABLE A-3-2: NIAGARA REGION POTENTIAL</b> | GROWTH - SUBWATERSHED AREAS (K | M2)   |
|--|--------------------------------|-------|
|  |                                | ···-/ |

| Teritiary Outlet | Quaternary<br>Watershed | Old Watershed       | Total Old WS<br>Area (km2) | Subwatershed            | Total Area<br>(km2) | Urban<br>Growth<br>Centre | Major<br>Transit<br>Area | District<br>Plan Area | Draft<br>Employment<br>Areas | Greenfield<br>Areas (Land<br>Supply) | Potential<br>Expansion<br>Area | Total<br>Potential<br>Growth | Total Potential<br>Growth as % of<br>Subwatershed | Built Up<br>Area |
|------------------|-------------------------|---------------------|----------------------------|-------------------------|---------------------|---------------------------|--------------------------|-----------------------|------------------------------|--------------------------------------|--------------------------------|------------------------------|---|------------------|
|                  |                         |                     |                            | TWEN Twenty Mile Creek  | 178.13              |                           |                          |                       | 0.59                         | 0.803                                | 5.15                           | 6.49                         | 4%  | 3.95             |
|                  |                         |                     |                            | TOTAL                   | 303.18              |                           |                          | 0.0                   | 1.3                          | 1.0                                  | 12.4                           | 14.57                        | 5%  | 4.9              |
| Niagara River    | Welland River West      | Upper Welland River | 471.76                     | UWR Buckhorn Creek      | 24.48               |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | UWR Elsie Creek         | 14.20               |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | UWR Eslie Creek         | 10.71               |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | UWR James Drain         | 6.24                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | UWR Little Wolf Creek   | 10.19               |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | UWR Mill Creek          | 20.06               |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | UWR Moores Creek        | 13.32               |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | UWR Oswego Creek        | 156.14              |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | UWR Sugar Creek Drain   | 10.67               |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | UWR Unnamed Creek       | 20.54               |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | UWR Welland River       | 144.84              |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | UWR West Wolf Creek     | 13.86               |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | UWR Wilson Creek        | 6.44                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | UWR Wolf Creek          | 13.48               |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | UWR Chick Hartner Drain | 6.59                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | TOTAL                   | 471.76              |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  | MISCELI                 | ANEOUS              | •                          | MITCHNER DRAIN          | 1.77                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | NIAGARA RIVER 6         | 0.20                |                           |                          |                       | 0.00                         |                                      |                                | 0.00                         | 0%  | 0.02             |
|                  |                         |                     |                            | NIAGARA RIVER 7         | 0.15                |                           |                          |                       | 0.06                         |                                      |                                | 0.06                         | 43%   | 0.06             |
|                  |                         |                     |                            | LAKE ONTARIO 12         | 0.27                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | LAKE ONTARIO 13         | 0.15                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | LAKE ONTARIO 17         | 0.34                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | LAKE ONTARIO 18         | 0.34                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | LAKE ONTARIO 19         | 0.47                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | LAKE ONTARIO 20         | 0.93                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | LAKE ONTARIO 21         | 0.40                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | LAKE ONTARIO 22         | 0.68                |                           |                          |                       | 0.34                         | 0.021                                |                                | 0.34                         | 50%   | 0.30             |
|                  |                         |                     |                            | LAKE ONTARIO 27         | 0.18                |                           |                          |                       |                              |                                      |                                |                              | 0%  | 0.01             |
|                  |                         |                     |                            | LAKE ONTARIO 37         | 0.43                |                           | 0.02                     |                       | 0.07                         |                                      |                                | 0.07                         | 16%   | 0.33             |
|                  |                         |                     |                            | LAKE ONTARIO 36         | 0.09                |                           | -                        |                       | 0.04                         |                                      |                                | 0.04                         | 38%   | 0.09             |
|                  |                         |                     |                            | LAKE ONTARIO 41         | 0.57                |                           |                          |                       | 0.10                         |                                      |                                | 0.10                         | 18%   | 0.10             |
|                  |                         |                     |                            | LAKE ONTARIO 40         | 0.17                |                           | 0.005                    | 1                     | 0.06                         |                                      |                                | 0.06                         | 34%   | 0.06             |
|                  |                         |                     |                            | LAKE ONTARIO 42         | 0.30                |                           |                          |                       | 0.08                         |                                      |                                | 0.08                         | 26%   | 0.08             |
|                  |                         |                     |                            | LAKE ONTARIO 43         | 0.30                |                           |                          |                       | 0.06                         |                                      |                                | 0.06                         | 19%   | 0.06             |
|                  |                         |                     |                            | BERTIE BAY DRAIN AREA 1 | 0.33                |                           |                          |                       |                              |                                      |                                |                              | 0%  |                  |
|                  |                         |                     |                            | TOTAL                   | 8.08                |                           | 0.0                      | 0.0                   | 0.8                          | 0.0                                  |                                | 0.81                         | 10%   | 1.1              |

## **APPENDIX B-3**:

# WATERSHED PLAN & LEGACY STUDY REVIEW

### Table WR1: NWP (E) - Watershed Plan Review

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| Watersheds                        | Subwatersheds               | Municipalities  | Applicable Watershed Plan/Study  | Supplemental Studies (if any)   | Hydrologic Modelling  | Hydraulic Modelling   | Floodline Mapping   | Water Quality  |
|-----------------------------------|-----------------------------|---|--|---|---|---|---|--|
| Beaverdams and Shriners<br>Creeks | BDSC BEAVER DAMS<br>CREEK   | Niagara Falls, Thorold  | Beaverdams and Shriners Creek<br>Watershed Plan - Phase One, NPCA,<br>2011 | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009), Beaverdams and Shriners<br>Creek Geomorphic Study, including Thompsons<br>Creek report (NPCA, 2010), Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA 2010)   | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study) | Hydraulic properties and<br>morphology of all reaches detailed<br>in Geomorphic Study. No direct<br>reference to modelling completed. | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | Surface water quality monitoring (4 stations). April 2008. Limited data.<br>Poor to marginal WQI. Impaired BioMAP Rating. Table 6 shows more<br>detail. Identified as Type 2 (important) fish habitat. Minimal discussions<br>regarding WQ criteria for future development.  |
| Beaverdams and Shriners<br>Creeks | BDSC SHRINERS CREEK         | Niagara Falls, Thorold  | Beaverdams and Shriners Creek<br>Watershed Plan - Phase One, NPCA,<br>2011 | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009), Beaverdams and Shriners<br>Creek Geomorphic Study, including Thompsons<br>Creek report (NPCA, 2010)   | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study) | Hydraulic properties and<br>morphology of all reaches detailed<br>in Geomorphic Study. No direct<br>reference to modelling completed. | Regulated floodplain mapping,<br>based on the regional storm,<br>date/source unknown. | Surface water quality monitoring (2 stations). April 2008. Limited data.<br>Marginal WQI. Impaired BioMAP Rating. Table 6 shows more detail.<br>Identified as Type 2 (important) fish habitat. Minimal discussions<br>regarding WQ criteria for future development.  |
| Beaverdams and Shriners<br>Creeks | BDSC TEN MILE CREEK         | Niagara Falls   | Beaverdams and Shriners Creek<br>Watershed Plan - Phase One, NPCA,<br>2011 | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009), Beaverdams and Shriners<br>Creek Geomorphic Study, including Thompsons<br>Creek report (NPCA, 2010) Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA 2010)  | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study) | No direct reference to modelling<br>completed   | Regulated floodplain mapping,<br>based on the regional storm,<br>date/source unknown. | Minimal water quality monitoring completed in this subwatershed - no<br>characterization or specific issues presented. Identified as Type 2<br>(important) fish habitat. Minimal discussions regarding WQ criteria for<br>future development.  |
| Beaverdams and Shriners<br>Creeks | BDSC WELLAND CANAL<br>NORTH | Niagara-on-the-Lake,<br>Pelham, St. Catharines,<br>Thorold, Welland | Beaverdams and Shriners Creek<br>Watershed Plan - Phase One, NPCA,<br>2011 | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009), Beaverdams and Shriners<br>Creek Geomorphic Study, including Thompsons<br>Creek report (NPCA, 2010) Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA 2010)  | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study) | Hydraulic properties and<br>morphology of all reaches detailed<br>in Geomorphic Study. No direct<br>reference to modelling completed. | No floodplain mapping GIS files   | Minimal water quality monitoring completed in this subwatershed - no<br>characterization or specific issues presented. Special consideration<br>may be required due to IPZ located within subwatershed. Table 4.2 in<br>Source Protection Plan to list policy responsibilities to be implemented<br>(NPCA, 2013). Identified as Type 3 (marginal) fish habitat. Minimal<br>discussions regarding WQ criteria for future development.   |
| Central Welland River             | CWR BIEDERMAN DRAIN         | Port Colborne   | Central Welland River Watershed<br>Plan, NPCA, 2010                        | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009), Central Welland River<br>Watershed Geomorphic Assessment (NPCA 2010),<br>Stormwater Management Policies and Guidelines<br>(AECOM 2010); Niagara River Fish Community<br>Report (2007-2011)(MNRF 2012).  | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study) | Not mentioned in this report  | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | General Watershed Recommendation: AGNPS (Agricultural Non-Point<br>Source) model to simulate surface runoff, sediment and nutrient<br>transport. Lack of water quality monitoring to identify issues. Identified<br>as Type 3 (marginal) fish habitat.   |
| Central Welland River             | CWR Draper Creek            | Pelham, Welland   | Central Welland River Watershed<br>Plan, NPCA, 2010                        | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009), Central Welland River<br>Watershed Geomorphic Assessment (NPCA 2010),<br>Stormwater Management Policies and Guidelines<br>(AECOM 2010) Niagara Peninsula Tier 1 Water<br>Budget and Water Quantity Stress Assessment<br>(NPCA 2010), Niagara River Fish Community Report<br>(2007-2011)(MNRF 2012).   | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study) | Not mentioned in this report  | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | Surface water quality monitoring (1 station). 2002-2009. Poor WQI.<br>Impaired BioMAP Rating. Table 9 shows more detail.<br>Reccommendation: AGNPS (Agricultural Non-Point Source) model to<br>simulate surface runoff, sediment and nutrient transport. Lower<br>reaches identified as Type 1 (critical) fish habitat.  |
| Central Welland River             | CWR INDIAN CREEK            | Port Colborne   | Central Welland River Watershed<br>Plan, NPCA, 2010                        | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009), Central Welland River<br>Watershed Geomorphic Assessment (NPCA 2010),<br>Stormwater Management Policies and Guidelines<br>(AECOM 2010), Surface Water Intake Protection<br>Zone SWP AR (GIS data), NPCA 2019. Source<br>Protection Plan for Niagara Peninsula Source<br>Protection Area, (NPCA, 2013) Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment (NPCA 2010)    | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study) | Not mentioned in this report  | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | No water quality monitoring / characterization for subwatershed.<br>Recommendation: AGNPS (Agricultural Non-Point Source) model to<br>simulate surface runoff, sediment and nutrient transport. Special<br>consideration may be required due to IPZ located within subwatershed.<br>Table 4.2 in Source Protection Plan to list policy responsibilities to be<br>implemented (NPCA, 2013). Identified as Type 2 (important) fish<br>habitat.   |
| Central Welland River             | CWR TOW PATH DRAIN          | Pelham, Thorold,<br>Welland   | Central Welland River Watershed<br>Plan, NPCA, 2010                        | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009), Central Welland River<br>Watershed Geomorphic Assessment (NPCA 2010),<br>Stormwater Management Policies and Guidelines<br>(AECOM 2010) Niagara Peninsula Tier 1 Water<br>Budget and Water Quantity Stress Assessment<br>(NPCA 2010)   | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study) | Not mentioned in this report  | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | No water quality monitoring / characterization for subwatershed.<br>Recommendation: AGNPS (Agricultural Non-Point Source) model to<br>simulate surface runoff, sediment and nutrient transport. Special<br>consideration may be required due to IPZ located within subwatershed.<br>Table 4.2 in Source Protection Plan to list policy responsibilities to be<br>implemented (NPCA, 2013). Some reaches have been identified as<br>important (Type 2) fish habitat - other reaches are unclassified.                       |
| Central Welland River             | CWR WELLAND CANAL<br>SOUTH  | Port Colborne, Thorold,<br>Welland                                  | Central Welland River Watershed<br>Plan, NPCA, 2010                        | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009), Central Welland River<br>Watershed Geomorphic Assessment (NPCA 2010),<br>Stormwater Management Policies and Guidelines<br>(AECOM 2010). Surface Water Intake Protection<br>Zone SWP AR (GIS data), NPCA 2019. Source<br>Protection Plan for Niagara Peninsula Source<br>Protection Area, (NPCA, 2013), Niagara Water<br>Quality Protection Strategy - LMA Summaries, 2003 -<br>Port Colborne LMA #3.2 | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study) | Not mentioned in this report  | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | Lack of SWM facilities to treat urban runoff, problems with nutrient<br>management, Port Colborne built-up area contributes urban<br>contaminants. Recommendation: AGNPS (Agricultural Non-Point<br>Source) model to simulate surface runoff, sediment and nutrient<br>transport. Special consideration may be required due to IPZ located<br>within subwatershed. Table 4.2 in Source Protection Plan to list policy<br>responsibilities to be implemented (NPCA, 2013). Identified as Type 3<br>(marginal) fish habitat. |

### Table WR1: NWP (E) - Watershed Plan Review

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| Watersheds                        | Subwatersheds               | Municipalities  | Erosion Control   | Flood Control   | Water Balance   | Groundwater Management   | Watercourse Management  |
|-----------------------------------|-----------------------------|---|---|---|---|--|---|
| Beaverdams and Shriners<br>Creeks | BDSC BEAVER DAMS<br>CREEK   | Niagara Falls, Thorold  | General Watershed Objective: Implementation of a<br>comprehensive, priority based erosion control program.<br>Stormwater Management, Erosion, and Sediment<br>Policies and Criteria (RMN and NPCA) used for all<br>municipalities | Singers Drain (Type F) drains Port<br>Robinson West, centre reach along Port<br>Robinson Road has significant flood<br>potential. | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), BDSC was found to have a Significant surface<br>water stress level, and a Low groundwater stress<br>level. | Groundwater Study completed outlining<br>threats/impacts. Lake Ontario shoreline, Fonthill<br>Kame-Delta, Niagara Escarpment, Sand Plan all<br>Highly Vulnerable Aquifers. Figure 14 illustrates<br>all areas  | From Geomorphic Study. Recommendations for<br>Ontario Street, Beaverdams Road, Nicols Lane.<br>Figure 15 illustrates all areas              |
| Beaverdams and Shriners<br>Creeks | BDSC SHRINERS CREEK         | Niagara Falls, Thorold  | General Watershed Objective: Implementation of a<br>comprehensive, priority based erosion control program.<br>Stormwater Management, Erosion, and Sediment<br>Policies and Criteria (RMN and NPCA) used for all<br>municipalities | Kalar Road field site altered by creation of<br>two on-line ponds for SWM. More detail<br>in Geomorphic Study                     | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), BDSC was found to have a Significant surface<br>water stress level, and a Low groundwater stress<br>level. | Groundwater Study completed outlining<br>threats/impacts. Lake Ontario shoreline, Fonthill<br>Kame-Delta, Niagara Escarpment, Sand Plan all<br>Highly Vulnerable Aquifers. Figure 14 illustrates<br>all areas  | From Geomorphic Study. Recommendations for<br>Kalar Road, Garner Road, Thorold Stone Road.<br>Figure 15 illustrates all areas               |
| Beaverdams and Shriners<br>Creeks | BDSC TEN MILE CREEK         | Niagara Falls   | General Watershed Objective: Implementation of a<br>comprehensive, priority based erosion control program.<br>Stormwater Management, Erosion, and Sediment<br>Policies and Criteria (RMN and NPCA) used for all<br>municipalities | No specific flood control measures/criteria discussed.  | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), BDSC was found to have a Significant surface<br>water stress level, and a Low groundwater stress<br>level. | Groundwater Study completed outlining<br>threats/impacts. Lake Ontario shoreline, Fonthill<br>Kame-Delta, Niagara Escarpment, Sand Plan all<br>Highly Vulnerable Aquifers. Figure 14 illustrates<br>all areas  | Not included in Geomorphic Study.   |
| Beaverdams and Shriners<br>Creeks | BDSC WELLAND CANAL<br>NORTH | Niagara-on-the-Lake,<br>Pelham, St. Catharines,<br>Thorold, Welland | General Watershed Objective: Implementation of a<br>comprehensive, priority based erosion control program.<br>Stormwater Management, Erosion, and Sediment<br>Policies and Criteria (RMN and NPCA) used for all<br>municipalities | No specific flood control measures/criteria<br>discussed.   | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), BDSC was found to have a Significant surface<br>water stress level, and a Low groundwater stress<br>level. | Groundwater Study completed outlining<br>threats/impacts. Lake Ontario shoreline, Fonthill<br>Kame-Delta, Niagara Escarpment, Sand Plan all<br>Highly Vulnerable Aquifers. Figure 14 illustrates<br>all areas. IPZ located in subwatershed based on<br>NPCA mapping (2019). Table 4.2 in Source<br>Protection Plan to list policy responsibilities to be<br>implemented (NPCA, 2013).  | From Geomorphic Study. Recommendations for<br>Port Robinson Road, Merittville Highway,<br>Cataract Road. Figure 15 illustrates all areas    |
| Central Welland River             | CWR BIEDERMAN DRAIN         | Port Colborne   | Reference to general SWM BMPs from Stormwater<br>Management Policies and Guidelines (AECOM 2010).   | Implement NPCA Stormwater Policies<br>(2010) and BMPs into regional and<br>municipal planning documents                           | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), CWR was found to have a Moderate surface<br>water stress level, and a Low groundwater stress<br>level.     | Onondaga Escarpment area has high<br>groundwater vulnerability due to high permeability<br>of the overburden. Figure 17  | N/A   |
| Central Welland River             | CWR Draper Creek            | Pelham, Welland   | Reference to general SWM BMPs from Stormwater<br>Management Policies and Guidelines (AECOM 2010).   | Implement NPCA Stormwater Policies<br>(2010) and BMPs into regional and<br>municipal planning documents                           | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), CWR was found to have a Moderate surface<br>water stress level, and a Low groundwater stress<br>level.     | Fonthill Kame-Delta has high groundwater<br>vulnerability due to high permeability of the<br>overburden. Figure 17   | Riparian Enhancement, Bank stabilization, water<br>quality/sediment accumulation monitoring etc.<br>NPCA Fluvial Geomorphology Study (2010) |
| Central Welland River             | CWR INDIAN CREEK            | Port Colborne   | Reference to general SWM BMPs from Stormwater<br>Management Policies and Guidelines (AECOM 2010).   | Implement NPCA Stormwater Policies<br>(2010) and BMPs into regional and<br>municipal planning documents                           | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), CWR was found to have a Moderate surface<br>water stress level, and a Low groundwater stress<br>level.     | Fonthill Kame-Delta has high groundwater<br>vulnerability due to high permeability of the<br>overburden. Figure 17. IPZ located in<br>subwatershed based on NPCA mapping (2019).<br>Table 4.2 in Source Protection Plan to list policy<br>responsibilities to be implemented (NPCA, 2013).   | N/A   |
| Central Welland River             | CWR TOW PATH DRAIN          | Pelham, Thorold,<br>Welland   | Reference to general SWM BMPs from Stormwater<br>Management Policies and Guidelines (AECOM 2010).   | Implement NPCA Stormwater Policies<br>(2010) and BMPs into regional and<br>municipal planning documents                           | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), CWR was found to have a Moderate surface<br>water stress level, and a Low groundwater stress<br>level.     | Fonthill Kame-Delta has high groundwater<br>vulnerability due to high permeability of the<br>overburden. Figure 17. IPZ located in<br>subwatershed based on NPCA mapping (2019).<br>Table 4.2 in Source Protection Plan to list policy<br>responsibilities to be implemented (NPCA, 2013).   | Riparian Enhancement, Bank stabilization,<br>sediment site control practices, WQ monitoring<br>etc. NPCA Fluvial Geomorphology Study (2010) |
| Central Welland River             | CWR WELLAND CANAL<br>SOUTH  | Port Colborne, Thorold,<br>Welland                                  | Reference to general SWM BMPs from Stormwater<br>Management Policies and Guidelines (AECOM 2010).   | Implement NPCA Stormwater Policies<br>(2010) and BMPs into regional and<br>municipal planning documents                           | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), CWR was found to have a Moderate surface<br>water stress level, and a Low groundwater stress<br>level.     | Onondaga Escarpment area has high<br>groundwater vulnerability due to high permeability<br>of the overburden. Figure 17. IPZ located in<br>subwatershed. Port Colbourne IPZ-1 & IPZ-2<br>have high vulnerability scores (contain significant<br>drinking water threats). More detail in Table 1.2 in<br>Source Protection Plan (NPCA, 2013). Table 4.2<br>to list policy responsibilities to be implemented<br>(NPCA, 2013). | N/A   |

#### Table WR1: NWP (E) - Watershed Plan Review

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|                                   | Subwatersheds               | Municipalities  | Watercourse Works   | SAR / Fishery Management  | Wetlands  | HDF Classification /Management |
|-----------------------------------|-----------------------------|---|---|---|---|--------------------------------|
| Beaverdams and Shriners<br>Creeks | BDSC BEAVER DAMS<br>CREEK   | Niagara Falls, Thorold  | Geomorphic Study identified several<br>problem areas; capital works and<br>monitoring are recommended for these<br>areas. | Indirect improvements through riparian plantings.<br>No direction on management or protection of aquatic Species<br>at Risk.  | No subwatershed specific direction.<br>Maintain and increase wetland cover<br>through enhancement of existing or<br>creation of new wetlands.   | N/A                            |
| Beaverdams and Shriners<br>Creeks | BDSC SHRINERS CREEK         | Niagara Falls, Thorold  | Geomorphic Study identified several<br>problem areas; capital works and<br>monitoring are recommended for these<br>areas. | Indirect improvements through riparian plantings.<br>No direction on management or protection of aquatic Species<br>at Risk.  | No subwatershed specific direction.<br>Maintain and increase wetland cover<br>through enhancement of existing or<br>creation of new wetlands.   | N/A                            |
| Beaverdams and Shriners<br>Creeks | BDSC TEN MILE CREEK         | Niagara Falls   | Not included in Geomorphic Study.   | Indirect improvements through riparian plantings.<br>No direction on management or protection of aquatic Species<br>at Risk.  | No subwatershed specific direction.<br>Maintain and increase wetland cover<br>through enhancement of existing or<br>creation of new wetlands.   | N/A                            |
| Beaverdams and Shriners<br>Creeks | BDSC WELLAND CANAL<br>NORTH | Niagara-on-the-Lake,<br>Pelham, St. Catharines,<br>Thorold, Welland | Geomorphic Study identified several<br>problem areas; capital works and<br>monitoring are recommended for these<br>areas. | Indirect improvements through riparian plantings.<br>No direction on management or protection of aquatic Species<br>at Risk.  | No subwatershed specific direction.<br>Maintain and increase wetland cover<br>through enhancement of existing or<br>creation of new wetlands.   | N/A                            |
| Central Welland River             | CWR BIEDERMAN DRAIN         | Port Colborne   | -   | No subwatershed specific direction.<br>Maintain and improve important fish habitat.<br>Maintain or increase habitat for Grass Pickerel.<br>Flow control mitigation - old canal syphon, binbrook reservoir.  | No specific direction by subwatershed.<br>General direction to maintain or increase<br>wetland cover.<br>Previous restoration works associated with<br>Wainfleet Bog.   | N/A                            |
| Central Welland River             | CWR Draper Creek            | Pelham, Welland   | -   | No subwatershed specific direction.<br>Maintain and improve important fish habitat.<br>Improve riparian width.<br>Increase substrate diversity in higher gradient reaches using<br>natural channel design.<br>Flow control mitigation - old canal syphon, binbrook reservoir. | No specific direction by subwatershed.<br>General direction to maintain or increase<br>wetland cover.<br>Fish community report recommends<br>extending existing restoration project to<br>include wetland marsh estuary from<br>Colbeck Drive downstream to river<br>interface. | N/A                            |
| Central Welland River             | CWR INDIAN CREEK            | Port Colborne   | -   | No subwatershed specific direction.<br>Maintain and improve important fish habitat.<br>Flow control mitigation - old canal syphon, binbrook reservoir.  | No specific direction by subwatershed.<br>General direction to maintain or increase<br>wetland cover.   | N/A                            |
| Central Welland River             | CWR TOW PATH DRAIN          | Pelham, Thorold,<br>Welland   | -   | No subwatershed specific direction.<br>Maintain and improve important fish habitat.<br>Flow control mitigation - old canal syphon, binbrook reservoir.  | No specific direction by subwatershed.<br>General direction to maintain or increase<br>wetland cover.   | N/A                            |
| Central Welland River             | CWR WELLAND CANAL<br>SOUTH  | Port Colborne, Thorold,<br>Welland                                  | -   | No subwatershed specific direction.<br>Maintain and improve important fish habitat.<br>Flow control mitigation - old canal syphon, binbrook reservoir.  | No specific direction by subwatershed.<br>General direction to maintain or increase<br>wetland cover.   | N/A                            |

#### **Climate Change**

Summary of provincial level climate change studies (Ontario) and general hydrologic cycle impications for the Great Lakes Basin. No specific study, discussion or adaptation plan regarding the Beaverdams/Shriners Creeks watershed.

Summary of provincial level climate change studies (Ontario) and general hydrologic cycle impications for the Great Lakes Basin. No specific study, discussion or adaptation plan regarding the Beaverdams/Shriners Creeks watershed.

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Summary of provincial level climate change studies (Ontario) and general hydrologic cycle impications for the Great Lakes Basin. No specific study, discussion or adaptation plan regarding the Beaverdams/Shriners Creeks watershed.

| Watersheds            | Subwatersheds                      | Municipalities           | Applicable Watershed Plan/Study                                  | Supplemental Studies (if any)   | Hydrologic Modelling   | Hydraulic Modelling  | Floodline Mapping   | Water Quality   |
|-----------------------|------------------------------------|--------------------------|--|---|--|--|---|---|
| Central Welland River | CWR Welland River                  | Welland                  | Central Welland River Watershed<br>Plan, NPCA, 2010              | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009), Central Welland River<br>Watershed Geomorphic Assessment (NPCA 2010),<br>Stormwater Management Policies and Guidelines<br>(AECOM 2010), Surface Water Intake Protection<br>Zone SWP AR (GIS data), NPCA 2019. Source<br>Protection Plan for Niagara Peninsula Source<br>Protection Area, (NPCA, 2013) | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study)  | Not mentioned in this report   | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | Surface water quality monitoring (2 stations). 2002-2009. Poor to<br>marginal WQI. Impaired BioMAP Rating. Table 9 shows more detail.<br>Special consideration may be required due to IPZ located within<br>subwatershed. Table 4.2 in Source Protection Plan to list policy<br>responsibilities to be implemented (NPCA, 2013). Welland River<br>Eutrophication Study. Portions have been identified as Type 1 (critical)<br>fish habitat. |
| Central Welland River | CWR WELLAND RIVER<br>BETWEEN CANAL | Welland                  | Central Welland River Watershed<br>Plan, NPCA, 2010              | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009), Central Welland River<br>Watershed Geomorphic Assessment (NPCA 2010),<br>Stormwater Management Policies and Guidelines<br>(AECOM 2010), Surface Water Intake Protection<br>Zone SWP AR (GIS data), NPCA 2019. Source<br>Protection Plan for Niagara Peninsula Source<br>Protection Area, (NPCA, 2013) | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study)  | Not mentioned in this report   | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | Reccommendation: AGNPS (Agricultural Non-Point Source) model to<br>simulate surface runoff, sediment and nutrient transport. Special<br>consideration may be required due to IPZ located within subwatershed.<br>Table 4.2 in Source Protection Plan to list policy responsibilities to be<br>implemented (NPCA, 2013). Identified as type 3 (marginal) fish habitat.   |
| Fort Erie             | FEC Beaver Creek                   | Fort Erie, Port Colborne | Fort Erie Creeks - Watershed Plan,<br>Phillips Engineering, 2008 | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009), Niagara River Fish<br>Community Report (2007-2011)(MNRF 2012).  | SWMHYMO model (100 year peak<br>flow) developed 2008, Land Use<br>data from 1989. HEC-HMS<br>continous hydrologic model<br>(detailed in WAS)   | HEC-RAS model of all creek<br>bridges and culvert structures<br>(March 2006)         | Regulated floodplain mapping,<br>based on the 100 year storm,<br>NPCA                 | No WQ monitoring characterization - Beaver Creek identified as Type<br>1 critical fish habitat. Table 5.4.4 (local opportunities) identifies<br>potential contaminant loading at decommissioned landfill.   |
| Fort Erie             | FEC Bertie Bay Drain Area<br>2A    | Fort Erie                | Fort Erie Creeks - Watershed Plan,<br>Phillips Engineering, 2008 | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009), Niagara River Fish<br>Community Report (2007-2011)(MNRF 2012).  | SWMHYMO model (100 year peak<br>flow) developed 2008, Land Use<br>data from 1989 - subwatershed may<br>be excluded from the model<br>boundaries. HEC-HMS continous<br>hydrologic model (detailed in WAS) | No floodplain mapping or<br>hydraulic modelling identified for<br>this subwatershed. | No floodplain mapping<br>identified for this<br>subwatershed.                         | Table 5.4.17 (local opportunities) identifies potential contaminant loading at Crescent Park and Dominion Road CSO.   |
| Fort Erie             | FEC Black Creek                    | Fort Erie, Port Colborne | Fort Erie Creeks - Watershed Plan,<br>Phillips Engineering, 2008 | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009), Niagara River Fish<br>Community Report (2007-2011)(MNRF 2012).  | SWMHYMO model (100 year peak<br>flow) developed 2008, Land Use<br>data from 1989. HEC-HMS<br>continous hydrologic model<br>(detailed in WAS)   | HEC-RAS model of all creek<br>bridges and culvert structures<br>(March 2006)         | Regulated floodplain mapping,<br>based on the 100 year storm,<br>NPCA                 | Surface water quality monitoring (1 station). Impaired BioMAP Rating.<br>High E.Coli, TP, Zinc, Iron. Table 2.7.4/2.7.6 shows more detail. WQ<br>protection level to follow fish habitat classification (Critical Habitat).<br>Limitations placed on E Coli.  |
| Fort Erie             | FEC Frenchmans Creek               | Fort Erie                | Fort Erie Creeks - Watershed Plan,<br>Phillips Engineering, 2008 | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009); Niagara River Fish<br>Community Report (2007-2011)(MNRF 2012).  | SWMHYMO model (100 year peak<br>flow) developed 2008, Land Use<br>data from 1989. HEC-HMS<br>continous hydrologic model<br>(detailed in WAS)   | HEC-RAS modelling completed by<br>NPCA in 2003                                       | , Regulated floodplain mapping,<br>based on the 100 year storm,<br>NPCA               | Surface water quality monitoring (4 stations). Impaired BioMAP Rating.<br>High E.Coli, TP, Zinc, Iron, Boron. Table 2.7.4/2.7.6 shows more<br>detail. WQ protection level to follow fish habitat classification (Critical<br>Habitat). Limitations placed on E Coli.  |

### Table WR1: NWP (E) - Watershed Plan Review

| Watersheds            | Subwatersheds                      | Municipalities           | Erosion Control   | Flood Control   | Water Balance   | Groundwater Management   | Watercourse Management  |
|-----------------------|------------------------------------|--------------------------|---|---|---|--|---|
| Central Welland River | CWR Welland River                  | Welland                  | Reference to general SWM BMPs from Stormwater<br>Management Policies and Guidelines (AECOM 2010).   | Implement NPCA Stormwater Policies<br>(2010) and BMPs into regional and<br>municipal planning documents   | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), CWR was found to have a Moderate surface<br>water stress level, and a Low groundwater stress<br>level.   | Fonthill Kame-Delta has high groundwater<br>vulnerability due to high permeability of the<br>overburden. Figure 17. IPZ located in<br>subwatershed based on NPCA mapping (2019).<br>Table 4.2 in Source Protection Plan to list policy<br>responsibilities to be implemented (NPCA, 2013). | Riparian Enhancement, Rill Remediation. NPCA<br>Fluvial Geomorphology Study (2010)  |
| Central Welland River | CWR WELLAND RIVER<br>BETWEEN CANAL | Welland                  | Reference to general SWM BMPs from Stormwater<br>Management Policies and Guidelines (AECOM 2010).   | Implement NPCA Stormwater Policies<br>(2010) and BMPs into regional and<br>municipal planning documents   | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), CWR was found to have a Moderate surface<br>water stress level, and a Low groundwater stress<br>level.   | Fonthill Kame-Delta has high groundwater<br>vulnerability due to high permeability of the<br>overburden. Figure 17. IPZ located in<br>subwatershed based on NPCA mapping (2019).<br>Table 4.2 in Source Protection Plan to list policy<br>responsibilities to be implemented (NPCA, 2013). | N/A   |
| Fort Erie             | FEC Beaver Creek                   | Fort Erie, Port Colborne | Recommendations: Extended detention storage to<br>detain runoff from 4 hour, 25mm rain event. Erosion<br>control facilities should be installed in study area.Table<br>5.4.4 with local opportunities - SWM Erosion Control<br>Enhancement. Erosion thresholds calculated for each<br>of the primary receivers. | Peak flow and volume control required in<br>Ridgeway (subs BEV 202, 203, 204,<br>2020), flood control mitigaton required in<br>existing damage centres. More details in<br>Table 5.4.4. | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), FEC was found to have<br>a Moderate surface water stress level, and a<br>moderate groundwater stress level. | Table 5.4.1 details summary of local<br>opportunities. NPCA Groundwater Study provides<br>contaminant susceptibility maps.   | Rapid Field Assessment done at only 2<br>locations. 2 areas with moderate RSAT<br>conditions (channel stability, scour/deposition,<br>riparian conditions etc.). Table 2.4.1. Prominent<br>areas of eriosion found.   |
| Fort Erie             | FEC Bertie Bay Drain Area<br>2A    | Fort Erie                | Recommendations: Extended detention storage to<br>detain runoff from 4 hour, 25mm rain event. Erosion<br>control facilities should be installed in study area. Table<br>5.4.17 with local opportunities. Erosion thresholds<br>calculated for each of the primary receivers.                                    | Shoreline protection required and retrofit<br>SWM for peak flow and volume control is<br>recommended. More details in Table<br>5.4.17.  | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), FEC was found to have<br>a Moderate surface water stress level, and a<br>moderate groundwater stress level. | Table 5.4.1 details summary of local<br>opportunities. NPCA Groundwater Study provides<br>contaminant susceptibility maps.   | No RSAT completed. Recommendations for local improvements outlined in Table 5.4.17.   |
| Fort Erie             | FEC Black Creek                    | Fort Erie, Port Colborne | Recommendations: Extended detention storage to<br>detain runoff from 4 hour, 25mm rain event. Erosion<br>control facilities should be installed in study area. Table<br>5.4.2 with local opportunities. Erosion thresholds<br>calculated for each of the primary receivers.                                     | Peak flow and volume control required in<br>Stevensville, subcatchment BLK 205.<br>More details in Table 5.4.2.   | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), FEC was found to have<br>a Moderate surface water stress level, and a<br>moderate groundwater stress level. | Table 5.4.1 details summary of local<br>opportunities. NPCA Groundwater Study provides<br>contaminant susceptibility maps.   | Rapid Field Assessment done. 2 areas with low<br>RSAT conditions (channel stability,<br>scour/deposition, riparian conditions etc.). Table<br>2.4.1. Black Creek < 50% riparian buffer within<br>30m of stream. Recommendations provided in<br>Table 5.4.2.       |
| Fort Erie             | FEC Frenchmans Creek               | Fort Erie                | Recommendations: Extended detention storage to<br>detain runoff from 4 hour, 25mm rain event. Erosion<br>control facilities should be installed in study area. Table<br>5.4.11 with local opportunities Erosion thresholds<br>calculated for each of the primary receivers.                                     | Flood control or mitigation required in<br>existing damage centres. More details in<br>Table 5.4.11.  | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), FEC was found to have<br>a Moderate surface water stress level, and a<br>moderate groundwater stress level. | Table 5.4.1 details summary of local<br>opportunities. NPCA Groundwater Study provides<br>contaminant susceptibility maps.   | Rapid Field Assessment done. 2 areas with low<br>RSAT conditions (channel stability,<br>scour/deposition, riparian conditions etc.). Table<br>2.4.1. Frenchmans Creek < 60% riparian buffer<br>within 30m of stream. Recommendations<br>provided in Table 5.4.11. |

#### Table WR1: NWP (E) - Watershed Plan Review

| Primarv | Findinas |
|---------|----------|
|         |          |

| Watersheds            | Subwatersheds                      | Municipalities           | Watercourse Works | SAR / Fishery Management  | Wetlands   | HDF Classification /Management |             |
|-----------------------|------------------------------------|--------------------------|-------------------|---|--|--------------------------------|-------------|
| Central Welland River | CWR Welland River                  | Welland                  | -                 | No subwatershed specific direction.<br>Maintain and improve important fish habitat.<br>Flow control mitigation - old canal syphon, binbrook reservoir.  | No specific direction by subwatershed.<br>General direction to maintain or increase<br>wetland cover.  | N/A                            | (<br>0      |
| Central Welland River | CWR WELLAND RIVER<br>BETWEEN CANAL | Welland                  | -                 | No subwatershed specific direction.<br>Maintain and improve important fish habitat.<br>Flow control mitigation - old canal syphon, binbrook reservoir.  | No specific direction by subwatershed.<br>General direction to maintain or increase<br>wetland cover.  | N/A                            | (<br>C      |
| Fort Erie             | FEC Beaver Creek                   | Fort Erie, Port Colborne | -                 | <ul> <li>Minimize thermal impacts; no net loss of productive capacity of fish habitat; enhance where feasible; remove barriers to movement; maintain or enhance riparian cover.</li> <li>Protect, enhance and restore important watercourses / aquatic habitat.</li> <li>Plan and manage based on habitat classification (direct and indirect habitat).</li> <li>Niagara Fish Community report identifies as important habitat for Grass Pickerel. Management recommendations include increaseing riparian habitat and instream habitat quality and diversity.</li> </ul>                                       | Enhancement of impacted slough mosaics<br>a specific recommendation.<br>Protect, enhane and restore important<br>wetlands. Restoration and enhancement of<br>existing features - focus on slough mosaic<br>habitat area restoration.<br>Improve wetland edge habitat along creek<br>(Nlagara Fish Community Report).   | N/A                            | ¢<br>F      |
| Fort Erie             | FEC Bertie Bay Drain Area<br>2A    | Fort Erie                | -                 | <ul> <li>Minimize thermal impacts; no net loss of productive capacity of fish habitat; enhance where feasible; remove barriers to movement; maintain or enhance riparian cover.</li> <li>Protect, enhance and restore important watercourses / aquatic habitat.</li> <li>Plan and manage based on habitat classification (direct and indirect habitat).</li> </ul>  | Bertie Bay Drain subwatershed had a<br>substanstial area of evaluated wetland with<br>local significance. Table 2.6.3. with more<br>details.<br>Enhancement of impacted slough mosaics<br>a specific recommendation.<br>Protect, enhane and restore important<br>wetlands. Restoration and enhancement of<br>existing features - focus on slough mosaic<br>habitat area restoration.<br>Improve wetland edge habitat along creek<br>(Nlagara Fish Community Report). | N/A                            | ¢<br>F      |
| Fort Erie             | FEC Black Creek                    | Fort Erie, Port Colborne | -                 | Minimize thermal impacts; no net loss of productive capacity of<br>fish habitat; enhance where feasible; remove barriers to<br>movement; maintain or enhance riparian cover.<br>Protect, enhance and restore important watercourses / aquatic<br>habitat.<br>Plan and manage based on habitat classification (direct and<br>indirect habitat).  | Enhancement of impacted slough mosaics<br>a specific recommendation.<br>Protect, enhane and restore important<br>wetlands. Restoration and enhancement of<br>existing features - focus on slough mosaic<br>habitat area restoration.<br>Improve wetland edge habitat along creek<br>(Nlagara Fish Community Report).   | N/A                            | ¢<br>F      |
| Fort Erie             | FEC Frenchmans Creek               | Fort Erie                | -                 | <ul> <li>Minimize thermal impacts; no net loss of productive capacity of fish habitat; enhance where feasible; remove barriers to movement; maintain or enhance riparian cover.</li> <li>Protect, enhance and restore important watercourses / aquatic habitat.</li> <li>Plan and manage based on habitat classification (direct and indirect habitat).</li> <li>Niagara Fish Community report identifies as habitat for Grass Pickerel. Management recommendations include maintaining previous habitat restorations lower Frenchman's, improve riparian habitat upstreatm of Bowen Road to Quarry.</li> </ul> | Enhancement of impacted slough mosaics<br>a specific recommendation.<br>Protect, enhane and restore important<br>wetlands. Restoration and enhancement of<br>existing features - focus on slough mosaic<br>habitat area restoration.<br>Improve wetland habitat in backwater<br>estuary to River.  | N/A                            | 0<br>F<br>4 |

#### Climate Change

Summary of provincial level climate change studies (Ontario) and general hydrologic cycle impications for the Great Lakes Basin. No specific study, discussion or adaptation plan regarding the Beaverdams/Shriners Creeks watershed.

Summary of provincial level climate change studies (Ontario) and general hydrologic cycle impications for the Great Lakes Basin. No specific study, discussion or adaptation plan regarding the Beaverdams/Shriners Creeks watershed.

Terrestrial Natural Heritage Issues contributing factors include climate change. Possible mitigation strategies listed in Table 4.3.2 / 5.3 - NHS. Discussions regarding green-infrastructure for climate change induced flood protection.

Terrestrial Natural Heritage Issues contributing factors include climate change. Possible mitigation strategies listed in Table 4.3.2 / 5.3 - NHS. Discussions regarding green-infrastructure for climate change induced flood protection.

Terrestrial Natural Heritage Issues contributing factors include climate change. Possible mitigation strategies listed in Table 4.3.2 / 5.3 - NHS. Discussions regarding green-infrastructure for climate change induced flood protection.

Terrestrial Natural Heritage Issues contributing factors include climate change. Possible mitigation strategies listed in Table I.3.2. Potentially significant corridor for biota migration.

Grimsby

Grimsby

GR Forty Mile Creek

GR Lake Ontario 35

Grimsby

Grimsby

| Watersheds                            | Subwatersheds                           | Municipalities | Applicable Watershed Plan/Study                                   | Supplemental Studies (if any)   | Hydrologic Modelling  | Hydraulic Modelling  |
|---------------------------------------|---|----------------|---|---|---|--|
| Fort Erie                             | FEC Kraft Drain                         | Fort Erie      | Fort Erie Creeks - Watershed Plan,<br>Phillips Engineering, 2008  | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009)  | SWMHYMO model (100 year peak<br>flow) developed 2008, Land Use<br>data from 1989. HEC-HMS<br>continous hydrologic model<br>(detailed in WAS)      | HEC-RAS model of all creek<br>bridges and culvert structures<br>(March 2006) |
| Fort Erie                             | FEC Miller Creek                        | Fort Erie      | Fort Erie Creeks - Watershed Plan,<br>Phillips Engineering, 2008  | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009), Niagara River Fish<br>Community Report (2007-2011)(MNRF 2012).                          | SWMHYMO model (100 year peak<br>flow) developed 2008, Land Use<br>data from 1989. HEC-HMS<br>continous hydrologic model<br>(detailed in WAS)      | HEC-RAS model of all creek<br>bridges and culvert structures<br>(March 2006) |
| Fort Erie                             | FEC Niagara River 15                    | Fort Erie      | Subwatershed not in watershed plan                                | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Chippawa LMA #2.17   | None mentioned specific to this study.  | None mentioned specific to this study.                                       |
| Fort Erie                             | FEC Niagara River 17                    | Fort Erie      | Subwatershed not in watershed plan                                | -   | -   | -  |
| Fort Erie                             | FEC Niagara River 18C,<br>18D, 18F, 18H | Fort Erie      | Subwatershed not in watershed plan                                | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Chippawa LMA #2.17   | None mentioned specific to this study.  | None mentioned specific to this study.                                       |
| Fort Erie                             | FEC Six Mile Creek Lake<br>Erie         | Fort Erie      | Fort Erie Creeks - Watershed Plan,<br>Phillips Engineering, 2008  | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009)  | SWMHYMO model (100 year peak<br>flow) developed 2008, Land Use<br>data from 1989. HEC-HMS<br>continous hydrologic model<br>(detailed in WAS)      | HEC-RAS model of all creek<br>bridges and culvert structures<br>(March 2006) |
| een, Sixteen, Eighteen Mile<br>Creeks | FSEM Fifteen Mile Creek                 | Pelham         | Fifteen-Sixteen-Eighteen Mile Creek<br>Watershed Plan, NPCA, 2008 | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009), Fifteen-Sixteen-Eighteen<br>Mile Creeks Watershed Geomorphic Assessment<br>(NPCA, 2006) | None mentioned specific to this<br>Watershed Plan study. HEC-HMS<br>continous hydrologic model<br>(detailed in Water Availability Study,<br>2009) | None mentioned specific to this study.                                       |

N/A - Check Regional Level Guidance

N/A - Check Regional Level Guidance

Niagara Water Quality Protection Strategy - LMA

Summaries, 2003 - Grimbsy LMA #1.2

Niagara Water Quality Protection Strategy - LMA

Summaries, 2003 - Beamsville LMA #1.3

None mentioned specific to this

study.

| Floodline Mapping   | Water Quality   |
|---|---|
| Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | No WQ monitoring characterization - unknown whether WQ monitoring network has been expanded into this subwatershed.   |
| Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | No WQ monitoring characterization - unknown whether WQ monitoring<br>network has been expanded into this subwatershed. Miller Creek is<br>designated as critical fish habitat.  |
| N/A   | LMA has issues associated with manure and nutrient management.<br>Chippawa built-up area accentuates storm runoff volumes and water<br>quality.   |
| -   | -   |
| N/A   | LMA has issues associated with manure and nutrient management.<br>Chippawa built-up area accentuates storm runoff volumes and water<br>quality.   |
| Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | No WQ monitoring characterization - unknown whether WQ monitoring<br>network has been expanded into this subwatershed. Six Mile Creek is<br>designated as critical fish habitat.  |
| Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | NPCA Water Quality Monitoring in 2007 found a "Marginal" water<br>quality rating, an impaired biomap rating, and found exceedances of<br>phosphorous as well as algae observed in summer months.                                    |
| Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | Urban STM runoff contaminants include Fecal Coliform, Total<br>Phosphorous, Total Kjeldahl Nitrogen, Total Ammonia, Copper, Total<br>Suspended Solids.  |
| N/A   | Urban STM runoff contaminants include Fecal Coliform, Total<br>Phosphorous, Total Kjeldahl Nitrogen, Total Ammonia, Copper, Total<br>Suspended Solids. Approx 35% of urban area in the LMA is treated by<br>SWM (quantity/quality). |

### Table WR1: NWP (E) - Watershed Plan Review

| Primarv | Findinas |
|---------|----------|
|         |          |

| Watersheds                                | Subwatersheds                           | Municipalities | Erosion Control   | Flood Control   | Water Balance   | Groundwater Management   | Watercourse Management   |
|---|---|----------------|---|---|---|--|--|
| Fort Erie                                 | FEC Kraft Drain                         | Fort Erie      | Recommendations: Extended detention storage to<br>detain runoff from 4 hour, 25mm rain event. Erosion<br>control facilities should be installed in study area.Table<br>5.4.15 with local opportunities Erosion thresholds<br>calculated for each of the primary receivers.  | Flood control or mitigation required in<br>existing damage centres. More details in<br>Table 5.4.15.  | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), FEC was found to have<br>a Moderate surface water stress level, and a<br>moderate groundwater stress level.     | Table 5.4.1 details summary of local<br>opportunities. NPCA Groundwater Study provides<br>contaminant susceptibility maps.   | No RSAT completed. Kraft Drain > 90% riparian<br>buffer within 30m of stream. Recommendations<br>provided in Table 5.4.15.   |
| Fort Erie                                 | FEC Miller Creek                        | Fort Erie      | Recommendations: Extended detention storage to<br>detain runoff from 4 hour, 25mm rain event. Erosion<br>control facilities should be installed in study area.Table<br>5.4.8 with local opportunities. Erosion thresholds<br>calculated for each of the primary receivers.  | Peak flow and volume control required in<br>subcatchments MIL 100,101. More details<br>in Table 5.4.8.  | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), FEC was found to have<br>a Moderate surface water stress level, and a<br>moderate groundwater stress level.     | Table 5.4.1 details summary of local<br>opportunities. NPCA Groundwater Study provides<br>contaminant susceptibility maps.   | Rapid Field Assessment done. No areas with low<br>RSAT conditions (channel stability,<br>scour/deposition, riparian conditions etc.). Table<br>2.4.1. Miller < 65% riparian buffer within 30m of<br>stream. Recommendations provided in Table<br>5.4.8.  |
| Fort Erie                                 | FEC Niagara River 15                    | Fort Erie      | No specific criteria or issues outlined.  | Chippawa built-up area accentuates storm runoff volumes and water quality.  | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), FEC was found to have a Moderate surface<br>water stress level, and a moderate groundwater<br>stress level.  | Medium sensitivity groundwater areas, along the<br>Niagara River, are susceptible to contamination<br>from surface sources due to fractured nature of<br>overburden and high susceptibility in areas where<br>bedrock outcrops at surface.             | Add stream/drain buffers, and design urban<br>expansion with well buffered, naturalized<br>waterways.  |
| Fort Erie                                 | FEC Niagara River 17                    | Fort Erie      | -   | -   | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), FEC was found to have a Moderate surface<br>water stress level, and a moderate groundwater<br>stress level.  | -  | -  |
| Fort Erie                                 | FEC Niagara River 18C,<br>18D, 18F, 18H | Fort Erie      | No specific criteria or issues outlined.  | Chippawa built-up area accentuates storm runoff volumes and water quality.  | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), FEC was found to have a Moderate surface<br>water stress level, and a moderate groundwater<br>stress level.  | Medium sensitivity groundwater areas, along the<br>Niagara River, are susceptible to contamination<br>from surface sources due to fractured nature of<br>overburden and high susceptibility in areas where<br>bedrock outcrops at surface.             | Add stream/drain buffers, and design urban<br>expansion with well buffered, naturalized<br>waterways.  |
| Fort Erie                                 | FEC Six Mile Creek Lake<br>Erie         | Fort Erie      | Recommendations: Extended detention storage to<br>detain runoff from 4 hour, 25mm rain event. Erosion<br>control facilities should be installed in study area.Table<br>5.4.18 with local opportunities. Erosion thresholds<br>calculated for each of the primary receivers. | Flood control or mitigation required in<br>existing damage centres. More details in<br>Table 5.4.18.  | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), FEC was found to have<br>a Moderate surface water stress level, and a<br>moderate groundwater stress level.     | Table 5.4.1 details summary of local<br>opportunities. NPCA Groundwater Study provides<br>contaminant susceptibility maps.   | Rapid Field Assessment done. No areas with low<br>RSAT conditions (channel stability,<br>scour/deposition, riparian conditions etc.). Table<br>2.4.1. Six Mile Creek < 70% riparian buffer within<br>30m of stream. Recommendations provided in<br>Table 5.4.18.                               |
| Fifteen, Sixteen, Eighteen Mile<br>Creeks | FSEM Fifteen Mile Creek                 | Pelham         | General SWM BMPs are outlined (similar to other<br>Watershed Plans).  | General SWM BMPs are outlined (similar<br>to other Watershed Plans). No specific<br>flood control objectives related to the<br>area.  | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), FSEM was found to<br>have a Significant surface water stress level, and a<br>moderate groundwater stress level. | High groundwater vulnerability in south-east<br>portion of subwatershed due to presence of<br>permeable soil and shalow depth of groundwater<br>table. Figure 14 with full map.  | Geomorphic Study identified several erosion and<br>sediment accumulation sites with<br>recommendations (Table 7 on Watershed<br>Plan).A riparian planting program would also<br>benefit this portion of the subwatershed to assist<br>in the enhancement of water quality and fish<br>habitat. |
| Grimsby                                   | GR Forty Mile Creek                     | Grimsby        | No specific criteria outlined. No watercourse erosion<br>prone or problem areas identified - only shoreline<br>erosion discussed.   | Approx 30% of urban area in LMA is<br>treated by existing SWM facilities. There<br>is a lack of SWM facilities to treat urban<br>runoff - surface and structural flooding<br>expected under 2-5 year storm along<br>Forty Mile Creek. | In absence of WS Plan - Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010), GR was found to<br>have a Significant surface water stress level, and a<br>low groundwater stress level.   | Medium sensitivity groundwater areas are<br>susceptible to contamination from surface<br>sources due to fractured nature of overburden<br>and high susceptibility in areas where bedrock<br>outcrops at surface.                                       | Mild to severe shore erosion (0.3 to 1.3 m per year). Consider naturalizing drains and valley between Escarpment/Lake, add stream buffers.   |
| Grimsby                                   | GR Lake Ontario 35                      | Grimsby        | No specific criteria outlined. No watercourse erosion<br>prone or problem areas identified - only shoreline<br>erosion discussed.   | Approx 35% of urban area in the LMA is<br>treated by existing SWM facilities<br>(quantity/quality).   | In absence of WS Plan - Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010), GR was found to<br>have a Significant surface water stress level, and a<br>low groundwater stress level.   | Groundwater sensitivity rates Moderate for much<br>of the area due to shallow but low permeability<br>overburden. Some areas rise to High (Vineland<br>Station, Grimbsy Beach) due to exposed bedrock<br>at the Escarpment, and permeable sand plains. | Mild to moderate shore erosion (0.3 to 1 m per<br>year). Investigate opportunities to establish some<br>shoreline natural restoration areas  |

#### Table WR1: NWP (E) - Watershed Plan Review

| Watersheds                                | Subwatersheds                           | Municipalities | Watercourse Works | SAR / Fishery Management   | Wetlands   | HDF Classification /Management |        |
|---|---|----------------|-------------------|--|--|--------------------------------|--------|
|   |   |                |                   | Minimize thermal impacts; no net loss of productive capacity of<br>fish habitat; enhance where feasible; remove barriers to<br>movement; maintain or enhance riparian cover. | Enhancement of impacted slough mosaics a specific recommendation.  |                                |        |
| Fort Erie                                 | FEC Kraft Drain                         | Fort Erie      | -                 | Protect, enhance and restore important watercourses / aquatic habitat.   | Protect, enhane and restore important<br>wetlands. Restoration and enhancement of  | N/A                            | F      |
|   |   |                |                   | Plan and manage based on habitat classification (direct and indirect habitat).   | habitat area restoration.  |                                |        |
|   |   |                |                   | Minimize thermal impacts; no net loss of productive capacity of<br>fish habitat; enhance where feasible; remove barriers to<br>movement; maintain or enhance riparian cover. | Enhancement of impacted slough mosaics a specific recommendation.  |                                |        |
| Fort Erie                                 | FEC Miller Creek                        | Fort Erie      | -                 | Protect, enhance and restore important watercourses / aquatic habitat.   | Protect, enhane and restore important<br>wetlands. Restoration and enhancement of<br>existing features - focus on slough mosaic  | N/A                            | (<br>F |
|   |   |                |                   | Plan and manage based on habitat classification (direct and indirect habitat).   | habitat area restoration.  |                                | '      |
|   |   |                |                   | Fish Community Report recommends improvement to riparian habitat and increasing stormwater retention in the watershed.   | estuary to River   |                                |        |
|   |   |                |                   | Minimize thermal impacts; no net loss of productive capacity of<br>fish habitat; enhance where feasible; remove barriers to<br>movement; maintain or enhance riparian cover. | Enhancement of impacted slough mosaics a specific recommendation.  |                                |        |
| Fort Erie                                 | FEC Niagara River 15                    | Fort Erie      | -                 | Protect, enhance and restore important watercourses / aquatic habitat.   | Protect, enhane and restore important<br>wetlands. Restoration and enhancement of<br>avieting features, focus on slough messic   | N/A                            |        |
|   |   |                |                   | Plan and manage based on habitat classification (direct and indirect habitat).   | habitat area restoration.  |                                |        |
|   |   |                |                   | Minimize thermal impacts; no net loss of productive capacity of<br>fish habitat; enhance where feasible; remove barriers to<br>movement; maintain or enhance riparian cover. | Enhancement of impacted slough mosaics<br>a specific recommendation.   |                                |        |
| Fort Erie                                 | FEC Niagara River 17                    | Fort Erie      | -                 | Protect, enhance and restore important watercourses / aquatic habitat.   | Protect, enhane and restore important<br>wetlands. Restoration and enhancement of<br>existing features - focus on slough mosaic. | N/A                            |        |
|   |   |                |                   | Plan and manage based on habitat classification (direct and indirect habitat).   | habitat area restoration.  |                                |        |
|   |   |                |                   | Minimize thermal impacts; no net loss of productive capacity of<br>fish habitat; enhance where feasible; remove barriers to<br>movement; maintain or enhance riparian cover. | Enhancement of impacted slough mosaics<br>a specific recommendation.   |                                |        |
| Fort Erie                                 | FEC Niagara River 18C,<br>18D, 18F, 18H | Fort Erie      | -                 | Protect, enhance and restore important watercourses / aquatic habitat.   | Protect, enhane and restore important<br>wetlands. Restoration and enhancement of<br>existing features - focus on slough mosaic  | N/A                            |        |
|   |   |                |                   | Plan and manage based on habitat classification (direct and indirect habitat).   | habitat area restoration.  |                                |        |
|   |   |                |                   | Minimize thermal impacts; no net loss of productive capacity of<br>fish habitat; enhance where feasible; remove barriers to<br>movement; maintain or enhance riparian cover. | Enhancement of impacted slough mosaics<br>a specific recommendation.   |                                |        |
| Fort Erie                                 | FEC SIX MILE CREEK LAKE<br>Erie         | Fort Erie      | -                 | Protect, enhance and restore important watercourses / aquatic habitat.   | Protect, enhane and restore important<br>wetlands. Restoration and enhancement of<br>existing features - focus on slough mosaic  | N/A                            | F      |
|   |   |                |                   | Plan and manage based on habitat classification (direct and indirect habitat).   | habitat area restoration.  |                                |        |
|   |   |                |                   | /fish habitat.   | Recommendations for enhancement to   |                                | ç      |
| Fifteen, Sixteen, Eighteen Mile<br>Creeks | FSEM Fifteen Mile Creek                 | Pelham         |                   | Recommendations for removal of fish barriers at several locations in the watershed.  | existing and creation of new wetlands where suitable conditions exist.   | N/A                            | ۲<br>۲ |
|   |   |                |                   | Report recommends additional study of fish and aquatic<br>habitat at Fifteen Mile Pond.  |  |                                |        |
| Grimsby                                   | GR Forty Mile Creek                     | Grimsby        | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.                 | -  | N/A                            |        |
| Grimsby                                   | GR Lake Ontario 35                      | Grimsby        | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.                 | -  | N/A                            | _      |

| Climate | Change |
|---------|--------|
|         |        |

Terrestrial Natural Heritage Issues contributing factors include climate change. Possible mitigation strategies listed in Table 4.3.2.

Terrestrial Natural Heritage Issues contributing factors include climate change. Possible mitigation strategies listed in Table 4.3.2.

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Terrestrial Natural Heritage Issues contributing factors include climate change. Possible mitigation strategies listed in Table 4.3.2.

Summary of provincial level climate change studies (Ontario) and general hydrologic cycle impications for the Great Lakes Basin. No specific study, discussion or adaptation plan regarding the Fifteen-Sixteen-Eighteen Mile Creeks watershed.

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| Watersheds    | Subwatersheds                       | Municipalities | Applicable Watershed Plan/Study     | Supplemental Studies (if any)   | Hydrologic Modelling                   | Hydraulic Modelling                    | Floodline Mapping   | Water Quality   |
|---------------|-------------------------------------|----------------|-------------------------------------|---|--|--|---|---|
| Grimsby       | GR Lake Ontario 37                  | Grimsby        | N/A - Check Regional Level Guidance | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Beamsville LMA #1.3  | None mentioned specific to this study. | None mentioned specific to this study. | N/A   | Urban STM runoff contaminants include Fecal Coliform, Total<br>Phosphorous, Total Kjeldahl Nitrogen, Total Ammonia, Copper, Total<br>Suspended Solids. Lack of stormwater management facilities to treat<br>urban runoff  |
| Grimsby       | GR Lake Ontario 38                  | Grimsby        | N/A - Check Regional Level Guidance | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Beamsville LMA #1.3  | None mentioned specific to this study. | None mentioned specific to this study. | N/A   | Urban STM runoff contaminants include Fecal Coliform, Total<br>Phosphorous, Total Kjeldahl Nitrogen, Total Ammonia, Copper, Total<br>Suspended Solids. Lack of stormwater management facilities to treat<br>urban runoff  |
| Grimsby       | GR Lake Ontario 39                  | Grimsby        | N/A - Check Regional Level Guidance | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Bearnsville LMA #1.3   | None mentioned specific to this study. | None mentioned specific to this study. | N/A   | Urban STM runoff contaminants include Fecal Coliform, Total<br>Phosphorous, Total Kjeldahl Nitrogen, Total Ammonia, Copper, Total<br>Suspended Solids. Lack of stormwater management facilities to treat<br>urban runoff  |
| Grimsby       | GR Lake Ontario 44                  | Grimsby        | N/A - Check Regional Level Guidance | Surface Water Intake Protection Zone SWP AR (GIS<br>data), NPCA 2019. Source Protection Plan for<br>Niagara Peninsula Source Protection Area, (NPCA,<br>2013) | -                                      | -                                      | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | Special consideration may be required due to IPZ located within subwatershed.   |
| Grimsby       | GR Lake Ontario 44A                 | Grimsby        | N/A - Check Regional Level Guidance | Surface Water Intake Protection Zone SWP AR (GIS data), NPCA 2019. Source Protection Plan for Niagara Peninsula Source Protection Area, (NPCA, 2013)          | -                                      | -                                      | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | Special consideration may be required due to IPZ located within subwatershed.   |
| Miscellaneous | LAKE ONTARIO 22                     | Lincoln        | N/A - Check Regional Level Guidance | -   |  |  |   |   |
| Miscellaneous | LAKE ONTARIO 36                     | Grimsby        | N/A - Check Regional Level Guidance | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Grimbsy LMA #1.2   | None mentioned specific to this study. | None mentioned specific to this study. | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | Urban STM runoff contaminants include Fecal Coliform, Total<br>Phosphorous, Total Kjeldahl Nitrogen, Total Ammonia, Copper, Total<br>Suspended Solids. Lack of stormwater management facilities to treat<br>urban runoff. |
| Miscellaneous | LAKE ONTARIO 37                     | Grimsby        | N/A - Check Regional Level Guidance | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Beamsville LMA #1.3  | None mentioned specific to this study. | None mentioned specific to this study. | N/A   | Urban STM runoff contaminants include Fecal Coliform, Total<br>Phosphorous, Total Kjeldahl Nitrogen, Total Ammonia, Copper, Total<br>Suspended Solids. Lack of stormwater management facilities to treat<br>urban runoff. |
| Miscellaneous | LAKE ONTARIO 40                     | Grimsby        | N/A - Check Regional Level Guidance | Surface Water Intake Protection Zone SWP AR (GIS<br>data), NPCA 2019. Source Protection Plan for<br>Niagara Peninsula Source Protection Area, (NPCA,<br>2013) | -                                      | -                                      | -   | Special consideration may be required due to IPZ located within subwatershed.   |
| Miscellaneous | LAKE ONTARIO 41                     | Grimsby        | N/A - Check Regional Level Guidance | Surface Water Intake Protection Zone SWP AR (GIS<br>data), NPCA 2019. Source Protection Plan for<br>Niagara Peninsula Source Protection Area, (NPCA,<br>2013) | -                                      | -                                      | -   | Special consideration may be required due to IPZ located within subwatershed.   |
| Miscellaneous | LAKE ONTARIO 42                     | Grimsby        | N/A - Check Regional Level Guidance | Surface Water Intake Protection Zone SWP AR (GIS<br>data), NPCA 2019. Source Protection Plan for<br>Niagara Peninsula Source Protection Area, (NPCA,<br>2013) | -                                      | -                                      | -   | Special consideration may be required due to IPZ located within subwatershed.   |
| Miscellaneous | LAKE ONTARIO 43                     | Grimsby        | N/A - Check Regional Level Guidance | Surface Water Intake Protection Zone SWP AR (GIS<br>data), NPCA 2019. Source Protection Plan for<br>Niagara Peninsula Source Protection Area, (NPCA,<br>2013) | -                                      | -                                      | -   | Special consideration may be required due to IPZ located within subwatershed.   |
| Lincoln       | LIN Bartlett                        | Lincoln        | N/A - Check Regional Level Guidance | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Beamsville LMA #1.3  | None mentioned specific to this study. | None mentioned specific to this study. | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | Urban STM runoff contaminants include Fecal Coliform, Total<br>Phosphorous, Total Kjeldahl Nitrogen, Total Ammonia, Copper, Total<br>Suspended Solids. Lack of stormwater management facilities to treat<br>urban runoff  |
| Lincoln       | LIN Beamsville<br>Creek/KonkleCreek | Lincoln        | N/A - Check Regional Level Guidance | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Beamsville LMA #1.3  | None mentioned specific to this study. | None mentioned specific to this study. | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | Urban STM runoff contaminants include Fecal Coliform, Total<br>Phosphorous, Total Kjeldahl Nitrogen, Total Ammonia, Copper, Total<br>Suspended Solids. Lack of stormwater management facilities to treat<br>urban runoff  |
| Lincoln       | LIN Lake Ontario 23                 | Lincoln        | N/A - Check Regional Level Guidance | -   | -                                      | -                                      | -   | -   |
| Lincoln       | LIN Lake Ontario 26                 | Lincoln        | N/A - Check Regional Level Guidance | -   | -                                      | -                                      | -   | -   |

| Watersheds    | Subwatersheds                       | Municipalities | Erosion Control   | Flood Control   | Water Balance  | Groundwater Management   | Watercourse Management   |
|---------------|-------------------------------------|----------------|---|---|--|--|--|
| Grimsby       | GR Lake Ontario 37                  | Grimsby        | No specific criteria outlined. No watercourse erosion<br>prone or problem areas identified - only shoreline<br>erosion discussed. | Approx 35% of urban area in the LMA is<br>treated by existing SWM facilities<br>(quantity/quality).   | In absence of WS Plan - Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010), GR was found to<br>have a Significant surface water stress level, and a<br>low groundwater stress level.  | Groundwater sensitivity rates Moderate for much<br>of the area due to shallow but low permeability<br>overburden. Some areas rise to High (Vineland<br>Station, Grimbsy Beach) due to exposed bedrock<br>at the Escarpment, and permeable sand plains. | Mild to moderate shore erosion (0.3 to 1 m per<br>year). Investigate opportunities to establish some<br>shoreline natural restoration areas      |
| Grimsby       | GR Lake Ontario 38                  | Grimsby        | No specific criteria outlined. No watercourse erosion<br>prone or problem areas identified - only shoreline<br>erosion discussed. | Approx 35% of urban area in the LMA is<br>treated by existing SWM facilities<br>(quantity/quality).   | In absence of WS Plan - Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010), GR was found to<br>have a Significant surface water stress level, and a<br>low groundwater stress level.  | Groundwater sensitivity rates Moderate for much<br>of the area due to shallow but low permeability<br>overburden. Some areas rise to High (Vineland<br>Station, Grimbsy Beach) due to exposed bedrock<br>at the Escarpment, and permeable sand plains. | Mild to moderate shore erosion (0.3 to 1 m per<br>year). Investigate opportunities to establish some<br>shoreline natural restoration areas      |
| Grimsby       | GR Lake Ontario 39                  | Grimsby        | No specific criteria outlined. No watercourse erosion<br>prone or problem areas identified - only shoreline<br>erosion discussed. | Approx 35% of urban area in the LMA is<br>treated by existing SWM facilities<br>(quantity/quality).   | In absence of WS Plan - Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010), GR was found to<br>have a Significant surface water stress level, and a<br>low groundwater stress level.  | Groundwater sensitivity rates Moderate for much<br>of the area due to shallow but low permeability<br>overburden. Some areas rise to High (Vineland<br>Station, Grimbsy Beach) due to exposed bedrock<br>at the Escarpment, and permeable sand plains. | Mild to moderate shore erosion (0.3 to 1 m per<br>year). Investigate opportunities to establish some<br>shoreline natural restoration areas      |
| Grimsby       | GR Lake Ontario 44                  | Grimsby        | -   | -   | In absence of WS Plan - Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010), GR was found to<br>have a Significant surface water stress level, and a<br>low groundwater stress level.  | IPZ located in subwatershed. Threat policies for<br>IPZ associated with Grimsby not developed due<br>to low vulnerability score.   | -  |
| Grimsby       | GR Lake Ontario 44A                 | Grimsby        | -   | -   | In absence of WS Plan - Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010), GR was found to<br>have a Significant surface water stress level, and a<br>low groundwater stress level.  | IPZ located in subwatershed. Threat policies for<br>IPZ associated with Grimsby not developed due<br>to low vulnerability score.   | -  |
| Miscellaneous | LAKE ONTARIO 22                     | Lincoln        |   |   | -  |  |  |
| Miscellaneous | LAKE ONTARIO 36                     | Grimsby        | No specific criteria outlined. No watercourse erosion<br>prone or problem areas identified - only shoreline<br>erosion discussed. | Approx 30% of urban area in LMA is<br>treated by existing SWM facilities. Lack of<br>stormwater management facilities to treat<br>urban runoff.   | f<br>t   | Medium sensitivity groundwater areas are<br>susceptible to contamination from surface<br>sources due to fractured nature of overburden<br>and high susceptibility in areas where bedrock<br>outcrops at surface.                                       | Mild to severe shore erosion (0.3 to 1.3 m per<br>year). Consider naturalizing drains and valley<br>between Escarpment/Lake, add stream buffers. |
| Miscellaneous | LAKE ONTARIO 37                     | Grimsby        | No specific criteria outlined. No watercourse erosion<br>prone or problem areas identified - only shoreline<br>erosion discussed. | Approx 35% of urban area in the LMA is<br>treated by existing SWM facilities<br>(quantity/quality). Lack of stormwater<br>management facilities to treat urban<br>runoff.                             | -  | Groundwater sensitivity rates Moderate for much<br>of the area due to shallow but low permeability<br>overburden. Some areas rise to High (Vineland<br>Station, Grimbsy Beach) due to exposed bedrock<br>at the Escarpment, and permeable sand plains. | Mild to moderate shore erosion (0.3 to 1 m/year)   |
| Miscellaneous | LAKE ONTARIO 40                     | Grimsby        | -   | -   | -  | IPZ located in subwatershed. Threat policies for<br>IPZ associated with Grimsby not developed due<br>to low vulnerability score.   | -  |
| Miscellaneous | LAKE ONTARIO 41                     | Grimsby        | -   | -   | -  | IPZ located in subwatershed. Threat policies for<br>IPZ associated with Grimsby not developed due<br>to low vulnerability score.   | -  |
| Miscellaneous | LAKE ONTARIO 42                     | Grimsby        | -   | -   | -  | IPZ located in subwatershed. Threat policies for<br>IPZ associated with Grimsby not developed due<br>to low vulnerability score.   | -  |
| Miscellaneous | LAKE ONTARIO 43                     | Grimsby        | -   | -   | -  | IPZ located in subwatershed. Threat policies for<br>IPZ associated with Grimsby not developed due<br>to low vulnerability score.   | -  |
| Lincoln       | LIN Bartlett                        | Lincoln        | High to moderate flooding and erosion risk to buildings and open spaces, in Bartlett Creek.                                       | Approx 35% of urban area in the LMA is<br>treated by existing SWM facilities<br>(quantity/quality). High to moderate<br>flooding and erosion risk to buildings and<br>open spaces, in Bartlett Creek. | In absence of WS Plan - Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010), LIN was found to<br>have a Significant surface water stress level, and a<br>low groundwater stress level. | Groundwater sensitivity rates Moderate for much<br>of the area due to shallow but low permeability<br>overburden. Some areas rise to High (Vineland<br>Station, Grimbsy Beach) due to exposed bedrock<br>at the Escarpment, and permeable sand plains. | Mild to moderate shore erosion (0.3 to 1 m per<br>year). Barlett Creek is a municipal drain draining<br>to Lake Ontario.                         |
| Lincoln       | LIN Beamsville<br>Creek/KonkleCreek | Lincoln        | High to moderate flooding and erosion risk to buildings<br>and open spaces, in Konkle Creek.                                      | Approx 35% of urban area in the LMA is<br>treated by SWM (quantity/quality). High to<br>moderate flooding and erosion risk to<br>buildings and open spaces, in Bartlett<br>Creek.                     | In absence of WS Plan - Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010), LIN was found to<br>have a Significant surface water stress level, and a<br>low groundwater stress level. | Groundwater sensitivity rates Moderate for much<br>of the area due to shallow but low permeability<br>overburden. Some areas rise to High (Vineland<br>Station, Grimbsy Beach) due to exposed bedrock<br>at the Escarpment, and permeable sand plains. | Mild to moderate shore erosion (0.3 to 1 m per<br>year). Investigate opportunities to establish some<br>shoreline natural restoration areas      |
| Lincoln       | LIN Lake Ontario 23                 | Lincoln        | -   | -   | In absence of WS Plan - Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010), LIN was found to<br>have a Significant surface water stress level, and a<br>low groundwater stress level. | -  | -  |
| Lincoln       | LIN Lake Ontario 26                 | Lincoln        | -   | -   | In absence of WS Plan - Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010), LIN was found to<br>have a Significant surface water stress level, and a<br>low groundwater stress level. | -  | -  |

| Watersheds    | Subwatersheds                       | Municipalities | Watercourse Works | SAR / Fishery Management  | Wetlands | HDF Classification /Management | Climate Change |
|---------------|-------------------------------------|----------------|-------------------|---|----------|--------------------------------|----------------|
| Grimsby       | GR Lake Ontario 37                  | Grimsby        | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -        | N/A                            | -              |
| Grimsby       | GR Lake Ontario 38                  | Grimsby        | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -        | N/A                            | -              |
| Grimsby       | GR Lake Ontario 39                  | Grimsby        | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -        | N/A                            | -              |
| Grimsby       | GR Lake Ontario 44                  | Grimsby        | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -        | N/A                            | -              |
| Grimsby       | GR Lake Ontario 44A                 | Grimsby        | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -        | N/A                            | -              |
| Miscellaneous | LAKE ONTARIO 22                     | Lincoln        | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -        | N/A                            | -              |
| Miscellaneous | LAKE ONTARIO 36                     | Grimsby        | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -        | N/A                            | -              |
| Miscellaneous | LAKE ONTARIO 37                     | Grimsby        | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -        | N/A                            | -              |
| Miscellaneous | LAKE ONTARIO 40                     | Grimsby        | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -        | N/A                            | -              |
| Miscellaneous | LAKE ONTARIO 41                     | Grimsby        | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -        | N/A                            | -              |
| Miscellaneous | LAKE ONTARIO 42                     | Grimsby        | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -        | N/A                            | -              |
| Miscellaneous | LAKE ONTARIO 43                     | Grimsby        | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -        | N/A                            | -              |
| Lincoln       | LIN Bartlett                        | Lincoln        | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -        | N/A                            | -              |
| Lincoln       | LIN Beamsville<br>Creek/KonkleCreek | Lincoln        | -                 | Konkle Creek Natural Resource Study (Geomorphic Solutions<br>2012) includes fish habitat assessment, but no management<br>recommendations.<br>'Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found. | -        | N/A                            | -              |
| Lincoln       | LIN Lake Ontario 23                 | Lincoln        | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -        | N/A                            | -              |
| Lincoln       | LIN Lake Ontario 26                 | Lincoln        | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -        | N/A                            | -              |

| Watersheds            | Subwatersheds                | Municipalities         | Applicable Watershed Plan/Study                            | Supplemental Studies (if any)  | Hydrologic Modelling  | Hydraulic Modelling   | Floodline Mapping   | Water Quality  |
|-----------------------|------------------------------|------------------------|--|--|---|---|---|--|
| Lake Erie North Shore | LENS Bay Beach Area<br>Drain | Fort Erie              | Lake Erie North Shore Watershed<br>Plan, NPCA, 2010        | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009. Lake Erie North Shore<br>Watershed Geomorphic Assessment, NPCA, 2009.<br>Surface Water Intake Protection Zone SWP AR (GIS<br>data), NPCA 2019. Source Protection Plan for<br>Niagara Peninsula Source Protection Area, (NPCA,<br>2013). Stormwater Management Policies and<br>Guidelines (AECOM 2010) | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study) | Hydraulic properties and<br>morphology of all reaches detailed<br>in Geomorphic Study. No direct<br>reference to modelling completed. | No floodplain mapping<br>identified for this<br>subwatershed.                         | Special consideration may be required due to IPZ located within subwatershed.  |
| Lake Erie North Shore | LENS Eagle Marsh Drain       | Port Colborne          | Lake Erie North Shore Watershed<br>Plan, NPCA, 2010        | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009. Lake Erie North Shore<br>Watershed Geomorphic Assessment, NPCA, 2009.<br>Surface Water Intake Protection Zone SWP AR (GIS<br>data), NPCA 2019. Source Protection Plan for<br>Niagara Peninsula Source Protection Area, (NPCA,<br>2013). Stormwater Management Policies and<br>Guidelines (AECOM 2010) | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study) | Hydraulic properties and<br>morphology of all reaches detailed<br>in Geomorphic Study. No direct<br>reference to modelling completed. | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | Surface water quality monitoring (1 station). 2007-2009. Limited data.<br>Poor WQI. Impaired BioMAP Rating. Table 8 shows more detail.<br>Minimal discussions regarding WQ criteria for future development.<br>Special consideration may be required due to IPZ located within<br>subwatershed.  |
| Lake Erie North Shore | LENS Lake Erie 2             | Fort Erie              | Lake Erie North Shore Watershed<br>Plan, NPCA, 2010        | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009. Lake Erie North Shore<br>Watershed Geomorphic Assessment, NPCA, 2009.<br>Surface Water Intake Protection Zone SWP AR (GIS<br>data), NPCA 2019. Source Protection Plan for<br>Niagara Peninsula Source Protection Area, (NPCA,<br>2013). Stormwater Management Policies and<br>Guidelines (AECOM 2010) | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study) | Hydraulic properties and<br>morphology of all reaches detailed<br>in Geomorphic Study. No direct<br>reference to modelling completed. | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | Special consideration may be required due to IPZ located within subwatershed.  |
| Lake Erie North Shore | LENS Lake Erie 2B            | Fort Erie              | Lake Erie North Shore Watershed<br>Plan, NPCA, 2010        | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009. Lake Erie North Shore<br>Watershed Geomorphic Assessment, NPCA, 2009.<br>Surface Water Intake Protection Zone SWP AR (GIS<br>data), NPCA 2019. Source Protection Plan for<br>Niagara Peninsula Source Protection Area, (NPCA,<br>2013). Stormwater Management Policies and<br>Guidelines (AECOM 2010) | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study) | Hydraulic properties and<br>morphology of all reaches detailed<br>in Geomorphic Study. No direct<br>reference to modelling completed. | No floodplain mapping<br>identified for this<br>subwatershed.                         | Special consideration may be required due to IPZ located within adjacent subwatershed and the Lake Erie outlet.  |
| Lake Erie North Shore | LENS Lake Erie 4             | Port Colborne          | Lake Erie North Shore Watershed<br>Plan, NPCA, 2010        | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009. Lake Erie North Shore<br>Watershed Geomorphic Assessment, NPCA, 2009.<br>Surface Water Intake Protection Zone SWP AR (GIS<br>data), NPCA 2019. Source Protection Plan for<br>Niagara Peninsula Source Protection Area, (NPCA,<br>2013). Stormwater Management Policies and<br>Guidelines (AECOM 2010) | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study) | Hydraulic properties and<br>morphology of all reaches detailed<br>in Geomorphic Study. No direct<br>reference to modelling completed. | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | Special consideration may be required due to IPZ located within subwatershed.  |
| Lake Erie North Shore | LENS Wignell Drain           | Port Colborne          | Lake Erie North Shore Watershed<br>Plan, NPCA, 2010        | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009. Lake Erie North Shore<br>Watershed Geomorphic Assessment, NPCA, 2009.<br>Surface Water Intake Protection Zone SWP AR (GIS<br>data), NPCA 2019. Source Protection Plan for<br>Niagara Peninsula Source Protection Area, (NPCA,<br>2013). Stormwater Management Policies and<br>Guidelines (AECOM 2010) | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study) | Hydraulic properties and<br>morphology of all reaches detailed<br>in Geomorphic Study. No direct<br>reference to modelling completed. | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | Surface water quality monitoring (1 station). 2007-2009. Limited data.<br>Poor WQI. Impaired BioMAP Rating. Table 8 shows more detail.<br>Minimal discussions regarding WQ criteria for future development.<br>Special consideration may be required due to IPZ located within<br>subwatershed.  |
| Lower Welland River   | LWR Thompson Creek           | Niagara Falls, Thorold | Lower Welland River Characterization<br>Report, NPCA, 2011 | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009), Beaverdams and Shriners<br>Creek Geomorphic Study, including Thompsons<br>Creek (NPCA 2010); Niagara River Fish Community<br>Report (2007-2011)(MNRF 2012)   | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study) | Detailed in Geomorphic Study  | Regulated floodplain mapping,<br>based on the 100 year storm,<br>NPCA                 | Not detailed in plan or eutrophication study (insufficient monitoring at<br>the time of WS plan - 1 monitoring location installed in 2010). W/C<br>identified as Type 2 (important) fish habitat.  |
| Lower Welland River   | LWR Welland River            | Niagara Falls, Thorold | Lower Welland River Characterization<br>Report, NPCA, 2011 | Groundwater Study [Waterloo Hydrogeologic Inc.<br>(WHI) 2005], Water Availability Study<br>(AquaResource Inc 2009), Welland River<br>Eutrophication Study (NPCA, 2011). Surface Water<br>Intake Protection Zone SWP AR (GIS data), NPCA<br>2019. Source Protection Plan for Niagara Peninsula<br>Source Protection Area, (NPCA, 2013)  | HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study) | Not mentioned in this report  | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | Eutrophication Study conducted 2008-2011. 23 monitoring stations.<br>High TP, TKN, TOC. Details in full study. Special consideration may be<br>required due to IPZ located within subwatershed. Table 4.2 in Source<br>Protection Plan to list policy responsibilities to be implemented (NPCA,<br>2013). Identified as both Type 1 and 2 (critical/important) fish habitat. |

| Primary Findings      |                              |                        |   |  |   |   |  |
|-----------------------|------------------------------|------------------------|---|--|---|---|--|
| Watersheds            | Subwatersheds                | Municipalities         | Erosion Control   | Flood Control  | Water Balance   | Groundwater Management  | Watercourse Management   |
| Lake Erie North Shore | LENS Bay Beach Area<br>Drain | Fort Erie              | General Watershed Objective: Implementation of a<br>comprehensive, priority based erosion control program.<br>Stormwater Management, Erosion, and Sediment<br>Policies and Criteria (RMN and NPCA) used for all<br>municipalities. Reference to general SWM BMPs from<br>Stormwater Management Policies and Guidelines<br>(AECOM 2010). | Lack of stormwater facilities to treat<br>quantity and quality of urban runoff.<br>Implement NPCA Stormwater Policies<br>(2010) and BMPs into regional and<br>municipal planning documents | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), LENS was found to have a Moderate surface<br>water stress level, and a Significant groundwater<br>stress level - this was the only watershed to be<br>assigned a significant groundwater rating. | Groundwater Study completed outlining<br>threats/impacts. Figure 17a/b illustrates areas<br>with medium/high vulnerability to groundwater<br>contamination due to presence of permeable soils<br>and shallow depth of groundwater table.  | Areas to consider Riparian cover improvements listed in Table 23 Restoration Opoourtunities.   |
| Lake Erie North Shore | LENS Eagle Marsh Drain       | Port Colborne          | General Watershed Objective: Implementation of a<br>comprehensive, priority based erosion control program.<br>Stormwater Management, Erosion, and Sediment<br>Policies and Criteria (RMN and NPCA) used for all<br>municipalities. Reference to general SWM BMPs from<br>Stormwater Management Policies and Guidelines<br>(AECOM 2010). | Lack of stormwater facilities to treat<br>quantity and quality of urban runoff.<br>Implement NPCA Stormwater Policies<br>(2010) and BMPs into regional and<br>municipal planning documents | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), LENS was found to have a Moderate surface<br>water stress level, and a Significant groundwater<br>stress level - this was the only watershed to be<br>assigned a significant groundwater rating. | Groundwater Study completed outlining<br>threats/impacts. Figure 17a/b illustrates areas<br>with medium/high vulnerability to groundwater<br>contamination due to presence of permeable soils<br>and shallow depth of groundwater table.  | Areas to consider Riparian cover improvements<br>listed in Table 17 Restoration Opoourtunities.  |
| Lake Erie North Shore | LENS Lake Erie 2             | Fort Erie              | General Watershed Objective: Implementation of a<br>comprehensive, priority based erosion control program.<br>Stormwater Management, Erosion, and Sediment<br>Policies and Criteria (RMN and NPCA) used for all<br>municipalities. Reference to general SWM BMPs from<br>Stormwater Management Policies and Guidelines<br>(AECOM 2010). | Lack of stormwater facilities to treat<br>quantity and quality of urban runoff.<br>Implement NPCA Stormwater Policies<br>(2010) and BMPs into regional and<br>municipal planning documents | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), LENS was found to have a Moderate surface<br>water stress level, and a Significant groundwater<br>stress level - this was the only watershed to be<br>assigned a significant groundwater rating. | Groundwater Study completed outlining<br>threats/impacts. Figure 17a/b illustrates areas<br>with medium/high vulnerability to groundwater<br>contamination due to presence of permeable soils<br>and shallow depth of groundwater table.  | -  |
| Lake Erie North Shore | LENS Lake Erie 2B            | Fort Erie              | General Watershed Objective: Implementation of a<br>comprehensive, priority based erosion control program.<br>Stormwater Management, Erosion, and Sediment<br>Policies and Criteria (RMN and NPCA) used for all<br>municipalities. Reference to general SWM BMPs from<br>Stormwater Management Policies and Guidelines<br>(AECOM 2010). | Lack of stormwater facilities to treat<br>quantity and quality of urban runoff.<br>Implement NPCA Stormwater Policies<br>(2010) and BMPs into regional and<br>municipal planning documents | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), LENS was found to have a Moderate surface<br>water stress level, and a Significant groundwater<br>stress level - this was the only watershed to be<br>assigned a significant groundwater rating. | Groundwater Study completed outlining<br>threats/impacts. Figure 17a/b illustrates areas<br>with medium/high vulnerability to groundwater<br>contamination due to presence of permeable soils<br>and shallow depth of groundwater table.  | -  |
| Lake Erie North Shore | LENS Lake Erie 4             | Port Colborne          | General Watershed Objective: Implementation of a<br>comprehensive, priority based erosion control program.<br>Stormwater Management, Erosion, and Sediment<br>Policies and Criteria (RMN and NPCA) used for all<br>municipalities. Reference to general SWM BMPs from<br>Stormwater Management Policies and Guidelines<br>(AECOM 2010). | Lack of stormwater facilities to treat<br>quantity and quality of urban runoff.<br>Implement NPCA Stormwater Policies<br>(2010) and BMPs into regional and<br>municipal planning documents | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), LENS was found to have a Moderate surface<br>water stress level, and a Significant groundwater<br>stress level - this was the only watershed to be<br>assigned a significant groundwater rating. | Groundwater Study completed outlining<br>threats/impacts. Figure 17a/b illustrates areas<br>with medium/high vulnerability to groundwater<br>contamination due to presence of permeable soils<br>and shallow depth of groundwater table.  | -  |
| Lake Erie North Shore | LENS Wignell Drain           | Port Colborne          | General Watershed Objective: Implementation of a<br>comprehensive, priority based erosion control program.<br>Stormwater Management, Erosion, and Sediment<br>Policies and Criteria (RMN and NPCA) used for all<br>municipalities. Reference to general SWM BMPs from<br>Stormwater Management Policies and Guidelines<br>(AECOM 2010). | Lack of stormwater facilities to treat<br>quantity and quality of urban runoff.<br>Implement NPCA Stormwater Policies<br>(2010) and BMPs into regional and<br>municipal planning documents | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), LENS was found to have a Moderate surface<br>water stress level, and a Significant groundwater<br>stress level - this was the only watershed to be<br>assigned a significant groundwater rating. | Groundwater Study completed outlining<br>threats/impacts. Figure 17a/b illustrates areas<br>with medium/high vulnerability to groundwater<br>contamination due to presence of permeable soils<br>and shallow depth of groundwater table.  | Areas to consider Riparian cover improvements<br>listed in Table 18 Restoration Opoourtunities.  |
| Lower Welland River   | LWR Thompson Creek           | Niagara Falls, Thorold | Chinguacousy soils present in northern border of<br>Thompsons Creek. Very erodible. Erosion control<br>measures should be considered. W/C characterized<br>through Geomorphic Study.  | Not detailed in plan   | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), LWR was found to have a Moderate surface<br>water stress level, and a Low groundwater stress<br>level.   | High/medium groundwater vulnerability in the<br>north & east portion of study. Full map in Figure<br>17.  | Heartland Forest site assessed as part of NPCA<br>Geomorphic Study of Thompsons Creek. Bank<br>erosion monitoring reccommended &<br>watercourses classified. |
| Lower Welland River   | LWR Welland River            | Niagara Falls, Thorold | General guidance referring to Stormwater Management<br>Policies and Guidelines (AECOM 2010), Appendix B   | Not detailed in plan   | Accoding to Niagara Peninsula Tier 1 Water Budget<br>and Water Quantity Stress Assessment (NPCA,<br>2010), LWR was found to have a Moderate surface<br>water stress level, and a Low groundwater stress<br>level.   | High/medium groundwater vulnerability in the<br>west & east portion of study. Full map in Figure<br>17. IPZ located in subwatershed. Niagara Falls<br>IPZ-1 has high vulnerability scores (contain<br>significant drinking water threats). More detail in<br>Table 1.2 in Source Protection Plan (NPCA,<br>2013). Table 4.2 in Source Protection Plan to list<br>policy responsibilities to be implemented (NPCA,<br>2013). | General recommendation for Riparian<br>Establishment/Enhancement. More detail in<br>Table 12   |

#### Table WR1: NWP (E) - Watershed Plan Review

| Primary | Findings |
|---------|----------|
|         |          |

| Watersheds            | Subwatersheds                | Municipalities         | Watercourse Works  | SAR / Fishery Management  | Wetlands   | HDF Classification /Management |    |
|-----------------------|------------------------------|------------------------|--|---|--|--------------------------------|----|
| Lake Erie North Shore | LENS Bay Beach Area<br>Drain | Fort Erie              | -  | Class E Municipal Drain. Fish habitat assessment not<br>conducted.<br>Restore or maintain riparian buffers for water quality per<br>drainage BMPs.  | Protect existing wetland (e.g., through<br>buffers).<br>Restore wetlands, where suitability exists -<br>Port Abino Wetland Complex.  | -                              | ç  |
| Lake Erie North Shore | LENS Eagle Marsh Drain       | Port Colborne          | -  | Portions of watershed are important or critical habitat, others<br>are muniicipal drains and not assessed for fish habitat.<br>Habitat protection through riparian plantings  | Wetland restoration or creation, one sites<br>identified specifically: watercourse north of<br>Highway 3. General dirction for creation /<br>enhancement where suitability exists with<br>focus adjacent or proxiimal to existing<br>wetlands.<br>Protect exsting wetlands.  | -                              | ç  |
| Lake Erie North Shore | LENS Lake Erie 2             | Fort Erie              | -  | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -  | -                              | c  |
| Lake Erie North Shore | LENS Lake Erie 2B            | Fort Erie              | -  | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -  | -                              | ç  |
| Lake Erie North Shore | LENS Lake Erie 4             | Port Colborne          | -  | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -  | -                              | c  |
| Lake Erie North Shore | LENS Wignell Drain           | Port Colborne          | -  | Primarily managed as municipal drains. Some have also been<br>assessed for fish habitat - Michener Drain, Wigness Drain.<br>Agircultural and drain BMPs and riparian plantings to improve<br>water quality and fish habitat.  | Restoration efforts identified for 2 areas:<br>(1) North of Durham Street: headwaters<br>region, (2) South of Durham Street.<br>(1) high suitability for wetland restoration -<br>riparian-wetland features along<br>watercourses, around existing wetland<br>complexes. Protect & enhance existing<br>wetlands.<br>(2) high suitability to infill gaps in and<br>around Nickel Beach marsh PSW to create<br>a large natural area. Protect & enhance<br>existing wetlands. | -                              | °, |
| Lower Welland River   | LWR Thompson Creek           | Niagara Falls, Thorold | Specific recommendations outlined as part of Geomorphic Study. | Important Fish habitat. Smaller tributaries are unevaluated for<br>fish habitat. Allanport Municipal Drain occurs within<br>subwatershd.<br>Fish barrier removals - past actions to improve habitat.<br>Increase riparian cover to support fish and fish habitat.<br>Implement agricultural BMPs.<br>None prescribed in fish community report | Protect existing wetland cover -<br>recommendation to identify a 'Critical<br>Function Zone (CFZ)" buffer to protect<br>wetland functions.<br>Enhance or create wetlands where<br>suitable conditions exist; focus on<br>headwater stream areas.   | N/A                            | ç  |
| Lower Welland River   | LWR Welland River            | Niagara Falls, Thorold | Not included in Geomorphic Study.                              | Critical and important fish habitat. Smaller tributaries are<br>unevaluated for fish habitat.<br>Increase riparian cover to support fish and fish habitat.<br>Implement agricultural BMPs. Investigate possibility of<br>bioengineering projects to address impacts of flow variability.  | Protect existing wetland cover -<br>recommendation to identify a 'Critical<br>Function Zone (CFZ)" buffer to protect<br>wetland functions.<br>Enhance or create wetlands where<br>suitable conditions exist; opportunities<br>identifie along Welland River.   | N/A                            | ç  |

#### Climate Change

Summary of provincial level climate change studies (Ontario) and general hydrologic cycle impications for the Great Lakes Basin. No specific study, discussion or adaptation plan regarding the Lake Erie North Shore watershed.

Summary of provincial level climate change studies (Ontario) and general hydrologic cycle impications for the Great Lakes Basin. No specific study, discussion or adaptation plan regarding the Lake Erie North Shore watershed.

Summary of provincial level climate change studies (Ontario) and general hydrologic cycle impications for the Great Lakes Basin. No specific study, discussion or adaptation plan regarding the Lake Erie North Shore watershed.

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Summary of provincial level climate change studies (Ontario) and general hydrologic cycle impications for the Great Lakes Basin. No specific study, discussion or adaptation plan regarding the Lake Erie North Shore watershed.

Summary of provincial level climate change studies (Ontario) and general hydrologic cycle impications for the Great Lakes Basin. No specific study, discussion or adaptation plan regarding the Lower Welland River.

Summary of provincial level climate change studies (Ontario) and general hydrologic cycle impications for the Great Lakes Basin. No specific study, discussion or adaptation plan regarding the Lower Welland River.

### Table WR1: NWP (E) - Watershed Plan Review

| Primary         | Findinas |
|-----------------|----------|
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| Watersheds          | Subwatersheds               | Municipalities                          | Applicable Watershed Plan/Study   | Supplemental Studies (if any)   | Hydrologic Modelling  | Hydraulic Modelling  | Floodline Mapping  | Water Quality  |
|---------------------|-----------------------------|---|---|---|---|--|--|--|
| Niagara Falls Urban | NFU CHIPPAWA POWER<br>CANAL | Niagara Falls                           | N/A - Check Regional Level Guidance   | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Welland River East #2.15;<br>Niagara River Fish Community Assessment (2007-<br>2011) (MNRF 2012) | None mentioned specific to this study.  | None mentioned specific to this study.   | No floodplain mapping in GIS<br>files.   | Urban STM runoff contaminants include Fecal Coliform, Total<br>Phosphorous, Total Kjeldahl Nitrogen, Total Ammonia, Copper, Total<br>Suspended Solids. Lack of stormwater management facilities to treat<br>urban runoff   |
| Niagara Falls Urban | NFU Niagara Falls Urban     | Niagara Falls, Niagara-<br>on-the-Lake  | N/A - Check Regional Level Guidance   | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Welland River East #2.15;<br>Niagara River Fish Community Assessment (2007-<br>2011)             | None mentioned specific to this study.  | None mentioned specific to this study.   | No floodplain mapping in GIS<br>files.   | Lack of SWM to treat urban runoff from primarily built-up areas.   |
| Miscellaneous       | NIAGARA RIVER 6             | Niagara Falls                           | N/A - Check Regional Level Guidance   | -   | -   | -  | -  | -  |
| Miscellaneous       | NIAGARA RIVER 7             | Niagara Falls                           | N/A - Check Regional Level Guidance   | -   | -   | -  | -  | -  |
| Niagara-on-the-Lake | NOTL Eight Mile Creek       | Niagara-on-the-Lake                     | Niagara-on-the-Lake Watershed<br>Study, Aquafor Beech Ltd, 2008   | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Niagara-on-the-Lake #1.10  | No long-term streamflow gauge<br>data was available to calibrate the<br>hydrologic models. Flows were also<br>estimated using regional<br>relationships for comparison. The<br>"Index Flood Method", as outlined in<br>the MNR Technical Guidelines for<br>Floodplain Mapping was applied.<br>HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study, 2009) | HEC-RAS modelling completed<br>for this reach (2008) - DEM based<br>and topographic survey completed<br>at hydraulic structures. | Regulated floodplain mapping,<br>based on the 100 year storm,<br>Aquafor Beech 2008. | Management actions focus on the reduction of nutrient, suspended<br>sediment, bacteria and chloride loadings to drains and streams from<br>urban and rural sources. These measures will ensure a safe supply of<br>clean water for irrigation purposes and to support aquatic life                             |
| Niagara-on-the-Lake | NOTL Four Mile Creek        | Niagara Falls, Niagara-<br>on-the-Lake  | Niagara-on-the-Lake Watershed<br>Study, Aquafor Beech Ltd, 2008   | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Niagara-on-the-Lake #1.10  | No long-term streamflow gauge<br>data was available to calibrate the<br>hydrologic models. Flows were also<br>estimated using regional<br>relationships for comparison. The<br>"Index Flood Method", as outlined in<br>the MNR Technical Guidelines for<br>Floodplain Mapping was applied.<br>HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study, 2009) | HEC-RAS modelling completed<br>for this reach (2008) - DEM based<br>and topographic survey completed<br>at hydraulic structures. | Regulated floodplain mapping,<br>based on the 100 year storm,<br>Aquafor Beech 2008. | Impaired water quality - Management actions focus on the reduction of<br>nutrient, suspended sediment, bacteria and chloride loadings to drains<br>and streams from urban and rural sources. These measures will<br>ensure a safe supply of clean water for irrigation purposes and to<br>support aquatic life |
| Niagara-on-the-Lake | NOTL Four Mile Pond         | Niagara-on-the-Lake                     | Niagara-on-the-Lake Watershed<br>Study, Aquafor Beech Ltd, 2008   | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Niagara-on-the-Lake #1.10  | No long-term streamflow gauge<br>data was available to calibrate the<br>hydrologic models. Flows were also<br>estimated using regional<br>relationships for comparison. The<br>"Index Flood Method", as outlined in<br>the MNR Technical Guidelines for<br>Floodplain Mapping was applied.<br>HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study, 2009) | HEC-RAS modelling completed<br>for this reach (2008) - DEM based<br>and topographic survey completed<br>at hydraulic structures. | Regulated floodplain mapping,<br>based on the 100 year storm,<br>Aquafor Beech 2008. | Impaired water quality - Management actions focus on the reduction of<br>nutrient, suspended sediment, bacteria and chloride loadings to drains<br>and streams from urban and rural sources. These measures will<br>ensure a safe supply of clean water for irrigation purposes and to<br>support aquatic life |
| Niagara-on-the-Lake | NOTL Lake Ontario 10        | St. Catharines, Niagara-<br>on-the-Lake | Subwatershed not in watershed plan -<br>general findings from this plan could be<br>assumed/applied to these areas. | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Thorold #1.9   | None mentioned specific to this study.  | None mentioned specific to this study.   | No floodplain mapping in GIS files.  | Lack of stormwater facilities to treat quantity and quality of urban runoff.   |

| Watersheds          | Subwatersheds               | Municipalities                          | Erosion Control   | Flood Control  | Water Balance  | Groundwater Management  | Watercourse Management  |
|---------------------|-----------------------------|---|---|--|--|---|---|
| Niagara Falls Urban | NFU CHIPPAWA POWER<br>CANAL | Niagara Falls                           | No specific criteria or problem areas outlined.   | The lack of slough forest and the<br>presence of built-up expansion of Niagara<br>Falls in the north portion of the LMA<br>contributes to major flooding below.<br>Approx 5% of existing urban area in LMA<br>is treated by existing SWM facilities<br>(quantity). | In absence of WS Plan - Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010), NFU was found to<br>have a Low surface water stress level, and a Low<br>groundwater stress level.   | Most of the LMA is rated Low groundwater<br>sensitivity to contamination and Low recharge<br>due to the depth of silt/clay till overburden. Its<br>thinning out in the north central portion, however,<br>raises that area, extending as far as to the large<br>waste ponds, to a Moderate sensitivity.   | Chippawa power Canal embankment is very<br>steep and unstable. NWQPS recommended<br>conduting an inventory of eroding and erosion<br>prone sites on area streams and shorelines. Add<br>stream/drain buffers, and design urban<br>expansion with well buffered, naturalized<br>waterways.   |
| Niagara Falls Urban | NFU Niagara Falls Urban     | Niagara Falls, Niagara-<br>on-the-Lake  | No specific criteria or problem areas outlined.   | No existing SWM facilities. Severe to moderate flooding in Queenston.  | In absence of WS Plan - Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010), NFU was found to<br>have a Low surface water stress level, and a Low<br>groundwater stress level.   | Given the sand plains and bedrock close to the<br>surface in the Escarpment vicinity, much of the<br>area has High potential for groundwater<br>contamination.  | Add stream/drain buffers, and design urban<br>expansion with well buffered, naturalized<br>waterways.   |
| Miscellaneous       | NIAGARA RIVER 6             | Niagara Falls                           | -   | -  | -  | -   | -   |
| Miscellaneous       | NIAGARA RIVER 7             | Niagara Falls                           | -   | -  | -  | -   | -   |
| Niagara-on-the-Lake | NOTL Eight Mile Creek       | Niagara-on-the-Lake                     | Stream Erosion Control: an erosion remediation plan<br>and a riparian zone management program are<br>identified to address stream erosion downstream of<br>municipal drains; these measures will further eliminate<br>sources of sediment to streams providing cleaner<br>water for irrigation and reduced impacts on aquatic life.<br>No specific erosion control SWM criteria outlined for<br>future development in the area. | Watershed-wide encouragement for<br>SWM BMPs design and implementation<br>for both new and existing (retrofit) urban<br>areas to improve/maintain pre-<br>development hydrologic regime. No<br>specific sizing criteria provided for the<br>subwatersheds.         | Area-wide water balance was performed to<br>characterize the impacts of potential development.<br>The results demonstrated increases in runoff, and<br>decreases in infiltration. Characterizing the impacts,<br>but no mitigation plans. Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010),, NOTL was found<br>to have a Significant surface water stress level, and<br>a Low groundwater stress level. | The majority of the watershed is characterized by<br>surface conditions that resulted in a low (blue) to<br>moderate (green) susceptibility to groundwater<br>contamination (Groundwater Study, 2005).<br>Groundwater recharge potential varies across the<br>watershed, infiltration/recharge is to be<br>maintained. Baseflow within watercourses is an<br>important consideration for agricultural land<br>owners, and fish habitat. | Implement a strategic drain maintenance and<br>management program to reduce costs and<br>improve stability (erosion and sedimentation of<br>drains): self-sustaining drain design, grade<br>controls, vegetated erosion protection, riparian<br>buffer enhancement. Plan new development to<br>incorporate existing woodlots, riparian forests<br>and naturalized channels with riparian vegetation   |
| Niagara-on-the-Lake | NOTL Four Mile Creek        | Niagara Falls, Niagara-<br>on-the-Lake  | Stream Erosion Control: an erosion remediation plan<br>and a riparian zone management program are<br>identified to address stream erosion downstream of<br>municipal drains; these measures will further eliminate<br>sources of sediment to streams providing cleaner<br>water for irrigation and reduced impacts on aquatic life.<br>No specific erosion control SWM criteria outlined for<br>future development in the area. | Watershed-wide encouragement for<br>SWM BMPs design and implementation<br>for both new and existing (retrofit) urban<br>areas to improve/maintain pre-<br>development hydrologic regime. No<br>specific sizing criteria provided for the<br>subwatersheds.         | Area-wide water balance was performed to<br>characterize the impacts of potential development.<br>The results demonstrated increases in runoff, and<br>decreases in infiltration. Characterizing the impacts,<br>but no mitigation plans. Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010),, NOTL was found<br>to have a Significant surface water stress level, and<br>a Low groundwater stress level. | The majority of the watershed is characterized by<br>surface conditions that resulted in a low (blue) to<br>moderate (green) susceptibility to groundwater<br>contamination (Groundwater Study, 2005).<br>Groundwater recharge potential varies across the<br>watershed, infiltration/recharge is to be<br>maintained. Baseflow within watercourses is an<br>important consideration for agricultural land<br>owners, and fish habitat. | Implement a strategic drain maintenance and<br>management program to reduce costs and<br>improve stability (erosion and sedimentation of<br>drains): self-sustaining drain design, grade<br>controls, vegetated erosion protection, riparian<br>buffer enhancement. Moderate erosion along<br>Four Mile Creek. Protection/improvement of<br>critical and important fish habitat. plan new<br>development to incorporate existing woodlots,<br>riparian forests and naturalized channels with<br>riparian vegetation |
| Niagara-on-the-Lake | NOTL Four Mile Pond         | Niagara-on-the-Lake                     | Stream Erosion Control: an erosion remediation plan<br>and a riparian zone management program are<br>identified to address stream erosion downstream of<br>municipal drains; these measures will further eliminate<br>sources of sediment to streams providing cleaner<br>water for irrigation and reduced impacts on aquatic life.<br>No specific erosion control SWM criteria outlined for<br>future development in the area. | Watershed-wide encouragement for<br>SWM BMPs design and implementation<br>for both new and existing (retrofit) urban<br>areas to improve/maintain pre-<br>development hydrologic regime. No<br>specific sizing criteria provided for the<br>subwatersheds.         | Area-wide water balance was performed to<br>characterize the impacts of potential development.<br>The results demonstrated increases in runoff, and<br>decreases in infiltration. Characterizing the impacts,<br>but no mitigation plans. Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010),, NOTL was found<br>to have a Significant surface water stress level, and<br>a Low groundwater stress level. | The majority of the watershed is characterized by<br>surface conditions that resulted in a low (blue) to<br>moderate (green) susceptibility to groundwater<br>contamination (Groundwater Study, 2005).<br>Groundwater recharge potential varies across the<br>watershed, infiltration/recharge is to be<br>maintained. Baseflow within watercourses is an<br>important consideration for agricultural land<br>owners, and fish habitat. | Implement a strategic drain maintenance and<br>management program to reduce costs and<br>improve stability (erosion and sedimentation of<br>drains): self-sustaining drain design, grade<br>controls, vegetated erosion protection, riparian<br>buffer enhancement. Moderate erosion along<br>Four Mile Creek. Protection/improvement of<br>critical and important fish habitat. plan new<br>development to incorporate existing woodlots,<br>riparian forests and naturalized channels with<br>riparian vegetation |
| Niagara-on-the-Lake | NOTL Lake Ontario 10        | St. Catharines, Niagara-<br>on-the-Lake | No specific criteria outlined.  | Lack of stormwater facilities to treat quantity and quality of urban runoff.   | -  | Medium sensitivity groundwater areas are<br>susceptible to contamination from surface<br>sources due to fractured nature of overburden<br>and high susceptibility in areas where bedrock<br>outcrops at surface. High sensitivity groundwater<br>areas have high susceptibility to contamination<br>from surface sources.   | Moderate lack of tributary buffers through<br>intensive cropland causing non-point source<br>loading from agriculture. Low extent of forest and<br>wetland for water protection, especially of slough<br>forests in wet clay plains.  |

### Table WR1: NWP (E) - Watershed Plan Review

| Primary | Findings |
|---------|----------|
|         |          |

| Watersheds          | Subwatersheds           | Municipalities                          | Watercourse Works | SAR / Fishery Management  | Wetlands                            | HDF Classification /Management  | Climate Change  |
|---------------------|-------------------------|---|-------------------|---|-------------------------------------|---|---|
|                     |                         |   |                   | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  |                                     |   |   |
| Niagara Falls Urban | CANAL                   | Niagara Falls                           | -                 | Triangle Island, at the Junction of the Niagara River and<br>Chippawa Diversion Channel - recommendations to mitigate<br>flow control, connectivity controllers. Fish Community Report<br>also provides general direction for management within<br>watershed. | -                                   | N/A   | -   |
| Niagara Falls Urban | NFU Niagara Falls Urban | Niagara Falls, Niagara-<br>on-the-Lake  | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -                                   | N/A   | -   |
|                     |                         |   |                   | Fish Community Report also provides general direction for<br>management within watershed.   |                                     |   |   |
| Miscellaneous       | NIAGARA RIVER 6         | Niagara Falls                           | -                 | Stated 'pending completion' of Management Plan for 2018. No further status could be found.  | -                                   | -   | -   |
| Miscellaneous       | NIAGARA RIVER 7         | Niagara Falls                           | -                 | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | -                                   | -   | -   |
|                     |                         |   |                   | No sub-watershed specific direction. General direction for<br>watershed:  |                                     |   |   |
| Niggara on the Lake |                         | Niggers on the Leke                     |                   | Habitat limitations: water quality, erosion & sedimentation, low<br>or poor instream cover, low riparian cover, hydrologic habitat<br>instability.  | Protect remaining wetland behitate  | N/A - Municipal Drains discussed  | Minimal discussion of climate change. No  |
| падага-оп-тле-саке  | NOTL Eight Mile Creek   | Niagara-on-the-Lake                     | -                 | Objective:Protect, enhance or restore populations of native aquatic species and their habitats.   | Protect remaining wetland habitats. | for agricultural drainage/irrigation.                                     | assessment or mitigagtion plan discussed.   |
|                     |                         |   |                   | Recommendations: Riparian plantings or buffer zone with a target of 5m on either side   |                                     |   |   |
|                     |                         |   |                   | No targeted management for SAR<br>Improvements and aquatic enhacements proposed for lower   |                                     |   |   |
|                     |                         |   |                   | Habitat limitations: water quality, erosion & sedimentation, low<br>or poor instream cover, low riparian cover, hydrologic habitat<br>instability.  |                                     |   |   |
| Niagara-on-the-Lake | NOTL Four Mile Creek    | Niagara Falls, Niagara-<br>on-the-Lake  | -                 | Objective:Protect, enhance or restore populations of native aquatic species and their habitats.   | Protect remaining wetland habitats. | N/A - Municipal Drains discussed for agricultural drainage/irrigation.    | Minimal discussion of climate change. No<br>assessment or mitigagtion plan discussed. |
|                     |                         |   |                   | Recommendations: Riparian plantings or buffer zone with a target of 5m on either side; habitat improvements for Virgil Reservoir.   |                                     |   |   |
|                     |                         |   |                   | No targeted management for SAR<br>No sub-watershed specific direction. General direction for  |                                     |   |   |
|                     |                         |   |                   | Watersned:<br>Habitat limitations: water quality, erosion & sedimentation, low<br>or poor instream cover, low riparian cover, hydrologic habitat  |                                     |   |   |
| Niagara-on-the-Lake | NOTL Four Mile Pond     | Niagara-on-the-Lake                     | -                 | Instability.<br>Objective:Protect, enhance or restore populations of native<br>aquatic species and their habitats.  | Protect remaining wetland habitats. | N/A - Municipal Drains discussed<br>for agricultural drainage/irrigation. | Minimal discussion of climate change. No<br>assessment or mitigagtion plan discussed. |
|                     |                         |   |                   | Recommendations: Riparian plantings or buffer zone with a target of 5m on either side.  |                                     |   |   |
|                     |                         |   |                   | No targeted management for SAR<br>No sub-watershed specific direction. General direction for<br>watershed   |                                     |   |   |
|                     |                         | St. Oothering Allow                     |                   | Habitat limitations: water quality, erosion & sedimentation, low<br>or poor instream cover, low riparian cover, hydrologic habitat<br>instability.  |                                     |   |   |
| Niagara-on-the-Lake | NOTL Lake Ontario 10    | ວເ. Catnarines, Niagara-<br>on-the-Lake | -                 | Objective:Protect, enhance or restore populations of native aquatic species and their habitats.   | Protect remaining wetland habitats. | -   | -   |
|                     |                         |   |                   | Recommendations: Riparian plantings or buffer zone with a target of 5m on either side   |                                     |   |   |
|                     |                         |   |                   | No targeted management for SAR  |                                     |   |   |
| Watersheds           | Subwatersheds       | Municipalities                         | Applicable Watershed Plan/Study   | Supplemental Studies (if any)  | Hydrologic Modelling Hydraulic Modelling  |  | Floodline Mapping   | Water Quality  |  |  |
|----------------------|---------------------|--|---|--|---|--|---|--|--|--|
| Niagara-on-the-Lake  | NOTL Lake Ontario 9 | St. Catharines                         | Subwatershed not in watershed plan -<br>general findings from this plan could be<br>assumed/applied to these areas. | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Thorold #1.9  | None mentioned specific to this study.  | None mentioned specific to this study.   | No floodplain mapping in GIS<br>files.  | Lack of stormwater facilities to treat quantity and quality of urban runoff.   |  |  |
| Niagara-on-the-Lake  | NOTL Six Mile Creek | Niagara Falls, Niagara-<br>on-the-Lake | Niagara-on-the-Lake Watershed<br>Study, Aquafor Beech Ltd, 2008   | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Niagara-on-the-Lake #1.10   | No long-term streamflow gauge<br>data was available to calibrate the<br>hydrologic models. Flows were also<br>estimated using regional<br>relationships for comparison. The<br>"Index Flood Method", as outlined in<br>the MNR Technical Guidelines for<br>Floodplain Mapping was applied.<br>HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study, 2009) | HEC-RAS modelling completed<br>for this reach (2008) - DEM based<br>and topographic survey completed<br>at hydraulic structures. | Regulated floodplain mapping,<br>based on the 100 year storm,<br>Aquafor Beech 2008.  | Management actions focus on the reduction of nutrient, suspended<br>sediment, bacteria and chloride loadings to drains and streams from<br>urban and rural sources. These measures will ensure a safe supply of<br>clean water for irrigation purposes and to support aquatic life   |  |  |
| Niagara-on-the-Lake  | NOTL Two Mile Creek | Niagara-on-the-Lake                    | Niagara-on-the-Lake Watershed<br>Study, Aquafor Beech Ltd, 2008   | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Niagara-on-the-Lake #1.10   | No long-term streamflow gauge<br>data was available to calibrate the<br>hydrologic models. Flows were also<br>estimated using regional<br>relationships for comparison. The<br>"Index Flood Method", as outlined in<br>the MNR Technical Guidelines for<br>Floodplain Mapping was applied.<br>HEC-HMS continous hydrologic<br>model (detailed in Water Availability<br>Study, 2009) | HEC-RAS modelling completed<br>for this reach (2008) - DEM based<br>and topographic survey completed<br>at hydraulic structures. | Regulated floodplain mapping,<br>based on the 100 year storm,<br>Aquafor Beech 2008.  | Monthly grab samples at Lakeshore Road. Frequent exceedance of<br>nitrate, TP, suspended solids, chloride, bacteria. Impaired water quality<br>- Management actions focus on the reduction of nutrient, suspended<br>sediment, bacteria and chloride loadings to drains and streams from<br>urban and rural sources. These measures will ensure a safe supply of<br>clean water for irrigation purposes and to support aquatic life. |  |  |
| St. Catharines Urban | SCU BEAMER CREEK    | St. Catharines                         | N/A - Check Regional Level Guidance   | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - St. Catharines East #1.8  | None mentioned specific to this study.  | None mentioned specific to this study.   | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | Impermeable surface of this most urban LMA accelerates runoff to the<br>streams and storm sewer system, carrying urban non-point source<br>contaminants associated with e.g., roads and lawn care, and<br>contributing to the most flooding and erosion problems of any LMA.<br>Majority of existing urban area in LMA is uncontrolled - NWQPS<br>specifically recommends providing source control SWM for new<br>developments.      |  |  |
| St. Catharines Urban | SCU WALKER CREEK    | St. Catharines                         | N/A - Check Regional Level Guidance   | Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - St. Catharines East #1.8  | None mentioned specific to this study.  | None mentioned specific to this study.   | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | Impermeable surface of this most urban LMA accelerates runoff to the<br>streams and storm sewer system, carrying urban non-point source<br>contaminants associated with e.g., roads and lawn care, and<br>contributing to the most flooding and erosion problems of any LMA.<br>Majority of existing urban area in LMA is uncontrolled - NWQPS<br>specifically recommends providing source control SWM for new<br>developments.      |  |  |
| South Niagara Falls  | SNF Bayers Creek    | Fort Erie, Niagara Falls               | South Niagara Falls Watershed<br>Report, NPCA, 2008   | Niagara Peninsula Conservation Authority. 2007b<br>The South Niagara Falls Watershed Geomorphic<br>Assessment, Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 - Netherby #2.14 | None mentioned specific to this<br>Watershed Plan study. HEC-HMS<br>continous hydrologic model<br>(detailed in Water Availability Study,<br>2009)   | None mentioned specific to this study.   | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | NPCA Water Quality Monitoring in 2007 found a "Marginal" water<br>quality rating, an impaired biomap rating, and found exceedances of<br>phosphorous/chloride/E.coli and nutrient/chloride enrichment from<br>upstream urban/agricultural areas. Lack of riparian buffer identified.   |  |  |
| South Niagara Falls  | SNF Grassy Brook    | Niagara Falls                          | South Niagara Falls Watershed<br>Report, NPCA, 2008   | Niagara Peninsula Conservation Authority. 2007b<br>The South Niagara Falls Watershed Geomorphic<br>Assessment, Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 - Netherby #2.14 | None mentioned specific to this<br>Watershed Plan study. HEC-HMS<br>continous hydrologic model<br>(detailed in Water Availability Study,<br>2009)   | None mentioned specific to this study.   | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. | NPCA Water Quality Monitoring in 2007 found a "Marginal" water<br>quality rating, an impaired biomap rating, and found exceedances of<br>phosphorous as well as algae observed in summer months. Benthic<br>invertebrate data indicate impaired water quality in Grassy Brook<br>(NWQPS, 2003)   |  |  |

## Table WR1: NWP (E) - Watershed Plan Review Primary Findings

| Watersheds           | Subwatersheds       | Municipalities                         | Erosion Control   | Flood Control  | Water Balance  | Groundwater Management  | Watercourse Management  |
|----------------------|---------------------|--|---|--|--|---|---|
| Niagara-on-the-Lake  | NOTL Lake Ontario 9 | St. Catharines                         | No specific criteria outlined.  | Lack of stormwater facilities to treat quantity and quality of urban runoff.   | -  | Medium sensitivity groundwater areas are<br>susceptible to contamination from surface<br>sources due to fractured nature of overburden<br>and high susceptibility in areas where bedrock<br>outcrops at surface. High sensitivity groundwater<br>areas have high susceptibility to contamination<br>from surface sources.   | Moderate lack of tributary buffers through<br>intensive cropland causing non-point source<br>loading from agriculture. Low extent of forest and<br>wetland for water protection, especially of slough<br>forests in wet clay plains.                                  |
| Niagara-on-the-Lake  | NOTL Six Mile Creek | Niagara Falls, Niagara-<br>on-the-Lake | Stream Erosion Control: an erosion remediation plan<br>and a riparian zone management program are<br>identified to address stream erosion downstream of<br>municipal drains; these measures will further eliminate<br>sources of sediment to streams providing cleaner<br>water for irrigation and reduced impacts on aquatic life.<br>Erosion control work on Airport Drain just upstream of<br>Six Mile watercourse. No specific erosion control SWM<br>criteria outlined for future development in the area. | Watershed-wide encouragement for<br>SWM BMPs design and implementation<br>for both new and existing (retrofit) urban<br>areas to improve/maintain pre-<br>development hydrologic regime. No<br>specific sizing criteria provided for the<br>subwatersheds.   | Area-wide water balance was performed to<br>characterize the impacts of potential development.<br>The results demonstrated increases in runoff, and<br>decreases in infiltration. Characterizing the impacts,<br>but no mitigation plans. Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010),, NOTL was found<br>to have a Significant surface water stress level, and<br>a Low groundwater stress level. | The majority of the watershed is characterized by<br>surface conditions that resulted in a low (blue) to<br>moderate (green) susceptibility to groundwater<br>contamination (Groundwater Study, 2005).<br>Groundwater recharge potential varies across the<br>watershed, infiltration/recharge is to be<br>maintained. Baseflow within watercourses is an<br>important consideration for agricultural land<br>owners, and fish habitat. | Implement a strategic drain maintenance and<br>management program to reduce costs and<br>improve stability (erosion and sedimentation of<br>drains): self-sustaining drain design, grade<br>controls (specified for Six Mile Creek), vegetated<br>erosion protection. |
| Niagara-on-the-Lake  | NOTL Two Mile Creek | Niagara-on-the-Lake                    | Stream Erosion Control: an erosion remediation plan<br>and a riparian zone management program are<br>identified to address stream erosion downstream of<br>municipal drains; these measures will further eliminate<br>sources of sediment to streams providing cleaner<br>water for irrigation and reduced impacts on aquatic life.<br>Erosion control work on Airport Drain just upstream of<br>Six Mile watercourse. No specific erosion control SWM<br>criteria outlined for future development in the area. | Channel capacity improvements<br>recommended aong Conc. 2 near Line 4.<br>Table 2.4 with more details. Watershed-<br>wide encouragement for SWM BMPs<br>design and implementation for both new<br>and existing (retrofit) urban areas to<br>improve/maintain pre-development<br>hydrologic regime. No specific sizing<br>criteria provided for the subwatersheds.  | Area-wide water balance was performed to<br>characterize the impacts of potential development.<br>The results demonstrated increases in runoff, and<br>decreases in infiltration. Characterizing the impacts,<br>but no mitigation plans. Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010),, NOTL was found<br>to have a Significant surface water stress level, and<br>a Low groundwater stress level. | The majority of the watershed is characterized by<br>surface conditions that resulted in a low (blue) to<br>moderate (green) susceptibility to groundwater<br>contamination (Groundwater Study, 2005).<br>Groundwater recharge potential varies across the<br>watershed, infiltration/recharge is to be<br>maintained. Baseflow within watercourses is an<br>important consideration for agricultural land<br>owners, and fish habitat. | Implement a strategic drain maintenance and<br>management program to reduce costs and<br>improve stability (erosion and sedimentation of<br>drains): self-sustaining drain design, grade<br>controls (specified for Six Mile Creek), vegetated<br>erosion protection. |
| St. Catharines Urban | SCU BEAMER CREEK    | St. Catharines                         | Impermeable surface of this most urban LMA<br>accelerates runoff to the streams and storm sewer<br>system, carrying urban non-point source contaminants<br>associated with e.g., roads and lawn care, and<br>contributing to the <b>most flooding and erosion</b><br><b>problems</b> of any LMA. NWQPS specifically<br>recommends providing source control SWM for new<br>developments.   | Impermeable surface of this most urban<br>LMA accelerates runoff to the streams<br>and storm sewer system, carrying urban<br>non-point source contaminants<br>associated with e.g., roads and lawn<br>care, and contributing to the <b>most</b><br><b>flooding and erosion problems</b> of any<br>LMA. Only approx. 1% of urban area is<br>treated by existing SWM facilities.<br>NWQPS specifically recommends<br>providing source control SWM for new<br>developments. | In absence of WS Plan - Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010), SCU was found<br>to have a Low surface water stress level, and a Low<br>groundwater stress level.   | The southern half is Moderate sensitivity due to<br>shallow clay till overburden over bedrock; the<br>northern half is rated High sensitivity on the<br>permeable sand plain.   | Mild to severe shore erosion (0 to 2 m per year).<br>Most erosion problems identified in all of the<br>LMA (Niagara WQPS, 2003). Encourage tree<br>planting in both urban areas and stream<br>corridors.  |
| St. Catharines Urban | SCU WALKER CREEK    | St. Catharines                         | Impermeable surface of this most urban LMA<br>accelerates runoff to the streams and storm sewer<br>system, carrying urban non-point source contaminants<br>associated with e.g., roads and lawn care, and<br>contributing to the <b>most flooding and erosion</b><br><b>problems</b> of any LMA. NWQPS specifically<br>recommends providing source control SWM for new<br>developments.   | Impermeable surface of this most urban<br>LMA accelerates runoff to the streams<br>and storm sewer system, carrying urban<br>non-point source contaminants<br>associated with e.g., roads and lawn<br>care, and contributing to the <b>most</b><br><b>flooding and erosion problems</b> of any<br>LMA. Only approx. 1% of urban area is<br>treated by existing SWM facilities.<br>NWQPS specifically recommends<br>providing source control SWM for new<br>developments. | In absence of WS Plan - Accoding to Niagara<br>Peninsula Tier 1 Water Budget and Water Quantity<br>Stress Assessment (NPCA, 2010), SCU was found<br>to have a Low surface water stress level, and a Low<br>groundwater stress level.   | The southern half is Moderate sensitivity due to<br>shallow clay till overburden over bedrock; the<br>northern half is rated High sensitivity on the<br>permeable sand plain.   | Mild to severe shore erosion (0 to 2 m per year).<br>Most erosion problems identified in all of the<br>LMA (Niagara WQPS, 2003). Encourage tree<br>planting in both urban areas and stream<br>corridors.  |
| South Niagara Falls  | SNF Bayers Creek    | Fort Erie, Niagara Falls               | Problem areas identified through Geomorphic Study.<br>No specific erosion control SWM criteria outlined for<br>the area (erosion thresholds, volumetric sizing).  | Urban rain barrel and downspout<br>disconnection programs should be<br>implemented region-wide. General SWM<br>BMPs are outlined (similar to other<br>Watershed Plans). No specific flood<br>control objectives related to the area.   | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), SNF was found to have<br>a Moderate surface water stress level, and a Low<br>groundwater stress level.   | No specific requirements for this subwatershed<br>have been outlined in the document. Areas of<br>sensitivity outlined in the intrinsic vulnerability<br>mapping (ref. groundwater study).  | A riparian planting program would also benefit<br>this portion of the subwatershed to assist in the<br>enhancement of water quality and fish habitat.<br>Wherever possible, projects should benefit the<br>SAR in the subwatershed (grass pickerel).                  |
| South Niagara Falls  | SNF Grassy Brook    | Niagara Falls                          | Problem areas identified through Geomorphic Study.<br>No specific erosion control SWM criteria outlined for<br>the area (erosion thresholds, volumetric sizing).  | Urban rain barrel and downspout<br>disconnection programs should be<br>implemented region-wide. General SWM<br>BMPs are outlined (similar to other<br>Watershed Plans). No specific flood<br>control objectives related to the area.   | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), SNF was found to have<br>a Moderate surface water stress level, and a Low<br>groundwater stress level.   | No specific requirements for this subwatershed<br>have been outlined in the document. Areas of<br>sensitivity outlined in the intrinsic vulnerability<br>mapping (ref. groundwater study).  | A riparian planting program would also benefit<br>this portion of the subwatershed to assist in the<br>enhancement of water quality and fish habitat.   |

| Primary Findings                                      |                     |  |   |  |  |   |  |
|---|---------------------|--|---|--|--|---|--|
| Watersheds  | Subwatersheds       | Municipalities                         | Watercourse Works   | SAR / Fishery Management   | Wetlands   | HDF Classification /Management  | Climate Change   |
| Niagara-on-the-Lake NOTL Lake Ontario 9 St. Catharine |                     | St. Catharines                         | -   | No sub-watershed specific direction. General direction for<br>watershed:<br>Habitat limitations: water quality, erosion & sedimentation, low<br>or poor instream cover, low riparian cover, hydrologic habitat<br>instability.<br>Objective:Protect, enhance or restore populations of native<br>aquatic species and their habitats.<br>Recommendations: Riparian plantings or buffer zone with a<br>target of 5m on either side                                   | Protect remaining wetland habitats.  | -   | -  |
| Niagara-on-the-Lake                                   | NOTL Six Mile Creek | Niagara Falls, Niagara-<br>on-the-Lake | -   | No sub-watershed specific direction. General direction for<br>watershed:<br>Habitat limitations: water quality, erosion & sedimentation, low<br>or poor instream cover, low riparian cover, hydrologic habitat<br>instability.<br>Objective:Protect, enhance or restore populations of native<br>aquatic species and their habitats.<br>Recommendations: Riparian plantings or buffer zone with a<br>target of 5m on either side<br>No targeted management for SAR | Protect remaining wetland habitats.  | N/A - Municipal Drains discussed for agricultural drainage/irrigation.    | Minimal discussion of climate change. No assessment or mitigagtion plan discussed. |
| Niagara-on-the-Lake                                   | NOTL Two Mile Creek | Niagara-on-the-Lake                    | -   | No sub-watershed specific direction. General direction for<br>watershed:<br>Habitat limitations: water quality, erosion & sedimentation, low<br>or poor instream cover, low riparian cover, hydrologic habitat<br>instability.<br>Objective:Protect, enhance or restore populations of native<br>aquatic species and their habitats.<br>Recommendations: Riparian plantings or buffer zone with a<br>target of 5m on either side                                   | No direction tied to Two-Mile Creek.   | N/A - Municipal Drains discussed<br>for agricultural drainage/irrigation. | Minimal discussion of climate change. No assessment or mitigagtion plan discussed. |
| St. Catharines Urban                                  | SCU BEAMER CREEK    | St. Catharines                         | Severe stream bank erosion and slope<br>failure along residential backyard and<br>downstream end of Beamer Creek at<br>Arthur St. Dicks.  | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.   | -  | -   | -  |
| St. Catharines Urban                                  | SCU WALKER CREEK    | St. Catharines                         | -   | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.   | -  | -   | -  |
| South Niagara Falls                                   | SNF Bayers Creek    | Fort Erie, Niagara Falls               | The South Niagara Falls Watershed<br>Geomorphic Assessment (NPCA 2007b)<br>identified several erosion and sediment<br>accumulation sites in the Bayers Creek<br>subwatershed. Primary<br>recommendations include improving<br>riparian buffers, wetland and<br>upland/ecological linkages<br>improvements.                              | Removal of barriers to movement, riparian buffer<br>establishment a priority for water quality and habitat<br>improvements.<br>Bayers Creek Southeast and Northeast of the QEW -<br>opportunities to benefit SAR (grass pickerel) and provincial<br>rare species wherever possible.  | Protect and enhance existing wetlands,<br>restore or create wetlands where suitability<br>exists.<br>Bayers Creek Southeast and Northeast of<br>the QEW - opportunities to benefit SAR<br>and provincial rare species wherever<br>possible. List of key species provided in<br>report. | N/A   | General impacts of climate change listed. No<br>mitigation strategies outlined.    |
| South Niagara Falls                                   | SNF Grassy Brook    | Niagara Falls                          | The South Niagara Falls Watershed<br>Geomorphic Assessment (NPCA 2007b)<br>identified several erosion and sediment<br>accumulation sites in the Grassy Brook<br>subwatershed. Primary<br>recommendations include improving<br>riparian buffers, and limitations on<br>creekside urban activities (farm<br>crossings, ATV trails, etc.). | Removal of barriers to movement, riparian buffer<br>establishment a priority for water quality and habitat<br>improvements. Focus on headwaters as opportunites to<br>improve water quality and thermal conditions.<br>Opportunities to benefit SAR (grass pickerel) and provincial<br>rare species wherever possible.   | Protect and enhance existing wetlands,<br>restore or create wetlands where suitability<br>exists.<br>High restoration potential identified for<br>Grassy Brook Wetlands.   | N/A   | General impacts of climate change listed. No mitigation strategies outlined.       |

# Table WR1: NWP (E) - Watershed Plan Review Primary Findings

| Watersheds          | Subwatersheds         | Municipalities          | Applicable Watershed Plan/Study                     | Supplemental Studies (if any)   | Hydrologic Modelling  | Hydraulic Modelling   | Floodline Mapping   | Water Quality  |
|---------------------|-----------------------|-------------------------|---|---|---|---|---|--|
| South Niagara Falls | SNF Hunters Drain     | Niagara Falls           | South Niagara Falls Watershed<br>Report, NPCA, 2008 | Niagara Peninsula Conservation Authority. 2007b<br>The South Niagara Falls Watershed Geomorphic<br>Assessment, Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 - Netherby #2.14  | None mentioned specific to this<br>Watershed Plan study. HEC-HMS<br>continous hydrologic model<br>(detailed in Water Availability Study,<br>2009) | None mentioned specific to this study.                          | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown.   | NPCA Water Quality Monitoring in 2007 found a "Marginal" water quality rating.   |
| South Niagara Falls | SNF Lyons Creek       | Niagara Falls, Welland  | South Niagara Falls Watershed<br>Report, NPCA, 2008 | Niagara Peninsula Conservation Authority. 2007b<br>The South Niagara Falls Watershed Geomorphic<br>Assessment, Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 - Netherby #2.14  | None mentioned specific to this<br>Watershed Plan study. HEC-HMS<br>continous hydrologic model<br>(detailed in Water Availability Study,<br>2009) | None mentioned specific to this study.                          | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown. Note -<br>main channel of Lyons Creek<br>flows through PSW (Lyons<br>Creek Floodplain Wetland). | NPCA Water Quality Monitoring in 2007 found a "Marginal" water<br>quality rating, an impaired biomap rating, and found exceedances of<br>phosphorous. Special consideration may be required due to IPZ<br>located within subwatershed. Invertebrate sampling in Lyons Creek<br>indicates intermediate (grey zone) water quality (NWQPS, 2003).<br>Table 4.2 in Source Protection Plan to list policy responsibilities to be<br>implemented (NPCA, 2013).   |
| South Niagara Falls | SNF Niagara River 9   | Niagara Falls           | South Niagara Falls Watershed<br>Report, NPCA, 2008 | Niagara Peninsula Conservation Authority. 2007b<br>The South Niagara Falls Watershed Geomorphic<br>Assessment. Surface Water Intake Protection Zone<br>SWP AR (GIS data), NPCA 2019, Niagara Water<br>Quality Protection Strategy - LMA Summaries, 2003 -<br>Netherby #2.14. Source Protection Plan for Niagara<br>Peninsula Source Protection Area, (NPCA, 2013) | None mentioned specific to this<br>Watershed Plan study. HEC-HMS<br>continous hydrologic model<br>(detailed in Water Availability Study,<br>2009) | None mentioned specific to this study.                          | No floodplain mapping<br>identified for this<br>subwatershed.   | NPCA Water Quality Monitoring in 2007 found a "Marginal" water<br>quality rating in adjacent watersheds - no specified reporting for this<br>subwatershed.   |
| South Niagara Falls | SNF Niagara River 11C | Niagara Falls           | South Niagara Falls Watershed<br>Report, NPCA, 2008 | Niagara Peninsula Conservation Authority. 2007b<br>The South Niagara Falls Watershed Geomorphic<br>Assessment. Surface Water Intake Protection Zone<br>SWP AR (GIS data), NPCA 2019, Niagara Water<br>Quality Protection Strategy - LMA Summaries, 2003 -<br>Netherby #2.14. Source Protection Plan for Niagara<br>Peninsula Source Protection Area, (NPCA, 2013) | None mentioned specific to this<br>Watershed Plan study. HEC-HMS<br>continous hydrologic model<br>(detailed in Water Availability Study,<br>2009) | None mentioned specific to this study and/or this subwatershed. | No floodplain mapping<br>identified for this<br>subwatershed.   | NPCA Water Quality Monitoring in 2007 found a "Marginal" water<br>quality rating in adjacent subwatersheds - no specified reporting for this<br>subwatershed.  |
| South Niagara Falls | SNF Tee Creek         | Niagara Falls           | South Niagara Falls Watershed<br>Report, NPCA, 2008 | Niagara Peninsula Conservation Authority. 2007b<br>The South Niagara Falls Watershed Geomorphic<br>Assessment. Surface Water Intake Protection Zone<br>SWP AR (GIS data), NPCA 2019, Niagara Water<br>Quality Protection Strategy - LMA Summaries, 2003 -<br>Netherby #2.14. Source Protection Plan for Niagara<br>Peninsula Source Protection Area, (NPCA, 2013) | None mentioned specific to this<br>Watershed Plan study. HEC-HMS<br>continous hydrologic model<br>(detailed in Water Availability Study,<br>2009) | None mentioned specific to this study.                          | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown.   | NPCA Water Quality Monitoring in 2007 found a "Marginal" water<br>quality rating, an impaired biomap rating, and found exceedances of<br>phosphorous.  |
| South Niagara Falls | SNF Usshers Creek     | Niagara Falls           | South Niagara Falls Watershed<br>Report, NPCA, 2008 | Niagara Peninsula Conservation Authority. 2007b<br>The South Niagara Falls Watershed Geomorphic<br>Assessment. Surface Water Intake Protection Zone<br>SWP AR (GIS data), NPCA 2019, Niagara Water<br>Quality Protection Strategy - LMA Summaries, 2003 -<br>Netherby #2.14. Source Protection Plan for Niagara<br>Peninsula Source Protection Area, (NPCA, 2013) | None mentioned specific to this<br>Watershed Plan study. HEC-HMS<br>continous hydrologic model<br>(detailed in Water Availability Study,<br>2009) | None mentioned specific to this study.                          | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown.   | NPCA Water Quality Monitoring in 2007 found a "Marginal" water<br>quality rating, an impaired biomap rating, and found exceedances of<br>phosphorous as well as algae observed in summer months. Vulnerable<br>to low baseflow and stagnation  |
| Twelve Mile Creek   | TWEL Dicks Creek      | St. Catharines, Thorold | Twelve Mile Creek Watershed Plan,<br>NPCA, 2006     | Niagara Peninsula Conservation Authority<br>Groundwater Study Final Report. Prepared for<br>Niagara Peninsula Conservation Authority, Regional<br>Municipality of Niagara, City of Hamilton and<br>Haldimand County; Healthy Twelve Mile Creek<br>Project   | None mentioned specific to this<br>Watershed Plan study. HEC-HMS<br>continous hydrologic model<br>(detailed in Water Availability Study,<br>2009) | None mentioned specific to this study.                          | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown.   | Multiple water quality monitoring programs initiated for the Watershed<br>(NPCA/PWQMN). Water quality results are not summarized on a<br>subwatershed basis in the noted text. Of the monitoring stations<br>discussed, a mix between impaired/unimpaired water quality was found<br>historically, with exeedances of Phosphorous. Wet weather, high peak<br>flows and contamination is a concern for this Watershed (City of St.<br>Catharines).Special consideration may be required due to IPZ located<br>within subwatershed. Table 4.2 in Source Protection Plan to list policy<br>responsibilities to be implemented (NPCA, 2013). |

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| Watersheds          | Subwatersheds         | Municipalities          | Erosion Control Flood Control Water Balance  |  | Groundwater Management   | Watercourse Management  |   |
|---------------------|-----------------------|-------------------------|--|--|--|---|---|
| South Niagara Falls | SNF Hunters Drain     | Niagara Falls           | Problem areas identified through Geomorphic Study.<br>No specific erosion control SWM criteria outlined for<br>the area (erosion thresholds, volumetric sizing).                               | Urban rain barrel and downspout<br>disconnection programs should be<br>implemented region-wide. General SWM<br>BMPs are outlined (similar to other<br>Watershed Plans). No specific flood<br>control objectives related to the area. | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), SNF was found to have<br>a Moderate surface water stress level, and a Low<br>groundwater stress level.   | No specific requirements for this subwatershed<br>have been outlined in the document. Areas of<br>sensitivity outlined in the intrinsic vulnerability<br>mapping (ref. groundwater study).  | A riparian planting program would also benefit<br>this portion of the subwatershed to assist in the<br>enhancement of water quality and fish habitat.   |
| South Niagara Falls | SNF Lyons Creek       | Niagara Falls, Welland  | Problem areas identified through Geomorphic Study.<br>No specific erosion control SWM criteria outlined for<br>the area (erosion thresholds, volumetric sizing).                               | Urban rain barrel and downspout<br>disconnection programs should be<br>implemented region-wide. General SWM<br>BMPs are outlined (similar to other<br>Watershed Plans). No specific flood<br>control objectives related to the area. | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), SNF was found to have<br>a Moderate surface water stress level, and a Low<br>groundwater stress level.   | As part of the objectives for the NPCA<br>Groundwater Study (Waterloo Hydrogeologic<br>Inc.2005), several potential contaminant sites<br>have been identified in the Lyons Creek<br>subwatershed. These include a closed landfill, a<br>hazardous waste receiver depot, several<br>automotive wrecker facilities and numerous sand<br>and gravel pits. IPZ located in subwatershed<br>based on NPCA mapping (2019). Table 4.2 in<br>Source Protection Plan to list policy<br>responsibilities to be implemented (NPCA, 2013).   | Prioritize riparian buffer strip planting on<br>tributaries with no cover, establish riparian<br>habitat between fragmented wetland complexes.<br>Projects should benefit the Species at Risk<br>within the subwatershed, whenever possible.  |
| South Niagara Falls | SNF Niagara River 9   | Niagara Falls           | Problem areas identified through Geomorphic Study.<br>No specific erosion control SWM criteria outlined for<br>the area (erosion thresholds, volumetric sizing).                               | Urban rain barrel and downspout<br>disconnection programs should be<br>implemented region-wide. General SWM<br>BMPs are outlined (similar to other<br>Watershed Plans). No specific flood<br>control objectives related to the area. | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), SNF was found to have<br>a Moderate surface water stress level, and a Low<br>groundwater stress level.   | No specific requirements for this subwatershed<br>have been outlined in the document. Areas of<br>sensitivity outlined in the intrinsic vulnerability<br>mapping (ref. groundwater study).  | A riparian planting program would also benefit<br>this portion of the subwatershed to assist in the<br>enhancement of water quality and fish habitat.   |
| South Niagara Falls | SNF Niagara River 11C | Niagara Falls           | Problem areas identified through Geomorphic Study.<br>No specific erosion control SWM criteria outlined for<br>the area (erosion thresholds, volumetric sizing).                               | Urban rain barrel and downspout<br>disconnection programs should be<br>implemented region-wide. General SWM<br>BMPs are outlined (similar to other<br>Watershed Plans). No specific flood<br>control objectives related to the area. | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), SNF was found to have<br>a Moderate surface water stress level, and a Low<br>groundwater stress level.   | No specific requirements for this subwatershed<br>have been outlined in the document. Areas of<br>sensitivity outlined in the intrinsic vulnerability<br>mapping for the watershed (ref. groundwater<br>study).   | No specific documentation outlined for this<br>subwatershed. Based upon guiance from other<br>adjacent systems, a riparian planting program<br>would also benefit this portion of the<br>subwatershed to assist in the enhancement of<br>water quality and fish habitat.                        |
| South Niagara Falls | SNF Tee Creek         | Niagara Falls           | Problem areas identified through Geomorphic Study.<br>No specific erosion control SWM criteria outlined for<br>the area (erosion thresholds, volumetric sizing).                               | Urban rain barrel and downspout<br>disconnection programs should be<br>implemented region-wide. General SWM<br>BMPs are outlined (similar to other<br>Watershed Plans). No specific flood<br>control objectives related to the area. | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), SNF was found to have<br>a Moderate surface water stress level, and a Low<br>groundwater stress level.   | No specific requirements for this subwatershed<br>have been outlined in the document. Areas of<br>sensitivity outlined in the intrinsic vulnerability<br>mapping (ref. groundwater study).  | A riparian planting program would also benefit<br>this portion of the subwatershed to assist in the<br>enhancement of water quality and fish habitat.   |
| South Niagara Falls | SNF Usshers Creek     | Niagara Falls           | Problem areas identified through Geomorphic Study.<br>No specific erosion control SWM criteria outlined for<br>the area (erosion thresholds, volumetric sizing).                               | Urban rain barrel and downspout<br>disconnection programs should be<br>implemented region-wide. General SWM<br>BMPs are outlined (similar to other<br>Watershed Plans). No specific flood<br>control objectives related to the area. | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), SNF was found to have<br>a Moderate surface water stress level, and a Low<br>groundwater stress level.   | No specific requirements for this subwatershed<br>have been outlined in the document. Areas of<br>sensitivity outlined in the intrinsic vulnerability<br>mapping (ref. groundwater study).  | A riparian planting program would also benefit<br>this portion of the subwatershed to assist in the<br>enhancement of water quality and fish habitat.   |
| Twelve Mile Creek   | TWEL Dicks Creek      | St. Catharines, Thorold | Localized need for erosion control at identified sites, as<br>per Flood and Erosion Control Study (Aquafor Beech,<br>1995). No specific erosion control SWM criteria<br>outlined for the area. | Urban rain barrel and downspout<br>disconnection programs should be<br>implemented region-wide. General SWM<br>BMPs are outlined (similar to other<br>Watershed Plans). No specific flood<br>control objectives related to the area. | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), TWEL/UTWEL was<br>found to have a Low surface water stress level, and<br>a Low groundwater stress level. | A Groundwater Study (2005) has been completed<br>for the land area within the jurisdiction of the<br>NPCA. This study identified potential groundwater<br>recharge and discharge areas throughout the<br>watershed, which found potential discharge areas<br>in the vicinity of Short Hills Provincial Park and<br>the watershed below the Niagara Escarpment. A<br>significant potential recharge area was found in<br>the Fonthill Kame-Delta Complex. IPZ located in<br>subwatershed based on NPCA mapping (2019).<br>Table 4.2 in Source Protection Plan to list policy<br>responsibilities to be implemented (NPCA, 2013). | The Dicks Creek subwatershed is primarily<br>urbanized. Therefore, naturalization of the<br>watercourses and upland areas are not suitable<br>for restoration. Priority should continue to be<br>placed on preserving and enhancing the existing<br>Natural Heritage of the Niagara Escarpment. |

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| Finnary Findings    |                       | -                       |  |   |   |                                | _ |
|---------------------|-----------------------|-------------------------|--|---|---|--------------------------------|---|
| Watersheds          | Subwatersheds         | Municipalities          | Watercourse Works  | SAR / Fishery Management  | Wetlands  | HDF Classification /Management |   |
| South Niagara Falls | SNF Hunters Drain     | Niagara Falls           | The South Niagara Falls Watershed<br>Geomorphic Assessment (NPCA 2007b)<br>identified several erosion and sediment<br>accumulation sites in the Hunters Drain<br>subwatershed. Recommendations<br>include increasing riparian buffer zone,<br>diversifying plantings, crossings, etc.  | Riparian buffer establishment a priority for water quality and<br>habitat improvements. Focus on headwaters as opportunites<br>to improve water quality and thermal conditions.<br>Study to assess and idenify barriers to movement.<br>Recommendation to remove barriers where possible.   | Protect and enhance existing wetlands,<br>restore or create wetlands where suitability<br>exists.<br>High restoration potential identified in<br>headwater areas adjaecnt to watercourses<br>and existing natural areas.  | N/A                            | G |
| South Niagara Falls | SNF Lyons Creek       | Niagara Falls, Welland  | The South Niagara Falls Watershed<br>Geomorphic Assessment (NPCA 2007b)<br>identified several erosion and sediment<br>accumulation sites in the Lyons Creek<br>subwatershed. Recommendations<br>include increasing riparian buffer zone,<br>diversifying plantings, crossings, etc.  | Riparian buffer establishment a priority for water quality and<br>habitat improvements.<br>Opportunities to benefit SAR (grass pickerel, lake chubsucker)<br>and provincial rare species wherever possible.<br>Project opportunities identified include: assessment of barriers<br>to fish movement and prioritizing removals (in-stream debris<br>removal). Opportunities to naturalize portions of watercourses.  | Protect and enhance existing wetlands,<br>restore or create wetlands where suitability<br>exists.<br>Oopportunities to benefit SAR and<br>provincial rare species wherever possible.<br>Watershed has higher number of SAR and<br>provincially rare species. List of key<br>species provided in report.   | N/A                            | Ģ |
| South Niagara Falls | SNF Niagara River 9   | Niagara Falls           | The South Niagara Falls Watershed<br>Geomorphic Assessment (NPCA 2007b)<br>identified several erosion and sediment<br>accumulation sites in the South Niagara<br>Falls subwatersheds.<br>Recommendations specific to the<br>Niagara River 9 Subwatershed include<br>increasing riparian buffer zone,<br>diversifying plantings, crossings, etc.<br>(ref. Niagara River 9 Restoration<br>Strategy). | Area occurs within provincial Fisheries Management Zone 16.<br>Stated 'pending completion' of Management Plan for 2018. No<br>further status could be found.  | Wetland protection, enhancement and<br>restoration opportunities identified as part<br>of the Niagara River 9 Restoration<br>Strategy.  | N/A                            | Ģ |
| South Niagara Falls | SNF Niagara River 11C | Niagara Falls           | The South Niagara Falls Watershed<br>Geomorphic Assessment (NPCA 2007b)<br>identified several erosion and sediment<br>accumulation sites in the Lyons Creek<br>subwatershed. Recommendations<br>include increasing riparian buffer zone,<br>diversifying plantings, crossings, etc.  | No documentation specified for this subwatershed.   | No documentation specified for this subwatershed.   | N/A                            | ( |
| South Niagara Falls | SNF Tee Creek         | Niagara Falls           | The South Niagara Falls Watershed<br>Geomorphic Assessment (NPCA 2007b)<br>identified several erosion and sediment<br>accumulation sites in the Lyons Creek<br>subwatershed. Recommendations<br>include increasing riparian buffer zone,<br>diversifying plantings, crossings, etc.  | Ideal' opportunity for riparian habitat establishment. Prioritize<br>areas with little or no cover and between fragmented wetland<br>complexes.<br>Opportunities to benefit SAR (lake chubsucker) and provincial<br>rare species wherever possible.<br>Project Opportunities:<br>Assess and idenify barriers to movement. Recommendation to<br>remove barriers where possible.<br>Naturalization of channelized features  | Protect and enhance existing wetlands,<br>restore or create wetlands where suitability<br>exists.<br>Opportunities to restore riparian wetlands<br>with sites idetified. Benefit SAR and<br>provincial rare species wherever possible.<br>Watershed has higher number of SAR and<br>provincially rare species. List of key<br>species provided in report.     | N/A                            | Ģ |
| South Niagara Falls | SNF Usshers Creek     | Niagara Falls           | The South Niagara Falls Watershed<br>Geomorphic Assessment (NPCA 2007b)<br>identified several erosion and sediment<br>accumulation sites in the Lyons Creek<br>subwatershed. Recommendations<br>include increasing riparian buffer zone,<br>diversifying plantings, crossings, etc.  | Riparian habitat is a key recommendation: Maintain existing<br>cover (South of QEW), increase cover (North of QEW) - with<br>focus on areas with little or no cover and between existing<br>features.<br>Opportunities to benefit SAR (grass pickerel) and provincial<br>rare species wherever possible - north of QEW.<br>Project Opportunities:<br>Assess and idenify barriers to movement. Recommendation to<br>remove barriers where possible.<br>Naturalization of channelized features. | Protect and enhance existing wetlands,<br>restore or create wetlands where suitability<br>exists. Key areas identified: Willoughy<br>Barsh, wetland on north side of QEW.<br>Benefit SAR and provincial rare species<br>wherever possible. Watershed has higher<br>number of SAR and provincially rare<br>species. List of key species provided in<br>report. | N/A                            | c |
| Twelve Mile Creek   | TWEL Dicks Creek      | St. Catharines, Thorold | Several sites have been identified as<br>having erosion potential in the Dicks<br>Creek subwatershed (Aquafor Beech<br>1995). A total of 4 sites have been listed<br>as having high priority; 5 sites were<br>given moderate priority and 12 sites<br>were given low priority. All of these sites<br>require, to some degree, engineered<br>erosion control works.                                 | No specific direction related to this subwatershed.<br>Subwatershed is primarily urbanized and not considered<br>suitable for restoration and enhancement.<br>Criteria assessment and stewardship actions through the<br>Healthy Twelve Mile Creek project (Trout Unlimited Canada)   | No specific direction related to this<br>subwatershed. Subwatershed is primarily<br>urbanized and not considered suitable for<br>restoration and enhancement.   | N/A                            |   |

| Climate Change   |
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| General impacts of climate change listed. No<br>mitigation strategies outlined.                      |
| Seneral impacts of climate change listed. No<br>mitigation strategies outlined.                      |
| Seneral impacts of climate change listed. No<br>mitigation strategies outlined.                      |
| General impacts of climate change listed for<br>the watershed. No mitigation strategies<br>outlined. |
| Seneral impacts of climate change listed. No<br>mitigation strategies outlined.                      |
| eneral impacts of climate change listed. No<br>mitigation strategies outlined.                       |
| No discussion of climate change.   |

#### Table WR1: NWP (E) - Watershed Plan Review Primary Findings

| Watersheds        | Subwatersheds                   | Municipalities                     | Applicable Watershed Plan/Study                 | Supplemental Studies (if any)   | Hydrologic Modelling  | Hydraulic Modelling                    | Floodline Mapping  | Water Quality  |
|-------------------|---------------------------------|------------------------------------|---|---|---|--|--|--|
| Twelve Mile Creek | TWEL Francis Creek              | St. Catharines                     | Twelve Mile Creek Watershed Plan,<br>NPCA, 2006 | Niagara Peninsula Conservation Authority<br>Groundwater Study Final Report. Prepared for<br>Niagara Peninsula Conservation Authority, Regional<br>Municipality of Niagara, City of Hamilton and<br>Haldimand County, Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 - Upper Twelve<br>Mile Creek #1.1, St. Catharines West #1.6; ; Healthy<br>Twelve Mile Creek Project   | None mentioned specific to this<br>Watershed Plan study. HEC-HMS<br>continous hydrologic model<br>(detailed in Water Availability Study,<br>2009) | None mentioned specific to this study. | Regulated floodplain mapping,<br>based on the 100 year storm,<br>NPCA Study 2005.          | Multiple water quality monitoring programs initiated for the Watershed<br>(NPCA/PWQMN). Water quality results are not summarized on a<br>subwatershed basis in the noted text. Of the monitoring stations<br>discussed, a mix between impaired/unimpaired water quality was found<br>historically, with exeedances of Phosphorous. Wet weather, high peak<br>flows and contamination is a concern for this Watershed (City of St.<br>Catharines).  |
| Twelve Mile Creek | TWEL Lake Gibson Systen         | n St. Catharines, Thorold          | Twelve Mile Creek Watershed Plan,<br>NPCA, 2006 | Niagara Peninsula Conservation Authority<br>Groundwater Study Final Report. Prepared for<br>Niagara Peninsula Conservation Authority, Regional<br>Municipality of Niagara, City of Hamilton and<br>Haldimand County. Surface Water Intake Protection<br>Zone SWP AR (GIS data), NPCA 2019. Source<br>Protection Plan for Niagara Peninsula Source<br>Protection Area, (NPCA, 2013); ; Healthy Twelve<br>Mile Creek Project  | None mentioned specific to this<br>Watershed Plan study. HEC-HMS<br>continous hydrologic model<br>(detailed in Water Availability Study,<br>2009) | None mentioned specific to this study. | No floodplain mapping in GIS<br>files - classified as a<br>Waterbody.                      | Multiple water quality monitoring programs initiated for the Watershed<br>(NPCA/PWQMN). Water quality results are not summarized on a<br>subwatershed basis in the noted text. Of the monitoring stations<br>discussed, a mix between impaired/unimpaired water quality was found<br>historically, with exeedances of Phosphorous. Wet weather, high peak<br>flows and contamination is a concern for this Watershed (City of St.<br>Catharines).Special consideration may be required due to IPZ located<br>within subwatershed. Table 4.2 in Source Protection Plan to list policy<br>responsibilities to be implemented (NPCA, 2013). |
| Twelve Mile Creek | TWEL Lower Twelve Mile<br>Creek | St. Catharines                     | Twelve Mile Creek Watershed Plan,<br>NPCA, 2006 | Niagara Peninsula Conservation Authority<br>Groundwater Study Final Report. Prepared for<br>Niagara Peninsula Conservation Authority, Regional<br>Municipality of Niagara, City of Hamilton and<br>Haldimand County, Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 - St. Catharines<br>East #1.8; ; Healthy Twelve Mile Creek Project  | None mentioned specific to this<br>Watershed Plan study. HEC-HMS<br>continous hydrologic model<br>(detailed in Water Availability Study,<br>2009) | None mentioned specific to this study. | No floodplain mapping in GIS<br>files.   | Multiple water quality monitoring programs initiated for the Watershed<br>(NPCA/PWQMN). Water quality results are not summarized on a<br>subwatershed basis in the noted text. Of the monitoring stations<br>discussed, a mix between impaired/unimpaired water quality was found<br>historically, with exeedances of Phosphorous. Wet weather, high peak<br>flows and contamination is a concern for this Watershed (City of St.<br>Catharines).  |
| Twelve Mile Creek | TWEL Richardson Creek           | St. Catharines                     | Twelve Mile Creek Watershed Plan,<br>NPCA, 2006 | Niagara Peninsula Conservation Authority<br>Groundwater Study Final Report. Prepared for<br>Niagara Peninsula Conservation Authority, Regional<br>Municipality of Niagara, City of Hamilton and<br>Haldimand County, Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 - Upper Twelve<br>Mile Creek #1.1, St. Catharines West #1.6; ; Healthy<br>Twelve Mile Creek Project   | None mentioned specific to this<br>Watershed Plan study. HEC-HMS<br>continous hydrologic model<br>(detailed in Water Availability Study,<br>2009) | None mentioned specific to this study. | Regulated floodplain mapping,<br>based on the 100 year storm,<br>NPCA Study 2005.          | Multiple water quality monitoring programs initiated for the Watershed<br>(NPCA/PWQMN). Water quality results are not summarized on a<br>subwatershed basis in the noted text. Of the monitoring stations<br>discussed, a mix between impaired/unimpaired water quality was found<br>historically, with exeedances of Phosphorous. Wet weather, high peak<br>flows and contamination is a concern for this Watershed (City of St.<br>Catharines).  |
| Twelve Mile Creek | TWEL Upper Twelve Mile<br>Creek | Pelham, St. Catharines,<br>Thorold | Twelve Mile Creek Watershed Plan,<br>NPCA, 2006 | Niagara Peninsula Conservation Authority<br>Groundwater Study Final Report. Prepared for<br>Niagara Peninsula Conservation Authority, Regional<br>Municipality of Niagara, City of Hamilton and<br>Haldimand County, Niagara Peninsula<br>Conservation Authority. 2005b. Upper Twelve Mile<br>Creek Watershed Erosion Study. Welland, Ontario.<br>Niagara Source Protection Plan Assessment Report,<br>NPCA 2013.Surface Water Intake Protection Zone<br>SWP AR (GIS data), NPCA 2019, Niagara Water<br>Quality Protection Strategy - LMA Summaries, 2003 -<br>Upper Twelve Mile Creek #1.1, Pelham Union #1.4.<br>Source Protection Plan for Niagara Peninsula Source<br>Protection Area, (NPCA, 2013); ; Healthy Twelve<br>Mile Creek Project | None mentioned specific to this<br>Watershed Plan study. HEC-HMS<br>continous hydrologic model<br>(detailed in Water Availability Study,<br>2009) | None mentioned specific to this study. | Regulated floodplain mapping,<br>based on the 100 year storm,<br>NPCA Study, year unknown. | Multiple water quality monitoring programs initiated for the Watershed<br>(NPCA/PWQMN). Water quality results are not summarized on a<br>subwatershed basis in the noted text. Of the monitoring stations<br>discussed, a mix between impaired/unimpaired water quality was found<br>historically, with exeedances of Phosphorous. Wet weather, high peak<br>flows and contamination is a concern for this Watershed (City of St.<br>Catharines).Special consideration may be required due to IPZ located<br>within subwatershed. Table 4.2 in Source Protection Plan to list policy<br>responsibilities to be implemented (NPCA, 2013). |
| Twenty Mile Creek | TWEN North Creek                | West Lincoln                       | Twenty Mile Creek Watershed Plan,<br>NPCA, 2006 | Niagara Peninsula Conservation Authority<br>Groundwater Study Final Report. Prepared for<br>Niagara Peninsula Conservation Authority, Regional<br>Municipality of Niagara, City of Hamilton and<br>Haldimand County. Niagara Water Quality Protection<br>Strategy Final Technical Report (Volume 2) Local<br>Management Areas Summaries, NPCA (2003)  | None mentioned specific to this<br>Watershed Plan study. HEC-HMS<br>continous hydrologic model<br>(detailed in Water Availability Study,<br>2009) | None mentioned specific to this study. | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown.      | <ul> <li>Water quality monitoring (single) indicates nutrient enrichment and<br/>impaire BioMAP rating. Promotion of NPCA's education program -<br/>agricultural water quality and nutrient management BMPs.</li> <li>Encouragement of general structural BMPs watershed wide, including<br/>off-line infiltration basins, sediment forebays, sand filters, vegetated<br/>swales, etc. No specific criteria related to water quality objectives. Key<br/>Issue identified: Lack of stormwater management facilities to treat<br/>urban runoff (LMA Summary, NPCA 2003)</li> </ul>  |
| Twenty Mile Creek | TWEN Spring Creek               | West Lincoln                       | Twenty Mile Creek Watershed Plan,<br>NPCA, 2006 | Niagara Peninsula Conservation Authority<br>Groundwater Study Final Report. Prepared for<br>Niagara Peninsula Conservation Authority, Regional<br>Municipality of Niagara, City of Hamilton and<br>Haldimand County   | None mentioned specific to this<br>Watershed Plan study. HEC-HMS<br>continous hydrologic model<br>(detailed in Water Availability Study,<br>2009) | None mentioned specific to this study. | Regulated floodplain mapping,<br>based on the 100 year storm,<br>date/source unknown.      | Water quality monitoring (single) indicates nutrient enrichment and<br>impaire BioMAP rating. Encouragement of general structural BMPs<br>watershed wide, including off-line infiltration basins, sediment forebays,<br>sand filters, vegetated swales, etc. No specific criteria related to water<br>quality objectives.  |

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|--|---------------------------------|------------------------------------|--|--|--|---|---|
| Watersheds                             | Subwatersheds                   | Municipalities                     | Erosion Control  | Flood Control  | Water Balance  | Groundwater Management  | Watercourse Management  |
| Twelve Mile Creek                      | TWEL Francis Creek              | St. Catharines                     | No specific erosion control SWM criteria outlined for the area.  | Urban rain barrel and downspout<br>disconnection programs should be<br>implemented region-wide. General SWM<br>BMPs are outlined (similar to other<br>Watershed Plans). No specific flood<br>control objectives related to the area.   | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), TWEL/UTWEL was<br>found to have a Low surface water stress level, and<br>a Low groundwater stress level.   | The LMA is almost completely of Moderate<br>sensitivity to groundwater contamination because<br>of the shallow depth of clay overburden. Small<br>areas of High sensitivity correspond to sands<br>under St. Catharines and to the QEW area on the<br>west side of the LMA. (NWQPS, 2003)   | The City of St. Catharines currently maintains<br>Francis Creek as a storm channel to prevent<br>flooding in adjacent lands, therefore riparian<br>planting may not be feasible.  |
| Twelve Mile Creek                      | TWEL Lake Gibson System         | St. Catharines, Thorold            | No specific erosion control SWM criteria outlined for the area.  | Urban rain barrel and downspout<br>disconnection programs should be<br>implemented region-wide. General SWM<br>BMPs are outlined (similar to other<br>Watershed Plans). No specific flood<br>control objectives related to the area.   | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), TWEL/UTWEL was<br>found to have a Low surface water stress level, and<br>a Low groundwater stress level.   | IPZ located in subwatershed. DeCew Falls with 3<br>intakes with high vulneribility score (contain<br>significant drinking water threats). More detail in<br>Table 1.2 in Source Protection Plan (NPCA,<br>2013). Table 4.2 in Source Protection Plan to list<br>policy responsibilities to be implemented (NPCA,<br>2013).  | Buffer strip planting along watercourses and<br>riparian restoration along the shoreline of Lake<br>Gibson. Encouragement for designing new urban<br>areas with naturalized and stream side parks<br>(NWQPS, 2003).   |
| Twelve Mile Creek                      | TWEL Lower Twelve Mile<br>Creek | St. Catharines                     | Impermeable surface of this most urban LMA<br>accelerates runoff to the streams and storm sewer<br>system, carrying urban non-point source contaminants<br>associated with e.g., roads and lawn care, and<br>contributing to the <b>most flooding and erosion</b><br><b>problems</b> of any LMA. NWQPS specifically<br>recommends providing source control SWM for new<br>developments.  | Impermeable surface of this most urban<br>LMA accelerates runoff to the streams<br>and storm sewer system, carrying urban<br>non-point source contaminants<br>associated with e.g., roads and lawn<br>care, and contributing to the <b>most</b><br><b>flooding and erosion problems</b> of any<br>LMA. Only approx. 1% of urban area is<br>treated by existing SWM facilities.<br>NWQPS specifically recommends<br>providing source control SWM for new<br>developments. | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), TWEL/UTWEL was<br>found to have a Low surface water stress level, and<br>a Low groundwater stress level.   | The lower Twelve Mile Creek valley area<br>approaching the Escarpment is of Moderate<br>sensitivity where the kame gives way to shallow<br>clay till over bedrock (NWQPS, 2003).  | Buffer strip planting along watercourses that<br>currently have no buffer; priority should be<br>placed on riparian creation to protect and<br>enhance water quality.   |
| Twelve Mile Creek                      | TWEL Richardson Creek           | St. Catharines                     | Promotion of NPCA's education program - agricultural sediment control BMPs.  | Less than 1% of existing urban area in<br>LMA is treated by existing SWM facilities<br>(quantity/quality) (NWQPS, 2003).<br>Encouragement for general SWM BMPs.  | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), TWEL/UTWEL was<br>found to have a Low surface water stress level, and<br>a Low groundwater stress level.   | The LMA is almost completely of Moderate<br>sensitivity to groundwater contamination because<br>of the shallow depth of clay overburden. Small<br>areas of High sensitivity correspond to sands<br>under St. Catharines and to the QEW area on the<br>west side of the LMA (NWQPS, 2003).   | Buffer strip planting along watercourses that<br>currently have no buffer (agricultural); priority<br>should be placed on riparian creation to protect<br>and enhance water quality and help reduce<br>sediment and temperature impacts.  |
| Twelve Mile Creek                      | TWEL Upper Twelve Mile<br>Creek | Pelham, St. Catharines,<br>Thorold | Encouragement of general structural BMPs watershed<br>wide. New developments to include stormwater basins<br>which capture water and detain for 24 - 40 hours<br>before release (watershed wide). Ensure new<br>development in Smithville, Jordan Valley and Jordan<br>Station is designed and constructed tominimize<br>sediment loss (NWQPS, 2003). No other specified<br>erosion control objectives.                                  | Approx. 20% of existing urban area in<br>LMA is treated by existing SWM facilities<br>(quantity/quality). Flood prone buildings in<br>the vicinity of Canboro St. Mild flooding<br>along Twenty Mile Creek. Lack of<br>stormwater management facilities to treat<br>urban runoff (NWQPS, 2003).  | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), TWEL/UTWEL was<br>found to have a Low surface water stress level, and<br>a Low groundwater stress level.   | The Groundwater Study (2005) has identified<br>several areas with high intrinsic susceptibility.<br>Additional studies should be conducted in this<br>subwatershed to ensure current and future land<br>uses do not conflict with the protection of<br>groundwater resources in susceptible areas as<br>part of the NPCA's Groundwater Study (2005)<br>and proposed Source Protection Plan. IPZ<br>located in subwatershed. DeCew Falls with 3<br>intakes with high vulneribility score (contain<br>significant drinking water threats). More detail in<br>Table 1.2 in Source Protection Plan (NPCA,<br>2013). Table 4.2 in Source Protection Plan to list<br>policy responsibilities to be implemented (NPCA,<br>2013). | Buffer strip planting along watercourses that currently have no buffer.   |
| Twenty Mile Creek                      | TWEN North Creek                | West Lincoln                       | Promotion of NPCA's education program - agricultural<br>sediment control BMPs. Encouragement of general<br>structural BMPs watershed wide, including off-line<br>infiltration basins, sediment forebays, sand filters,<br>vegetated swales, etc. New developments to include<br>stormwater basins which capture water and detain for<br>24 - 40 hours before release (watershed wide). No<br>other specified erosion control objectives. | Encouragement of general structural<br>BMPs watershed wide (similar to other<br>Watershed plans), including off-line<br>infiltration basins, wet ponds, sediment<br>forebays, vegetated swales, etc. No<br>specific criteria related to flood control<br>objectives.   | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), TWEN was found to<br>have a Significant surface water stress level, and a<br>Low groundwater stress level. | Medium sensitivity groundwater areas are<br>susceptible to contamination from surface<br>sources due to fractured nature of overburden<br>and high susceptibility in areas where bedrock<br>outcrops at surface.  | A riparian planting program is a priority for this<br>rural subwatershed. Planting buffers of at least<br>30 metres on each side of watercourses will aid<br>in enhancing and protecting water quality, which<br>has been identified as a problem in the North<br>Creek subwatershed. |
| Twenty Mile Creek                      | TWEN Spring Creek               | West Lincoln                       | Encouragement of general structural BMPs watershed<br>wide, including off-line infiltration basins, sediment<br>forebays, sand filters, vegetated swales, etc. New<br>developments to include stormwater basins which<br>capture water and detain for 24 - 40 hours before<br>release (watershed wide).  | Encouragement of general structural<br>BMPs watershed wide (similar to other<br>Watershed plans), including off-line<br>infiltration basins, wet ponds, sediment<br>forebays, vegetated swales, etc. No<br>specific criteria related to flood control<br>objectives.   | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), TWEN was found to<br>have a Significant surface water stress level, and a<br>Low groundwater stress level. | Several sites in this subwatershed have been<br>identified as having high groundwater intrinsic<br>susceptibility due to bedrock outcrops. A<br>challenge in this subwatershed will be to protect<br>groundwater resources in this primarily<br>agricultural area. Further study and<br>review/accordance with the NPCA's Groundwater<br>Study (2005) is required.  | Buffer strip planting along watercourses that<br>currently have no buffer; priority should be<br>placed on riparian creation to protect and<br>enhance water quality.   |

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| Watersheds        | Subwatersheds                   | Municipalities                     | Watercourse Works   | SAR / Fishery Management  | Wetlands   | HDF Classification /Management | Climate Change                   |
|-------------------|---------------------------------|------------------------------------|---|---|--|--------------------------------|----------------------------------|
| Twelve Mile Creek | TWEL Francis Creek              | St. Catharines                     | Flood and Erosion Control Study<br>(Aquafor Beech 1995) was completed<br>for the Juliana, Carter, Secord,<br>Rosedale, Dick's and Francis Creeks  | Restoration opportunites associated with chanelized portions<br>of the watercourse to improve the fishery.Criteria assessment<br>and stewardship actions through the Healthy Twelve Mile<br>Creek project (Trout Unlimited Canada)<br>Currently maintained as a storm channel; opportunites to<br>enhance aquatic habitat without compromising flood control<br>functions should be explored.   | No specific direction related to this<br>subwatershed. Subwatershed is priamrily<br>urbanized and not considered suitable for<br>restoration and enhancement.  | N/A                            | No discussion of climate change. |
| Twelve Mile Creek | TWEL Lake Gibson System         | St. Catharines, Thorold            | -   | Restoration / enhancement / management of the Lake Gibon<br>System fishery are not explored due to concerns around<br>contamination. Riparian plantings are recommended.Criteria<br>assessment and stewardship actions through the Healthy<br>Twelve Mile Creek project (Trout Unlimited Canada)<br>Remainder of subwatershed areas are ubanized and generally<br>not suitable for restoration / enhancement efforts.   | Explore opportunities to create wetlands<br>where suitable conditions exist to support<br>water quality / quantity - Lake Gibson<br>System.<br>Remainder of subwatershed areas are<br>ubanized and generally not suitable for<br>restoration / enhancement efforts.  | N/A                            | No discussion of climate change. |
| Twelve Mile Creek | TWEL Lower Twelve Mile<br>Creek | St. Catharines                     | The Lower Twelve Mile Creek Study<br>(2002) identified several erosion sites in<br>this subwatershed which require<br>additional plantings, naturalization and<br>constructed wetlands.   | Recommendation for riparian buffer policies as a means<br>through which fish and fish habitat can be protected or<br>enhanced. Direction that these policies should consider water<br>quality, quantity, impervious cover.<br>Restoration opportunies which would support management of<br>fish and fish habitat are identified.Criteria assessment and<br>stewardship actions through the Healthy Twelve Mile Creek<br>project (Trout Unlimited Canada)  | Recommended management actions<br>include restoration opportunities,<br>employment of agricultural Best<br>Management Practices, as supporting<br>wetlands, and through them water quality<br>and quantity. Wetland restoration<br>opportunities was guided by sutiability<br>criteria.<br>Recommends restoration effort be focused<br>in lower reaches. Five wetland<br>enhanement projects listed from the 2002<br>Lower Twelve Mile Creek Study   | N/A                            | No discussion of climate change. |
| Twelve Mile Creek | TWEL Richardson Creek           | St. Catharines                     | -   | Maintain and enhance riparian cover to address sedimentation<br>and other impacts to fish / fish habitat and species diversity -<br>confluence of Richardson and Francis Creeks and across the<br>Richardson Creek subwatershed.Criteria assessment and<br>stewardship actions through the Healthy Twelve Mile Creek<br>project (Trout Unlimited Canada)<br>Recommend use of agricultural BMPs for sediment control,<br>water quality, nutrient management.   | Restoration strategy:<br>Martindale Pond / Barnesdale Marsh PSW<br>at the mouth of Richardson Creek.<br>Preservation and enhancement of the<br>wetland through improving upstream water<br>quality.<br>Enhance or restore wetlands near<br>confluence of francis and richardson<br>creeks to improve water quality.<br>Create wetlands in aras where conditions  | N/A                            | No discussion of climate change. |
| Twelve Mile Creek | TWEL Upper Twelve Mile<br>Creek | Pelham, St. Catharines,<br>Thorold | The Upper Twelve Mile Creek<br>Watershed Erosion Study (2005)<br>identified several erosion sites<br>throughout the watershed and on private<br>property. Each requires monitoring and<br>mitigation (buffer zones, structural<br>measures, etc.) as appropriate. | Coldwater system with a self-sustaining population of brook<br>trout.<br>Focus on preserving critical fish habitat, improving Important<br>fish habitat (e.g., through fish barrier removal)<br>Recommends riparian buffer policies as a means through<br>which fish and fish habitat can be protected or enhanced.<br>Restoration opportunies which would support management of<br>fish and fish habitat are identified: Marlene Stuart Streit Park,<br>St. John's Conservation Area pond (thermal impacts). Criteria<br>assessment and stewardship actions through the Healthy<br>Twelve Mile Creek project (Trout Unlimited Canada)<br>Report recommends or identifies studies associated with<br>thermal impacts and brook trout habitat. | Recommends opportunites / means to<br>increase wetland cover in addition to<br>maintaining existing cover where<br>conditions exist<br>Recommended management actions<br>include restoration opportunities,<br>employment of agricultural Best<br>Management Practices, as supporting<br>wetlands, and through them water quality<br>and quantity. Wetland restoration<br>opportunities was guided by sutiability<br>criteria.<br>Enhancement of existing wetlands to act<br>as natural flood storaage and support<br>groundwater recharge | N/A                            | No discussion of climate change. |
| Twenty Mile Creek | TWEN North Creek                | West Lincoln                       | -   | Indirect improvements through riparian plantings.<br>Preserve Critical Fish habitat, maintain and improve Important<br>Fish Habitat.<br>No direction on management or protection of aquatic Species<br>at Risk.   | Creation of wetlands where suitable conditions exist.  | N/A                            | No discussion of climate change. |
| Twenty Mile Creek | TWEN Spring Creek               | West Lincoln                       | -   | Indirect improvements through riparian plantings.<br>Preserve Critical Fish habitat, maintain and improve Important<br>Fish Habitat.<br>No direction on management or protection of aquatic Species<br>at Risk.   | Creation of wetlands where suitable conditions exist.  | N/A                            | No discussion of climate change. |

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| Watersheds        | Subwatersheds          | Municipalities        | Applicable Watershed Plan/Study                 | Supplemental Studies (if any)  | Hydrologic Modelling  | Hydraulic Modelling   | Floodline Mapping  | Water Quality  |
|-------------------|------------------------|-----------------------|---|--|---|---|--|--|
| Twenty Mile Creek | TWEN Twenty Mile Creek | Lincoln, West Lincoln | Twenty Mile Creek Watershed Plan,<br>NPCA, 2006 | Niagara Peninsula Conservation Authority. 2005c.<br>Twenty Mile Creek Floodplain Mapping, City of<br>Hamilton, Town of Lincoln and the Township of West<br>Lincoln. Welland, Ontario. Niagara Water Quality<br>Protection Strategy Final Technical Report (Volume<br>2), Niagara Water Quality Protection Strategy - LMA<br>Summaries, 2003 - Upper Twelve Mile Creek #1.1,<br>Pelham Union #1.4 | None mentioned specific to this<br>Watershed Plan study. HEC-HMS<br>continous hydrologic model<br>(detailed in Water Availability Study,<br>2009) | Floodplain Mapping Study<br>Completed by NPCA in 2005.<br>Identified 21 crossings that<br>aggravate flooding along the main<br>channel. | Floodplain mapping for the<br>main branch of Twenty Mile<br>Creek, completed in 2005 by<br>NPCA, based on the 100 year<br>storm event. | Water quality monitoring (several) indicates nutrient enrichment and<br>impaire BioMAP rating. Encouragement of general structural BMPs<br>watershed wide, including off-line infiltration basins, sediment forebays,<br>sand filters, vegetated swales, etc. No specific criteria related to water<br>quality objectives. Key Issue identified: Lack of stormwater<br>management facilities to treat urban runoff (LMA Summary, NPCA<br>2003) |

| Primary Findings |  |
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| Watersheds        | Subwatersheds          | Municipalities        | Erosion Control   | Flood Control  | Water Balance  | Groundwater Management  | Watercourse Management   |
|-------------------|------------------------|-----------------------|---|--|--|---|--|
| Twenty Mile Creek | TWEN Twenty Mile Creek | Lincoln, West Lincoln | Encouragement of general structural BMPs watershed<br>wide, including off-line infiltration basins, sediment<br>forebays, sand filters, vegetated swales, etc. New<br>developments to include stormwater basins which<br>capture water and detain for 24 - 40 hours before<br>release (watershed wide). No other specified erosion<br>control objectives. | Flooding has been identified as an issue<br>in this portion of the subwatershed. A rain<br>barrel program should be implemented to<br>reduce rain water from entering the<br>combined sewer system in the Town of<br>Smithville, and to encourage water<br>conservation. One combined sewer<br>overflow has been identified in the Town<br>of Smithville (NWQPS 2003). Clay soils<br>and lack of natural cover reduces water<br>storage,<br>contributing to high flood risk in Smithville<br>and to intermittent dry streambeds<br>(NWQPS 2003). | WS Plan completed prior to the Niagara Peninsula<br>Tier 1 Water Budget and Water Quantity Stress<br>Assessment. Accoding to Niagara Peninsula Tier 1<br>Water Budget and Water Quantity Stress<br>Assessment (NPCA, 2010), TWEN was found to<br>have a Significant surface water stress level, and a<br>Low groundwater stress level. | Several sites in this subwatershed have been<br>identified as having high groundwater intrinsic<br>susceptibility due to bedrock outcrops. Two<br>known karst areas exist in this subwatershed<br>(Terra-Dynamics Consulting Inc. 2005).<br>Additional study is required for both areas to<br>ensure they are protected from future<br>development. Medium sensitivity groundwater<br>areas are susceptible to contamination from<br>surface sources due tofractured nature of<br>overburden and high susceptibility in areas where<br>bedrock outcrops at surface. | Many stretches of the main branch and its<br>smaller tributaries are without riparian cover;<br>therefore, priority should be placed on<br>establishing vegetated buffers (minimum 15-30<br>m) along watercourses to enhance water quality.<br>Specific to Smithville, wetland restoration<br>targeted to low-lying clay areas upstream of<br>Smithville to help mitigate flooding issues<br>(NWQPS 2003). |

#### Table WR1: NWP (E) - Watershed Plan Review

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| Watersheds        | Subwatersheds          | Municipalities        | Watercourse Works | SAR / Fishery Management  | Wetlands  | HDF Classification /Management |
|-------------------|------------------------|-----------------------|-------------------|---|---|--------------------------------|
| Twenty Mile Creek | TWEN Twenty Mile Creek | Lincoln, West Lincoln | -                 | Indirect improvements through riparian plantings.<br>Preserve Critical Fish habitat, maintain and improve Important<br>Fish Habitat.<br>No direction on management or protection of aquatic Species<br>at Risk. | Creation of wetlands where suitable conditions exist. | N/A                            |

#### Climate Change

No discussion of climate change.

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|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
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| LIGHT BLUE - MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

|                                   |                             |   |  | Supplemental Studies (if any)   | Hydrologic Modelling  | Hydraulic Modelling  | Floodline Mapping  | Water Quality  | Erosion Control  |
|-----------------------------------|-----------------------------|---|--|---|---|--|--|--|--|
| Beaverdams and Shriners<br>Creeks | BDSC BEAVER DAMS CREEK      | Niagara Falls, Thorold  | Beaverdams and Shriners<br>Creek Watershed Plan - Phase<br>One, NPCA, 2011 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009),<br>Beaverdams and Shriners Creek<br>Geomorphic Study, including<br>Thompsons Creek report (NPCA,<br>2010)                                    | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues identified. Further<br>study required for mitigation plan<br>for future greenfield, infill & re-<br>development.  | General watershed objective for erosion control,<br>reference to regional level guidance for BMPs.<br>Geomorphic Study identifies areas of concern<br>and characterization of w/c. Further study is<br>required to determine erosion thresholds for<br>receiving w/c and SWM erosion control sizing<br>with respect to future development. |
| Beaverdams and Shriners<br>Creeks | BDSC SHRINERS CREEK         | Niagara Falls, Thorold  | Beaverdams and Shriners<br>Creek Watershed Plan - Phase<br>One, NPCA, 2011 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009),<br>Beaverdams and Shriners Creek<br>Geomorphic Study, including<br>Thompsons Creek report (NPCA,<br>2010)                                    | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues identified. Further<br>study required for mitigation plan<br>for future greenfield, infill & re-<br>development.  | General watershed objective for erosion control,<br>reference to regional level guidance for BMPs.<br>Geomorphic Study identifies areas of concern<br>and characterization of w/c. Further study is<br>required to determine erosion thresholds for<br>receiving w/c and SWM erosion control sizing<br>with respect to future development. |
| Beaverdams and Shriners<br>Creeks | BDSC TEN MILE CREEK         | Niagara Falls   | Beaverdams and Shriners<br>Creek Watershed Plan - Phase<br>One, NPCA, 2011 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009),<br>Beaverdams and Shriners Creek<br>Geomorphic Study, including<br>Thompsons Creek report (NPCA,<br>2010)                                    | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Minimal WQ monitoring<br>characterization completed for<br>this subwatershed. Further study<br>required for identification of<br>issues and mitigation plan.           | General watershed objective for erosion control,<br>reference to regional level guidance for BMPs.<br>Further study is required to determine erosion<br>thresholds for receiving w/c and SWM erosion<br>control sizing with respect to future<br>development.  |
| Beaverdams and Shriners<br>Creeks | BDSC WELLAND CANAL<br>NORTH | Niagara-on-the-Lake, Pelham,<br>St. Catharines, Thorold,<br>Welland | Beaverdams and Shriners<br>Creek Watershed Plan - Phase<br>One, NPCA, 2011 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009),<br>Beaverdams and Shriners Creek<br>Geomorphic Study, including<br>Thompsons Creek report (NPCA,<br>2010)                                    | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | No hydraulic modelling found.  | No floodplain mapping<br>found                               | Minimal WQ monitoring<br>characterization completed for<br>this subwatershed. Further study<br>required for identification of<br>issues and mitigation plan.           | General watershed objective for erosion control,<br>reference to regional level guidance for BMPs.<br>Geomorphic Study identifies areas of concern<br>and characterization of w/c. Further study is<br>required to determine erosion thresholds for<br>receiving w/c and SWM erosion control sizing<br>with respect to future development. |
| Central Welland River             | CWR BIEDERMAN DRAIN         | Port Colborne   | Central Welland River<br>Watershed Plan, NPCA, 2010                        | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009), Central<br>Welland River Watershed<br>Geomorphic Assessment (NPCA<br>2010), Stormwater Management<br>Policies and Guidelines (AECOM<br>2010) | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | No WQ monitoring<br>characterization completed for<br>this subwatershed. Further study<br>required for identification of<br>issues and mitigation plan.                | General watershed objective for erosion control,<br>reference to regional level guidance for BMPs.<br>Further study is required to determine erosion<br>thresholds for receiving w/c and SWM erosion<br>control sizing with respect to future<br>development.  |
| Central Welland River             | CWR Draper Creek            | Pelham, Welland   | Central Welland River<br>Watershed Plan, NPCA, 2010                        | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009), Central<br>Welland River Watershed<br>Geomorphic Assessment (NPCA<br>2010), Stormwater Management<br>Policies and Guidelines (AECOM<br>2010) | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development. | General watershed objective for erosion control,<br>reference to regional level guidance for BMPs.<br>Geomorphic Study identifies areas of concern<br>and characterization of w/c. Further study is<br>required to determine erosion thresholds for<br>receiving w/c and SWM erosion control sizing<br>with respect to future development. |

#### Table WR2: NWP (E) - Watershed Plan Review

| Gap | Analysis |   |
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| LIGHT BLUE = MAJOR GAP | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
|                        | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds                        | Subwatersheds               | Municipalities  | Flood Control  | Water Balance/Budget  | Groundwater Management   | Watercourse Management   |
|-----------------------------------|-----------------------------|---|--|---|--|--|
| Beaverdams and Shriners<br>Creeks | BDSC BEAVER DAMS CREEK      | Niagara Falls, Thorold  | Existing municipal drain noted to have<br>significant flood potential. Further study is<br>required for assessment and sizing of SWM<br>for future greenfield, infill & re-development.  | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development.  | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development. | Localized recommendations for watercourse<br>management based on Geomorphic Study.<br>Further study required to determine any W/0<br>management opportunities as part of future<br>development.                                      |
| Beaverdams and Shriners<br>Creeks | BDSC SHRINERS CREEK         | Niagara Falls, Thorold  | Further study is required for assessment and sizing of SWM for future greenfield, infill & re-<br>development.   | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development.  | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development. | Localized recommendations for watercourse<br>management based on Geomorphic Study.<br>Further study required to determine any W/<br>management opportunities as part of future<br>development.                                       |
| Beaverdams and Shriners<br>Creeks | BDSC TEN MILE CREEK         | Niagara Falls   | Further study is required for assessment and sizing of SWM for future greenfield, infill & re-<br>development.   | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development.  | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development. | No mention of this subwatershed in watershed plan or geomorphic study  |
| Beaverdams and Shriners<br>Creeks | BDSC WELLAND CANAL<br>NORTH | Niagara-on-the-Lake, Pelham,<br>St. Catharines, Thorold,<br>Welland | Further study is required for assessment and sizing of SWM for future greenfield, infill & re-<br>development.   | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development.  | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development. | Localized recommendations for watercourse<br>management based on Geomorphic Study.<br>Further study required to determine any W/<br>management opportunities as part of future<br>development.                                       |
| Central Welland River             | CWR BIEDERMAN DRAIN         | Port Colborne   | General policies and guidelines for flood<br>control, reference to regional level guidance<br>for BMPs (AECOM). Further study is required<br>for assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HIMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development. | General drain maintenenace recommended<br>Further study required to determine any W/0<br>management opportunities as part of future<br>development.  |
| Central Welland River             | CWR Draper Creek            | Pelham, Welland   | General policies and guidelines for flood<br>control, reference to regional level guidance<br>for BMPs (AECOM). Further study is required<br>for assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HIMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan. | Problem areas identified as part of NPCA<br>Fluvial Geomorphology Study - monitoring<br>and recommendations identified. Further<br>study required to determine any W/C<br>management opportunities as part of future<br>development. |

#### Watercourse Works

Geomorphic Study specific to this subwatershed has been completed and identified several erosion sites & problem areas with specific works/recommendations.

Geomorphic Study specific to this subwatershed has been completed and identified several erosion sites & problem areas with specific works/recommendations.

Not included in Geomorphic Study.

Geomorphic Study specific to this subwatershed has been completed and identified several erosion sites & problem areas with specific works/recommendations.

Not included in Geomorphic Study.

Geomorphic Study specific to this subwatershed has been completed and identified several erosion sites & problem areas with specific works/recommendations.

| Gap | Analysis |  |
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| LIGHT BLUE = MAJOR GAP | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
|                        | BE CONFIRMED              | SIGNIFICANT GAP |

|                                   |                             |   | SAR / Fishery Management   | Wetlands  | HDF Classification<br>/Management  | Climate Change  |
|-----------------------------------|-----------------------------|---|--|---|--|---|
| Beaverdams and Shriners<br>Creeks | BDSC BEAVER DAMS CREEK      | Niagara Falls, Thorold  | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. No direction on SAR is provided.                  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>Very general direction provided.<br>Refined targets or other<br>management objectives should<br>be considered. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| Beaverdams and Shriners<br>Creeks | BDSC SHRINERS CREEK         | Niagara Falls, Thorold  | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. No direction on SAR is provided.                  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>Very general direction provided.<br>Refined targets or other<br>management objectives should<br>be considered. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| Beaverdams and Shriners<br>Creeks | BDSC TEN MILE CREEK         | Niagara Falls   | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.   | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>Very general direction provided.<br>Refined targets or other<br>management objectives should<br>be considered. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| Beaverdams and Shriners<br>Creeks | BDSC WELLAND CANAL<br>NORTH | Niagara-on-the-Lake, Pelham,<br>St. Catharines, Thorold,<br>Welland | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. No direction on SAR is provided.                  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>Very general direction provided.<br>Refined targets or other<br>management objectives should<br>be considered. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| Central Welland River             | CWR BIEDERMAN DRAIN         | Port Colborne   | <ul> <li>Species information available at a system scale and for most or all higher order watercourses. Gaps anticipated to exist in lower order streams.</li> <li>Updated SAR species information and mapping generally available through current information sources.</li> <li>Mangement direction and objectives for fish are very limited. No direction on SAR is provided.</li> </ul> | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>Very general direction provided.<br>Refined targets or other<br>management objectives should<br>be considered. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| Central Welland River             | CWR Draper Creek            | Pelham, Welland   | <ul> <li>Species information available at a system scale and for most or all higher order watercourses. Gaps anticipated to exist in lower order streams.</li> <li>Updated SAR species information and mapping generally available through current information sources.</li> <li>Mangement direction and objectives for fish are very limited. No direction on SAR is provided.</li> </ul> | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>Very general direction provided.<br>Refined targets or other<br>management objectives should<br>be considered. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |

|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
| LIGHT BLUE - MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds            | Subwatersheds                      | Municipalities                  | Applicable Watershed<br>Plan/Study                  | Supplemental Studies (if any)   | Hydrologic Modelling  | Hydraulic Modelling  | Floodline Mapping  | Water Quality  | Erosion Control  |
|-----------------------|------------------------------------|---------------------------------|---|---|---|--|--|--|--|
| Central Welland River | CWR INDIAN CREEK                   | Port Colborne                   | Central Welland River<br>Watershed Plan, NPCA, 2010 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009), Central<br>Welland River Watershed<br>Geomorphic Assessment (NPCA<br>2010), Stormwater Management<br>Policies and Guidelines (AECOM<br>2010), Surface Water Intake<br>Protection Zone SWP AR (GIS data),<br>NPCA 2019  | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | No WQ monitoring<br>characterization completed for<br>this subwatershed. IPZ located in<br>subwatershed, applicable<br>policies to be followed. Further<br>study required for identification of<br>issues and mitigation plan. | General watershed objective for erosion control,<br>reference to regional level guidance for BMPs.<br>Further study is required to determine erosion<br>thresholds for receiving w/c and SWM erosion<br>control sizing with respect to future<br>development.  |
| Central Welland River | CWR TOW PATH DRAIN                 | Pelham, Thorold, Welland        | Central Welland River<br>Watershed Plan, NPCA, 2010 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009), Central<br>Welland River Watershed<br>Geomorphic Assessment (NPCA<br>2010), Stormwater Management<br>Policies and Guidelines (AECOM<br>2010)   | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | No WQ monitoring<br>characterization completed for<br>this subwatershed. Further study<br>required for identification of<br>issues and mitigation plan.  | General watershed objective for erosion control,<br>reference to regional level guidance for BMPs.<br>Geomorphic Study identifies areas of concern<br>and characterization of w/c. Further study is<br>required to determine erosion thresholds for<br>receiving w/c and SWM erosion control sizing<br>with respect to future development. |
| Central Welland River | CWR WELLAND CANAL<br>SOUTH         | Port Colborne, Thorold, Welland | Central Welland River<br>Watershed Plan, NPCA, 2010 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009), Central<br>Welland River Watershed<br>Geomorphic Assessment (NPCA<br>2010), Stormwater Management<br>Policies and Guidelines (AECOM<br>2010). Surface Water Intake<br>Protection Zone SWP AR (GIS data),<br>NPCA 2019. Source Protection Plan<br>for Niagara Peninsula Source<br>Protection Area, (NPCA, 2013) | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues identified. IPZ located<br>in subwatershed, applicable<br>policies to be followed. Further<br>study required for mitigation plan<br>for future greenfield, infill & re-<br>development.                             | General watershed objective for erosion control,<br>reference to regional level guidance for BMPs.<br>Further study is required to determine erosion<br>thresholds for receiving w/c and SWM erosion<br>control sizing with respect to future<br>development.  |
| Central Welland River | CWR Welland River                  | Welland                         | Central Welland River<br>Watershed Plan, NPCA, 2010 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009), Central<br>Welland River Watershed<br>Geomorphic Assessment (NPCA<br>2010), Stormwater Management<br>Policies and Guidelines (AECOM<br>2010), Surface Water Intake<br>Protection Zone SWP AR (GIS data),<br>NPCA 2019. Source Protection Plan<br>for Niagara Peninsula Source<br>Protection Area, (NPCA, 2013) | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues identified. Further<br>study required for mitigation plan<br>for future greenfield, infill & re-<br>development.  | General watershed objective for erosion control,<br>reference to regional level guidance for BMPs.<br>Geomorphic Study identifies areas of concern<br>and characterization of w/c. Further study is<br>required to determine erosion thresholds for<br>receiving w/c and SWM erosion control sizing<br>with respect to future development. |
| Central Welland River | CWR WELLAND RIVER<br>BETWEEN CANAL | Welland                         | Central Welland River<br>Watershed Plan, NPCA, 2010 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009), Central<br>Welland River Watershed<br>Geomorphic Assessment (NPCA<br>2010), Stormwater Management<br>Policies and Guidelines (AECOM<br>2010), Surface Water Intake<br>Protection Zone SWP AR (GIS data),<br>NPCA 2019. Source Protection Plan<br>for Niagara Peninsula Source<br>Protection Area, (NPCA, 2013) | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues identified. IPZ located<br>in subwatershed, applicable<br>policies to be followed. Further<br>study required for mitigation plan<br>for future greenfield, infill & re-<br>development.                             | General watershed objective for erosion control,<br>reference to regional level guidance for BMPs.<br>Further study is required to determine erosion<br>thresholds for receiving w/c and SWM erosion<br>control sizing with respect to future<br>development.  |

| Gap Analysis |  |
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|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
| LIGHT BLUE - MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds            | Subwatersheds                      | Municipalities                  | Flood Control  | Water Balance/Budget   | Groundwater Management  | Watercourse Management   |
|-----------------------|------------------------------------|---------------------------------|--|--|---|--|
| Central Welland River | CWR INDIAN CREEK                   | Port Colborne                   | General policies and guidelines for flood<br>control, reference to regional level guidance<br>for BMPs (AECOM). Further study is required<br>for assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study,<br>including IPZ areas which will<br>require additional policies to be<br>followed. Further study is<br>required for mitigation plan for<br>future greenfield, infill & re-<br>development. | Riparian buffer planting program for areas<br>with minimal buffer (existing watercourse),<br>drain maintenance. Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part of<br>future development.   |
| Central Welland River | CWR TOW PATH DRAIN                 | Pelham, Thorold, Welland        | General policies and guidelines for flood<br>control, reference to regional level guidance<br>for BMPs (AECOM). Further study is required<br>for assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan.  | Problem areas identified as part of NPCA<br>Fluvial Geomorphology Study - monitoring<br>and recommendations identified. Riparian<br>buffer planting program for areas with<br>minimal buffer (existing watercourse). Furthe<br>study required to determine any W/C<br>management requirements and/or<br>opportunities as part of future development. |
| Central Welland River | CWR WELLAND CANAL<br>SOUTH         | Port Colborne, Thorold, Welland | General policies and guidelines for flood<br>control, reference to regional level guidance<br>for BMPs (AECOM). Further study is required<br>for assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study,<br>including IPZ areas which will<br>require additional policies to be<br>followed. Further study is<br>required for mitigation plan for<br>future greenfield, infill & re-<br>development. | No recommendations found in NPCA Fluvial<br>Geomorphic Study. Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part of<br>future development.   |
| Central Welland River | CWR Welland River                  | Welland                         | General policies and guidelines for flood<br>control, reference to regional level guidance<br>for BMPs (AECOM). Further study is required<br>for assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan.  | General recommendations for watercourse<br>management found in NPCA Fluvial<br>Geomorphology Study. Further study<br>required to determine any W/C management<br>requirements and/or opportunities as part of<br>future development.   |
| Central Welland River | CWR WELLAND RIVER<br>BETWEEN CANAL | Welland                         | General policies and guidelines for flood<br>control, reference to regional level guidance<br>for BMPs (AECOM). Further study is required<br>for assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study,<br>including IPZ areas which will<br>require additional policies to be<br>followed. Further study is<br>required for mitigation plan for<br>future greenfield, infill & re-<br>development. | No recommendations found in NPCA Fluvial<br>Geomorphic Study. Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part of<br>future development.   |

|     | Watercourse Works  |
|-----|--|
|     | Not included in Geomorphic<br>Study.   |
| T I | Geomorphic Study specific to<br>this subwatershed has been<br>completed and identified several<br>erosion sites & problem areas<br>with specific<br>works/recommendations. |
|     | Not included in Geomorphic<br>Study.   |
|     | Geomorphic Study specific to<br>this subwatershed has been<br>completed and identified several<br>erosion sites & problem areas<br>with specific<br>works/recommendations. |
|     | Not included in Geomorphic<br>Study.   |

| Gap | Analysis |  |
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|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
| LIGHT BLUE - MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds            | Subwatersheds                      | Municipalities                  | SAR / Fishery Management   | Wetlands  | HDF Classification<br>/Management  | Climate Change  |
|-----------------------|------------------------------------|---------------------------------|--|---|--|---|
| Central Welland River | CWR INDIAN CREEK                   | Port Colborne                   | <ul> <li>Species information available at a system scale and for most or all higher order watercourses. Gaps anticipated to exist in lower order streams.</li> <li>Updated SAR species information and mapping generally available through current information sources.</li> <li>Mangement direction and objectives for fish are very limited. No direction on SAR is provided.</li> </ul> | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>Very general direction provided.<br>Refined targets or other<br>management objectives should<br>be considered. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| Central Welland River | CWR TOW PATH DRAIN                 | Pelham, Thorold, Welland        | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. No direction on SAR is provided.                  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>Very general direction provided.<br>Refined targets or other<br>management objectives should<br>be considered. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| Central Welland River | CWR WELLAND CANAL<br>SOUTH         | Port Colborne, Thorold, Welland | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. No direction on SAR is provided.                  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>Very general direction provided.<br>Refined targets or other<br>management objectives should<br>be considered. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| Central Welland River | CWR Welland River                  | Welland                         | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. No direction on SAR is provided.                  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>Very general direction provided.<br>Refined targets or other<br>management objectives should<br>be considered. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| Central Welland River | CWR WELLAND RIVER<br>BETWEEN CANAL | Welland                         | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. No direction on SAR is provided.                  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>Very general direction provided.<br>Refined targets or other<br>management objectives should<br>be considered. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |

| Gap Analysis           |                           |                 |
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|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
| LIGHT BLUE - MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds | Subwatersheds                | Municipalities           | Applicable Watershed<br>Plan/Study                               | Supplemental Studies (if any)   | Hydrologic Modelling  | Hydraulic Modelling                               | Floodline Mapping  | Water Quality  | Erosion Control  |
|------------|------------------------------|--------------------------|--|---|---|---|--|--|--|
| Fort Erie  | FEC Beaver Creek             | Fort Erie, Port Colborne | Fort Erie Creeks - Watershed<br>Plan, Phillips Engineering, 2008 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009)   | Yes - SWMHYMO model<br>assessing future land uses /<br>development. | Yes - HEC-RAS modelling<br>completed by Phillips. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | No WQ monitoring<br>characterization completed for<br>this subwatershed. Mass balance<br>assessment completed for future<br>land use. Further study required<br>for identification of issues and<br>mitigation plan. | Erosion thresholds for receiving watercourses<br>determined as part of Watershed Plan. General<br>recommendations for extended detention<br>storage provided. Further study required for<br>volumetric sizing with respect to future<br>development. |
| Fort Erie  | FEC Bertie Bay Drain Area 2A | Fort Erie                | Fort Erie Creeks - Watershed<br>Plan, Phillips Engineering, 2008 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009), Niagara<br>River Fish Community Report (2007-<br>2011)(MNRF 2012). | No hydrological modelling found for subwatershed area.              | No hydraulic modelling found.                     | No floodplain mapping<br>found                               | No WQ monitoring<br>characterization completed for<br>this subwatershed. Mass balance<br>assessment completed for future<br>land use. Further study required<br>for identification of issues and<br>mitigation plan. | Erosion thresholds for receiving watercourses<br>determined as part of Watershed Plan. General<br>recommendations for extended detention<br>storage provided. Further study required for<br>volumetric sizing with respect to future<br>development. |
| Fort Erie  | FEC Black Creek              | Fort Erie, Port Colborne | Fort Erie Creeks - Watershed<br>Plan, Phillips Engineering, 2008 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>9 Water Availability Study<br>(AquaResource Inc 2009)   | Yes - SWMHYMO model<br>assessing future land uses /<br>development. | Yes - HEC-RAS modelling completed by Phillips.    | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues identified - mass<br>balance assessment completed<br>for future land use. Further study<br>required for mitigation plan for<br>future greenfield, infill & re-<br>development.                            | Erosion thresholds for receiving watercourses<br>determined as part of Watershed Plan. General<br>recommendations for extended detention<br>storage provided. Further study required for<br>volumetric sizing with respect to future<br>development. |
| Fort Erie  | FEC Frenchmans Creek         | Fort Erie                | Fort Erie Creeks - Watershed<br>Plan, Phillips Engineering, 2008 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>9 Water Availability Study<br>(AquaResource Inc 2009)   | Yes - SWMHYMO model<br>assessing future land uses /<br>development. | Yes - HEC-RAS modelling<br>completed by Phillips. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues identified - mass<br>balance assessment completed<br>for future land use. Further study<br>required for mitigation plan for<br>future greenfield, infill & re-<br>development.                            | Erosion thresholds for receiving watercourses<br>determined as part of Watershed Plan. General<br>recommendations for extended detention<br>storage provided. Further study required for<br>volumetric sizing with respect to future<br>development. |
| Fort Erie  | FEC Miller Creek             | Fort Erie                | Fort Erie Creeks - Watershed<br>Plan, Phillips Engineering, 2008 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009)   | Yes - SWMHYMO model<br>assessing future land uses /<br>development. | Yes - HEC-RAS modelling<br>completed by Phillips. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | No WQ monitoring<br>characterization completed for<br>this subwatershed. Mass balance<br>assessment completed for future<br>land use. Further study required<br>for identification of issues and<br>mitigation plan. | Erosion thresholds for receiving watercourses<br>determined as part of Watershed Plan. General<br>recommendations for extended detention<br>storage provided. Further study required for<br>volumetric sizing with respect to future<br>development. |

| Gap A | nalysis |  |
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|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
| LIGHT BLUE = MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds | Subwatersheds                | Municipalities           | Flood Control  | Water Balance/Budget   | Groundwater Management  | Watercourse Management   | Watercourse Works |
|------------|------------------------------|--------------------------|--|--|---|--|-------------------|
| Fort Erie  | FEC Beaver Creek             | Fort Erie, Port Colborne | Areas of concern and summary of local<br>opportunities outlined. Peak flow comparison<br>completed for existing v future land uses.<br>Further study required for SWM assessment<br>and volumetric sizing. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Problem areas, monitoring needs and<br>recommendations identified. Further study<br>required to determine any W/C management<br>opportunities as part of future development. | -                 |
| Fort Erie  | FEC Bertie Bay Drain Area 2A | Fort Erie                | Areas of concern and summary of local<br>opportunities outlined. Peak flow comparison<br>completed for existing v future land uses.<br>Further study required for SWM assessment<br>and volumetric sizing. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Problem areas, monitoring needs and<br>recommendations identified. Further study<br>required to determine any W/C management<br>opportunities as part of future development. | -                 |
| Fort Erie  | FEC Black Creek              | Fort Erie, Port Colborne | Areas of concern and summary of local<br>opportunities outlined. Peak flow comparison<br>completed for existing v future land uses.<br>Further study required for SWM assessment<br>and volumetric sizing. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Problem areas, monitoring needs and<br>recommendations identified. Further study<br>required to determine any W/C management<br>opportunities as part of future development. | -                 |
| Fort Erie  | FEC Frenchmans Creek         | Fort Erie                | Areas of concern and summary of local<br>opportunities outlined. Peak flow comparison<br>completed for existing v future land uses.<br>Further study required for SWM assessment<br>and volumetric sizing. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Problem areas, monitoring needs and<br>recommendations identified. Further study<br>required to determine any W/C management<br>opportunities as part of future development. | -                 |
| Fort Erie  | FEC Miller Creek             | Fort Erie                | Areas of concern and summary of local<br>opportunities outlined. Peak flow comparison<br>completed for existing v future land uses.<br>Further study required for SWM assessment<br>and volumetric sizing. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Problem areas, monitoring needs and<br>recommendations identified. Further study<br>required to determine any W/C management<br>opportunities as part of future development. | -                 |

| Gan | Analysis  |  |
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| Gap | Allalysis |  |

|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
| LIGHT BLUE - MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds | Subwatersheds                | Municipalities           | SAR / Fishery Management   | Wetlands  | HDF Classification<br>/Management  | Climate Change   |
|------------|------------------------------|--------------------------|--|---|--|--|
| Fort Erie  | FEC Beaver Creek             | Fort Erie, Port Colborne | <ul> <li>Species information available at a system scale and for most or all higher order watercourses. Gaps anticipated to exist in lower order streams.</li> <li>Updated SAR species information and mapping generally available through current information sources.</li> <li>Mangement direction and objectives for fish include some specific recommendations, but could be expanded or refined. Management direction and objectives for SAR limited or not present.</li> </ul> | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Refined targets or other<br>management objectives should<br>be considered.<br>One direction is made re:<br>restoration / enhancement to<br>slough forests. Further refinment<br>may be warranted. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed, with specific for<br>NHS. No mitigation strategies<br>outlined specific to the watershed<br>- further study required. |
| Fort Erie  | FEC Bertie Bay Drain Area 2A | Fort Erie                | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish include<br>some specific recommendations, but could be<br>expanded or refined. Management direction and<br>objectives for SAR limited or not present.            | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Refined targets or other<br>management objectives should<br>be considered.<br>One direction is made re:<br>restoration / enhancement to<br>slough forests. Further refinment<br>may be warranted. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed, with specific for<br>NHS. No mitigation strategies<br>outlined specific to the watershed<br>- further study required. |
| Fort Erie  | FEC Black Creek              | Fort Erie, Port Colborne | <ul> <li>Species information available at a system scale and for most or all higher order watercourses. Gaps anticipated to exist in lower order streams.</li> <li>Updated SAR species information and mapping generally available through current information sources.</li> <li>Mangement direction and objectives for fish include some specific recommendations, but could be expanded or refined. Management direction and objectives for SAR limited or not present.</li> </ul> | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Refined targets or other<br>management objectives should<br>be considered.<br>One direction is made re:<br>restoration / enhancement to<br>slough forests. Further refinment<br>may be warranted. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed, with specific for<br>NHS. No mitigation strategies<br>outlined specific to the watershed<br>- further study required. |
| Fort Erie  | FEC Frenchmans Creek         | Fort Erie                | <ul> <li>Species information available at a system scale and for most or all higher order watercourses. Gaps anticipated to exist in lower order streams.</li> <li>Updated SAR species information and mapping generally available through current information sources.</li> <li>Mangement direction and objectives for fish include some specific recommendations, but could be expanded or refined. Management direction and objectives for SAR limited or not present.</li> </ul> | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Refined targets or other<br>management objectives should<br>be considered.<br>One direction is made re:<br>restoration / enhancement to<br>slough forests. Further refinment<br>may be warranted. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed, with specific for<br>NHS. No mitigation strategies<br>outlined specific to the watershed<br>- further study required. |
| Fort Erie  | FEC Miller Creek             | Fort Erie                | <ul> <li>Species information available at a system scale and for most or all higher order watercourses. Gaps anticipated to exist in lower order streams.</li> <li>Updated SAR species information and mapping generally available through current information sources.</li> <li>Mangement direction and objectives for fish include some specific recommendations, but could be expanded or refined. Management direction and objectives for SAR limited or not present.</li> </ul> | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Refined targets or other<br>management objectives should<br>be considered.<br>One direction is made re:<br>restoration / enhancement to<br>slough forests. Further refinment<br>may be warranted. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed, with specific for<br>NHS. No mitigation strategies<br>outlined specific to the watershed<br>- further study required. |

#### Table WR2: NWP (E) - Watershed Plan Review

| Gap Analysis |              |
|--------------|--------------|
|              | PURPLE = PAR |

| LIGHT BLUE = MAJOR GAP | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
|                        | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds | Subwatersheds                           | Municipalities | Applicable Watershed<br>Plan/Study                               | Supplemental Studies (if any)   | Hydrologic Modelling   | Hydraulic Modelling                               | Floodline Mapping  | Water Quality  | Erosion Control  |
|------------|---|----------------|--|---|--|---|--|--|--|
| Fort Erie  | FEC Kraft Drain                         | Fort Erie      | Fort Erie Creeks - Watershed<br>Plan, Phillips Engineering, 2008 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009) | Yes - SWMHYMO model<br>assessing future land uses /<br>development.  | Yes - HEC-RAS modelling<br>completed by Phillips. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | No WQ monitoring<br>characterization completed for<br>this subwatershed. Mass balance<br>assessment completed for future<br>land use. Further study required<br>for identification of issues and<br>mitigation plan. | Erosion thresholds for receiving watercourses<br>determined as part of Watershed Plan. General<br>recommendations for extended detention<br>storage provided. Further study required for<br>volumetric sizing with respect to future<br>development. |
| Fort Erie  | FEC Niagara River 15                    | Fort Erie      | Subwatershed not in watershed<br>plan                            | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Chippawa LMA #2.17                            | No hydrological modelling found                                      | No hydraulic modelling found.                     | No floodplain mapping<br>found                               | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development.   | Further study required for problem areas,<br>erosion thresholds and volumetric sizing.   |
| Fort Erie  | FEC Niagara River 17                    | Fort Erie      | Subwatershed not in watershed plan                               | -   | No hydrological modelling found                                      | No hydraulic modelling found.                     | No floodplain mapping<br>found                               | Subwatershed not found in the studies reviewed - requires further study.   | Subwatershed not found in the studies reviewed<br>- requires further study.  |
| Fort Erie  | FEC Niagara River 18C, 18D,<br>18F, 18H | Fort Erie      | Subwatershed not in watershed plan                               | -   | No hydrological modelling found                                      | No hydraulic modelling found.                     | No floodplain mapping<br>found                               | Subwatershed not found in the studies reviewed - requires further study.   | Subwatershed not found in the studies reviewed<br>- requires further study.  |
| Fort Erie  | FEC Six Mile Creek Lake Erie            | Fort Erie      | Fort Erie Creeks - Watershed<br>Plan, Phillips Engineering, 2008 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009) | Yes - SWMHYMO modell<br>assessing future land uses /<br>development. | Yes - HEC-RAS modelling completed by Phillips.    | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | No WQ monitoring<br>characterization completed for<br>this subwatershed. Mass balance<br>assessment completed for future<br>land use. Further study required<br>for identification of issues and<br>mitigation plan. | Erosion thresholds for receiving watercourses<br>determined as part of Watershed Plan. General<br>recommendations for extended detention<br>storage provided. Further study required for<br>volumetric sizing with respect to future<br>development. |

| LIGHT BLUE = MAJOR GAP | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
|                        | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds | Subwatersheds                           | Municipalities | Flood Control  | Water Balance/Budget   | Groundwater Management  | Watercourse Management  | Watercourse Works |
|------------|---|----------------|--|--|---|---|-------------------|
| Fort Erie  | FEC Kraft Drain                         | Fort Erie      | Areas of concern and summary of local<br>opportunities outlined. Peak flow comparison<br>completed for existing v future land uses.<br>Further study required for SWM assessment<br>and volumetric sizing. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Problem areas, monitoring needs and<br>recommendations identified. Further study<br>required to determine any W/C management<br>opportunities as part of future development.                                    | _                 |
| Fort Erie  | FEC Niagara River 15                    | Fort Erie      | LMA existing key issues summarized. General<br>management actions provided. Further study<br>is required for assessment and sizing of SWM<br>for future greenfield, infill & re-development.               | Small drainage areas (i.e. directly draining to<br>lake, etc.) were not included in the HEC-HMS<br>modelling. Further study required to determine<br>local sensitivities to water budget, and<br>determine impliciations/mitigation options for<br>future development.   | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Add stream/drain buffers, and design urban<br>expansion with well buffered, naturalized<br>waterways. Further study required to<br>determine any W/C management<br>opportunities as part of future development. | -                 |
| Fort Erie  | FEC Niagara River 17                    | Fort Erie      | Subwatershed not found in the studies reviewed - requires further study.   | Small drainage areas (i.e. directly draining to<br>lake, etc.) were not included in the HEC-HMS<br>modelling. Further study required to determine<br>local sensitivities to water budget, and<br>determine impliciations/mitigation options for<br>future development.   | Subwatershed not found in the studies reviewed - requires further study.  | Subwatershed not found in the studies reviewed - requires further study.  | -                 |
| Fort Erie  | FEC Niagara River 18C, 18D,<br>18F, 18H | Fort Erie      | Subwatershed not found in the studies reviewed - requires further study.   | Small drainage areas (i.e. directly draining to<br>lake, etc.) were not included in the HEC-HMS<br>modelling. Further study required to determine<br>local sensitivities to water budget, and<br>determine impliciations/mitigation options for<br>future development.   | Subwatershed not found in the studies reviewed - requires further study.  | Subwatershed not found in the studies reviewed - requires further study.  | -                 |
| Fort Erie  | FEC Six Mile Creek Lake Erie            | Fort Erie      | Areas of concern and summary of local<br>opportunities outlined. Peak flow comparison<br>completed for existing v future land uses.<br>Further study required for SWM assessment<br>and volumetric sizing. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Problem areas, monitoring needs and<br>recommendations identified. Further study<br>required to determine any W/C management<br>opportunities as part of future development.                                    | -                 |

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| Gap | Allalysis |  |

| LIGHT BLUE = MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |
|------------------------|---------------------------|-----------------|
|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |

| Watersheds | Subwatersheds                           | Municipalities | SAR / Fishery Management   | Wetlands  | HDF Classification<br>/Management  | Climate Change   |
|------------|---|----------------|--|---|--|--|
| Fort Erie  | FEC Kraft Drain                         | Fort Erie      | <ul> <li>Species information available at a system scale and for most or all higher order watercourses. Gaps anticipated to exist in lower order streams.</li> <li>Updated SAR species information and mapping generally available through current information sources.</li> <li>Mangement direction and objectives for fish include some specific recommendations, but could be expanded or refined. Management direction and objectives for SAR limited or not present.</li> </ul> | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Refined targets or other<br>management objectives should<br>be considered.<br>One direction is made re:<br>restoration / enhancement to<br>slough forests. Further refinment<br>may be warranted. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed, with specific for<br>NHS. No mitigation strategies<br>outlined specific to the watershed<br>- further study required. |
| Fort Erie  | FEC Niagara River 15                    | Fort Erie      | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish include<br>some specific recommendations, but could be<br>expanded or refined. Management direction and<br>objectives for SAR limited or not present.            | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Refined targets or other<br>management objectives should<br>be considered.<br>One direction is made re:<br>restoration / enhancement to<br>slough forests. Further refinment<br>may be warranted. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -  |
| Fort Erie  | FEC Niagara River 17                    | Fort Erie      | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.   | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Refined targets or other<br>management objectives should<br>be considered.<br>One direction is made re:<br>restoration / enhancement to<br>slough forests. Further refinment                      | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -  |
| Fort Erie  | FEC Niagara River 18C, 18D,<br>18F, 18H | Fort Erie      | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.   | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Refined targets or other<br>management objectives should<br>be considered.<br>One direction is made re:<br>restoration / enhancement to<br>slough forests. Further refinment<br>may be warranted. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -  |
| Fort Erie  | FEC Six Mile Creek Lake Erie            | Fort Erie      | <ul> <li>Species information available at a system scale and for most or all higher order watercourses. Gaps anticipated to exist in lower order streams.</li> <li>Updated SAR species information and mapping generally available through current information sources.</li> <li>Mangement direction and objectives for fish include some specific recommendations, but could be expanded or refined. Management direction and objectives for SAR limited or not present.</li> </ul> | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Refined targets or other<br>management objectives should<br>be considered.<br>One direction is made re:<br>restoration / enhancement to<br>slough forests. Further refinment<br>may be warranted. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed, with specific for<br>NHS. No mitigation strategies<br>outlined specific to the watershed<br>- further study required. |

| Gap | Analysis |
|-----|----------|
|     |          |

| LIGHT BLUE = MAJOR GAP | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
|                        | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds                                | Subwatersheds           | Municipalities | Applicable Watershed<br>Plan/Study                                   | Supplemental Studies (if any)  | Hydrologic Modelling  | Hydraulic Modelling  | Floodline Mapping  | Water Quality  | Erosion Control  |
|---|-------------------------|----------------|--|--|---|--|--|--|--|
| Fifteen, Sixteen, Eighteen Mile<br>Creeks | FSEM Fifteen Mile Creek | Pelham         | Fifteen-Sixteen-Eighteen Mile<br>Creek Watershed Plan, NPCA,<br>2008 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009), Fifteen-<br>Sixteen-Eighteen Mile Creeks<br>Watershed Geomorphic Assessment<br>(NPCA, 2006) | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues summarized. Further<br>study required for mitigation plan<br>for future greenfield, infill & re-<br>development.  | Further study required for problem areas,<br>erosion thresholds and volumetric sizing.   |
| Grimsby                                   | GR Forty Mile Creek     | Grimsby        | N/A - Check Regional Level<br>Guidance                               | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Grimbsy LMA #1.2   | No hydrological modelling found   | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development. | LMA key issues summarized related to<br>shoreline erosion. General management actions<br>provided. Further study is required to determine<br>erosion thresholds for receiving w/c and SWM<br>erosion control sizing with respect to future<br>development. |
| Grimsby                                   | GR Lake Ontario 35      | Grimsby        | N/A - Check Regional Level<br>Guidance                               | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Beamsville LMA #1.3  | No hydrological modelling found   | No hydraulic modelling found.  | No floodplain mapping<br>found                               | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development. | LMA key issues summarized related to<br>shoreline erosion. General management actions<br>provided. Further study is required to determine<br>erosion thresholds for receiving w/c and SWM<br>erosion control sizing with respect to future<br>development. |
| Grimsby                                   | GR Lake Ontario 37      | Grimsby        | N/A - Check Regional Level<br>Guidance                               | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Beamsville LMA #1.3  | No hydrological modelling found   | No hydraulic modelling found.  | No floodplain mapping<br>found                               | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development. | LMA key issues summarized related to<br>shoreline erosion. General management actions<br>provided. Further study is required to determine<br>erosion thresholds for receiving w/c and SWM<br>erosion control sizing with respect to future<br>development. |
| Grimsby                                   | GR Lake Ontario 38      | Grimsby        | N/A - Check Regional Level<br>Guidance                               | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Beamsville LMA #1.3  | No hydrological modelling found   | No hydraulic modelling found.  | No floodplain mapping<br>found                               | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development. | LMA key issues summarized related to<br>shoreline erosion. General management actions<br>provided. Further study is required to determine<br>erosion thresholds for receiving w/c and SWM<br>erosion control sizing with respect to future<br>development. |
| Grimsby                                   | GR Lake Ontario 39      | Grimsby        | N/A - Check Regional Level<br>Guidance                               | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Beamsville LMA #1.3  | No hydrological modelling found   | No hydraulic modelling found.  | No floodplain mapping<br>found                               | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development. | LMA key issues summarized related to<br>shoreline erosion. General management actions<br>provided. Further study is required to determine<br>erosion thresholds for receiving w/c and SWM<br>erosion control sizing with respect to future<br>development. |

| LIGHT BLUE = MAJOR GAP | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
|                        | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds                                | Subwatersheds           | Municipalities | Flood Control  | Water Balance/Budget   | Groundwater Management  | Watercourse Management  | Watercourse Works |
|---|-------------------------|----------------|--|--|---|---|-------------------|
| Fifteen, Sixteen, Eighteen Mile<br>Creeks | FSEM Fifteen Mile Creek | Pelham         | Further study is required for assessment and<br>sizing of SWM for future greenfield, infill & re-<br>development.  | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Problem areas, monitoring needs and<br>recommendations identified. Further study<br>required to determine any W/C management<br>opportunities as part of future development.        |                   |
| Grimsby                                   | GR Forty Mile Creek     | Grimsby        | LMA existing key issues summarized. General<br>management actions provided. Further study<br>is required for assessment and sizing of SWM<br>for future greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Shore erosion briefly characterized. General<br>recommendations provided. Further study<br>required to determine any W/C management<br>opportunities as part of future development. | -                 |
| Grimsby                                   | GR Lake Ontario 35      | Grimsby        | LMA existing key issues summarized. General<br>management actions provided. Further study<br>is required for assessment and sizing of SWM<br>for future greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Shore erosion briefly characterized. General<br>recommendations provided. Further study<br>required to determine any W/C management<br>opportunities as part of future development. | -                 |
| Grimsby                                   | GR Lake Ontario 37      | Grimsby        | LMA existing key issues summarized. General<br>management actions provided. Further study<br>is required for assessment and sizing of SWM<br>for future greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Shore erosion briefly characterized. General<br>recommendations provided. Further study<br>required to determine any W/C management<br>opportunities as part of future development. | -                 |
| Grimsby                                   | GR Lake Ontario 38      | Grimsby        | LMA existing key issues summarized. General<br>management actions provided. Further study<br>is required for assessment and sizing of SWM<br>for future greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Shore erosion briefly characterized. General<br>recommendations provided. Further study<br>required to determine any W/C management<br>opportunities as part of future development. | -                 |
| Grimsby                                   | GR Lake Ontario 39      | Grimsby        | LMA existing key issues summarized. General<br>management actions provided. Further study<br>is required for assessment and sizing of SWM<br>for future greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Shore erosion briefly characterized. General<br>recommendations provided. Further study<br>required to determine any W/C management<br>opportunities as part of future development. | -                 |

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| Watersheds                                | Subwatersheds           | Municipalities | SAR / Fishery Management  | Wetlands   | HDF Classification<br>/Management  | Climate Change  |
|---|-------------------------|----------------|---|--|--|---|
| Fifteen, Sixteen, Eighteen Mile<br>Creeks | FSEM Fifteen Mile Creek | Pelham         | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish include<br>some specific recommendations, but could be<br>expanded or refined. Management direction and<br>objectives for SAR limited or not present. | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Refined targets or other<br>management objectives should<br>be considered.<br>Criteria review completed to<br>consider potentially suitable<br>areas for restoration /<br>enhancement. Refinement of<br>targets may be warranted to<br>provide further direction.<br>Completed at the broader<br>watershed scale (map provided). | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| Grimsby                                   | GR Forty Mile Creek     | Grimsby        | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.  | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -   |
| Grimsby                                   | GR Lake Ontario 35      | Grimsby        | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.  | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -   |
| Grimsby                                   | GR Lake Ontario 37      | Grimsby        | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.  | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -   |
| Grimsby                                   | GR Lake Ontario 38      | Grimsby        | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.  | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -   |
| Grimsby                                   | GR Lake Ontario 39      | Grimsby        | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.  | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -   |

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|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
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| LIGHT BLUE = MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds    | Subwatersheds       | Municipalities | Applicable Watershed<br>Plan/Study     | Supplemental Studies (if any)  | Hydrologic Modelling            | Hydraulic Modelling  | Floodline Mapping  | Water Quality   | Erosion Control   |
|---------------|---------------------|----------------|--|--|---------------------------------|--|--|---|---|
| Grimsby       | GR Lake Ontario 44  | Grimsby        | N/A - Check Regional Level<br>Guidance | Surface Water Intake Protection Zone<br>SWP AR (GIS data), NPCA 2019.<br>Source Protection Plan for Niagara<br>Peninsula Source Protection Area,<br>(NPCA, 2013) | No hydrological modelling found | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | IPZ identified in the<br>subwatershed (relevant policies<br>to be followed), however no other<br>key issues found in the studies<br>reviewed - further study is<br>required to identify potential<br>issues and mitigation plan<br>accordingly. | Further study required for problem areas, erosion thresholds and volumetric sizing. |
| Grimsby       | GR Lake Ontario 44A | Grimsby        | N/A - Check Regional Level<br>Guidance | Surface Water Intake Protection Zone<br>SWP AR (GIS data), NPCA 2019.<br>Source Protection Plan for Niagara<br>Peninsula Source Protection Area,<br>(NPCA, 2013) | No hydrological modelling found | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | IPZ identified in the<br>subwatershed (relevant policies<br>to be followed), however no other<br>key issues found in the studies<br>reviewed - further study is<br>required to identify potential<br>issues and mitigation plan<br>accordingly. | Further study required for problem areas, erosion thresholds and volumetric sizing. |
| Miscellaneous | LAKE ONTARIO 22     | Lincoln        | N/A - Check Regional Level<br>Guidance | -  | No hydrological modelling found | No hydraulic modelling found.  | No floodplain mapping<br>found                               | Subwatershed not found in the studies reviewed - requires further study.  | Subwatershed not found in the studies reviewed<br>- requires further study.         |
| Miscellaneous | LAKE ONTARIO 36     | Grimsby        | N/A - Check Regional Level<br>Guidance | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Grimbsy LMA #1.2   | No hydrological modelling found | No hydraulic modelling found.  | No floodplain mapping<br>found                               | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development.  | Further study required for problem areas, erosion thresholds and volumetric sizing. |
| Miscellaneous | LAKE ONTARIO 37     | Grimsby        | N/A - Check Regional Level<br>Guidance | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Beamsville LMA #1.3  | No hydrological modelling found | No hydraulic modelling found.  | No floodplain mapping<br>found                               | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development.  | Further study required for problem areas, erosion thresholds and volumetric sizing. |
| Miscellaneous | LAKE ONTARIO 40     | Grimsby        | N/A - Check Regional Level<br>Guidance | Surface Water Intake Protection Zone<br>SWP AR (GIS data), NPCA 2019.<br>Source Protection Plan for Niagara<br>Peninsula Source Protection Area,<br>(NPCA, 2013) | No hydrological modelling found | No hydraulic modelling found.  | No floodplain mapping<br>found                               | IPZ identified in the<br>subwatershed, however no other<br>key issues found in the studies<br>reviewed - further study is<br>required to identify potential<br>issues and mitigation plan<br>accordingly.                                       | Further study required for problem areas, erosion thresholds and volumetric sizing. |
| Miscellaneous | LAKE ONTARIO 41     | Grimsby        | N/A - Check Regional Level<br>Guidance | Surface Water Intake Protection Zone<br>SWP AR (GIS data), NPCA 2019.<br>Source Protection Plan for Niagara<br>Peninsula Source Protection Area,<br>(NPCA, 2013) | No hydrological modelling found | No hydraulic modelling found.  | No floodplain mapping<br>found                               | IPZ identified in the<br>subwatershed, however no other<br>key issues found in the studies<br>reviewed - further study is<br>required to identify potential<br>issues and mitigation plan<br>accordingly.                                       | Further study required for problem areas, erosion thresholds and volumetric sizing. |

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| LIGHT BLUE = MAJOR GAP | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
|                        | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds    | Subwatersheds       | Municipalities | Flood Control  | Water Balance/Budget   | Groundwater Management   | Watercourse Management  | Watercourse Works |
|---------------|---------------------|----------------|--|--|--|---|-------------------|
| Grimsby       | GR Lake Ontario 44  | Grimsby        | Further study is required for identification of at<br>risk areas, assessment and sizing of SWM for<br>future greenfield, infill & re-development.  | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in SPP. Further study<br>is recommended for updated<br>inventory of contaminant sources<br>and management plan .   | Further study required to determine any W/C<br>management requirements and/or<br>opportunities as part of future development.   | -                 |
| Grimsby       | GR Lake Ontario 44A | Grimsby        | Further study is required for identification of at risk areas, assessment and sizing of SWM for future greenfield, infill & re-development.  | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in SPP. Further study<br>is recommended for updated<br>inventory of contaminant sources<br>and management plan .   | Further study required to determine any W/C<br>management requirements and/or<br>opportunities as part of future development.   | -                 |
| Miscellaneous | LAKE ONTARIO 22     | Lincoln        | Subwatershed not found in the studies reviewed - requires further study.   | Small drainage areas (i.e. directly draining to<br>lake, etc.) were not included in the HEC-HMS<br>modelling. Further study required to determine<br>local sensitivities to water budget, and<br>determine impliciations/mitigation options for<br>future development.   | Subwatershed not found in the studies reviewed - requires further study.   | Subwatershed not found in the studies reviewed - requires further study.  | -                 |
| Miscellaneous | LAKE ONTARIO 36     | Grimsby        | LMA existing key issues summarized. General<br>management actions provided. Further study<br>is required for assessment and sizing of SWM<br>for future greenfield, infill & re-development. | Small drainage areas (i.e. directly draining to<br>lake, etc.) were not included in the HEC-HMS<br>modelling. Further study required to determine<br>local sensitivities to water budget, and<br>determine impliciations/mitigation options for<br>future development.   | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan .  | Shore erosion briefly characterized. General<br>recommendations provided. Further study<br>required to determine any W/C management<br>opportunities as part of future development. | -                 |
| Miscellaneous | LAKE ONTARIO 37     | Grimsby        | LMA existing key issues summarized. General<br>management actions provided. Further study<br>is required for assessment and sizing of SWM<br>for future greenfield, infill & re-development. | Small drainage areas (i.e. directly draining to<br>lake, etc.) were not included in the HEC-HMS<br>modelling. Further study required to determine<br>local sensitivities to water budget, and<br>determine impliciations/mitigation options for<br>future development.   | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan .  | Shore erosion briefly characterized. General<br>recommendations provided. Further study<br>required to determine any W/C management<br>opportunities as part of future development. | -                 |
| Miscellaneous | LAKE ONTARIO 40     | Grimsby        | Further study is required for identification of at<br>risk areas, assessment and sizing of SWM for<br>future greenfield, infill & re-development.  | Small drainage areas (i.e. directly draining to<br>lake, etc.) were not included in the HEC-HMS<br>modelling. Further study required to determine<br>local sensitivities to water budget, and<br>determine impliciations/mitigation options for<br>future development.   | IPZ located in subwatershed.<br>Threat policies for IPZ<br>associated with Grimsby not<br>developed due to low<br>vulnerability score. Further study<br>is recommended for updated<br>inventory of contaminant sources<br>and management plan. | Further study required to determine any W/C<br>management requirements and/or<br>opportunities as part of future development.   | -                 |
| Miscellaneous | LAKE ONTARIO 41     | Grimsby        | Further study is required for identification of at<br>risk areas, assessment and sizing of SWM for<br>future greenfield, infill & re-development.  | Small drainage areas (i.e. directly draining to<br>lake, etc.) were not included in the HEC-HMS<br>modelling. Further study required to determine<br>local sensitivities to water budget, and<br>determine impliciations/mitigation options for<br>future development.   | IPZ located in subwatershed.<br>Threat policies for IPZ<br>associated with Grimsby not<br>developed due to low<br>vulnerability score. Further study<br>is recommended for updated<br>inventory of contaminant sources<br>and management plan. | Further study required to determine any W/C<br>management requirements and/or<br>opportunities as part of future development.   | -                 |

| Gap Analysis |                 |
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| Gap Analysis           |                           |                 |  |  |  |  |  |  |  |
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|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |  |  |  |  |  |  |  |
| LIGHT BLUE - MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |  |  |  |  |  |  |  |
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| Watersheds    | Subwatersheds       | Municipalities | SAR / Fishery Management   | Wetlands  | HDF Classification<br>/Management  | Climate Change |
|---------------|---------------------|----------------|--|---|--|----------------|
| Grimsby       | GR Lake Ontario 44  | Grimsby        | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies. | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -              |
| Grimsby       | GR Lake Ontario 44A | Grimsby        | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies. | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -              |
| Miscellaneous | LAKE ONTARIO 22     | Lincoln        | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies. | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -              |
| Miscellaneous | LAKE ONTARIO 36     | Grimsby        | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies. | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -              |
| Miscellaneous | LAKE ONTARIO 37     | Grimsby        | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies. | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -              |
| Miscellaneous | LAKE ONTARIO 40     | Grimsby        | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies. | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -              |
| Miscellaneous | LAKE ONTARIO 41     | Grimsby        | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies. | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -              |

| Gap Allalysis          |                           |                 |
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|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
| LIGHT BLUE - MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds            | Subwatersheds                       | Municipalities | Applicable Watershed<br>Plan/Study                  | Supplemental Studies (if any)  | Hydrologic Modelling  | Hydraulic Modelling  | Floodline Mapping  | Water Quality   | Erosion Control  |
|-----------------------|-------------------------------------|----------------|---|--|---|--|--|---|--|
| Miscellaneous         | LAKE ONTARIO 42                     | Grimsby        | N/A - Check Regional Level<br>Guidance              | Surface Water Intake Protection Zone<br>SWP AR (GIS data), NPCA 2019.<br>Source Protection Plan for Niagara<br>Peninsula Source Protection Area,<br>(NPCA, 2013)   | No hydrological modelling found   | No hydraulic modelling found.  | No floodplain mapping<br>found                               | IPZ identified in the<br>subwatershed, however no other<br>key issues found in the studies<br>reviewed - further study is<br>required to identify potential<br>issues and mitigation plan<br>accordingly. | Further study required for problem areas, erosion thresholds and volumetric sizing.  |
| Miscellaneous         | LAKE ONTARIO 43                     | Grimsby        | N/A - Check Regional Level<br>Guidance              | Surface Water Intake Protection Zone<br>SWP AR (GIS data), NPCA 2019.<br>Source Protection Plan for Niagara<br>Peninsula Source Protection Area,<br>(NPCA, 2013)   | No hydrological modelling found   | No hydraulic modelling found.  | No floodplain mapping<br>found                               | IPZ identified in the<br>subwatershed, however no other<br>key issues found in the studies<br>reviewed - further study is<br>required to identify potential<br>issues and mitigation plan<br>accordingly. | Further study required for problem areas, erosion thresholds and volumetric sizing.  |
| Lincoln               | LIN Bartlett                        | Lincoln        | N/A - Check Regional Level<br>Guidance              | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Beamsville LMA #1.3  | No hydrological modelling found   | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development.                                    | LMA key issues and problem areas<br>summarized. General management actions<br>provided. No erosion thresholds or sizing details<br>provided - requires further study.  |
| Lincoln               | LIN Beamsville<br>Creek/KonkleCreek | Lincoln        | N/A - Check Regional Level<br>Guidance              | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Beamsville LMA #1.3  | No hydrological modelling found   | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development.                                    | LMA key issues and problem areas<br>summarized. General management actions<br>provided. No erosion thresholds or sizing details<br>provided - requires further study.  |
| Lincoln               | LIN Lake Ontario 23                 | Lincoln        | N/A - Check Regional Level<br>Guidance              | -  | No hydrological modelling found   | No hydraulic modelling found.  | No floodplain mapping<br>found                               | Subwatershed not found in the studies reviewed - requires further study.  | Subwatershed not found in the studies reviewed<br>- requires further study.  |
| Lincoln               | LIN Lake Ontario 26                 | Lincoln        | N/A - Check Regional Level<br>Guidance              | -  | No hydrological modelling found   | No hydraulic modelling found.  | No floodplain mapping<br>found                               | Subwatershed not found in the studies reviewed - requires further study.  | Subwatershed not found in the studies reviewed<br>- requires further study.  |
| Lake Erie North Shore | LENS Bay Beach Area Drain           | Fort Erie      | Lake Erie North Shore<br>Watershed Plan, NPCA, 2010 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009. Lake Erie<br>North Shore Watershed Geomorphic<br>Assessment, NPCA, 2009. Surface<br>Water Intake Protection Zone SWP<br>AR (GIS data), NPCA 2019. Source<br>Protection Plan for Niagara Peninsula<br>Source Protection Area, (NPCA,<br>2013). Stormwater Management<br>Policies and Guidelines (AECOM<br>2010) | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | IPZ identified in the<br>subwatershed, however no other<br>key issues found in the studies<br>reviewed - further study is<br>required to identify potential<br>issues and mitigation plan<br>accordingly. | General watershed objective for erosion control,<br>reference to regional level guidance for BMPs.<br>Geomorphic Study identifies areas of concern<br>and characterization of w/c. Further study is<br>required to determine erosion thresholds for<br>receiving w/c and SWM erosion control sizing<br>with respect to future development. |

|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
| LIGHT BLUE - MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds            | Subwatersheds                       | Municipalities | Flood Control  | Water Balance/Budget   | Groundwater Management   | Watercourse Management  | Watercourse Works |
|-----------------------|-------------------------------------|----------------|--|--|--|---|-------------------|
| Miscellaneous         | LAKE ONTARIO 42                     | Grimsby        | Further study is required for identification of at<br>risk areas, assessment and sizing of SWM for<br>future greenfield, infill & re-development.  | Small drainage areas (i.e. directly draining to<br>lake, etc.) were not included in the HEC-HMS<br>modelling. Further study required to determine<br>local sensitivities to water budget, and<br>determine impliciations/mitigation options for<br>future development.   | IPZ located in subwatershed.<br>Threat policies for IPZ<br>associated with Grimsby not<br>developed due to low<br>vulnerability score. Further study<br>is recommended for updated<br>inventory of contaminant sources<br>and management plan. | Further study required to determine any W/C<br>management requirements and/or<br>opportunities as part of future development.   | -                 |
| Miscellaneous         | LAKE ONTARIO 43                     | Grimsby        | Further study is required for identification of at risk areas, assessment and sizing of SWM for future greenfield, infill & re-development.  | Small drainage areas (i.e. directly draining to<br>lake, etc.) were not included in the HEC-HMS<br>modelling. Further study required to determine<br>local sensitivities to water budget, and<br>determine impliciations/mitigation options for<br>future development.   | IPZ located in subwatershed.<br>Threat policies for IPZ<br>associated with Grimsby not<br>developed due to low<br>vulnerability score. Further study<br>is recommended for updated<br>inventory of contaminant sources<br>and management plan. | Further study required to determine any W/C<br>management requirements and/or<br>opportunities as part of future development.   | -                 |
| Lincoln               | LIN Bartlett                        | Lincoln        | Areas of flood concern identified. Further<br>study is required for assessment and sizing of<br>SWM for future greenfield, infill & re-<br>development.  | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan .  | Shore erosion briefly characterized. General<br>recommendations provided. Further study<br>required to determine any W/C management<br>opportunities as part of future development. | -                 |
| Lincoln               | LIN Beamsville<br>Creek/KonkleCreek | Lincoln        | Areas of flood concern identified. Further<br>study is required for assessment and sizing of<br>SWM for future greenfield, infill & re-<br>development.  | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan .  | Shore erosion briefly characterized. General<br>recommendations provided. Further study<br>required to determine any W/C management<br>opportunities as part of future development. | -                 |
| Lincoln               | LIN Lake Ontario 23                 | Lincoln        | Subwatershed not found in the studies reviewed - requires further study.   | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Subwatershed not found in the studies reviewed - requires further study.   | Subwatershed not found in the studies reviewed - requires further study.  | -                 |
| Lincoln               | LIN Lake Ontario 26                 | Lincoln        | Subwatershed not found in the studies reviewed - requires further study.   | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Subwatershed not found in the studies reviewed - requires further study.   | Subwatershed not found in the studies reviewed - requires further study.  | -                 |
| Lake Erie North Shore | LENS Bay Beach Area Drain           | Fort Erie      | General policies and guidelines for flood<br>control, reference to regional level guidance<br>for BMPs (AECOM). Further study is required<br>for assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan .  | Further study required to determine any W/C<br>management requirements and/or<br>opportunities as part of future development.   | -                 |

| Gap Analysis |        |
|--------------|--------|
|              | PURPLE |

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|--|---------------------------|-----------------|
|  | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
| LIGHT BLUE = MAJOR GAP                 | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds            | Subwatersheds                       | Municipalities | SAR / Fishery Management   | Wetlands  | HDF Classification<br>/Management  | Climate Change  |
|-----------------------|-------------------------------------|----------------|--|---|--|---|
| Miscellaneous         | LAKE ONTARIO 42                     | Grimsby        | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.     | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.   | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -   |
| Miscellaneous         | LAKE ONTARIO 43                     | Grimsby        | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.     | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.   | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -   |
| Lincoln               | LIN Bartlett                        | Lincoln        | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.     | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.   | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -   |
| Lincoln               | LIN Beamsville<br>Creek/KonkleCreek | Lincoln        | Little to no fisheries information and limited or no<br>habitat information available.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>No mangement direction and objectives for fish and<br>no direction on SAR. | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.   | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -   |
| Lincoln               | LIN Lake Ontario 23                 | Lincoln        | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.     | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.   | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -   |
| Lincoln               | LIN Lake Ontario 26                 | Lincoln        | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.     | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.   | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -   |
| Lake Erie North Shore | LENS Bay Beach Area Drain           | Fort Erie      | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.     | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>Very general direction provided.<br>Refined targets or other<br>management objectives should<br>be considered. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |

| Gap Analysis           |                           |
|------------------------|---------------------------|
|                        | PURPLE = PARTIAL GAP / TO |
| LIGHT DLUE - WAJUK GAP |                           |

|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
| LIGHT BLUE = MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds            | Subwatersheds          | Municipalities | Applicable Watershed<br>Plan/Study                  | Supplemental Studies (if any)  | Hydrologic Modelling  | Hydraulic Modelling  | Floodline Mapping  | Water Quality  | Erosion Control  |
|-----------------------|------------------------|----------------|---|--|---|--|--|--|--|
| Lake Erie North Shore | LENS Eagle March Drain | Port Colborne  | Lake Erie North Shore<br>Watershed Plan, NPCA, 2011 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009. Lake Erie<br>North Shore Watershed Geomorphic<br>Assessment, NPCA, 2009. Surface<br>Water Intake Protection Zone SWP<br>AR (GIS data), NPCA 2019. Source<br>Protection Plan for Niagara Peninsula<br>Source Protection Area, (NPCA,<br>2013). Stormwater Management<br>Policies and Guidelines (AECOM<br>2010) | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development. IPZ identified in the<br>subwatershed, however no other<br>key issues found in the studies<br>reviewed - further study is<br>required to identify potential<br>issues and mitigation plan<br>accordingly. | General watershed objective for erosion control,<br>reference to regional level guidance for BMPs.<br>Geomorphic Study identifies areas of concern<br>and characterization of w/c. Further study is<br>required to determine erosion thresholds for<br>receiving w/c and SWM erosion control sizing<br>with respect to future development. |
| Lake Erie North Shore | LENS Lake Erie 2       | Fort Erie      | Lake Erie North Shore<br>Watershed Plan, NPCA, 2012 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009. Lake Erie<br>North Shore Watershed Geomorphic<br>Assessment, NPCA, 2009. Surface<br>Water Intake Protection Zone SWP<br>AR (GIS data), NPCA 2019. Source<br>Protection Plan for Niagara Peninsula<br>Source Protection Area, (NPCA,<br>2013). Stormwater Management<br>Policies and Guidelines (AECOM<br>2010) | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | IPZ identified in the<br>subwatershed, however no other<br>key issues found in the studies<br>reviewed - further study is<br>required to identify potential<br>issues and mitigation plan<br>accordingly.  | General watershed objective for erosion control,<br>reference to regional level guidance for BMPs.<br>Geomorphic Study identifies areas of concern<br>and characterization of w/c. Further study is<br>required to determine erosion thresholds for<br>receiving w/c and SWM erosion control sizing<br>with respect to future development. |
| Lake Erie North Shore | LENS Lake Erie 2B      | Fort Erie      | Lake Erie North Shore<br>Watershed Plan, NPCA, 2010 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009. Lake Erie<br>North Shore Watershed Geomorphic<br>Assessment, NPCA, 2009. Surface<br>Water Intake Protection Zone SWP<br>AR (GIS data), NPCA 2019. Source<br>Protection Plan for Niagara Peninsula<br>Source Protection Area, (NPCA,<br>2013). Stormwater Management<br>Policies and Guidelines (AECOM<br>2010) | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | No hydraulic modelling found.  | No floodplain mapping<br>found                               | IPZ identified in adjacent<br>subwatershed/lake outlet,<br>however no other key issues<br>found in the studies reviewed -<br>further study is required to<br>identify potential issues and<br>mitigation plan accordingly.   | General watershed objective for erosion control,<br>reference to regional level guidance for BMPs.<br>Geomorphic Study identifies areas of concern<br>and characterization of w/c. Further study is<br>required to determine erosion thresholds for<br>receiving w/c and SWM erosion control sizing<br>with respect to future development. |
| Lake Erie North Shore | LENS Lake Erie 4       | Port Colborne  | Lake Erie North Shore<br>Watershed Plan, NPCA, 2013 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009. Lake Erie<br>North Shore Watershed Geomorphic<br>Assessment, NPCA, 2009. Surface<br>Water Intake Protection Zone SWP<br>AR (GIS data), NPCA 2019. Source<br>Protection Plan for Niagara Peninsula<br>Source Protection Area, (NPCA,<br>2013). Stormwater Management<br>Policies and Guidelines (AECOM<br>2010) | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | IPZ identified in the<br>subwatershed, however no other<br>key issues found in the studies<br>reviewed - further study is<br>required to identify potential<br>issues and mitigation plan<br>accordingly.  | General watershed objective for erosion control,<br>reference to regional level guidance for BMPs.<br>Geomorphic Study identifies areas of concern<br>and characterization of w/c. Further study is<br>required to determine erosion thresholds for<br>receiving w/c and SWM erosion control sizing<br>with respect to future development. |
| Lake Erie North Shore | LENS Wignell Drain     | Port Colborne  | Lake Erie North Shore<br>Watershed Plan, NPCA, 2014 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009. Lake Erie<br>North Shore Watershed Geomorphic<br>Assessment, NPCA, 2009. Surface<br>Water Intake Protection Zone SWP<br>AR (GIS data), NPCA 2019. Source<br>Protection Plan for Niagara Peninsula<br>Source Protection Area, (NPCA,<br>2013). Stormwater Management<br>Policies and Guidelines (AECOM<br>2010) | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development. IPZ identified in the<br>subwatershed, however no other<br>key issues found in the studies<br>reviewed - further study is<br>required to identify potential<br>issues and mitigation plan<br>accordingly. | General watershed objective for erosion control,<br>reference to regional level guidance for BMPs.<br>Geomorphic Study identifies areas of concern<br>and characterization of w/c. Further study is<br>required to determine erosion thresholds for<br>receiving w/c and SWM erosion control sizing<br>with respect to future development. |

| Gap | Analysis |
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|     |          |

|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
| LIGHT BLUE - MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds            | Subwatersheds          | Municipalities | Flood Control  | Water Balance/Budget  | Groundwater Management  | Watercourse Management   |
|-----------------------|------------------------|----------------|--|---|---|--|
| Lake Erie North Shore | LENS Eagle March Drain | Port Colborne  | General policies and guidelines for flood<br>control, reference to regional level guidance<br>for BMPs (AECOM). Further study is required<br>for assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development.  | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Further study required to determine any W/o<br>management requirements and/or<br>opportunities as part of future development |
| Lake Erie North Shore | LENS Lake Erie 2       | Fort Erie      | General policies and guidelines for flood<br>control, reference to regional level guidance<br>for BMPs (AECOM). Further study is required<br>for assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development.  | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Further study required to determine any W/0<br>management requirements and/or<br>opportunities as part of future development |
| Lake Erie North Shore | LENS Lake Erie 2B      | Fort Erie      | General policies and guidelines for flood<br>control, reference to regional level guidance<br>for BMPs (AECOM). Further study is required<br>for assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HIMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Further study required to determine any W/o<br>management requirements and/or<br>opportunities as part of future development |
| Lake Erie North Shore | LENS Lake Erie 4       | Port Colborne  | General policies and guidelines for flood<br>control, reference to regional level guidance<br>for BMPs (AECOM). Further study is required<br>for assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development.  | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Further study required to determine any W/0<br>management requirements and/or<br>opportunities as part of future development |
| Lake Erie North Shore | LENS Wignell Drain     | Port Colborne  | General policies and guidelines for flood<br>control, reference to regional level guidance<br>for BMPs (AECOM). Further study is required<br>for assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development.  | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Further study required to determine any W/0<br>management requirements and/or<br>opportunities as part of future development |



| Gap / | Analysis |
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|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
| LIGHT BLUE - MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds            | Subwatersheds          | Municipalities | SAR / Fishery Management   | Wetlands  | HDF Classification<br>/Management  | Climate Change  |
|-----------------------|------------------------|----------------|--|---|--|---|
| Lake Erie North Shore | LENS Eagle March Drain | Port Colborne  | <ul> <li>Species information available at a system scale and for most or all higher order watercourses. Gaps anticipated to exist in lower order streams.</li> <li>Updated SAR species information and mapping generally available through current information sources.</li> <li>Mangement direction and objectives for fish are very limited. No direction on SAR is provided.</li> </ul> | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Some general locations identified<br>for enhancement and restoration.<br>Suitabilty criteria assessmenet<br>completed, consider refined<br>direction or targets to support<br>management direction. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| Lake Erie North Shore | LENS Lake Erie 2       | Fort Erie      | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.   | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.   | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| Lake Erie North Shore | LENS Lake Erie 2B      | Fort Erie      | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.   | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.   | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| Lake Erie North Shore | LENS Lake Erie 4       | Port Colborne  | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.   | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.   | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| Lake Erie North Shore | LENS Wignell Drain     | Port Colborne  | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. No direction on SAR is provided.                  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Some general locations identified<br>for enhancement and restoration.<br>Suitabilty criteria assessmenet<br>completed, consider refined<br>direction or targets to support<br>management direction. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| Gap Analysis           |                           |                 |
|------------------------|---------------------------|-----------------|
|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
| LIGHT BLUE - MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds          | Subwatersheds               | Municipalities                         | Applicable Watershed<br>Plan/Study                            | Supplemental Studies (if any)  | Hydrologic Modelling  | Hydraulic Modelling  | Floodline Mapping  | Water Quality  | Erosion Control  |
|---------------------|-----------------------------|--|---|--|---|--|--|--|--|
| Lower Welland River | LWR Thompson Creek          | Niagara Falls, Thorold                 | Lower Welland River<br>Characterization Report,<br>NPCA, 2011 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009),<br>Beaverdams and Shriners Creek<br>Geomorphic Study, including<br>Thompsons Creek (NPCA 2010)  | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping<br>from NPCA                        | Insuffiicient water quality<br>monitoring data to provide<br>characterization at time of WS<br>Plan. Further study required for<br>identification of<br>issues/characterization, and<br>mitigation plan for future<br>greenfield, infill & re-<br>development. | General watershed objective for erosion control,<br>reference to regional level guidance for BMPs.<br>Geomorphic Study identifies areas of concern<br>and characterization of w/c. Further study is<br>required to determine erosion thresholds for<br>receiving w/c and SWM erosion control sizing<br>with respect to future development. |
| Lower Welland River | LWR Welland River           | Niagara Falls, Thorold                 | Lower Welland River<br>Characterization Report,<br>NPCA, 2011 | Groundwater Study [Waterloo<br>Hydrogeologic Inc. (WHI) 2005],<br>Water Availability Study<br>(AquaResource Inc 2009), Welland<br>River Eutrophication Study (NPCA,<br>2011). Surface Water Intake<br>Protection Zone SWP AR (GIS data),<br>NPCA 2019. Source Protection Plan<br>for Niagara Peninsula Source<br>Protection Area, (NPCA, 2013) | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Eutrophication study outlines the<br>water quality issues. Due to IPZ<br>located within subwatershed,<br>relevant IPZ policies to be<br>followed. Further study required<br>for mitigation plan for future<br>greenfield, infill & re-<br>development.         | General management actions provided. Further<br>study is required to determine erosion<br>thresholds for receiving w/c and SWM erosion<br>control sizing with respect to future<br>development.  |
| Niagara Falls Urban | NFU CHIPPAWA POWER<br>CANAL | Niagara Falls                          | N/A - Check Regional Level<br>Guidance                        | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Welland River East #2.15   | No hydrological modelling found   | No hydraulic modelling found.  | No floodplain mapping<br>found                               | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development.   | Further study required for problem areas, erosion thresholds and volumetric sizing.  |
| Niagara Falls Urban | NFU Niagara Falls Urban     | Niagara Falls, Niagara-on-the-<br>Lake | N/A - Check Regional Level<br>Guidance                        | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Welland River East #2.15   | No hydrological modelling found   | No hydraulic modelling found.  | No floodplain mapping<br>found                               | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development.   | Further study required for problem areas, erosion thresholds and volumetric sizing.  |
| Miscellaneous       | NIAGARA RIVER 6             | Niagara Falls                          | N/A - Check Regional Level<br>Guidance                        | -  | No hydrological modelling found   | No hydraulic modelling found.  | No floodplain mapping<br>found                               | Subwatershed not found in the studies reviewed - requires further study.   | Subwatershed not found in the studies reviewed<br>- requires further study.  |
| Miscellaneous       | NIAGARA RIVER 7             | Niagara Falls                          | N/A - Check Regional Level<br>Guidance                        | -  | No hydrological modelling found   | No hydraulic modelling found.  | No floodplain mapping<br>found                               | Subwatershed not found in the studies reviewed - requires further study.   | Subwatershed not found in the studies reviewed<br>- requires further study.  |

# Table WR2: NWP (E) - Watershed Plan Review

| Gap | Analysis |  |
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|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
| LIGHT BLUE = MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds          | Subwatersheds               | Municipalities                         | Flood Control Water Balance/Budget Groun  |  | Groundwater Management  | Watercourse Management  |
|---------------------|-----------------------------|--|---|--|---|---|
| Lower Welland River | LWR Thompson Creek          | Niagara Falls, Thorold                 | Further study is required for identification of at<br>risk areas, assessment and sizing of SWM for<br>future greenfield, infill & re-development.       | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Problem areas identified as part of NPCA<br>Geomorphology Study - monitoring and<br>recommendations identified. Further study<br>required to determine any W/C managemen<br>requirements and/or opportunities as part o<br>future development.  |
| Lower Welland River | LWR Welland River           | Niagara Falls, Thorold                 | Further study is required for identification of at<br>risk areas, assessment and sizing of SWM for<br>future greenfield, infill & re-development.       | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | General recommendations provided. Furthe<br>study required to determine any W/C<br>management requirements and/or<br>opportunities as part of future development  |
| Niagara Falls Urban | NFU CHIPPAWA POWER<br>CANAL | Niagara Falls                          | Areas of flood concern identified. Further<br>study is required for assessment and sizing of<br>SWM for future greenfield, infill & re-<br>development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | Key issues identified - NWQPS<br>recommended conduting an inventory of<br>eroding and erosion prone sites on area<br>streams and shorelines - unknown if this ha<br>been completed. Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part o<br>future development. |
| Niagara Falls Urban | NFU Niagara Falls Urban     | Niagara Falls, Niagara-on-the-<br>Lake | Areas of flood concern identified. Further<br>study is required for assessment and sizing of<br>SWM for future greenfield, infill & re-<br>development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan . | General recommendations provided. Furthe<br>study required to determine any W/C<br>management requirements and/or<br>opportunities as part of future development  |
| Miscellaneous       | NIAGARA RIVER 6             | Niagara Falls                          | Subwatershed not found in the studies reviewed - requires further study.  | -  | Subwatershed not found in the studies reviewed - requires further study.  | Subwatershed not found in the studies reviewed - requires further study.  |
| Miscellaneous       | NIAGARA RIVER 7             | Niagara Falls                          | Subwatershed not found in the studies reviewed - requires further study.  | -  | Subwatershed not found in the studies reviewed - requires further study.  | Subwatershed not found in the studies reviewed - requires further study.  |

# Watercourse Works Geomorphic Study specific to this subwatershed has been completed and identified several erosion sites & problem areas with specific works/recommendations. Not included in Geomorphic Study. ---

| Gap | Analysis |  |
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| LIGHT BLUE = MAJOR GAP | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
|                        | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds  | Subwatersheds         Municipalities         SAR / Fishery Management         Wetlands |   | HDF Classification<br>/Management   | Climate Change   |  |   |
|---|--|---|---|--|--|---|
| Lower Welland River   | LWR Thompson Creek   | Niagara Falls, Thorold  | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. No direction on SAR is provided. | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Some general locations identified<br>for enhancement and restoration.<br>Suitabilty criteria assessment<br>completed, consider refined<br>direction or targets to support<br>management direction. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| Lower Welland River   | LWR Welland River  | Niagara Falls, Thorold  | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. No direction on SAR is provided. | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Some general locations identified<br>for enhancement and restoration.<br>Suitabilty criteria assessment<br>completed, consider refined<br>direction or targets to support<br>management direction. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| Niagara Falls Urban   | NFU CHIPPAWA POWER<br>CANAL  | Niagara Falls   | Little to no fisheries information and limited or no<br>habitat information available.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>No mangement direction and objectives for fish and<br>no direction on SAR.  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.  | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -   |
| Niagara Falls Urban   | NFU Niagara Falls Urban  | Niagara Falls, Niagara-on-the-<br>Lake  | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.  | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -   |
| Miscellaneous   | NIAGARA RIVER 6  | Niagara Falls   | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.  | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -   |
| Miscellaneous       NIAGARA RIVER 7       Niagara Falls       Species information available at a system scale at for most or all higher order watercourses. Gaps exist in lower order streams.         Miscellaneous       NIAGARA RIVER 7       Niagara Falls       Updated SAR species information and mapping generally available through current information sources.         Not found in studies.       Not found in studies. |  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study.  | -  |  |   |

| Gap | Analysis |
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| LIGHT BLUE = MAJOR GAP | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
|                        | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds          | Subwatersheds         | Municipalities                          | Applicable Watershed<br>Plan/Study   | Supplemental Studies (if any)   | Hydrologic Modelling  | Hydraulic Modelling                                    | Floodline Mapping                                   | Water Quality  | Erosion Control   |
|---------------------|-----------------------|---|--|---|---|--|---|--|---|
| Niagara-on-the-Lake | NOTL Eight Mile Creek | Niagara-on-the-Lake                     | Niagara-on-the-Lake<br>Watershed Study, Aquafor<br>Beech Ltd, 2008   | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Niagara-on-the-Lake #1.10 | Flows estimated using Index<br>Flood Method. HEC-HMS<br>continous hydrologic model<br>developed, however focus<br>placed on groundwater/water<br>availability - not SWM / future<br>land use based. | Yes - HEC-RAS modelling<br>completed by Aquafor Beech. | Yes - Floodplain Mapping<br>from Aquafor Beech 2008 | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development.         | Erosion remediation plan / riparian zone<br>management program is recommended. Further<br>study is required to determine erosion<br>thresholds for receiving w/c and SWM erosion<br>control sizing with respect to future<br>development. |
| Niagara-on-the-Lake | NOTL Four Mile Creek  | Niagara Falls, Niagara-on-the-<br>Lake  | Niagara-on-the-Lake<br>Watershed Study, Aquafor<br>Beech Ltd, 2008   | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Niagara-on-the-Lake #1.10 | Flows estimated using Index<br>Flood Method. HEC-HMS<br>continous hydrologic model<br>developed, however focus<br>placed on groundwater/water<br>availability - not SWM / future<br>land use based. | Yes - HEC-RAS modelling<br>completed by Aquafor Beech. | Yes - Floodplain Mapping<br>from Aquafor Beech 2008 | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development.         | Erosion remediation plan / riparian zone<br>management program is recommended. Further<br>study is required to determine erosion<br>thresholds for receiving w/c and SWM erosion<br>control sizing with respect to future<br>development. |
| Niagara-on-the-Lake | NOTL Four Mile Pond   | Niagara-on-the-Lake                     | Niagara-on-the-Lake<br>Watershed Study, Aquafor<br>Beech Ltd, 2008   | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Niagara-on-the-Lake #1.10 | Flows estimated using Index<br>Flood Method. HEC-HMS<br>continous hydrologic model<br>developed, however focus<br>placed on groundwater/water<br>availability - not SWM / future<br>land use based. | Yes - HEC-RAS modelling<br>completed by Aquafor Beech. | Yes - Floodplain Mapping<br>from Aquafor Beech 2008 | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development.         | Erosion remediation plan / riparian zone<br>management program is recommended. Further<br>study is required to determine erosion<br>thresholds for receiving w/c and SWM erosion<br>control sizing with respect to future<br>development. |
| Niagara-on-the-Lake | NOTL Lake Ontario 10  | St. Catharines, Niagara-on-the-<br>Lake | Subwatershed not in watershed<br>plan - general findings from this<br>plan could be assumed/applied<br>to these areas. | -   | No hydrological modelling found   | No hydraulic modelling found.                          | No floodplain mapping<br>found                      | Subwatershed not found in the studies reviewed - requires further study.   | Subwatershed not found in the studies reviewed<br>- requires further study.   |
| Niagara-on-the-Lake | NOTL Lake Ontario 9   | St. Catharines                          | Subwatershed not in watershed<br>plan - general findings from this<br>plan could be assumed/applied<br>to these areas. | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Thorold #1.9              | No hydrological modelling found   | No hydraulic modelling found.                          | No floodplain mapping<br>found                      | Key issues summarized for LMA.<br>General management actions<br>provided. Further study required<br>for mitigation plan for future<br>greenfield, infill & re-<br>development. | Further study required for problem areas, erosion thresholds and volumetric sizing.   |
| Niagara-on-the-Lake | NOTL Six Mile Creek   | Niagara Falls, Niagara-on-the-<br>Lake  | Niagara-on-the-Lake<br>Watershed Study, Aquafor<br>Beech Ltd, 2008   | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Niagara-on-the-Lake #1.10 | Flows estimated using Index<br>Flood Method. HEC-HMS<br>continous hydrologic model<br>developed, however focus<br>placed on groundwater/water<br>availability - not SWM / future<br>land use based. | Yes - HEC-RAS modelling completed by Aquafor Beech.    | Yes - Floodplain Mapping<br>from Aquafor Beech 2008 | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development.         | Erosion remediation plan / riparian zone<br>management program is recommended. Further<br>study is required to determine erosion<br>thresholds for receiving w/c and SWM erosion<br>control sizing with respect to future<br>development. |

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| LIGHT BLUE = MAJOR GAP | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
|                        | BE CONFIRMED              | SIGNIFICANT GAP |
|                        |                           |                 |

| Watersheds          | Subwatersheds         | Municipalities                          | Flood Control   | Water Balance/Budget   | Groundwater Management  | Watercourse Management   | Watercourse Works |
|---------------------|-----------------------|---|---|--|---|--|-------------------|
| Niagara-on-the-Lake | NOTL Eight Mile Creek | Niagara-on-the-Lake                     | General management actions provided -<br>encouragement for SWM BMP<br>design/implementation for both new and<br>existing (retrofit) urban areas. Further study is<br>required for assessment and sizing of SWM<br>for future greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Low/medium susceptibility<br>identified. Groundwater recharge<br>varies across subwatershed -<br>infiltration/recharge to be<br>maintained. Baseflow also<br>specifically mentioned. Further<br>study is recommended for<br>updated inventory of<br>contaminant sources and<br>management plan. | Stream Erosion Control remediation plan<br>identified for in-stream works and on-going<br>maintenance program outlined to mitigate<br>erosion issues. Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part of<br>future development. | -                 |
| Niagara-on-the-Lake | NOTL Four Mile Creek  | Niagara Falls, Niagara-on-the-<br>Lake  | General management actions provided -<br>encouragement for SWM BMP<br>design/implementation for both new and<br>existing (retrofit) urban areas. Further study is<br>required for assessment and sizing of SWM<br>for future greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Low/medium susceptibility<br>identified. Groundwater recharge<br>varies across subwatershed -<br>infiltration/recharge to be<br>maintained. Baseflow also<br>specifically mentioned. Further<br>study is recommended for<br>updated inventory of<br>contaminant sources and<br>management plan. | Stream Erosion Control remediation plan<br>identified for in-stream works and on-going<br>maintenance program outlined to mitigate<br>erosion issues. Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part of<br>future development. | -                 |
| Niagara-on-the-Lake | NOTL Four Mile Pond   | Niagara-on-the-Lake                     | General management actions provided -<br>encouragement for SWM BMP<br>design/implementation for both new and<br>existing (retrofit) urban areas. Further study is<br>required for assessment and sizing of SWM<br>for future greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Low/medium susceptibility<br>identified. Groundwater recharge<br>varies across subwatershed -<br>infiltration/recharge to be<br>maintained. Baseflow also<br>specifically mentioned. Further<br>study is recommended for<br>updated inventory of<br>contaminant sources and<br>management plan. | Stream Erosion Control remediation plan<br>identified for in-stream works and on-going<br>maintenance program outlined to mitigate<br>erosion issues. Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part of<br>future development. | -                 |
| Niagara-on-the-Lake | NOTL Lake Ontario 10  | St. Catharines, Niagara-on-the-<br>Lake | Subwatershed not found in the studies reviewed - requires further study.  | -  | Subwatershed not found in the studies reviewed - requires further study.  | Subwatershed not found in the studies reviewed - requires further study.   | -                 |
| Niagara-on-the-Lake | NOTL Lake Ontario 9   | St. Catharines                          | Lack of existing SWM facilities identified -<br>Further study is required for assessment and<br>sizing of SWM for future greenfield, infill & re-<br>development.   | -  | Vulnerable or at-risk areas<br>identified. Further study is<br>recommended for updated<br>inventory of contaminant sources<br>and management plan .   | Identification of key issues and general<br>management recommendations. Further<br>study required to determine any W/C<br>management requirements and/or<br>opportunities as part of future development.   | -                 |
| Niagara-on-the-Lake | NOTL Six Mile Creek   | Niagara Falls, Niagara-on-the-<br>Lake  | General management actions provided -<br>encouragement for SWM BMP<br>design/implementation for both new and<br>existing (retrofit) urban areas. Further study is<br>required for assessment and sizing of SWM<br>for future greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Low/medium susceptibility<br>identified. Groundwater recharge<br>varies across subwatershed -<br>infiltration/recharge to be<br>maintained. Baseflow also<br>specifically mentioned. Further<br>study is recommended for<br>updated inventory of<br>contaminant sources and<br>management plan. | Stream Erosion Control remediation plan<br>identified for in-stream works and on-going<br>maintenance program outlined to mitigate<br>erosion issues. Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part of<br>future development. | -                 |

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|------------------------|---------------------------|-----------------|
|                        | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds          | Subwatersheds         | Municipalities                          | SAR / Fishery Management  | Wetlands   | HDF Classification<br>/Management  | Climate Change  |
|---------------------|-----------------------|---|---|--|--|---|
| Niagara-on-the-Lake | NOTL Eight Mile Creek | Niagara-on-the-Lake                     | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. No direction on SAR is provided. | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>Very broad direction at<br>watershed level only. Refinement<br>recommended. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | Minimal discussion of climate<br>change. No specific assessment,<br>adaptation or mitigation plan for<br>the watershed - further study<br>required. |
| Niagara-on-the-Lake | NOTL Four Mile Creek  | Niagara Falls, Niagara-on-the-<br>Lake  | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. No direction on SAR is provided. | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>Very broad direction at<br>watershed level only. Refinement<br>recommended. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | Minimal discussion of climate<br>change. No specific assessment,<br>adaptation or mitigation plan for<br>the watershed - further study<br>required. |
| Niagara-on-the-Lake | NOTL Four Mile Pond   | Niagara-on-the-Lake                     | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. No direction on SAR is provided. | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>Very broad direction at<br>watershed level only. Refinement<br>recommended. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | Minimal discussion of climate<br>change. No specific assessment,<br>adaptation or mitigation plan for<br>the watershed - further study<br>required. |
| Niagara-on-the-Lake | NOTL Lake Ontario 10  | St. Catharines, Niagara-on-the-<br>Lake | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>Very broad direction at<br>watershed level only. Refinement<br>recommended. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -   |
| Niagara-on-the-Lake | NOTL Lake Ontario 9   | St. Catharines                          | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>Very broad direction at<br>watershed level only. Refinement<br>recommended. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -   |
| Niagara-on-the-Lake | NOTL Six Mile Creek   | Niagara Falls, Niagara-on-the-<br>Lake  | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. No direction on SAR is provided. | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>Very broad direction at<br>watershed level only. Refinement<br>recommended. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | Minimal discussion of climate<br>change. No specific assessment,<br>adaptation or mitigation plan for<br>the watershed - further study<br>required. |

| Gap | Analysis |
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|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
| LIGHT BLUE - MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds           | Subwatersheds       | Municipalities           | Applicable Watershed<br>Plan/Study                                 | Supplemental Studies (if any)  | Hydrologic Modelling  | Hydraulic Modelling  | Floodline Mapping  | Water Quality  | Erosion Control  |
|----------------------|---------------------|--------------------------|--|--|---|--|--|--|--|
| Niagara-on-the-Lake  | NOTL Two Mile Creek | Niagara-on-the-Lake      | Niagara-on-the-Lake<br>Watershed Study, Aquafor<br>Beech Ltd, 2008 | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Niagara-on-the-Lake #1.10  | Flows estimated using Index<br>Flood Method. HEC-HMS<br>continous hydrologic model<br>developed, however focus<br>placed on groundwater/water<br>availability - not SWM / future<br>land use based. | Yes - HEC-RAS modelling<br>completed by Aquafor Beech.   | Yes - Floodplain Mapping<br>from Aquafor Beech 2008          | Key issues summarized. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development.   | Erosion remediation plan / riparian zone<br>management program is recommended. Further<br>study is required to determine erosion<br>thresholds for receiving w/c and SWM erosion<br>control sizing with respect to future<br>development.  |
| St. Catharines Urban | SCU BEAMER CREEK    | St. Catharines           | N/A - Check Regional Level<br>Guidance                             | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 - St.<br>Catharines East #1.8   | No hydrological modelling found   | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues summarized. General<br>management actions provided.<br>NWQPS specifically<br>recommends providing source<br>control SWM for new<br>developments. Further study<br>required for mitigation plan for<br>future greenfield, infill & re-<br>development. | LMA key issues summarized. General<br>management actions provided. NWQPS<br>specifically recommends providing source<br>control SWM for new developments. No erosion<br>thresholds or sizing details provided - requires<br>further study. |
| St. Catharines Urban | SCU WALKER CREEK    | St. Catharines           | N/A - Check Regional Level<br>Guidance                             | Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 - St.<br>Catharines East #1.8   | No hydrological modelling found   | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues summarized. General<br>management actions provided.<br>NWQPS specifically<br>recommends providing source<br>control SWM for new<br>developments. Further study<br>required for mitigation plan for<br>future greenfield, infill & re-<br>development. | LMA key issues summarized. General<br>management actions provided. NWQPS<br>specifically recommends providing source<br>control SWM for new developments. No erosion<br>thresholds or sizing details provided - requires<br>further study. |
| South Niagara Falls  | SNF Bayers Creek    | Fort Erie, Niagara Falls | South Niagara Falls Watershed<br>Report, NPCA, 2008                | Niagara Peninsula Conservation<br>Authority. 2007b The South Niagara<br>Falls Watershed Geomorphic<br>Assessment, Niagara Water Quality<br>Protection Strategy - LMA Summaries,<br>2003 - Netherby #2.14 | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based.   | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues summarized. Further<br>study required for mitigation plan<br>for future greenfield, infill & re-<br>development.  | Geomorphic Study identifies problem areas and<br>provides recommendations. Further study<br>required for determining erosion thresholds and<br>volumetric sizing.  |
| South Niagara Falls  | SNF Grassy Brook    | Niagara Falls            | South Niagara Falls Watershed<br>Report, NPCA, 2008                | Niagara Peninsula Conservation<br>Authority. 2007b The South Niagara<br>Falls Watershed Geomorphic<br>Assessment, Niagara Water Quality<br>Protection Strategy - LMA Summaries,<br>2003 - Netherby #2.14 | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based.   | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues summarized. Further<br>study required for mitigation plan<br>for future greenfield, infill & re-<br>development.  | Geomorphic Study identifies problem areas and<br>provides recommendations. Further study<br>required for determining erosion thresholds and<br>volumetric sizing.  |
| South Niagara Falls  | SNF Hunters Drain   | Niagara Falls            | South Niagara Falls Watershed<br>Report, NPCA, 2008                | Niagara Peninsula Conservation<br>Authority. 2007b The South Niagara<br>Falls Watershed Geomorphic<br>Assessment, Niagara Water Quality<br>Protection Strategy - LMA Summaries,<br>2003 - Netherby #2.14 | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based.   | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues summarized. Further<br>study required for mitigation plan<br>for future greenfield, infill & re-<br>development.  | Geomorphic Study identifies problem areas and<br>provides recommendations. Further study<br>required for determining erosion thresholds and<br>volumetric sizing.  |

| Gap Analysis |  |
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| BE CONFIRMED SIGNIFICANT GA |                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|-----------------------------|------------------------|---------------------------|-----------------|
|                             | LIGHT BLUE - MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds           | Subwatersheds       | Municipalities           | Flood Control  | Water Balance/Budget   | Groundwater Management  | Watercourse Management  |
|----------------------|---------------------|--------------------------|--|--|---|---|
| Niagara-on-the-Lake  | NOTL Two Mile Creek | Niagara-on-the-Lake      | General management actions provided -<br>encouragement for SWM BMP<br>design/implementation for both new and<br>existing (retrofit) urban areas. Further study is<br>required for assessment and sizing of SWM<br>for future greenfield, infill & re-development.              | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Low/medium susceptibility<br>identified. Groundwater recharge<br>varies across subwatershed -<br>infiltration/recharge to be<br>maintained. Baseflow also<br>specifically mentioned. Further<br>study is recommended for<br>updated inventory of<br>contaminant sources and<br>management plan. | Stream Erosion Control remediation plan<br>identified for in-stream works and on-going<br>maintenance program outlined to mitigate<br>erosion issues. Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part o<br>future development. |
| St. Catharines Urban | SCU BEAMER CREEK    | St. Catharines           | LMA key issues summarized. General<br>management actions provided. NWQPS<br>specifically recommends providing source<br>control SWM for new developments. Further<br>study is required for assessment and sizing of<br>SWM for future greenfield, infill & re-<br>development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified. Further study is<br>recommended for updated<br>inventory of contaminant sources<br>and management plan .   | Shore erosion and problem areas briefly<br>characterized. General recommendations<br>provided. Further study required to determin<br>any W/C management opportunities as par<br>of future development.  |
| St. Catharines Urban | SCU WALKER CREEK    | St. Catharines           | LMA key issues summarized. General<br>management actions provided. NWQPS<br>specifically recommends providing source<br>control SWM for new developments. Further<br>study is required for assessment and sizing of<br>SWM for future greenfield, infill & re-<br>development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified. Further study is<br>recommended for updated<br>inventory of contaminant sources<br>and management plan.  | Shore erosion and problem areas briefly<br>characterized. General recommendations<br>provided. Further study required to determin<br>any W/C management opportunities as par<br>of future development.  |
| South Niagara Falls  | SNF Bayers Creek    | Fort Erie, Niagara Falls | General management actions provided -<br>recommendation for region-wide urban rain<br>barrel and downspout disconnection<br>programs. Further study is required for<br>assessment and sizing of SWM for future<br>greenfield, infill & re-development.                         | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | No at-risk areas identified.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan .  | General w/c management recommendation<br>provided (i.e. riparian buffer for WQ<br>enhancement). Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part o<br>future development.   |
| South Niagara Falls  | SNF Grassy Brook    | Niagara Falls            | General management actions provided -<br>recommendation for region-wide urban rain<br>barrel and downspout disconnection<br>programs. Further study is required for<br>assessment and sizing of SWM for future<br>greenfield, infill & re-development.                         | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | No at-risk areas identified.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan .  | General w/c management recommendation<br>provided (i.e. riparian buffer for WQ<br>enhancement). Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part o<br>future development.   |
| South Niagara Falls  | SNF Hunters Drain   | Niagara Falls            | General management actions provided -<br>recommendation for region-wide urban rain<br>barrel and downspout disconnection<br>programs. Further study is required for<br>assessment and sizing of SWM for future<br>greenfield, infill & re-development.                         | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | No at-risk areas identified.<br>Further study is recommended<br>for updated inventory of<br>contaminant sources and<br>management plan .  | General w/c management recommendation<br>provided (i.e. riparian buffer for WQ<br>enhancement). Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part o<br>future development.   |

|  | Watercourse Works                  |
|--|------------------------------------|
| n plan<br>n-going<br>hitigate<br>ired to<br>ent<br>s part of | -                                  |
| briefly  | Areas of bank erosion and slope    |
| lations  | stability issues preliminarily     |
| etermine   | outlined. Additional investigation |
| as part  | / study recommended.               |
| briefly<br>lations<br>etermine<br>as part                    | -                                  |
| ndation  | Erosion study specific to this     |
| WQ   | subwatershed has been              |
| ired to  | completed and identified several   |
| ent  | erosion sites with specific works  |
| s part of  | & recommendations.                 |
| ndation  | Erosion study specific to this     |
| WQ   | subwatershed has been              |
| ired to  | completed and identified several   |
| ent  | erosion sites with specific works  |
| s part of  | & recommendations.                 |
| ndation  | Erosion study specific to this     |
| WQ   | subwatershed has been              |
| ired to  | completed and identified several   |
| ent  | erosion sites with specific works  |
| s part of  | & recommendations.                 |

|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
| LIGHT BLUE - MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds           | Subwatersheds       | Municipalities           | SAR / Fishery Management   | Wetlands  | HDF Classification<br>/Management  | Climate Change  |
|----------------------|---------------------|--------------------------|--|---|--|---|
| Niagara-on-the-Lake  | NOTL Two Mile Creek | Niagara-on-the-Lake      | <ul> <li>Species information available at a system scale and for most or all higher order watercourses. Gaps anticipated to exist in lower order streams.</li> <li>Updated SAR species information and mapping generally available through current information sources.</li> <li>Mangement direction and objectives for fish are very limited. No direction on SAR is provided.</li> </ul>   | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No direction provided.   | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | Minimal discussion of climate<br>change. No specific assessment,<br>adaptation or mitigation plan for<br>the watershed - further study<br>required. |
| St. Catharines Urban | SCU BEAMER CREEK    | St. Catharines           | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.   | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.   | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -   |
| St. Catharines Urban | SCU WALKER CREEK    | St. Catharines           | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.   | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.   | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | -   |
| South Niagara Falls  | SNF Bayers Creek    | Fort Erie, Niagara Falls | <ul> <li>Species information available at a system scale and for most or all higher order watercourses. Gaps anticipated to exist in lower order streams.</li> <li>Updated SAR species information and mapping generally available through current information sources.</li> <li>Mangement direction and objectives for fish include some specific recommendations, but could be expanded or refined. Management direction and objectives for SAR is limited.</li> </ul> | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Some general locations identified<br>for enhancement and restoration.<br>Suitabilty criteria assessmenet<br>completed, consider refined<br>direction or targets to support<br>management direction. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required.         |
| South Niagara Falls  | SNF Grassy Brook    | Niagara Falls            | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish include<br>some specific recommendations, but could be<br>expanded or refined. Management direction and<br>objectives for SAR is limited.            | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Suitabilty criteria assessmenet<br>completed, consider refined<br>direction or targets to support<br>management direction.  | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required.         |
| South Niagara Falls  | SNF Hunters Drain   | Niagara Falls            | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. Limited direction on SAR is provided<br>for other subwatersheds in system.  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Suitabilty criteria assessmenet<br>completed, consider refined<br>direction or targets to support<br>management direction.  | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required.         |

| Gap | Analysis |  |
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| LIGHT BLUE = MAJOR GAP | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |  |
|------------------------|---------------------------|-----------------|--|
|                        | BE CONFIRMED              | SIGNIFICANT GAP |  |

| Watersheds          | Subwatersheds         | Municipalities         | Applicable Watershed<br>Plan/Study                  | Supplemental Studies (if any)  | Hydrologic Modelling  | Hydraulic Modelling  | Floodline Mapping  | Water Quality   | Erosion Control   |
|---------------------|-----------------------|------------------------|---|--|---|--|--|---|---|
| South Niagara Falls | SNF Lyons Creek       | Niagara Falls, Welland | South Niagara Falls Watershed<br>Report, NPCA, 2008 | Niagara Peninsula Conservation<br>Authority. 2007b The South Niagara<br>Falls Watershed Geomorphic<br>Assessment, Niagara Water Quality<br>Protection Strategy - LMA Summaries,<br>2003 - Netherby #2.14   | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues summarized. Further<br>study required for mitigation plan<br>for future greenfield, infill & re-<br>development.   | Geomorphic Study identifies problem areas and<br>provides recommendations. Further study<br>required for determining erosion thresholds and<br>volumetric sizing. |
| South Niagara Falls | SNF Niagara River 9   | Niagara Falls          | South Niagara Falls Watershed<br>Report, NPCA, 2008 | Niagara Peninsula Conservation<br>Authority. 2007b The South Niagara<br>Falls Watershed Geomorphic<br>Assessment. Surface Water Intake<br>Protection Zone SWP AR (GIS data),<br>NPCA 2019, Niagara Water Quality<br>Protection Strategy - LMA Summaries,<br>2003 - Netherby #2.14  | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | No hydraulic modelling found.  | No floodplain mapping<br>found                               | Key issues summarized. IPZ<br>located in subwatershed,<br>applicable policies to be followed.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development. | Geomorphic Study identifies problem areas and<br>provides recommendations. Further study<br>required for determining erosion thresholds and<br>volumetric sizing. |
| South Niagara Falls | SNF Niagara River 11C | Niagara Falls          | South Niagara Falls Watershed<br>Report, NPCA, 2008 | Niagara Peninsula Conservation<br>Authority. 2007b The South Niagara<br>Falls Watershed Geomorphic<br>Assessment. Surface Water Intake<br>Protection Zone SWP AR (GIS data),<br>NPCA 2019, Niagara Water Quality<br>Protection Strategy - LMA Summaries,<br>2003 - Netherby #2.14. Source<br>Protection Plan for Niagara Peninsula<br>Source Protection Area, (NPCA, 2013) | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | No hydraulic modelling found.  | No floodplain mapping<br>found                               | Details for the subwatershed not<br>found in the studies reviewed -<br>requires further study.  | Geomorphic Study identifies problem areas and<br>provides recommendations. Further study<br>required for determining erosion thresholds and<br>volumetric sizing. |
| South Niagara Falls | SNF Tee Creek         | Niagara Falls          | South Niagara Falls Watershed<br>Report, NPCA, 2008 | Niagara Peninsula Conservation<br>Authority. 2007b The South Niagara<br>Falls Watershed Geomorphic<br>Assessment. Surface Water Intake<br>Protection Zone SWP AR (GIS data),<br>NPCA 2019, Niagara Water Quality<br>Protection Strategy - LMA Summaries,<br>2003 - Netherby #2.14  | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues summarized. IPZ<br>located in subwatershed,<br>applicable policies to be followed.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development. | Geomorphic Study identifies problem areas and<br>provides recommendations. Further study<br>required for determining erosion thresholds and<br>volumetric sizing. |
| South Niagara Falls | SNF Usshers Creek     | Niagara Falls          | South Niagara Falls Watershed<br>Report, NPCA, 2008 | Niagara Peninsula Conservation<br>Authority. 2007b The South Niagara<br>Falls Watershed Geomorphic<br>Assessment. Surface Water Intake<br>Protection Zone SWP AR (GIS data),<br>NPCA 2019, Niagara Water Quality<br>Protection Strategy - LMA Summaries,<br>2003 - Netherby #2.14  | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Key issues summarized. IPZ<br>located in subwatershed,<br>applicable policies to be followed.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development. | Geomorphic Study identifies problem areas and<br>provides recommendations. Further study<br>required for determining erosion thresholds and<br>volumetric sizing. |

#### Table WR2: NWP (E) - Watershed Plan Review

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| LIGHT BLUE = MAJOR GAP | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
|                        | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds          | Subwatersheds         | Municipalities         | Flood Control  | Water Balance/Budget   | Groundwater Management  | Watercourse Management  |
|---------------------|-----------------------|------------------------|--|--|---|---|
| South Niagara Falls | SNF Lyons Creek       | Niagara Falls, Welland | General management actions provided -<br>recommendation for region-wide urban rain<br>barrel and downspout disconnection<br>programs. Further study is required for<br>assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified. Further study is<br>recommended for updated<br>inventory of contaminant sources<br>and management plan.  | General w/c management recommendation<br>provided (i.e. riparian buffer for WQ<br>enhancement). Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part o<br>future development. |
| South Niagara Falls | SNF Niagara River 9   | Niagara Falls          | General management actions provided -<br>recommendation for region-wide urban rain<br>barrel and downspout disconnection<br>programs. Further study is required for<br>assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study,<br>including IPZ areas which will<br>require additional policies to be<br>followed. Further study is<br>required for mitigation plan for<br>future greenfield, infill & re-<br>development. | General w/c management recommendation<br>provided (i.e. riparian buffer for WQ<br>enhancement). Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part o<br>future development. |
| South Niagara Falls | SNF Niagara River 11C | Niagara Falls          | General management actions provided -<br>recommendation for region-wide urban rain<br>barrel and downspout disconnection<br>programs. Further study is required for<br>assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study,<br>including IPZ areas which will<br>require additional policies to be<br>followed. Further study is<br>required for mitigation plan for<br>future greenfield, infill & re-<br>development. | General w/c management recommendation<br>provided (i.e. riparian buffer for WQ<br>enhancement). Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part o<br>future development. |
| South Niagara Falls | SNF Tee Creek         | Niagara Falls          | General management actions provided -<br>recommendation for region-wide urban rain<br>barrel and downspout disconnection<br>programs. Further study is required for<br>assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study,<br>including IPZ areas which will<br>require additional policies to be<br>followed. Further study is<br>required for mitigation plan for<br>future greenfield, infill & re-<br>development. | General w/c management recommendation<br>provided (i.e. riparian buffer for WQ<br>enhancement). Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part o<br>future development. |
| South Niagara Falls | SNF Usshers Creek     | Niagara Falls          | General management actions provided -<br>recommendation for region-wide urban rain<br>barrel and downspout disconnection<br>programs. Further study is required for<br>assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study,<br>including IPZ areas which will<br>require additional policies to be<br>followed. Further study is<br>required for mitigation plan for<br>future greenfield, infill & re-<br>development. | General w/c management recommendation<br>provided (i.e. riparian buffer for WQ<br>enhancement). Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part o<br>future development. |

#### Watercourse Works

Erosion study specific to this subwatershed has been completed and identified several erosion sites with specific works & recommendations.

Erosion study specific to this subwatershed has been completed and identified several erosion sites with specific works & recommendations.

Minimal information identified for this subwatershed - further study required.

Erosion study specific to this subwatershed has been completed and identified several erosion sites with specific works & recommendations.

Erosion study specific to this subwatershed has been completed and identified several erosion sites with specific works & recommendations.

| Gap | Analysis |
|-----|----------|
|     |          |

| LIGHT BLUE = MAJOR GAP | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
|                        | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds          | Subwatersheds         | Municipalities         | SAR / Fishery Management  | Wetlands   | HDF Classification<br>/Management  | Climate Change  |
|---------------------|-----------------------|------------------------|---|--|--|---|
| South Niagara Falls | SNF Lyons Creek       | Niagara Falls, Welland | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. Limited direction on SAR is provided<br>for other subwatersheds in system.   | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Suitabilty criteria assessmenet<br>completed, consider refined<br>direction or targets to support<br>management direction.<br>Some SAR associated with<br>wetlands and general direction to<br>support these species provided. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| South Niagara Falls | SNF Niagara River 9   | Niagara Falls          | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.  | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| South Niagara Falls | SNF Niagara River 11C | Niagara Falls          | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Not found in studies.  | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>No recommendations identified.  | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| South Niagara Falls | SNF Tee Creek         | Niagara Falls          | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish include<br>some specific recommendations, but could be<br>expanded or refined. Management direction and<br>objectives for SAR is limited. | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Suitabilty criteria assessmenet<br>completed, consider refined<br>direction or targets to support<br>management direction.<br>Some SAR associated with<br>wetlands and general direction to<br>support these species provided. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |
| South Niagara Falls | SNF Usshers Creek     | Niagara Falls          | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish include<br>some specific recommendations, but could be<br>expanded or refined. Management direction and<br>objectives for SAR is limited. | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Suitabilty criteria assessmenet<br>completed, consider refined<br>direction or targets to support<br>management direction.<br>Some SAR associated with<br>wetlands and general direction to<br>support these species provided. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | General impacts of climate<br>change listed. No mitigation<br>strategies outlined specific to the<br>watershed - further study<br>required. |

| Gap | Analysis |  |
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|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
| LIGHT BLUE - MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |
|                        |                           |                 |

| Watersheds        | Subwatersheds                | Municipalities          | Applicable Watershed<br>Plan/Study              | Supplemental Studies (if any)   | Hydrologic Modelling  | Hydraulic Modelling  | Floodline Mapping  | Water Quality   | Erosion Control  |
|-------------------|------------------------------|-------------------------|---|---|---|--|--|---|--|
| Twelve Mile Creek | TWEL Dicks Creek             | St. Catharines, Thorold | Twelve Mile Creek Watershed<br>Plan, NPCA, 2006 | Niagara Peninsula Conservation<br>Authority Groundwater Study Final<br>Report. Prepared for Niagara<br>Peninsula Conservation Authority,<br>Regional Municipality of Niagara, City<br>of Hamilton and Haldimand County  | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping,<br>source/date to be<br>confirmed. | Water quality monitoring<br>(watershed wide - lacking<br>localized characterization)<br>indicates historical exceedences<br>of Phosphorous - high level key<br>issues identified. General<br>management actions provided.<br>Further study required for<br>localized issues and mitigation<br>plan for future greenfield, infill &<br>re-development.   | Localized need for erosion control at identified<br>sites. No erosion thresholds or sizing details<br>provided - requires further study.   |
| Twelve Mile Creek | TWEL Francis Creek           | St. Catharines          | Twelve Mile Creek Watershed<br>Plan, NPCA, 2006 | Niagara Peninsula Conservation<br>Authority Groundwater Study Final<br>Report. Prepared for Niagara<br>Peninsula Conservation Authority,<br>Regional Municipality of Niagara, City<br>of Hamilton and Haldimand County,<br>Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Upper Twelve Mile Creek #1.1, St.<br>Catharines West #1.6                                | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping<br>from NPCA 2005                   | Water quality monitoring<br>(watershed wide - lacking<br>localized characterization)<br>indicates historical exceedences<br>of Phosphorous - high level key<br>issues identified. General<br>management actions provided.<br>Further study required for<br>localized issues and mitigation<br>plan for future greenfield, infill &<br>re-development.   | Further study required for problem areas,<br>erosion thresholds and volumetric sizing.   |
| Twelve Mile Creek | TWEL Lake Gibson System      | St. Catharines, Thorold | Twelve Mile Creek Watershed<br>Plan, NPCA, 2006 | Niagara Peninsula Conservation<br>Authority Groundwater Study Final<br>Report. Prepared for Niagara<br>Peninsula Conservation Authority,<br>Regional Municipality of Niagara, City<br>of Hamilton and Haldimand County.<br>Surface Water Intake Protection Zone<br>SWP AR (GIS data), NPCA 2019.<br>Source Protection Plan for Niagara<br>Peninsula Source Protection Area,<br>(NPCA, 2013) | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | No hydraulic modelling found.  | No floodplain mapping<br>found                               | Water quality monitoring<br>(watershed wide - lacking<br>localized characterization)<br>indicates historical exceedences<br>of Phosphorous - key issues<br>identified. IPZ located in<br>subwatershed, applicable<br>policies to be followed. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development. | Further study required for problem areas,<br>erosion thresholds and volumetric sizing.   |
| Twelve Mile Creek | TWEL Lower Twelve Mile Creek | St. Catharines          | Twelve Mile Creek Watershed<br>Plan, NPCA, 2006 | Niagara Peninsula Conservation<br>Authority Groundwater Study Final<br>Report. Prepared for Niagara<br>Peninsula Conservation Authority,<br>Regional Municipality of Niagara, City<br>of Hamilton and Haldimand County,<br>Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 - St.<br>Catharines East #1.8   | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | No hydraulic modelling found.  | No floodplain mapping<br>found                               | Water quality monitoring<br>(watershed wide - lacking<br>localized characterization)<br>indicates historical exceedences<br>of Phosphorous - high level key<br>issues identified. General<br>management actions provided.<br>Further study required for<br>localized issues and mitigation<br>plan for future greenfield, infill &<br>re-development.   | NWQPS specifically recommends providing<br>source control SWM for new developments -<br>most flooding/erosion problems of any LMA.<br>Subwatershed erosion study completed for<br>identification of problem areas. Further study<br>required for problem areas, erosion thresholds<br>and volumetric sizing. |
| Twelve Mile Creek | TWEL Richardson Creek        | St. Catharines          | Twelve Mile Creek Watershed<br>Plan, NPCA, 2006 | Niagara Peninsula Conservation<br>Authority Groundwater Study Final<br>Report. Prepared for Niagara<br>Peninsula Conservation Authority,<br>Regional Municipality of Niagara, City<br>of Hamilton and Haldimand County,<br>Niagara Water Quality Protection<br>Strategy - LMA Summaries, 2003 -<br>Upper Twelve Mile Creek #1.1, St.<br>Catharines West #1.6                                | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping<br>from NPCA 2005                   | Water quality monitoring<br>(watershed wide - lacking<br>localized characterization)<br>indicates historical exceedences<br>of Phosphorous - high level key<br>issues identified. General<br>management actions provided.<br>Further study required for<br>localized issues and mitigation<br>plan for future greenfield, infill &<br>re-development.   | General management actions provided -<br>specific mention for agricultural<br>BMPs/education.Further study required for<br>problem areas, erosion thresholds and<br>volumetric sizing.   |

#### Table WR2: NWP (E) - Watershed Plan Review

|  | Gap | Analysis |
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| LIGHT BLUE = MAJOR GAP | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |  |
|------------------------|---------------------------|-----------------|--|
|                        | BE CONFIRMED              | SIGNIFICANT GAP |  |

| Watersheds        | Subwatersheds                | Municipalities          | Flood Control   | Water Balance/Budget   | Groundwater Management  | Watercourse Management  |
|-------------------|------------------------------|-------------------------|---|--|---|---|
| Twelve Mile Creek | TWEL Dicks Creek             | St. Catharines, Thorold | General management actions provided -<br>recommendation for region-wide urban rain<br>barrel and downspout disconnection<br>programs. Further study is required for<br>assessment and sizing of SWM for future<br>greenfield, infill & re-development.  | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified. Further study is<br>recommended for updated<br>inventory of contaminant sources<br>and management plan .   | General w/c management recommendation<br>provided (i.e. riparian buffer for WQ<br>enhancement). Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part o<br>future development. |
| Twelve Mile Creek | TWEL Francis Creek           | St. Catharines          | General management actions provided -<br>recommendation for region-wide urban rain<br>barrel and downspout disconnection<br>programs. Further study is required for<br>assessment and sizing of SWM for future<br>greenfield, infill & re-development.  | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified. Further study is<br>recommended for updated<br>inventory of contaminant sources<br>and management plan .   | General w/c management recommendation<br>provided (i.e. riparian buffer for WQ<br>enhancement). Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part o<br>future development. |
| Twelve Mile Creek | TWEL Lake Gibson System      | St. Catharines, Thorold | General management actions provided -<br>recommendation for region-wide urban rain<br>barrel and downspout disconnection<br>programs. Further study is required for<br>assessment and sizing of SWM for future<br>greenfield, infill & re-development.  | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified in Groundwater Study,<br>including IPZ areas which will<br>require additional policies to be<br>followed. Further study is<br>required for mitigation plan for<br>future greenfield, infill & re-<br>development. | General w/c management recommendation<br>provided (i.e. riparian buffer for WQ<br>enhancement). Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part o<br>future development. |
| Twelve Mile Creek | TWEL Lower Twelve Mile Creek | St. Catharines          | General management actions provided.<br>NWQPS specifically recommends providing<br>source control SWM for new developments -<br>most flooding/erosion problems of any LMA<br>(lack of SWM facilities). Further study is<br>required for assessment and sizing of SWM<br>for future greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified. Further study is<br>recommended for updated<br>inventory of contaminant sources<br>and management plan .   | General w/c management recommendation<br>provided (i.e. riparian buffer for WQ<br>enhancement). Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part o<br>future development. |
| Twelve Mile Creek | TWEL Richardson Creek        | St. Catharines          | Lack of stormwater management facilities to<br>treat urban runoff. Further study is required<br>for assessment and sizing of SWM for future<br>greenfield, infill & re-development.   | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified. Further study is<br>recommended for updated<br>inventory of contaminant sources<br>and management plan .   | General w/c management recommendation<br>provided (i.e. riparian buffer for WQ<br>enhancement). Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part o<br>future development. |

# Watercourse Works

Erosion study specific to this subwatershed has been completed and identified several erosion sites with specific works & recommendations - however, work is from 1995 - would suggest these sites/findings may not be directly applicable now due to transient nature of watercourses.

Erosion study specific to this subwatershed has been completed and identified several erosion sites with specific works & recommendations - however, work is from 1995 - would suggest these sites/findings may not be directly applicable now due to transient nature of watercourses.

Erosion study specific to this subwatershed has been completed and identified several erosion sites with specific works/recommendations.

| Gap Analysis |  |
|--------------|--|
|--------------|--|

| LIGHT BLUE = MAJOR GAP | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
|                        | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds        | Subwatersheds                | Municipalities          | SAR / Fishery Management  | Wetlands  | HDF Classification<br>/Management  | Climate Change  |
|-------------------|------------------------------|-------------------------|---|---|--|---|
| Twelve Mile Creek | TWEL Dicks Creek             | St. Catharines, Thorold | <ul> <li>Species information available at a system scale and for most or all higher order watercourses. Gaps anticipated to exist in lower order streams.</li> <li>Updated SAR species information and mapping generally available through current information sources.</li> <li>Mangement direction and objectives for fish include some specific recommendations. Most notably direction provided through the Healthy Twelve Mile Creek Project (Trout Unlimited Canada)</li> </ul> | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided for<br>the watershed. No specific<br>management for this<br>subwatershed - primarily<br>urbanized and considered<br>unsuitable.   | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | No discussion of climate change impacts on the watershed. |
| Twelve Mile Creek | TWEL Francis Creek           | St. Catharines          | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish include<br>some specific recommendations. Most notably<br>direction provided through the Healthy Twelve Mile<br>Creek Project (Trout Unlimited Canada)            | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided for<br>the watershed. No specific<br>management for this<br>subwatershed - primarily<br>urbanized and considered<br>unsuitable.   | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | No discussion of climate change impacts on the watershed. |
| Twelve Mile Creek | TWEL Lake Gibson System      | St. Catharines, Thorold | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish include<br>some specific recommendations. Most notably<br>direction provided through the Healthy Twelve Mile<br>Creek Project (Trout Unlimited Canada)            | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided for<br>the watershed. Restore where<br>conditions are suitable, but much<br>of the this subwatershed<br>considered urbanized and<br>unsuitable.   | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | No discussion of climate change impacts on the watershed. |
| Twelve Mile Creek | TWEL Lower Twelve Mile Creek | St. Catharines          | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish include<br>some specific recommendations. Most notably<br>direction provided through the Healthy Twelve Mile<br>Creek Project (Trout Unlimited Canada)            | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Suitabilty criteria assessmenet<br>completed, consider refined<br>direction or targets to support<br>management direction. Some<br>specific areas identified for<br>enhancement and/or restoration. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | No discussion of climate change impacts on the watershed. |
| Twelve Mile Creek | TWEL Richardson Creek        | St. Catharines          | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish include<br>some specific recommendations. Most notably<br>direction provided through the Healthy Twelve Mile<br>Creek Project (Trout Unlimited Canada)            | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Suitabilty criteria assessmenet<br>completed, consider refined<br>direction or targets to support<br>management direction. Some<br>specific areas identified for<br>enhancement and/or restoration. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | No discussion of climate change impacts on the watershed. |

|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
| LIGHT BLUE - MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds        | Subwatersheds                | Municipalities                  | Applicable Watershed<br>Plan/Study              | Supplemental Studies (if any)  | Hydrologic Modelling  | Hydraulic Modelling  | Floodline Mapping                          | Water Quality   | Erosion Control  |
|-------------------|------------------------------|---------------------------------|---|--|---|--|--|---|--|
| Twelve Mile Creek | TWEL Upper Twelve Mile Creek | Pelham, St. Catharines, Thorold | Twelve Mile Creek Watershed<br>Plan, NPCA, 2006 | Niagara Peninsula Conservation<br>Authority Groundwater Study Final<br>Report. Prepared for Niagara<br>Peninsula Conservation Authority,<br>Regional Municipality of Niagara, City<br>of Hamilton and Haldimand County,<br>Niagara Peninsula Conservation<br>Authority. 2005b. Upper Twelve Mile<br>Creek Watershed Erosion Study.<br>Welland, Ontario. Niagara Water<br>Quality Protection Strategy - LMA<br>Summaries, 2003 - Upper Twelve Mile<br>Creek #1.1, Pelham Union #1.4 | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping<br>from NPCA      | Water quality monitoring<br>(watershed wide - lacking<br>localized characterization)<br>indicates historical exceedences<br>of Phosphorous - high level key<br>issues identified. General<br>management actions provided.<br>Further study required for<br>localized issues and mitigation<br>plan for future greenfield, infill &<br>re-development. | Subwatershed erosion study completed for<br>identification of problem areas. New<br>developments in Smithville, Jordan Valley and<br>Jordan Station should be designed and<br>constructed to minimize sediment loss. Further<br>study required for problem areas, erosion<br>thresholds and volumetric sizing. |
| Twenty Mile Creek | TWEN North Creek             | West Lincoln                    | Twenty Mile Creek Watershed<br>Plan, NPCA, 2006 | Niagara Peninsula Conservation<br>Authority Groundwater Study Final<br>Report. Prepared for Niagara<br>Peninsula Conservation Authority,<br>Regional Municipality of Niagara, City<br>of Hamilton and Haldimand County.<br>Niagara Water Quality Protection<br>Strategy Final Technical Report<br>(Volume 2) Local Management Areas<br>Summaries, NPCA (2003)  | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping<br>from NPCA      | Key issues identified. General<br>management actions provided -<br>specific mention for agricultural<br>BMPs/education, water quality<br>identified as an issue in this<br>subwatershed. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development.              | General management actions provided -<br>specific mention for agricultural<br>BMPs/education. Further study required for<br>problem areas, erosion thresholds and<br>volumetric sizing.  |
| Twenty Mile Creek | TWEN Spring Creek            | West Lincoln                    | Twenty Mile Creek Watershed<br>Plan, NPCA, 2006 | Niagara Peninsula Conservation<br>Authority Groundwater Study Final<br>Report. Prepared for Niagara<br>Peninsula Conservation Authority,<br>Regional Municipality of Niagara, City<br>of Hamilton and Haldimand County   | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Partial - Regulated floodplain<br>mapping found in GIS files,<br>hydraulic model type/source<br>unknown - to be confirmed. | Yes - Floodplain Mapping<br>from NPCA      | Key issues identified. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development.  | General management actions provided. Further<br>study required for problem areas, erosion<br>thresholds and volumetric sizing.   |
| Twenty Mile Creek | TWEN Twenty Mile Creek       | Lincoln, West Lincoln           | Twenty Mile Creek Watershed<br>Plan, NPCA, 2006 | Niagara Peninsula Conservation<br>Authority. 2005c. Twenty Mile Creek<br>Floodplain Mapping, City of Hamilton,<br>Town of Lincoln and the Township of<br>West Lincoln. Welland, Ontario.<br>Niagara Water Quality Protection<br>Strategy Final Technical Report<br>(Volume 2), Niagara Water Quality<br>Protection Strategy - LMA Summaries,<br>2003 - Upper Twelve Mile Creek #1.1,<br>Pelham Union #1.4  | No - HEC-HMS continous<br>hydrologic model developed,<br>however focus placed on<br>groundwater/water availability -<br>not SWM / future land use<br>based. | Yes - HEC-RAS modelling completed by NPCA  | Yes - Floodplain Mapping<br>from NPCA 2005 | Key issues identified. General<br>management actions provided.<br>Further study required for<br>mitigation plan for future<br>greenfield, infill & re-<br>development.  | General management actions provided. Further<br>study required for problem areas, erosion<br>thresholds and volumetric sizing.   |

| Gap | Analysis |  |
|-----|----------|--|
|     |          |  |

|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
| LIGHT BLUE - WAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds        | Subwatersheds                | Municipalities                  | Flood Control  | Water Balance/Budget   | Groundwater Management  | Watercourse Management   |
|-------------------|------------------------------|---------------------------------|--|--|---|--|
| Twelve Mile Creek | TWEL Upper Twelve Mile Creek | Pelham, St. Catharines, Thorold | Lack of stormwater management facilities to<br>treat urban runoff - flood prone buildings<br>identified. Further study is required for<br>assessment and sizing of SWM for future<br>greenfield, infill & re-development.  | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified. Further study is<br>recommended for updated<br>inventory of contaminant sources<br>and management plan . | General w/c management recommendation<br>provided (i.e. riparian buffer for WQ<br>enhancement). Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part of<br>future development. |
| Twenty Mile Creek | TWEN North Creek             | West Lincoln                    | General management actions<br>provided.Further study is required for<br>assessment and sizing of SWM for future<br>greenfield, infill & re-development.  | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified. Further study is<br>recommended for updated<br>inventory of contaminant sources<br>and management plan . | General w/c management recommendation<br>provided (i.e. riparian buffer for WQ<br>enhancement). Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part of<br>future development. |
| Twenty Mile Creek | TWEN Spring Creek            | West Lincoln                    | General management actions provided.<br>Further study is required for assessment and<br>sizing of SWM for future greenfield, infill & re-<br>development.  | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified. Further study is<br>recommended for updated<br>inventory of contaminant sources<br>and management plan . | General w/c management recommendation<br>provided (i.e. riparian buffer for WQ<br>enhancement). Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part of<br>future development. |
| Twenty Mile Creek | TWEN Twenty Mile Creek       | Lincoln, West Lincoln           | High flood risks have been identified in this<br>subwatershed due to hydrologic conditions<br>(soils, land use). Rain barrel program<br>recommended to reduce flows to combined<br>sewer systems. Further study is required for<br>assessment and sizing of SWM for future<br>greenfield, infill & re-development. | Water Budget and Water Quantity Stress<br>Assessment completed to identify potential<br>problem areas. Water budget analysis<br>completed using HEC-HMS modelling for the<br>watershed. Further study required to determine<br>local sensitivities, and implications/mitigation<br>options for future development. | Vulnerable or at-risk areas<br>identified. Further study is<br>recommended for updated<br>inventory of contaminant sources<br>and management plan . | General w/c management recommendation<br>provided (i.e. riparian buffer for WQ<br>enhancement). Further study required to<br>determine any W/C management<br>requirements and/or opportunities as part of<br>future development. |

| nt  | Watercourse Works  |
|---|--|
| nendation<br>or WQ<br>quired to<br>ment<br>as part of | Erosion study specific to this<br>subwatershed has been<br>completed and identified several<br>erosion sites with specific<br>works/recommendations. |
| nendation<br>or WQ<br>quired to<br>ment<br>as part of | -  |
| nendation<br>or WQ<br>quired to<br>ment<br>as part of | -  |
| nendation<br>or WQ<br>quired to<br>ment<br>as part of | -  |

| Gap | Analysis |
|-----|----------|
|     |          |

|                        | PURPLE = PARTIAL GAP / TO | DARK BLUE = NO  |
|------------------------|---------------------------|-----------------|
| LIGHT BLUE - MAJOR GAP | BE CONFIRMED              | SIGNIFICANT GAP |

| Watersheds        | Subwatersheds                | Municipalities                  | SAR / Fishery Management  | Wetlands   | HDF Classification<br>/Management  | Climate Change  |
|-------------------|------------------------------|---------------------------------|---|--|--|---|
| Twelve Mile Creek | TWEL Upper Twelve Mile Creek | Pelham, St. Catharines, Thorold | <ul> <li>Species information available at a system scale and for most or all higher order watercourses. Gaps anticipated to exist in lower order streams.</li> <li>Updated SAR species information and mapping generally available through current information sources.</li> <li>Mangement direction and objectives for fish include some specific recommendations. Most notably direction provided through the Healthy Twelve Mile Creek Project (Trout Unlimited Canada)</li> </ul> | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Suitabilty criteria assessmenet<br>completed, consider refined<br>direction or targets to support<br>management direction. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | No discussion of climate change impacts on the watershed. |
| Twenty Mile Creek | TWEN North Creek             | West Lincoln                    | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. No direction on SAR is provided.   | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Suitabilty criteria assessmenet<br>completed, consider refined<br>direction or targets to support<br>management direction. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | No discussion of climate change impacts on the watershed. |
| Twenty Mile Creek | TWEN Spring Creek            | West Lincoln                    | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. No direction on SAR is provided.   | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Suitabilty criteria assessmenet<br>completed, consider refined<br>direction or targets to support<br>management direction. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | No discussion of climate change impacts on the watershed. |
| Twenty Mile Creek | TWEN Twenty Mile Creek       | Lincoln, West Lincoln           | Species information available at a system scale and<br>for most or all higher order watercourses. Gaps<br>anticipated to exist in lower order streams.<br>Updated SAR species information and mapping<br>generally available through current information<br>sources.<br>Mangement direction and objectives for fish are<br>very limited. No direction on SAR is provided.   | Mapping data available and 2020<br>ELC for the Region provides<br>refined information on type and<br>cover.<br>General direction provided.<br>Suitabilty criteria assessmenet<br>completed, consider refined<br>direction or targets to support<br>management direction. | No headwater drainage feature<br>(HDF) identification, classification<br>or management plan - requires<br>further study. | No discussion of climate change impacts on the watershed. |

# **APPENDIX C-3**:

# GROWTH AREA SCREENING MATRIX

| VATERSHED PLAN          | - EQUIVALENCY                       |   |                      |           |             |              |                         |   |                         |                 |                                |              |                        |                  |             |         |                      |                     |  |
|-------------------------|-------------------------------------|---|----------------------|-----------|-------------|--------------|-------------------------|---|-------------------------|-----------------|--------------------------------|--------------|------------------------|------------------|-------------|---------|----------------------|---------------------|--|
| CATEGORY                | FACTORS                             | DESCRIPTION / MEASURE                       | RATING               | WEIGHTING |             |              | -                       | F   | OTENTIAL GR             | OWTH ARE        | AS                             |              |                        |                  |             |         |                      |                     |  |
|                         |                                     |   |                      | FACTOR    | FE          | -1<br>Pating | FE-<br>Moasuro          | -2<br>Pating  | FE-<br>Moasuro          | -3<br>Pating    | FE-<br>Moasuro                 | -4<br>Pating | FE-                    | -5<br>Poting     |             |         |                      |                     |  |
|                         |                                     |   |                      |           | wiedsure    | Rating       | IviedSule               | Rating  | IviedSule               | Rating          | wiedsure                       | Rating       | weasure                | Rating           |             |         |                      |                     |  |
| Location / Watershed    | Total GA Area                       | GA Only - Size in hertares (ha)             | N/A - Information    | _         | /37         | ha           | 3/                      | ha  | 544                     | ha              | 1/13                           | ha           | 350                    | ha               |             |         |                      |                     |  |
| System                  |                                     |   |                      |           |             |              | 51                      |   | 5111                    |                 |                                |              |                        |                  |             |         |                      |                     |  |
|                         |                                     | GA + 30 m Buffer - Size in hectares (ha)    |                      |           | 474         | ha           | 48                      | ha  | 589                     | ha              | 177                            | ha           | 395                    | ha               |             |         |                      |                     |  |
|                         |                                     |   |                      |           |             |              |                         |   |                         |                 |                                |              |                        |                  |             |         |                      |                     |  |
|                         | Municipality                        | N/A - Informational Purposes.               | N/A - Information    | -         | Fort        | Erie         | Fort                    | Erie  | Fort                    | Erie            | Fort                           | Erie         | Fort                   | Erie             |             |         |                      |                     |  |
|                         |                                     | Percentage of Growth Area in repective      |                      |           | I           |              | I                       |   |                         |                 | I                              |              | <b>.</b>               |                  |             |         |                      |                     |  |
|                         | Tertiary Watershed                  | Tertiary Watershed                          | N/A - Information    | -         | Niagara Ri  | ver (100%)   | Niagara Ri              | ver (69%)   | Niagara Riv             | /er (100%)      | Niagara Ri                     | ver (33%)    | Niagara Riv            | ver (100%)       |             |         |                      |                     |  |
|                         |                                     |   |                      |           |             |              | Lake Eri                | e (31%)   |                         |                 | Lake Erie                      | e (67%)      |                        |                  |             |         |                      |                     |  |
|                         |                                     |   |                      |           |             |              |                         |   |                         |                 | 1                              |              |                        |                  |             |         |                      |                     |  |
|                         | Quaternary Watershed                | Percentage of Growth Area in repective      | N/A - Information    | -         | Niagara Ri  | iver South   | Niagara River           | South (69%)   | Niagara Riv             | ver South       | Niagara River                  | South (33%)  | Niagara Riv            | Iver South       |             |         |                      |                     |  |
|                         |                                     | Quaternary watershed                        |                      |           | (100        | 070)         | Northoast               | FE-2       Measure       Rating       Measure         34 ha       1         34 ha       1         48 ha       1         1       48 ha       1         1       48 ha       1         1       1       1         48 ha       1       1         1       1       1 |                         | (70)            | Northoast                      | Lako Erio    | (100                   | 570)             |             |         |                      |                     |  |
|                         |                                     |   |                      |           |             |              | Shorelin                |   |                         | Shoreline (67%) |                                |              |                        |                  |             |         |                      |                     |  |
|                         |                                     |   |                      |           |             |              |                         |   |                         |                 |                                |              |                        |                  |             |         |                      |                     |  |
|                         |                                     |   |                      |           |             |              |                         |   |                         |                 |                                |              |                        |                  |             |         |                      |                     |  |
|                         | Subwatershed                        | Percentage of Growth Area in repective      | N/A Information      |           |             | real (069/)  |                         | Greek (60%)   |                         | Creek (2.49/)   | FEC Frenchr                    | nans Creek   |                        |                  |             |         |                      |                     |  |
|                         | Subwatersned                        | Subwatershed                                | N/A - Information    | -         | FEC DIACK C | leek (90%)   | FEC Six Mile Creek Lake |   | FEC Frenchmans Creek    |                 | (33%)<br>EEC Niagara Pivor 18E |              | FEC beaver C           | Creek (40%       |             |         |                      |                     |  |
|                         |                                     |   |                      |           |             |              | SNF Bayers              | Creek (4%)  | FEC SIX MILE<br>Frie (1 | Erie (11%)      |                                | Erie (11%)   |                        | mans Creek<br>%) | FEC Niagara | %)      | FEC Black C          | Creek (60%)         |  |
|                         |                                     |   |                      |           |             |              | LENS Bay Beach Area     |   | LENS Bay Beach Area     |                 | FFC Miller (                   | reek (32%)   | FEC Six Mile           | Creek Lake       |             |         |                      |                     |  |
|                         |                                     |   |                      |           |             |              |                         |   |                         |                 |                                | Drain (18%)  |                        | I LC IVIIIICI C  | 100K (3270) | Erie (4 | 45%)<br>v Drain Area |                     |  |
|                         |                                     |   |                      |           |             |              | LENS Lake Erie 2B (2%)  |   | LENS Lake Erie 2B (2%)  |                 | LENS Lake Erie 2B (2%)         |              | LENS Lake Erie 2B (2%) |                  |             |         | 2A (                 | y Drain Area<br>1%) |  |
|                         |                                     |   |                      |           |             |              | -                       |   | -                       |                 | •<br>•                         |              |                        |                  |             |         |                      |                     |  |
|                         |                                     |   | Sensitivity to       |           |             |              |                         |   |                         |                 |                                |              |                        |                  |             |         |                      |                     |  |
| 1. Physical Conditions  | Surficial Soils                     | Soil Drainage Class & Sensitivity           | = 3, Med = 2, High = | 0.5       | Net*Factor  | 1.31         | Net*Factor              | 1.27  | Net*Factor              | 1.13            | Net*Factor                     | 1.08         | Net*Factor             | 1.38             |             |         |                      |                     |  |
|                         |                                     | Distribution in GA (%)                      | 1, Unknown is Not    |           |             |              |                         |   |                         |                 |                                |              |                        |                  |             |         |                      |                     |  |
|                         | Unknown (- )                        | (4)   | Rated.               |           | 3%          |              | 1%                      |   | 0%                      |                 | 6%                             | -            | 44%                    |                  |             |         |                      |                     |  |
|                         | High (R, W, M                       | W)  |                      |           | 0%          | 1            | 0%                      | 1   | 21%                     | 1               | 17%                            | 1            | 2%                     | 1                |             |         |                      |                     |  |
|                         | Medium                              | (1)   |                      |           | 12%         | 2            | 45%                     | 2   | 33%                     | 2               | 45%                            | 2            | 9%                     | 2                |             |         |                      |                     |  |
|                         | Low (P, )                           | /P)   |                      |           | 84%         | 3            | 54%                     | 3   | 46%                     | 3               | 32%                            | 3            | 44%                    | 3                |             |         |                      |                     |  |
|                         |                                     |   | Constraint to        |           | I           |              | 1                       |   |                         |                 | 1                              |              |                        |                  |             |         |                      |                     |  |
|                         | Slopes/Topography                   | Surface Slopes Distribution in GA (%)       | Development: Low     | 0.5       | Net*Factor  | 1.47         | Net*Factor              | 1.44  | Net*Factor              | 1.42            | Net*Factor                     | 1.41         | Net*Factor             | 1.44             |             |         |                      |                     |  |
|                         |                                     |   | = 3, Med = 2, High = |           |             |              |                         |   |                         |                 |                                |              |                        |                  |             |         |                      |                     |  |
|                         | Mild (0-2                           | %)  | '                    |           | 93%         | 3            | 88%                     | 3   | 83%                     | 3               | 82%                            | 3            | 88%                    | 3                |             |         |                      |                     |  |
|                         | Medium (2-10                        | %)  |                      |           | 7%          | 2            | 12%                     | 2   | 16%                     | 2               | 18%                            | 2            | 12%                    | 2                |             |         |                      |                     |  |
|                         | Steep (>10                          | %)  |                      |           | 0%          | 1            | 0%                      | 1   | 0%                      | Ι               | 0%                             | 1            | 0%                     | 1                |             |         |                      |                     |  |
| 2. Groundwater System & | Intake Protection Zone (Lake-Rased) | Designated Area in GA & Drainage Systems    | (weighted equally)   | 1         | Net*Factor  | 2.25         | Net*Factor              | 2.25  | Net*Factor              | 2.25            | Net*Factor                     | 15           | Net*Factor             | 2.25             |             |         |                      |                     |  |
| Source Water Protection | (Lake-based)                        | Sesignated Area in On & Drainage Systems    |                      |           |             | 2.23         |                         | 2.23  |                         | 2.23            |                                | 1.5          |                        | 2.23             |             |         |                      |                     |  |
|                         |                                     | Designated Area in GA (%)                   | = 3, 0-5% = 2, 5-20% | 1         | -           | 3            | -                       | 3   | -                       | 3               | 1%                             | 2            | -                      | 3                |             |         |                      |                     |  |
|                         |                                     |   | = 1,>20% = 0         |           |             |              |                         |   |                         |                 |                                |              |                        |                  |             |         |                      |                     |  |
|                         |                                     | IPZ Present in any of the Quaternary        | N/A - Information    | 1         | Y           | -            | Y                       | -   | Y                       | -               | Y                              | -            | Y                      | -                |             |         |                      |                     |  |
|                         |                                     | IPZ Present in any of the Subwatersheds? (Y |                      | -         |             | 0            |                         | ~   |                         | ~               |                                | <u>^</u>     |                        | 6                |             |         |                      |                     |  |
|                         |                                     | (10)  | Y = 0, N = 7         | 1         | Y           | 0            | Y                       | 0   | Y                       | 0               | Y                              | 0            | Y                      | 0                |             |         |                      |                     |  |

| NWP (E) - Volum          | e 3: Growth Analysis - Appe           | endix C-3                                      |  |           |               |              |                |              |                |              |                |              |                |             |
|--------------------------|---------------------------------------|--|--|-----------|---------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|-------------|
| POTENTIAL GROWT          | TH AREA SCREENING MATRIX EV           | VALUATION                                      |  |           |               |              |                |              |                |              |                |              |                |             |
| WATERSHED PLAN           | - EQUIVALENCY                         |  |  |           |               |              |                |              |                |              |                |              |                |             |
| CATEGORY                 | FACTORS                               | DESCRIPTION / MEASURE                          | RATING   | WEIGHTING |               | _            |                |              | POTENTIAL GR   | OWTH ARE     | AS             | -            |                |             |
|                          |                                       |  |  | FACTOR    | FE<br>Measure | -1<br>Rating | FE-<br>Measure | -2<br>Rating | FE-<br>Measure | -3<br>Rating | FE-<br>Measure | -4<br>Rating | FE-<br>Measure | 5<br>Rating |
|                          | 1                                     | 1  |  |           | WicdSure      | Rating       | Wieddure       | Rating       | Wicubure       | Rating       | Wieddure       | Rating       | Wiedbure       | Rating      |
|                          |                                       |  | SGRA Occurrence:                                   |           |               |              |                |              |                |              |                |              |                |             |
|                          | Significant Groundwater Recharge Area | Quality & Quantity Sensitivity Distribution    | 0% = 3, 0-10% = 2, 10                              |           | Not*Coston    | 1            | Nat*Fastar     | 0.5          | Not*Footon     | 0            | Not*Coston     | 0            | Not*Conton     | 0.5         |
|                          | (SGRA)                                | in GA (%) Ranges                               | 50% = 1, >50% = 0                                  | 0.5       | Net^Factor    | I            | Net^Factor     | 0.5          | Net*Factor     | 0            | Net^Factor     | 0            | NethFactor     | 0.5         |
|                          |                                       |  | (1.5 for N/A)                                      |           |               |              |                |              |                |              |                |              |                |             |
|                          |                                       |  |  |           | 7%            | 2            | 46%            | 1            | 97%            | 0            | 78%            | 0            | 38%            | 1           |
|                          |                                       | T  | L  | [         | 1             |              | 1              |              | 1              |              | 1              |              | 1              |             |
|                          |                                       | Quality & Quantity Sancitivity Distribution    | HVA Occurrence: $0\%$                              |           |               |              |                |              |                |              |                |              |                |             |
|                          | Highly Vulnerable Aquifer (HVA)       | in GA (%) Ranges                               | $= 3, 0 - 10\% = 2, 10^{-1}$<br>50% = 1. > 50% = 0 | 0.5       | Net*Factor    | 1            | Net*Factor     | 0.5          | Net*Factor     | 0            | Net*Factor     | 0            | Net*Factor     | 1           |
|                          |                                       |  | (1.5 for N/A)                                      |           |               |              |                |              |                |              |                |              |                |             |
|                          |                                       |  |  |           | 0.5%          | 2            | 24%            | 1            | 93%            | 0            | 87%            | 0            | 9%             | 2           |
|                          |                                       |  |  |           | -             |              | -              |              | -              |              | -              |              | -              |             |
|                          |                                       | Hydrologic Stress Levels (Low, Moderate,       |  |           |               |              |                |              |                |              |                |              |                |             |
|                          | Water Quantity Stress Level           | Significant) via respective Water Availability | N/A - Information                                  | -         | Net*Factor    | NR           | Net*Factor     | NR           | Net*Factor     | NR           | Net*Factor     | NR           | Net*Factor     | NR          |
|                          |                                       | Study for primary "old watershed" (ref.        |  |           |               |              |                |              |                |              |                |              |                |             |
|                          | Surface Wate                          | r (quasource, 2010).                           |  |           | Mode          | erate        | Mode           | prate        | Mode           | Prate        | Mode           | prate        | Mode           | rate        |
|                          | Groundwater                           | r  |  |           | Moderat       | te / Low     | Moderate /     | Significant  | Mode           | erate        | Mode           | erate        | Mode           | rate        |
|                          |                                       |  |  |           | 1             |              |                |              |                |              |                |              |                |             |
|                          |                                       |  | = 3, 0-5% = 2, 5-                                  |           |               |              |                |              |                |              |                |              |                |             |
| 3. Natural Hazards       | Regulatory Flood Plain                | Area Distribution in GA + 30 m Buffer (%)      | 10% = 1, >10% =                                    | 0.5       | Net*Factor    | 1            | Net*Factor     | 1            | Net*Factor     | 0.5          | Net*Factor     | 1.5          | Net*Factor     | 0           |
|                          |                                       |  | 0  |           | 10/           | 2            | 20/            | 2            | 70/            | 1            |                | 2            | E 20/          | 0           |
|                          |                                       |  |  |           | 470           | 2            | 5 %            | 2            | 170            | 1            | -              | 3            | 52%            | 0           |
|                          |                                       |  | SL Occurrence: 0%                                  |           |               |              |                |              |                |              |                |              |                |             |
|                          | Regulated Shorelines                  | Area Distribution in GA + 30 m Buffer (%)      | = 3, 0-5% = 2, 5-10% = 10% = 10%                   | 0.5       | Net*Factor    | 1.5          | Net*Factor     | 1.5          | Net*Factor     | 1.5          | Net*Factor     | 1.5          | Net*Factor     | 1.5         |
|                          |                                       |  | 0  |           |               |              |                |              |                |              |                |              |                |             |
|                          |                                       |  |  |           | -             | 3            | -              | 3            | -              | 3            | -              | 3            | -              | 3           |
|                          |                                       |  | TOS Occurrence: 0%                                 |           | 1             |              | <u>г</u>       |              | 1              |              | -              |              |                |             |
|                          |                                       | Area Distribution in GA + 30 m Buffer (%)      | = 3, 0-5% = 2, 5-                                  |           | N             | 4            | N. INF. 1      | 1 5          | NI (*F. )      | 4 5          | N. INC.        | 1 5          | N. INF. I.     | 4           |
|                          | l op-of-slope Allowance               | (range)  | 10% = 1, >10% =                                    | 0.5       | Net^Factor    | I            | Net^Factor     | 1.5          | Net^Factor     | 1.5          | Net^Factor     | 1.5          | Net^Factor     | I           |
|                          |                                       |  | 0  |           | 1%            | 2            |                | 3            |                | 3            |                | 2            | 1%             | 2           |
|                          |                                       |  |  |           | 170           | 2            | <u>I</u>       | 5            | <u>I</u>       | 5            | 1              |              | 170            |             |
|                          |                                       |  | Karst Occurrence:                                  |           |               |              |                |              |                |              |                |              |                |             |
|                          | Karst                                 | Area Distribution in GA + 30 m Buffer (%)      | N/A = 3, Potential                                 | 1         | Net*Factor    | з            | Net*Factor     | 2            | Net*Factor     | 2            | Net*Factor     | 2            | Net*Factor     | З           |
|                          |                                       |  | = 2, Inferred = 1,                                 |           |               | 5            |                | -            |                | -            |                | -            | Het Fuctor     | 5           |
|                          |                                       |  | Known = 0  |           | 1000/         | 2            | 0.00           |              | 100/           | 2            | 70/            |              | 1000/          |             |
|                          | N/A (none,<br>Known (K                |  |  |           | 100%          | 3            | 9%<br>0%       | 3            | 42%            | 3            | 7%<br>0%       | 3            | 100%           | 3           |
|                          | Inferred (I)                          | )  |  |           | 0%            | 1            | 0%             | 1            | 38%            | 1            | 0%             | 1            | 0%             | 1           |
|                          | Potential (P,                         | )  |  |           | 0%            | 2            | 91%            | 2            | 17%            | 2            | 93%            | 2            | 0%             | 2           |
|                          | Back Dunes                            | N/A - data aan                                 | -  | -         |               | _            |                | -            | -              | -            |                | -            |                |             |
|                          |                                       |  |  |           | 1             |              | 1              |              | 1              |              |                |              |                |             |
|                          | Meander Belt                          | N/A - data gap                                 | -  | -         | -             | -            | -              | -            | -              | -            | -              | -            | -              | -           |
|                          |                                       |  |  |           | 1             |              | 1              |              | 1              |              |                |              | 1              |             |
| 4. Water Resource System | Headwater Drainage Feature            | N/A - data gap                                 | -  | -         | -             | -            | -              | -            | -              | -            | -              | -            | -              | -           |

| NTIAL GROW      | TH AREA SCREENING MATRIX EV  | ALUATION                                     |                            |           |            |        |            |        |              |          |            |        |            |    |
|-----------------|--|--|----------------------------|-----------|------------|--------|------------|--------|--------------|----------|------------|--------|------------|----|
| RSHED PLAN      | - EQUIVALENCY  |  |                            |           |            |        |            |        |              |          |            |        |            |    |
| CATEGORY        | FACTORS  | DESCRIPTION / MEASURE                        | RATING                     | WEIGHTING |            |        | -          |        | POTENTIAL GR | OWTH ARE | AS         |        | -          |    |
|                 |  |  |                            | FACTOR    | FE-        | 1      | FE-        | 2      | FE-          | 3        | FE-        | 4      | FE-        | -5 |
|                 |  |  |                            |           | Measure    | Rating | Measure    | Rating | Measure      | Rating   | Measure    | Rating | Measure    | Ra |
|                 |  |  |                            |           |            |        |            |        |              |          |            |        |            |    |
|                 | Watercourse Length & Sensitivity   | Composite Rating for Length and Sensitivity  | v (weighted equally)       | 1         | Net*Factor | 1 07   | Net*Factor | 2 00   | Net*Factor   | 2 03     | Net*Factor | 3 00   | Net*Factor |    |
|                 | ······································   |  | ) (                        | -         | 1          |        | 1          |        | 1            |          |            |        |            |    |
|                 |  | Total Length (m) in GA + 30 m Buffer -       | W/C Length/ha: 0           |           |            |        |            |        |              |          |            | -      |            |    |
|                 | Total Length   | normalized by total Area (m/ha)              | = 3, 0-5 = 2, 5-           | 1         | 5.3        | 1      | 1.2        | 2      | 3.0          | 2        | -          | 3      | 20         |    |
|                 |  |  | 15 = 1, >15 = 0            |           | 1          |        | 1          |        | 1            |          |            |        |            |    |
|                 | Total Sensitivity (3 Subcategories)  | Composite Rating for Sensitivity Subcategori | ies (weighted equally)     | 1         | Net*Factor | 1.13   | Net*Factor | 2.00   | Net*Factor   | 2.06     | Net*Factor | 3.00   | Net*Factor |    |
|                 |  |  |                            |           |            |        |            |        |              |          |            |        |            |    |
|                 | Channel Type   | Distribution of Total Length (%)             | Natural = 1.5,             | 1         | Net*Factor | 1.75   | Net*Factor | 3.00   | Net*Factor   | 2.47     | Net*Factor | 3.00   | Net*Factor |    |
|                 | Constructed  | _  | Constructed = $3$          |           | 17%        | 3      | 100%       | 3      | 65%          | 3        | 100%       | 3      | 7%         |    |
|                 | Natural  |  |                            |           | 83%        | 1.5    | -          | 1.5    | 35%          | 1.5      | -          | 1.5    | 93%        |    |
|                 |  | •  |                            |           |            |        |            |        |              |          |            |        |            |    |
|                 |  |  | Permanency                 |           |            |        |            |        |              |          |            |        |            |    |
|                 | Permanency   | Distribution of Total Length (%)             | Constraint: $P = 0, P/I$   | I         | Net*Factor | 0.48   | Net*Factor | 2.00   | Net*Factor   | 2.32     | Net*Factor | NK     | Net*Factor |    |
|                 | Permanent  |  | - 1, 1/L -2, 1 - J         |           | 78%        | 0      | -          | 0      | -            | 0        | -          | 0      | 92%        |    |
|                 | Permanent or Intermittent  |  |                            |           | -          | 1      | -          | 1      | -            | 1        | -          | 1      | -          |    |
|                 | Intermittent or Ephemeral  |  |                            |           | 18%        | 2      | 100%       | 2      | 68%          | 2        | -          | 2      | 8%         |    |
|                 |  |  |                            |           | 4%         | 3      | -          | 3      | 32%          | 3        | -          | 3      | -          |    |
|                 |  |  | Fish Habitat:              |           | 1          |        |            |        | 1            |          | 1          |        |            |    |
|                 |  |  | Туре 1 = 1,                |           |            |        |            |        |              |          |            |        |            |    |
|                 |  | Distribution of Total Length (%)             | Туре 2 = 2,                | 1         | Net*Factor | 1.17   | Net*Factor | 1.00   | Net*Factor   | 1.38     | Net*Factor | NR     | Net*Factor |    |
|                 | Eish Hahitat (MNRE)  |  | Type $3 = 3$ &             |           |            |        |            |        |              |          |            |        |            |    |
|                 | Type 1 - Critical  |  | O(ner = 2 (uvq)            |           | 83%        | 1      | 100%       | 1      | 62%          | 1        | -          | 1      | 95%        |    |
|                 | Type 2 - Important   |  |                            |           | 17%        | 2      | -          | 2      | -            | 2        | -          | 2      | -          |    |
|                 | Type 3 - Marginal  |  |                            |           | -          | 3      | -          | 3      | -            | 3        | -          | 3      | -          |    |
|                 | Other  |  |                            |           | 0%         | 2      | -          | 2      | 38%          | 2        | -          | 2      | 5%         |    |
|                 | Constructed Drain  | Composite Rating for Length and Sensitivity  | v (weighted equally)       | 1         | Net*Factor | 1 67   | Net*Factor | 0.56   | Net*Factor   | 1 13     | Net*Factor | 3 00   | Net*Factor |    |
|                 |  | Total Longth (m) in CA + 20 m Puffer         | Drain Length/ha:           |           |            |        |            | 0.00   |              |          |            | 0.00   |            |    |
|                 | Total Length   | normalized by total Area (m/ba)              | 0 = 3, 0-2 = 2, 2-         | 1         | 3.4        | 1      | 10.1       | 0      | 6.4          | 0        | 0.0        | 3      | 1.0        |    |
|                 |  |  | 5 = 1, >5 = 0              |           | 1          |        | 1          |        | I            |          |            |        |            |    |
|                 |  |  |                            |           | 1          |        | 1          |        | 1            |          | 1          |        | 1          |    |
|                 | Class / Review Process   | Distribution of Total Length (%)             | Class A-C, $E = 2$ , Class | 1         | Net*Factor | 2.33   | Net*Factor | 1.12   | Net*Factor   | 2.25     | Net*Factor | 3.00   | Net*Factor |    |
|                 |  |  | D, INK = 1, Class F = 5    |           |            |        |            |        |              |          |            |        |            |    |
|                 | Class A-C, E   |  |                            |           | 67%        | 2      | 12%        | 2      | 15%          | 2        | -          | 2      | 96%<br>1%  |    |
|                 | Class F  |  |                            |           | 33%        | 3      | -          | 3      | 55%          | 3        |            | 3      | -          |    |
|                 |  | •  |                            |           |            |        |            |        |              |          |            |        |            |    |
| Heritage System | New Niagara NHS  | NHS area within Growth Area (ha / %)         | -                          | -         | -          | -      | -          | -      | -            | -        | -          | -      | -          |    |
| ge -jeten       |  | Not complete. Cannot be assessed.            |                            |           |            |        |            |        |              |          |            |        |            |    |
|                 | Natural Heritage Features and Areas<br>Other Natural Heritage Features and Areas |  |                            |           | -          | -      | -          | -      | -            | -        | -          | -      | -          |    |
|                 | Supporting Features and Areas  |  |                            |           | -          | -      | -          | -      | -            | -        | -          | -      | -          |    |
|                 | Enhancement Areas  |  |                            |           | -          | -      | -          | -      | -            | -        | -          | -      | -          |    |
|                 | Linkages   |  |                            |           | -          | -      | -          | -      | -            | -        | -          | -      | -          |    |
|                 |  | 1  |                            |           | 1          |        | 1          |        | 1            |          | 1          |        | 1          |    |
|                 | Natural Cover Outside NHS  | Natural Cover outside of the NHS (ha / %) -  |                            | -         | -          | -      | -          | -      | -            | -        | - I        | -      | -          |    |
|                 |  | NHS not complete. Cannot be assessed.        |                            |           | 1          |        | 1          |        | 1            |          | 1          |        |            |    |

| NWP (E) - Volum | e 3: Growth Analysis - Appe                 | ndix C-3  |  |             |            |        |            |        |              |          |            |           |            |        |
|-----------------|---|---|--|-------------|------------|--------|------------|--------|--------------|----------|------------|-----------|------------|--------|
| POTENTIAL GROWT | H AREA SCREENING MATRIX EV                  | ALUATION  |  |             |            |        |            |        |              |          |            |           |            |        |
| WATERSHED PLAN  | - EQUIVALENCY                               |   |  |             |            |        |            |        |              |          |            |           |            |        |
| CATEGORY        | FACTORS                                     | DESCRIPTION / MEASURE                               | RATING   | WEIGHTING   |            |        |            |        | POTENTIAL GR | OWTH ARE | AS         |           |            | (      |
|                 |   |   |  | FACTOR      | FE         | -1     | FE         | -2     | FE           | -3       | FE         | -4        | FE         | -5     |
|                 |   |   |  |             | Measure    | Rating | Measure    | Rating | Measure      | Rating   | Measure    | Rating    | Measure    | Rating |
|                 |   | 1   |  |             |            |        |            |        |              |          |            |           | -          |        |
|                 | Natural Features and Areas                  | Varies. Used in Place of NHS Metric due to timing.  | 0 to 5 based on min,<br>max and quartile<br>values within each<br>factor element where<br>5=GA with least (i.e.,<br>best) and 0 = GA with<br>most (i.e., worst). | 2           | Net*Factor | 6.3    | Net*Factor | 9.3    | Net*Factor   | 5.4      | Net*Factor | 6.5       | Net*Factor | 4.8    |
|                 | Significant Features                        | % Cover in GA                                       |  | 1.25        | 5%         | 3      | 0%         | 5      | 8%           | 2        | 9%         | 2         | 17%        | 1      |
|                 | Natural Cover                               | % Cover in GA                                       |  | 1.25        | 21%        | 4      | 9%         | 4      | 36%          | 3        | 55%        | 1         | 57%        | 1      |
|                 | Wetlands - Provincially Significant         | Area in GA (ha)                                     |  | 1.25        | 20.8       | 2      | 0.0        | 5      | 42.9         | 2        | 13.6       | 3         | 58.6       | 1      |
|                 | Wetlands - unevaluated                      | Area in GA (ha)                                     |  | 1           | 25.5       | 1      | 1.7        | 4<br>E | 34.8         | 1        | 5.1        | 3<br>F    | 67.6       | 0      |
|                 | Woodlands                                   | Area in GA (ha)                                     |  | 1           | 43.1       | 2      | 0.0        | 4      | 106.2        | 1        | 31.9       | 3         | 63.1       | 2      |
|                 | Woodlands with Interior Habitat (>100m from | Count of footures in CA                             |  | 1.25        | 2          | -      | 0.0        |        | 6.0          | 0        | 1.0        | -         | 2.0        | 1      |
|                 | edge)                                       | Count of realures in GA                             |  | 1.25        | 2          | I      | 0.0        | 5      | 0.0          | 0        | 1.0        | 4         | 5.0        | I      |
|                 | Successional Habitats                       | Area in GA (ha)                                     |  | 0.75        | 2.8        | 3      | 0.8        | 4      | 10.6         | 3        | 27.7       | 1         | 11.9       | 3      |
|                 | Areas of Natural and Scientific Interest    | Area in GA (ha)                                     |  | 1.25        | 0          | 5      | 0.0        | 5      | 0.0          | 5        | 0.0        | 5         | 0.0        | 5      |
|                 | Communities                                 | Area in GA (ha)                                     |  | 1.25        | 0          | 5      | 0          | 5      | 0            | 5        | 0          | 5         | 0          | 5      |
|                 |   | •   |  |             |            |        |            |        |              |          |            |           |            |        |
|                 | Impact Risk                                 |   | 0 to 5 based on min,<br>max and quartile<br>values within each<br>factor element where<br>5=GA with least (i.e.,<br>best) and 0 = GA with<br>most (i.e., worst). | 2           | Net*Factor | 6.7    | Net*Factor | 4.7    | Net*Factor   | 4.0      | Net*Factor | 7.3       | Net*Factor | 5.3    |
|                 | Proximity of Signfiicant Features           | Count of features wtihin 120m of GA                 |  | 1           | 1          | 4      | 2          | 2      | 6            | 1        | 1          | 4         | 4          | 2      |
|                 | Edge to Area ratio                          | Ratio<br>Qualitative (0 (none) 1 (low) 2 (moderate) |  | 1           | 235.1      | 3      | 643.5      | 1      | 263.6        | 2        | 156.4      | 4         | 192.1      | 4      |
|                 |   | 3 (high)) - assigned for Risk of                    |  |             |            |        |            |        |              |          |            |           |            |        |
|                 | Fragmentation (qualitative)                 | fragmentation and potential Magnitude of            |  | 1           | 3          | 3      | 2          | 4      | 4            | 3        | 3          | 3         | 6          | 2      |
|                 |   | Fragmentation with a total potential value          |  |             |            |        |            |        |              |          |            |           |            |        |
|                 |   | of up to 6.   |  |             |            | 1      |            | 2      |              | 2        |            | 4         |            | -      |
|                 |   |   |  | Total Score | FE SCO     | RF     | FE SCO     | RF     | FE-          | RF       | FE SCO     | -4<br>DRF | FE SCO     | )RF    |
|                 |   | Water Resource Ratina                               |  | 22.0        | 16.        | .3     | 14         | 6      | 13.          | 4        | 16         | .6        | 14         | .5     |
|                 |   |   |  |             |            |        |            |        |              |          |            |           |            |        |
|                 |   | Natural Heritage Rating                             |  | 20.0        | 12.        | .9     | 14.        | 0      | 9.4          | 1        | 13.        | .9        | 10.        | .1     |
|                 |   | Net Tet 1 D. C.                                     |  | 42.0        | 20         | 2      |            | 6      | 20           | 0        |            | 4         | 24         | 6      |
|                 |   | Net Total Rating                                    |  | 42.0        | 29.        | 2      | 28.        | 0      | 22.          | ŏ        | 30.        | .4        | 24.        | 0      |
|                 | Settlement Area B                           | oundary Review - Environmental Ouestion             | n #3 - Impact Rating   |             | MODEST     | IMPACT | MODEST     | IMPACT | HIGH IN      | ЛРАСТ    | MINIMAI    | IMPACT    | HIGH IN    | МРАСТ  |
|                 |   | ,   |  |             |            | ••     |            |        |              | -        |            |           |            | -      |

| OTENTIAL GROW           | TH AREA SCREENING MATRIX E          | VALUATION                                |                           |  |               |            |                       |           |                        |           |                        |           |                        |             |         |                    |            |            |
|-------------------------|-------------------------------------|--|---------------------------|--|---------------|------------|-----------------------|-----------|------------------------|-----------|------------------------|-----------|------------------------|-------------|---------|--------------------|------------|------------|
| VATERSHED PLAN          | - FOUIVALENCY                       |  |                           |  |               |            |                       |           |                        |           |                        |           |                        |             |         |                    |            |            |
| CATEGORY                | FACTORS                             | DESCRIPTION / MEASURE                    | RATING                    | WEIGHTING  |               |            |                       |           | POTENTIAL GR           | OWTH ARE  | AS                     |           |                        |             |         |                    |            |            |
|                         |                                     |  |                           | FACTOR   | FE-           | 6          | FE-                   | 7         | FE-                    | -8        | GR-                    | 1         | NF                     | -1          |         |                    |            |            |
|                         |                                     |  |                           |  | Measure       | Rating     | Measure               | Rating    | Measure                | Rating    | Measure                | Rating    | Measure                | Rating      |         |                    |            |            |
| Location / Watershed    |                                     |  |                           |  |               |            |                       |           |                        |           |                        |           |                        |             |         |                    |            |            |
| System                  | Total GA Area                       | GA Only - Size in hectares (ha)          | N/A - Information         | -  | 98 r          | าล         | 81 r                  | na        | 201                    | na        | 12 r                   | na        | 329                    | ha          |         |                    |            |            |
|                         |                                     | GA + 30 m Buffer - Size in hectares (ha) |                           |  | 117 H         | ha         | 93 h                  | na        | 26 /                   | ha        | 17 H                   | na        | 354                    | ha          |         |                    |            |            |
|                         |                                     |  |                           |  | •             |            |                       |           |                        |           | -                      |           |                        |             |         |                    |            |            |
|                         | Municipality                        | N/A - Informational Purposes.            | N/A - Information         | -  | Fort          | Erie       | Fort E                | Erie      | Fort                   | Erie      | Grim                   | bsy       | Niagara                | a Falls     |         |                    |            |            |
|                         |                                     | Percentage of Growth Area in repective   |                           |  |               | (1000())   |                       | (10000)   |                        | (100%)    |                        | (1000)    |                        | : (10000)   |         |                    |            |            |
|                         | Tertiary watersned                  | Tertiary Watershed                       | N/A - Information         | -  | Niagara Riv   | er (100%)  | Niagara Riv           | er (100%) | iniagara Riv           | er (100%) | Lake Ontar             | 0 (100%)  | Lake Ontar             | 10 (100%)   |         |                    |            |            |
|                         |                                     |  |                           |  |               |            |                       |           |                        |           |                        |           |                        |             |         |                    |            |            |
|                         |                                     | Percentage of Growth Area in repective   |                           | Niagara River South Niagara River South Niagara Rive |               | ver South  | West Lake             | Ontario   | ek and NO              |           |                        |           |                        |             |         |                    |            |            |
|                         | Quaternary Watershed                | Quaternary Watershed                     | N/A - Information         | -  | (100          | %)         | a) (100%)             |           | (100                   | 1%)       | Shoreline              | (100%)    | (89                    | %)          |         |                    |            |            |
|                         |                                     |  |                           |  |               |            |                       |           |                        |           |                        |           | Welland Ca             | anal North  |         |                    |            |            |
|                         |                                     |  |                           |  |               |            |                       |           |                        |           |                        |           |                        |             |         |                    | (92)       | %)         |
|                         |                                     |  |                           |  |               |            |                       |           |                        |           |                        |           |                        |             |         |                    |            |            |
|                         |                                     |  |                           |  | -             |            | -                     |           | -                      |           | -                      |           | -                      |             |         |                    |            |            |
|                         | Subwatershed                        | Percentage of Growth Area in repective   | N/A - Information         | -  | FEC Black Cre | eek (100%) | FEC Black Creek (100% |           | FEC Black Creek (100%) |           | FEC Black Creek (100%) |           | FEC Black Creek (100%) |             | Outside | NPCA<br>ds (99.9%) | BDSC Shrir | ners Creek |
|                         |                                     | Subwatersneu                             |                           |  |               |            |                       |           |                        |           | GR Lake On             | tario 44A | BDSC Ten Mile Creek    |             |         |                    |            |            |
|                         |                                     |  |                           |  |               |            |                       |           |                        |           | (0.01                  | %)        | (62)                   | %)          |         |                    |            |            |
|                         |                                     |  |                           |  |               |            |                       |           |                        |           |                        |           | NOTL Six Mil           | e Creek (8% |         |                    |            |            |
|                         |                                     |  |                           |  |               |            |                       |           |                        |           |                        |           |                        |             |         |                    |            |            |
|                         |                                     | 1  |                           |  |               |            |                       |           |                        |           |                        |           |                        |             |         |                    |            |            |
|                         |                                     |  | Sensitivity to            |  | [             |            |                       |           |                        |           |                        |           |                        |             |         |                    |            |            |
| 1 Physical Conditions   | Surficial Sails                     | Soil Drainage Class & Sensitivity        | Urbanization: Low         | 0.5  | Not*Eactor    | 1 2 2      | Not*Eactor            | 0.96      | Not*Eactor             | 0.04      | Not*Eactor             | 1 50      | Not*Eactor             | 1 16        |         |                    |            |            |
| 1. Physical Conditions  |                                     | Distribution in GA (%)                   | 1, Unknown is Not         | 0.5  | Net Factor    | 1.20       | Net Factor            | 0.90      | Net Factor             | 0.94      | Net Factor             | 1.50      | Net Factor             | 1.10        |         |                    |            |            |
|                         |                                     |  | Rated.                    |  | 201           |            | 170/                  |           | 1.404                  |           | 00/                    |           |                        |             |         |                    |            |            |
|                         | Unknown (-, VA<br>Hiah (R. W. MW    |  |                           |  | 2%<br>0%      | - 1        | 17%<br>6%             | - 1       | 14%<br>24%             | - 1       | 0%<br>0%               | -<br>1    | 8%<br>1%               | -<br>1      |         |                    |            |            |
|                         | Medium (I                           | )  |                           |  | 43%           | 2          | 77%                   | 2         | 49%                    | 2         | 0%                     | 2         | 60%                    | 2           |         |                    |            |            |
|                         | Low (P, VP                          | )  |                           |  | 55%           | 3          | 0%                    | 3         | 13%                    | 3         | 100%                   | 3         | 31%                    | 3           |         |                    |            |            |
|                         |                                     |  | Constraint to             |  | r             |            | <b></b>               |           | <b>I</b>               |           | <b></b>                |           | <b>I</b>               |             |         |                    |            |            |
|                         | Slopes/Topography                   | Surface Slopes Distribution in GA (%)    | Development: Low          | 0.5  | Net*Factor    | 1.44       | Net*Factor            | 1.35      | Net*Factor             | 1.25      | Net*Factor             | 1.49      | Net*Factor             | 1.42        |         |                    |            |            |
|                         |                                     |  | = 3, Med = 2, High =<br>1 |  |               |            |                       |           |                        |           |                        |           |                        |             |         |                    |            |            |
|                         | Mild (0-2%)                         | )  |                           |  | 87%           | 3          | 69%                   | 3         | 50%                    | 3         | 98%                    | 3         | 84%                    | 3           |         |                    |            |            |
|                         | Medium (2-10%)<br>Steen (> 10%)     |  |                           |  | 13%           | 2          | 31%                   | 2         | 50%<br>0%              | 2         | 2%<br>0%               | 2         | 15%<br>0%              | 2           |         |                    |            |            |
|                         | Steep (>10%                         |  |                           |  | 070           | 1          | 0%                    | 1         | 070                    | 1         | 070                    | 1         | 078                    | 1           |         |                    |            |            |
| 2. Groundwater System & | Intake Protection Zone (Lake-Based) | Designated Area in GA & Drainage System  | s (weighted equally)      | 1  | Net*Factor    | 3          | Net*Factor            | 3         | Net*Factor             | 3         | Net*Factor             | 0         | Net*Factor             | 3           |         |                    |            |            |
| Source Water Protection |                                     |  | IPZ Occurrence: 0%        |  |               |            |                       |           |                        |           |                        |           |                        |             |         |                    |            |            |
|                         |                                     | Designated Area in GA (%)                | = 3, 0-5% = 2, 5-20%      | 1  | -             | 3          | -                     | 3         | -                      | 3         | 39%                    | 0         | -                      | 3           |         |                    |            |            |
|                         |                                     |  | = 1,>20% = 0              |  |               |            |                       |           |                        |           |                        |           |                        |             |         |                    |            |            |
|                         |                                     | IPZ Present in any of the Quaternary     |                           |  |               |            |                       |           |                        |           | -                      |           |                        |             |         |                    |            |            |
|                         |                                     | Watersheds? (Y / N)                      | N/A - Information         | 1  | Ŷ             | -          | Ŷ                     | -         | Ŷ                      | -         | Ŷ                      | -         | Ŷ                      | -           |         |                    |            |            |

| NWP (E) - Volum          | e 3: Growth Analysis - Appe                     | endix C-3   |   |           |               |              |                |             |                |                                       |                |              |                |             |
|--------------------------|---|---|---|-----------|---------------|--------------|----------------|-------------|----------------|---------------------------------------|----------------|--------------|----------------|-------------|
| POTENTIAL GROWT          | H AREA SCREENING MATRIX EV                      | /ALUATION   |   |           |               |              |                |             |                |                                       |                |              |                |             |
| WATERSHED PLAN           | - EQUIVALENCY                                   |   |   |           |               |              |                |             |                |                                       |                |              |                |             |
| CATEGORY                 | FACTORS   | DESCRIPTION / MEASURE   | RATING  | WEIGHTING |               |              |                | -           | POTENTIAL GR   | OWTH ARE                              | AS             |              |                |             |
|                          |   |   |   | FACTOR    | FE<br>Measure | -6<br>Rating | FE-<br>Measure | 7<br>Rating | FE-<br>Measure | -8<br>Rating                          | GR-<br>Measure | -1<br>Rating | NF-<br>Measure | 1<br>Rating |
|                          |   |   |   |           |               | · ·          |                |             |                | · · · · · · · · · · · · · · · · · · · |                |              |                | g           |
|                          | Significant Groundwater Recharge Area<br>(SGRA) | Quality & Quantity Sensitivity Distribution<br>in GA (%) Ranges   | SGRA Occurrence:<br>0% = 3, 0-10% = 2, 10-<br>50% = 1, >50% = 0                 | 0.5       | Net*Factor    | 0            | Net*Factor     | 0           | Net*Factor     | 0                                     | Net*Factor     | 1.5          | Net*Factor     | 1.5         |
|                          |   |   | (1.5 for N/A)   |           |               |              |                |             |                |                                       |                |              |                |             |
|                          |   |   |   |           | 66%           | 0            | 96%            | 0           | 74%            | 0                                     | -              | 3            | -              | 3           |
|                          |   |   | 1   |           |               |              |                |             | 1              |                                       | 1              |              |                |             |
|                          | Highly Vulnerable Aquifer (HVA)                 | Quality & Quantity Sensitivity Distribution<br>in GA (%) Ranges   | HVA Occurrence: 0%<br>= 3, 0-10% = 2, 10-<br>50% = 1, >50% = 0<br>(1.5 for N/A) | 0.5       | Net*Factor    | 1            | Net*Factor     | 0           | Net*Factor     | 0.5                                   | Net*Factor     | 1.5          | Net*Factor     | 1           |
|                          |   |   |   |           | 0.5%          | 2            | 100%           | 0           | 38%            | 1                                     | -              | 3            | 5%             | 2           |
|                          |   |   |   |           |               |              |                |             |                |                                       |                |              |                |             |
|                          | Water Quantity Stress Level                     | Hydrologic Stress Levels (Low, Moderate,<br>Significant) via respective Water Availability<br>Study for primary "old watershed" (ref.<br>AquaSource, 2010). | N/A - Information   | -         | Net*Factor    | NR           | Net*Factor     | NR          | Net*Factor     | NR                                    | Net*Factor     | NR           | Net*Factor     | NR          |
|                          | Surface Water                                   | r   |   |           | Mode          | erate        | Mode           | rate        | Mode           | erate                                 | Signifi        | icant        | Signifi        | cant        |
|                          | Groundwater                                     | r   |   |           | Mode          | erate        | Mode           | rate        | Mode           | erate                                 | Lov            | W            | Lov            | v           |
|                          |   | Γ   | FP Occurrence: 0%   |           | 1             |              | 1              |             | 1              |                                       | Т              |              |                |             |
| 3. Natural Hazards       | Regulatory Flood Plain                          | Area Distribution in GA + 30 m Buffer (%)   | = 3, 0-5% = 2, 5-<br>10% = 1, >10% =<br>0                                       | 0.5       | Net*Factor    | 1            | Net*Factor     | 0.5         | Net*Factor     | 1.5                                   | Net*Factor     | 1.5          | Net*Factor     | 1           |
|                          |   |   |   |           | 0%            | 2            | 6%             | 1           | -              | 3                                     | -              | 3            | 1%             | 2           |
|                          |   |   | SL Occurrence: 0%   |           | 1             |              | 1              |             | 1              |                                       | T              |              |                |             |
|                          | Regulated Shorelines                            | Area Distribution in GA + 30 m Buffer (%)   | = 3, 0-5% = 2, 5-<br>10% = 1, >10% =  | 0.5       | Net*Factor    | 1.5          | Net*Factor     | 1.5         | Net*Factor     | 1.5                                   | Net*Factor     | 1.5          | Net*Factor     | 1.5         |
|                          |   |   | ő   |           | -             | 3            | -              | 3           | -              | 3                                     | -              | 3            | -              | 3           |
|                          |   |   |   |           |               |              |                |             | 1              |                                       |                |              |                |             |
|                          | Top-of-slope Allowance                          | Area Distribution in GA + 30 m Buffer (%)<br>(range)  | = 3, 0-5% = 2, 5-<br>10% = 1, >10% =  | 0.5       | Net*Factor    | 1.5          | Net*Factor     | 1           | Net*Factor     | 1.5                                   | Net*Factor     | 1.5          | Net*Factor     | 1           |
|                          |   |   | 0   |           | -             | 3            | 0%             | 2           | -              | 3                                     | -              | 3            | 0%             | 2           |
|                          |   |   |   |           | -             |              |                |             | -              |                                       |                |              |                |             |
|                          | Karst   | Area Distribution in GA + 30 m Buffer (%)   | Karst Occurrence:<br>N/A = 3, Potential<br>= 2, Inferred = 1,<br>Known = 0      | 1         | Net*Factor    | 3            | Net*Factor     | 1           | Net*Factor     | 3                                     | Net*Factor     | 3            | Net*Factor     | 2           |
|                          | N/A (none)                                      |   |   |           | 100%          | 3            | 0%             | 3           | 101%           | 3                                     | 100%           | 3            | 0%             | 3           |
|                          | Known (K)                                       |   |   |           | 0%            | 0            | 6%             | 0           | 0%             | 0                                     | 0%             | 0            | 0%             | 0           |
|                          | Inferred (I)<br>Potential (P)                   |   |   |           | 0%<br>0%      | 1<br>2       | 94%<br>0%      | 1<br>2      | 0%<br>0%       | 1<br>2                                | 0%<br>0%       | 1<br>2       | 0%<br>100%     | 1<br>2      |
|                          | r otentiut (r)                                  |   |   |           | 070           | L            | 070            | ٢           | 070            | 2                                     | 070            | L            | 10070          | 2           |
|                          | Back Dunes                                      | N/A - data gap  | -   | -         | -             | -            | -              | -           | -              | -                                     | -              | -            | -              | -           |
|                          |   |   |   |           | -             |              | -              |             | 1              |                                       |                |              |                |             |
|                          | Meander Belt                                    | N/A - data gap  | -   | -         | -             | -            | -              | -           | -              | -                                     | -              | -            | <u> </u>       | -           |
| 4. Water Resource System | Headwater Drainage Feature                      | N/A - data gap  | -   | -         | -             | -            | -              | -           | -              | -                                     | -              | -            | -              | -           |

|                         | HAREA SCREENING MATRIX EN                 |  |                                |           |            |         |            |         |              |          |            |         |                       |         |
|-------------------------|---|--|--------------------------------|-----------|------------|---------|------------|---------|--------------|----------|------------|---------|-----------------------|---------|
| JIENTIAL GROWT          | H AREA SCREENING MATRIX EV                | ALUATION                                     |                                |           | _          |         |            |         |              |          |            |         |                       |         |
| ATERSHED PLAN           | - EQUIVALENCY                             |  |                                |           |            |         |            |         |              |          |            |         |                       |         |
| CATEGORY                | FACTORS                                   | DESCRIPTION / MEASURE                        | RATING                         | WEIGHTING |            |         |            |         | POTENTIAL GR | OWTH ARE | AS         |         | •                     |         |
|                         |   |  |                                | FACTOR    | FE-        | -6      | FE-1       | 7       | FE-          | 8        | GR-        | 1       | NF                    | -1      |
|                         |   |  |                                |           | Measure    | Rating  | Measure    | Rating  | Measure      | Rating   | Measure    | Rating  | Measure               | Ratin   |
|                         |   |  |                                |           |            |         |            |         |              |          |            |         |                       |         |
|                         | Wetenessing Longth & Consistivity         | Composite Dating for Langth and Consitivity  | (weighted equally)             | 1         | Net*Fector | 2.00    | Net*Fester | 1 40    | Nettor       | 2.00     | Not*Factor | 1 17    | Not*Factor            | 1.40    |
|                         | watercourse Length & Sensitivity          | Composite Rating for Length and Sensitivity  | (weighted equally)             | I         | Net^Factor | 2.00    | Net*Factor | 1.48    | Net*Factor   | 3.00     | Net*Factor | 1.17    | Net*Factor            | 1.48    |
|                         |   |  | W/C Lenath/ha: 0               |           | 1          |         | 1          |         | 1            |          | 1          |         | 1                     |         |
|                         | Total Length                              | Total Length (m) in GA + 30 m Buffer -       | = 3, 0-5 = 2, 5-               | 1         | 4          | 2       | 6          | 1       | -            | 3        | 37.1       | 0       | 6.9                   | 1       |
|                         | , , , , , , , , , , , , , , , , , , ,     | normalized by total Area (m/ha)              | 15 = 1, >15 = 0                |           |            |         |            |         |              |          |            |         |                       |         |
|                         |   |  |                                |           |            |         |            |         | •            |          | -          |         | -                     |         |
|                         | Total Sensitivity (3 Subcategories)       | Composite Rating for Sensitivity Subcategori | es (weighted equally)          | 1         | Net*Factor | 2.00    | Net*Factor | 1.95    | Net*Factor   | 3.00     | Net*Factor | 2.33    | Net*Factor            | 1.96    |
|                         |   | 1  |                                |           | 1          |         | -1         |         |              |          | -          |         | 1                     |         |
|                         | Channel Type                              | Distribution of Total Length (%)             | Natural = 1.5,                 | 1         | Net*Factor | 3.00    | Net*Factor | 1.86    | Net*Factor   | 3.00     | Net*Factor | 3.00    | Net*Factor            | 2.08    |
|                         | Constructed                               |  | Constructed = 3                |           | 100%       | 2       | 2.49/      | 2       | 100%         | 2        | 100%       | 2       | 20%                   | 2       |
|                         | Constructed                               |  |                                |           | 100%       | 5<br>15 | 24%        | 3<br>15 | 100%         | 3<br>15  | 100%       | 3<br>15 | 39%<br>61%            | 3<br>15 |
|                         |   |  |                                |           |            | 1.5     | 70%        | 1.5     | -            | 1.5      | -          | 1.5     | 0178                  | 1.5     |
|                         |   |  | Permanency                     | [         | 1          |         |            |         |              |          | 1          |         | 1                     |         |
|                         | Permanency                                | Distribution of Total Length (%)             | Constraint: $P = 0$ , $P/I$    | 1         | Net*Factor | 2.00    | Net*Factor | 3.00    | Net*Factor   | NR       | Net*Factor | 2.00    | Net*Factor            | 1.80    |
|                         | ,   |  | = 1, I/E =2, I = 3             |           |            |         |            |         |              |          |            |         |                       |         |
|                         | Permanent                                 |  |                                |           | -          | 0       | -          | 0       | -            | 0        | -          | 0       | -                     | 0       |
|                         | Permanent or Intermittent                 |  |                                |           | -          | 1       | -          | 1       | -            | 1        | -          | 1       | 20%                   | 1       |
|                         | Intermittent or Ephemeral                 |  |                                |           | 100%       | 2       | -          | 2       | -            | 2        | 100%       | 2       | 80%                   | 2       |
|                         | Intermittent                              |  |                                |           | -          | 3       | 100%       | 3       | -            | 3        | -          | 3       | -                     | 3       |
|                         |   |  | Eish Habitat                   |           | 1          |         |            |         |              |          |            |         |                       |         |
|                         |   |  | Type $1 = 1$                   |           |            |         |            |         |              |          |            |         |                       |         |
|                         |   | Distribution of Total Length (%)             | Type $2 = 2$                   | 1         | Net*Factor | 1 00    | Net*Factor | 1 00    | Net*Factor   | NR       | Net*Factor | 2 00    | Net*Factor            | 2 00    |
|                         |   | Distribution of Fotal Length (70)            | Type 2 = 2,<br>Type 3 = 3 = 8, |           |            | 1.00    | i detor    | 1.00    | i deloi      |          |            | 2.00    |                       | 2.00    |
|                         | Fish Habitat (MNRF)                       |  | Other = $2$ (ava)              |           |            |         |            |         |              |          |            |         |                       |         |
|                         | Type 1 - Critical                         |  |                                |           | 100%       | 1       | 100%       | 1       | -            | 1        | -          | 1       | -                     | 1       |
|                         | Type 2 - Important                        |  |                                |           | -          | 2       | -          | 2       | -            | 2        | -          | 2       | 99%                   | 2       |
|                         | Type 3 - Marginal                         |  |                                |           | -          | 3       | -          | 3       | -            | 3        | -          | 3       | -                     | 3       |
|                         | Other                                     |  |                                |           | -          | 2       | -          | 2       | -            | 2        | 100%       | 2       | 1%                    | 2       |
|                         |   |  |                                | -         | r          |         | 1          |         | T=           |          | T          |         | <b>L</b> <del>.</del> |         |
|                         | Constructed Drain                         | Composite Rating for Length and Sensitivity  | (weighted equally)             | 1         | Net*Factor | 3.00    | Net*Factor | 3.00    | Net*Factor   | 3.00     | Net*Factor | 3.00    | Net*Factor            | 3.00    |
|                         | Total Longth                              | Total Length (m) in GA + 30 m Buffer -       | Drain Lengin/na:               | 1         | 0.0        | 2       | 0.0        | 2       | 0.0          | 2        | 0.0        | 2       | 0.0                   | 2       |
|                         | Total Length                              | normalized by total Area (m/ha)              | 0 = 3, 0 = 2 = 2, 2 = 2        | 1         | 0.0        | 5       | 0.0        | 2       | 0.0          | 5        | 0.0        | 2       | 0.0                   | 5       |
|                         |   |  | 5 = 1, 25 = 0                  |           | •          |         |            |         | 1            |          |            |         |                       |         |
|                         |   |  | Class A C.E. 2 Class           |           | 1          |         |            |         |              |          |            |         |                       |         |
|                         | Class / Review Process                    | Distribution of Total Length (%)             | Class A-C, E = 2, Class        | 1         | Net*Factor | 3.00    | Net*Factor | 3.00    | Net*Factor   | 3.00     | Net*Factor | 3.00    | Net*Factor            | 3.00    |
|                         |   |  | D, $NR = 1$ , Class $F = 3$    |           |            |         |            |         |              |          |            |         |                       |         |
|                         | Class A-C, E                              |  |                                |           | -          | 2       | -          | 2       | -            | 2        | -          | 2       | -                     | 2       |
|                         | Class D, NR                               |  |                                |           | -          | 1       | -          | 1       | -            | 1        | -          | 1       | -                     | 1       |
|                         | Class F                                   |  |                                |           | -          | 3       | -          | 3       | -            | 3        | -          | 3       | -                     | 3       |
|                         | 1   | NULC area within Crowth Area (ha / 9/)       |                                |           | 1          |         | 1          |         | 1            |          | 1          |         |                       |         |
| Natural Heritage System | New Niagara NHS                           | NHS area within Growth Area (na / %)         | -                              | -         | -          | -       | -          | -       | -            | -        | -          | -       | -                     | -       |
|                         | Natural Heritage Features and Areas       | Not complete. Calmot be assessed.            |                                |           | - I        | -       |            | -       | - I          | -        | l .        | -       | - I                   | -       |
|                         | Other Natural Heritage Features and Areas |  |                                |           | -          | -       | -          | -       | -            | -        |            | -       | -                     | -       |
|                         | Supporting Features and Areas             |  |                                |           | -          | -       |            | -       | -            | -        | -          | -       | -                     | -       |
|                         | Enhancement Areas                         |  |                                |           | -          | -       | -          | -       | -            | -        | -          | -       | -                     | -       |
|                         | Linkages                                  |  |                                |           | -          | -       | -          | -       | -            | -        | -          | -       | -                     | _       |
|                         |   |  |                                |           |            |         |            |         |              |          |            |         |                       |         |
|                         |   | Natural Cover outside of the NHS (ba. / %) - |                                |           |            |         |            |         |              |          |            |         |                       |         |
|                         | Natural Cover Outside NHS                 |  | I .                            |           | 1          | _       | 1          |         | 1            |          | 1          | -       | I -                   | -       |
|                         |   | NHS not complete. Cannot be assessed         |                                | -         | -          | -       | -          | -       | -            | -        | -          |         |                       |         |

| NWP (E) - Volum | e 3: Growth Analysis - Appe                 | ndix C-3  |  |              |             |        |              |                |              |                |              |        |              |        |
|-----------------|---|---|--|--------------|-------------|--------|--------------|----------------|--------------|----------------|--------------|--------|--------------|--------|
| POTENTIAL GROWT | H AREA SCREENING MATRIX EV                  | ALUATION  |  |              |             |        |              |                |              |                |              |        |              |        |
| WATERSHED PLAN  | - EQUIVALENCY                               |   |  |              |             |        |              |                |              |                |              |        |              |        |
| CATEGORY        | FACTORS                                     | DESCRIPTION / MEASURE                                 | RATING   | WEIGHTING    |             |        |              |                | POTENTIAL GR | OWTH ARE       | AS           |        |              |        |
|                 |   |   |  | FACTOR       | FE          | -6     | FE           | 7              | FE-          | 8              | GR           | -1     | NF           | -1     |
|                 |   |   |  |              | Measure     | Rating | Measure      | Rating         | Measure      | Rating         | Measure      | Rating | Measure      | Rating |
|                 |   |   |  | -            |             |        |              |                | -            |                |              |        | -            |        |
|                 | Natural Features and Areas                  | Varies. Used in Place of NHS Metric due to<br>timing. | 0 to 5 based on min,<br>max and quartile<br>values within each<br>factor element where<br>5=GA with least (i.e.,<br>best) and 0 = GA with<br>most (i.e., worst). | 2            | Net*Factor  | 7.2    | Net*Factor   | 6.4            | Net*Factor   | 9.0            | Net*Factor   | 9.9    | Net*Factor   | 7.5    |
|                 | Significant Features                        | % Cover in GA   |  | 1.25         | 8%          | 3      | 9%           | 2              | 0%           | 5              | 0%           | 5      | 0%           | 5      |
|                 | Natural Cover                               | % Cover in GA   |  | 1.25         | 47%         | 2      | 82%          | 1              | 46%          | 3              | 0%           | 5      | 27%          | 3      |
|                 | Wetlands - Provincially Significant         | Area in GA (ha)                                       |  | 1.25         | 7.4         | 3      | 7.2          | 3              | 0.0          | 5              | 0.0          | 5      | 0.0          | 5      |
|                 | Wetlands - unevaluated                      | Area in GA (ha)                                       |  | 1            | 15.0        | 2      | 6.8          | 2              | 4.0          | 4              | 0.0          | 5      | 5.7          | 3      |
|                 | Woodlands                                   | Area in GA (ha)                                       |  | 1            | 22.6        | 3      | 22.2         | 3              | 5.0          | 4              | 0.0          | 5      | 36.5         | 3      |
|                 | Woodlands with Interior Habitat (>100m from |   |  | 1.25         | 1.0         | 5      |              |                | 5.0          |                | 0.0          | -      | 1.0          |        |
|                 | edge)                                       | Count of features in GA                               |  | 1.25         | 1.0         | 4      | 1.0          | 4              | 1.0          | 4              | 0.0          | 5      | 1.0          | 4      |
|                 | Successional Habitats                       | Area in GA (ha)                                       |  | 0.75         | 1.3         | 4      | 29.6         | 1              | 0.0          | 5              | 0.1          | 4      | 16.5         | 2      |
|                 | Areas of Natural and Scientific Interest    | Area in GA (ha)                                       |  | 1.25         | 0.0         | 5      | 0.0          | 5              | 0.0          | 5              | 0.0          | 5      | 0.0          | 5      |
|                 | Communities                                 | Area in GA (ha)                                       |  | 1.25         | 0           | 5      | 0            | 5              | 0            | 5              | 0            | 5      | 0            | 5      |
|                 |   |   |  |              |             |        | •            |                |              |                | •            |        |              |        |
|                 | Impact Risk                                 |   | 0 to 5 based on min,<br>max and quartile<br>values within each<br>factor element where<br>5=GA with least (i.e.,<br>best) and 0 = GA with<br>most (i.e., worst). | 2            | Net*Factor  | 8.0    | Net*Factor   | 6.7            | Net*Factor   | 6.0            | Net*Factor   | 6.7    | Net*Factor   | 6.0    |
|                 | Proximity of Signfiicant Features           | Count of features wtihin 120m of GA                   |  | 1            | 1           | 4      | 2            | 2              | 1            | 4              | 0            | 5      | 0            | 5      |
|                 | Edge to Area ratio                          | Ratio<br>Qualitative (0 (none), 1 (low), 2 (moderate) |  | 1            | 172.3       | 4      | 72.4         | 4              | 400.9        | 1              | 3021.6       | 0      | 291.6        | 2      |
|                 |   | 3 (high)) - assigned for Risk of                      |  |              |             |        |              |                |              |                |              |        |              |        |
|                 | Fragmentation (qualitative)                 | fragmentation and potential Magnitude of              |  | 1            | 2           | 4      | 2            | 4              | 2            | 4              | 1            | 5      | 5            | 2      |
|                 |   | Fragmentation with a total potential value            |  |              |             |        |              |                |              |                |              |        |              |        |
|                 |   | of up to 6.   |  |              |             |        |              |                |              |                |              |        |              |        |
|                 |   |   |  | Tatal        | FE          | -6     | FE-          | 7              | FE-          | 8              | GR           | -1     | NF           | -1     |
|                 |   | Water Resource Pating                                 |  | 1 otal Score | 10          | 7      | 12           | <b>KE</b><br>7 | 10           | <b>KE</b><br>2 | 17           | 7      | 10<br>5C0    | 1      |
|                 |   | water resource rating                                 |  | 22.0         | 10.         |        | <b>I</b> 15. | /              | 1 19.        | <u> </u>       | I 17.        | 1      | 1 10.        | 1      |
|                 |   | Natural Heritage Rating                               |  | 20.0         | 15.         | 2      | 13.          | 0              | 15.0         | 0              | 16.          | 5      | 13.          | 5      |
|                 |   |   |  |              |             |        | -            |                |              |                | -            |        |              |        |
|                 |   | Net Total Rating                                      |  | 42.0         | 33.         | 9      | 26.          | 8              | 34.          | 2              | 34.          | 2      | 31.          | 6      |
|                 | Cottlamont Area D                           | oundary Review - Environmental Question               | #3 - Impact Pating   |              | MINIMAL     | IMPACT | MODECT       | IMPACT         | MINIMAL      | IMPACT         | MINIMAL      | IMPACT | MINIMAL      | IMPACT |
|                 | Settlement Area B                           | oundary Review - Environmental Question               | i #5 - impact Kating   |              | IVIINIIVIAL |        | IVIODEST     |                |              |                | IVIIIVIIVIAL |        | IVIIINIIVIAL | INTACI |

|                        |   |  |                           |           |               |                   |                     |                  |               |              |               |              | -             |              |
|------------------------|---|--|---------------------------|-----------|---------------|-------------------|---------------------|------------------|---------------|--------------|---------------|--------------|---------------|--------------|
| ATERSHED PLAN          | - EQUIVALENCY   |  |                           |           | _             |                   |                     |                  |               |              |               |              |               |              |
| CATEGORY               | FACTORS   | DESCRIPTION / MEASURE                                    | RATING                    | WEIGHTING |               |                   |                     |                  | POTENTIAL GR  | OWTH ARE     | AS            |              |               |              |
|                        |   |  |                           | FACTOR    | NF            | -2                | NF                  | -3               | NF            | -4           | NF            | -5<br>Detine | NF            | -6           |
|                        |   |  |                           |           | Measure       | Rating            | Weasure             | Rating           | Weasure       | Rating       | weasure       | Rating       | Ivieasure     | Rating       |
| Location / Watershed   | Total GA Area<br>Municipality<br>Tertiary Watershed<br>Quaternary Watershed<br>Subwatershed | GA Only - Size in bectares (ba)                          | N/A - Information         | _         | 527           | ha                | 373                 | 12               | 467           | ha           | 311           | ha           | 656           |              |
| System                 | Fotal GA Area Municipality Fertiary Watershed Quaternary Watershed Subwatershed             |  |                           |           | 551           | i i d             | 575                 | iu               | 107           | Πά           | 5111          | la           |               |              |
|                        | Total GA Area Municipality Tertiary Watershed Quaternary Watershed Subwatershed             | GA + 30 m Buffer - Size in hectares (ha)                 |                           |           | 579           | ha                | 396                 | ha               | 493           | ha           | 337           | ha           | 703 I         | ha           |
|                        | Total GA Area<br>Municipality<br>Tertiary Watershed<br>Quaternary Watershed<br>Subwatershed |  |                           |           |               |                   | -                   |                  |               |              | *             |              |               |              |
|                        | Municipality<br>Tertiary Watershed<br>Quaternary Watershed<br>Subwatershed                  | N/A - Informational Purposes.                            | N/A - Information         | -         | Niagar        | a Falls           | Niagara             | a Falls          | Niagar        | a Falls      | Niagara       | a Falls      | Niagara       | a Falls      |
|                        | Municipality Tertiary Watershed Quaternary Watershed Subwatershed                           | Percentage of Growth Area in repective                   |                           |           |               | : (100%)          |                     | . (6400)         | N" D          | (1000)       |               | (1000)       |               | (1000())     |
|                        | Tertiary Watershed  | Tertiary Watershed                                       | N/A - Information         | -         | Lake Ontai    | rio (100%)        | Lake Onta           | rio (61%)        | Niagara Riv   | /er (100%)   | Niagara Riv   | er (100%)    | Niagara Riv   | ver (100%)   |
|                        |   |  |                           |           |               |                   | Niagara Ri          | ver (39%)        |               |              |               |              |               |              |
|                        | Quaternary Watershed  |  | 1                         |           |               |                   | L                   |                  | <b></b>       |              | L             |              |               |              |
|                        | Quaternary Watershed  | Ouaternary Watershed                                     | N/A - Information         | -         | (100          | anai North<br>)%) | Welland Rive        | r East (34%)     | Welland River | East (100%)  | Welland River | East (100%)  | Niagara River | South (22    |
|                        |   |  |                           |           | (100          | ,,,,              | Welland Ca          | nal North        |               |              |               |              |               |              |
|                        |   |  |                           |           |               |                   | (619                | %)               |               |              |               |              | Welland Rive  | r East (78%) |
|                        |   |  |                           |           |               |                   | Niagara River       | North (4%)       |               |              |               |              |               |              |
|                        |   |  |                           |           |               |                   | <u> </u>            |                  |               |              |               |              | L             |              |
|                        | Subwatershed  | Percentage of Growth Area in repective                   | N/A - Information         | _         | BDSC Beaver   | Dams Creek        | BDSC Beaver         | Dams Creek       | I WR Welland  | Piver (11%)  | SNE Lyons (   | rook (01%)   |               | Drain (349   |
|                        | Subwatersneu  | Subwatershed   | N/A - Information         | -         | (53           | %)                | (619<br>Chippowa Be | %)<br>Swor Canal |               | Kivel (1176) | SINF LYONS C  | 100K (9170)  | SINF Hullters | Dialit (54)  |
|                        |   |  |                           |           | BDSC Shriners | s Creek (47%)     | ) Chippawa Po       | 6)               | SNF Lyons (   | Creek (52%)  | SNF Tee C     | reek (9%)    | SNF Lyons C   | Creek (42%   |
|                        |   |  |                           |           |               |                   | LWR Thomp           | son Creek        | SNF Grassy    | Brook (37%)  |               |              | SNE Tee C     | Treek (2%)   |
|                        | bwatershed  |  |                           |           |               |                   | (349                | %)               | Siti Clussy   |              |               |              |               | .reek (£70)  |
|                        |   |  |                           |           |               |                   |                     |                  |               |              |               |              | SNF Usshers   | Creek (229   |
|                        |   |  | Constituto                |           | -             |                   |                     |                  | -             |              | -             |              |               |              |
|                        |   |  | Urbanization: Low         |           |               |                   |                     |                  |               |              |               |              |               |              |
| 1. Physical Conditions | Surficial Soils   | Soil Drainage Class & Sensitivity                        | = 3, Med = 2, High =      | 0.5       | Net*Factor    | 0.95              | Net*Factor          | 1.10             | Net*Factor    | 1.27         | Net*Factor    | 1.19         | Net*Factor    | 1.26         |
|                        |   | Distribution in GA (%)                                   | 1, Unknown is Not         |           |               |                   |                     |                  |               |              |               |              |               |              |
|                        | Unknown (   | VA)  | Rated.                    |           | 6%            | -                 | 14%                 | -                | 9%            | _            | 15%           | -            | 11%           | -            |
|                        | High (R, W, N   | 11/1)  |                           |           | 19%           | 1                 | 0%                  | 1                | 3%            | 1            | 12%           | 1            | 0%            | 1            |
|                        | Mediur<br>Low (P  | n (l)  |                           |           | 65%           | 2                 | 69%                 | 2                | 35%           | 2            | 29%           | 2            | 43%           | 2            |
|                        | LOW (P,   | VP)  |                           |           | 10%           | 3                 | 17%                 | 3                | 53%           | 3            | 44%           | 3            | 46%           | 3            |
|                        |   |  | Constraint to             |           |               |                   |                     |                  |               |              |               |              |               |              |
|                        | Slopes/Topography   | Surface Slopes Distribution in GA (%)                    | Development: Low          | 0.5       | Net*Factor    | 1.33              | Net*Factor          | 1.48             | Net*Factor    | 1.44         | Net*Factor    | 1.37         | Net*Factor    | 1.44         |
|                        |   |  | = 3, Med = 2, High =<br>1 |           |               |                   |                     |                  |               |              |               |              |               |              |
|                        | Mild (0-  | 2%)  |                           |           | 65%           | 3                 | 96%                 | 3                | 88%           | 3            | 74%           | 3            | 87%           | 3            |
|                        | Medium (2-1<br>Steen (> 1   | 9%)<br>9%)   |                           |           | 35%           | 2                 | 4%<br>0%            | 2                | 12%           | 2            | 26%<br>0%     | 2            | 13%           | 2            |
|                        | Sleep (>1   | 576)   | 1                         |           | 070           | 1                 | 070                 | 1                | 078           | I            | 078           | 1            | 070           |              |
| Groundwater System &   | Intake Protection Zone (Lake-Based)   | Designated Area in GA & Drainage Systems                 | (weighted equally)        | 1         | Net*Factor    | 3                 | Net*Factor          | 2.25             | Net*Factor    | 2.25         | Net*Factor    | 2.25         | Net*Factor    | 2.25         |
| ource Water Protection |   |  | IPZ Occurrence: 0%        | -         |               | -                 |                     |                  |               | 2            |               | #            |               |              |
|                        |   | Designated Area in GA (%)                                | = 3, 0-5% = 2, 5-20%      | 1         | -             | 3                 | -                   | 3                | -             | 3            | -             | 3            | -             | 3            |
|                        |   |  | = 1,>20% = 0              |           |               |                   |                     |                  |               |              |               |              |               |              |
|                        |   | IP2 Present in any of the Quaternary Watersheds? (Y / N) | N/A - Information         | 1         | Y             | -                 | Y                   | -                | Y             | -            | Ŷ             | -            | Y             | -            |
|                        |   | IPZ Present in any of the Subwatersheds? (Y              | V.O.N. 1                  | 1         | Δ.            | 1                 | V                   | 0                | V             | 0            | V             | 0            | V             | 0            |
|                        |   | L  | r = 0, IN = 1             | 1         | IN            | I                 | Ŷ                   | U                | Ŷ             | U            | Ŷ             | U            | Ŷ             | 0            |

| NWP (E) - Volum          | e 3: Growth Analysis - Appe           | endix C-3                                      |   |           |               |              |                |              |                |              |               |              |                |             |
|--------------------------|---------------------------------------|--|---|-----------|---------------|--------------|----------------|--------------|----------------|--------------|---------------|--------------|----------------|-------------|
| POTENTIAL GROWT          | H AREA SCREENING MATRIX E             | ALUATION                                       |   |           |               |              |                |              |                |              |               |              |                |             |
| WATERSHED PLAN           | - EQUIVALENCY                         |  |   |           |               |              |                |              |                |              |               |              |                |             |
| CATEGORY                 | FACTORS                               | DESCRIPTION / MEASURE                          | RATING                                  | WEIGHTING |               |              | 1              |              | POTENTIAL GR   | OWTH ARE     | AS            | _            | 1              |             |
|                          |                                       |  |   | FACTOR    | NF<br>Measure | -2<br>Rating | NF-<br>Measure | -3<br>Rating | NF-<br>Measure | -4<br>Rating | NF<br>Measure | -5<br>Rating | NF-<br>Measure | 6<br>Rating |
|                          | •                                     | •  |   |           | Medsure       | Ruting       | Wicubure       | Rating       | Weddure        | Rating       | Weddure       | Rating       | Wicuburc       | Rating      |
|                          |                                       |  | SGRA Occurrence:                        |           |               |              |                |              |                |              |               |              |                |             |
|                          | Significant Groundwater Recharge Area | Quality & Quantity Sensitivity Distribution    | 0% = 3, 0-10% = 2, 10                   | 0.5       | Not*⊑octor    | 1 Г          | Not*Factor     | 1 Г          | Not*Factor     | 0.5          | Not*⊑ostor    | 1            | Not*⊏o stor    | 1 Г         |
|                          | (SGRA)                                | in GA (%) Ranges                               | 50% = 1, >50% = 0                       | 0.5       | Net Factor    | 1.5          | INEL FACIOI    | 1.5          | Net Factor     | 0.5          | INEL FACIOI   | I            | Net Factor     | 1.5         |
|                          |                                       |  | (1.5 for N/A)                           |           |               |              |                |              |                |              |               |              |                |             |
|                          |                                       |  |   |           | -             | 3            | -              | 3            | 24%            | 1            | 1%            | 2            | -              | 3           |
|                          |                                       |  |   |           | 1             |              | T              |              | 1              |              | T             |              | 1              |             |
|                          |                                       | Quality & Quantity Sensitivity Distribution    | = 3. 0-10% = 2. 10-                     |           |               |              |                |              |                |              |               |              |                |             |
|                          | Highly Vulnerable Aquifer (HVA)       | in GA (%) Ranges                               | 50% = 1, >50% = 0                       | 0.5       | Net*Factor    | 0.5          | Net*Factor     | 1            | Net*Factor     | 1            | Net*Factor    | 1            | Net*Factor     | 1           |
|                          |                                       |  | (1.5 for N/A)                           |           |               |              |                |              |                |              |               |              |                |             |
|                          |                                       |  |   |           | 19%           | 1            | 0.8%           | 2            | 0.7%           | 2            | 0.2%          | 2            | 0.2%           | 2           |
|                          |                                       |  | -                                       |           | 1             |              | 1              |              | 1              |              | 1             |              | 1              |             |
|                          |                                       | Hydrologic Stress Levels (Low, Moderate,       |   |           |               |              |                |              |                |              |               |              |                |             |
|                          | Water Quantity Stress Level           | Significant) via respective water Availability | N/A - Information                       | -         | Net*Factor    | NR           | Net*Factor     | NR           | Net*Factor     | NR           | Net*Factor    | NR           | Net*Factor     | NR          |
|                          |                                       | AquaSource, 2010).                             |   |           |               |              |                |              |                |              |               |              |                |             |
|                          | Surface Water                         | -  |   |           | Signif        | ficant       | Moderate /     | Significant  | Mode           | erate        | Mode          | erate        | Mode           | rate        |
|                          | Groundwater                           |  |   |           | Lo            | W            | Lov            | N            | Lo             | W            | Lo            | W            | Lov            | N           |
|                          |                                       | ſ  | FP Occurrence: 0%                       |           | 1             |              | T              |              | 1              |              | T             |              | 1              |             |
| 3 Natural Hazardo        | Pegulatory Flood Plain                | Area Distribution in $GA + 30$ m Buffer (%)    | = 3, 0-5% = 2, 5-                       | 0.5       | Net*Eactor    | 0.5          | Net*Eactor     | 0            | Net*Eactor     | 0            | Net*Eactor    | 0.5          | Net*Eactor     | 0           |
| 5. Natural Hazarda       |                                       |  | 10% = 1, >10% =                         | 0.5       | Net l'actor   | 0.5          | Net Factor     | 0            | Net racior     | 0            | Net Factor    | 0.5          | Net ractor     | 0           |
|                          |                                       |  | 0                                       |           | 7%            | 1            | 11%            | 0            | 17%            | 0            | 9%            | 1            | 10%            | 0           |
|                          |                                       |  |   |           |               |              | -              |              | -              |              | -             |              | -              |             |
|                          |                                       |  | SL Occurrence: $0\%$<br>= 3 0-5% = 2 5- |           |               |              |                |              |                |              |               |              |                |             |
|                          | Regulated Shorelines                  | Area Distribution in GA + 30 m Buffer (%)      | 10% = 1, >10% =                         | 0.5       | Net*Factor    | 1.5          | Net*Factor     | 1.5          | Net*Factor     | 1.5          | Net*Factor    | 1.5          | Net*Factor     | 1.5         |
|                          |                                       |  | 0                                       |           |               | 2            |                |              |                | -            |               |              |                |             |
|                          |                                       |  |   |           | -             | 3            | -              | 3            | -              | 3            | -             | 3            | -              | 3           |
|                          |                                       |  | TOS Occurrence: 0%                      |           | 1             |              | Г              |              |                |              | T             |              |                |             |
|                          | Top-of-slope Allowance                | Area Distribution in GA + 30 m Buffer (%)      | = 3, 0-5% = 2, 5-                       | 0.5       | Net*Factor    | 1            | Net*Factor     | 1.5          | Net*Factor     | 1            | Net*Factor    | 1            | Net*Factor     | 1           |
|                          |                                       | (range)  | 10% = 1, >10% =<br>0                    |           |               |              |                |              |                |              |               |              |                |             |
|                          |                                       |  | Ĵ                                       |           | 4%            | 2            | -              | 3            | 1%             | 2            | 4%            | 2            | 1%             | 2           |
|                          |                                       |  | [                                       |           |               |              | 1              |              |                |              | 1             |              | 1              |             |
|                          |                                       |  | Karst Occurrence:                       |           |               |              |                |              |                |              |               |              |                |             |
|                          | Karst                                 | Area Distribution in GA + 30 m Buffer (%)      | = 2, Inferred = 1,                      | 1         | Net*Factor    | 2            | Net*Factor     | 2            | Net*Factor     | 3            | Net*Factor    | 3            | Net*Factor     | 3           |
|                          |                                       |  | Known = 0                               |           |               |              |                |              |                |              |               |              |                |             |
|                          | N/A (none)                            |  |   |           | 0%            | 3            | 0%             | 3            | 98%            | 3            | 100%          | 3            | 100%           | 3           |
|                          | Known (K)                             |  |   |           | 0%            | 0            | 0%             | 0            | 0%             | 0            | 0%            | 0            | 0%             | 0           |
|                          | Potential (P)                         |  |   |           | 100%          | 2            | 100%           | 2            | 2%             | 2            | 0%            | 2            | 0%             | 2           |
|                          |                                       |  | -                                       |           |               |              |                |              |                |              |               |              |                |             |
|                          | Back Dunes                            | N/A - data gap                                 | -                                       | -         | -             | -            | -              | -            | -              | -            | -             | -            | -              | -           |
|                          | Meander Belt                          | N/A - data gap                                 | - 1                                     | -         | -             | -            | -              | -            | -              | -            | -             | -            | -              | -           |
|                          |                                       | · 2-F  | •                                       |           |               |              |                |              | ı              |              |               |              |                |             |
| 4. Water Resource System | Headwater Drainage Feature            | N/A - data gap                                 | -                                       | -         | -             | -            | -              | -            | -              | -            | -             | -            | -              | -           |

|                           | HAREA SCREENING MATRIVEL                  |  |                           |           | _           |        |             |        |              |          |            |        |            |       |
|---------------------------|---|--|---------------------------|-----------|-------------|--------|-------------|--------|--------------|----------|------------|--------|------------|-------|
| JIENTIAL GROWT            | H AREA SCREENING WATRIA EV                | ALUATION                                     |                           |           | _           |        |             |        |              |          |            |        |            |       |
| ATERSHED PLAN             | - EQUIVALENCY                             |  |                           |           |             |        |             |        |              |          |            |        |            |       |
| CATEGORY                  | FACTORS                                   | DESCRIPTION / MEASURE                        | RATING                    | WEIGHTING |             |        | _           |        | POTENTIAL GR | OWTH ARE | AS         |        | -          |       |
|                           |   |  |                           | FACTOR    | NF          | -2     | NF-         | -3     | NF           | 4        | NF         | -5     | NF         | -6    |
|                           |   |  |                           |           | Measure     | Rating | Measure     | Rating | Measure      | Rating   | Measure    | Rating | Measure    | Ratin |
|                           |   |  |                           |           |             |        |             |        |              |          |            |        |            |       |
|                           |   |  |                           |           |             |        | -           |        | -            |          | -          |        | •          |       |
|                           | Watercourse Length & Sensitivity          | Composite Rating for Length and Sensitivity  | (weighted equally)        | 1         | Net*Factor  | 0.95   | Net*Factor  | 2.21   | Net*Factor   | 0.88     | Net*Factor | 1.29   | Net*Factor | 0.77  |
|                           |   |  | W/C Longth/hg: 0          | [         | 1           |        | 1           |        |              |          | 1          |        |            |       |
|                           | Total Length                              | Total Length (m) in GA + 30 m Buffer -       | -3.0-5-2.5-               | 1         | 15.0        | 0      | 5.0         | 2      | 16.4         | 0        | 14.4       | 1      | 19.4       | 0     |
|                           | lotat Echyth                              | normalized by total Area (m/ha)              | 15 = 1 > 15 = 0           | ,         | 15.0        | Ū      | 5.0         | 2      | 10.4         | 0        | 74.4       |        | 13.4       | 0     |
|                           |   |  | 15 - 1, 715 - 0           |           |             |        | •           |        | •            |          | •          |        |            |       |
|                           | Total Sensitivity (3 Subcategories)       | Composite Rating for Sensitivity Subcategori | es (weighted equally)     | 1         | Net*Factor  | 1.90   | Net*Factor  | 2.42   | Net*Factor   | 1.75     | Net*Factor | 1.58   | Net*Factor | 1.55  |
|                           |   |  |                           |           |             |        |             |        |              |          |            |        |            |       |
|                           | Channel Type                              | Distribution of Total Length (%)             | Natural = 1.5,            | 1         | Not*Eactor  | 1 85   | Not*Eactor  | 2 00   | Not*Factor   | 2 5 5    | Not*Eactor | 2 21   | Not*Eactor | 2 30  |
|                           | Channet Type                              | Distribution of Total Length (76)            | Constructed = 3           | ,         | Iver Tuccor | 1.05   | Iver Tuctor | 2.55   | INEL TUCION  | 2.55     | Net Tuctor | 2.21   | Net Tuctor | 2.50  |
|                           | Constructed                               |  |                           |           | 23%         | 3      | 99%         | 3      | 70%          | 3        | 47%        | 3      | 53%        | 3     |
|                           | Natural                                   |  |                           |           | 77%         | 1.5    | 1%          | 1.5    | 30%          | 1.5      | 53%        | 1.5    | 47%        | 1.5   |
|                           |   |  | Pormanonau                |           | 1           |        |             |        |              |          |            |        |            |       |
|                           | Parmananay                                | Distribution of Total Longth (%)             | Constraint: $P = 0$ $P/I$ | 1         | Not*Eactor  | 1 86   | Not*Eactor  | 2.26   | Not*Eactor   | 1 2 1    | Not*Eactor | 0 00   | Not*Eactor | 1 05  |
|                           | rennanency                                | Distribution of Total Length (%)             | -1 I/E - 2 I - 3          | ,         | Net Factor  | 1.00   | Net Factor  | 2.20   | IVEL FUCION  | 1.51     | Net Fuctor | 0.99   | Net Factor | 1.05  |
|                           | Permanent                                 |  | - 1, 1/L -2, 1 - 3        |           | -           | 0      | -           | 0      | 28%          | 0        | 51%        | 0      | 47%        | 0     |
|                           | Permanent or Intermittent                 |  |                           |           | 45%         | 1      | -           | 1      | 31%          | 1        | -          | 1      | 0%         | 1     |
|                           | Intermittent or Ephemeral                 |  |                           |           | 23%         | 2      | 74%         | 2      | 23%          | 2        | 49%        | 2      | 53%        | 2     |
|                           | Intermittent                              |  |                           |           | 32%         | 3      | 26%         | 3      | 18%          | 3        | -          | 3      | -          | 3     |
|                           |   |  |                           |           |             |        |             |        |              |          |            |        |            |       |
|                           |   |  | Fish Habitat:             |           |             |        |             |        |              |          |            |        |            |       |
|                           |   |  | Туре 1 = 1,               |           |             |        |             |        |              |          |            |        |            |       |
|                           |   | Distribution of Total Length (%)             | Туре 2 = 2,               | 1         | Net*Factor  | 2.00   | Net*Factor  | 2.00   | Net*Factor   | 1.40     | Net*Factor | 1.53   | Net*Factor | 1.28  |
|                           | Fick Hickitet (MANDE)                     |  | Type 3 = 3 &              |           |             |        |             |        |              |          |            |        |            |       |
|                           | FISH Habitat (MINRF)                      | ,  | Other = 2 (ava)           |           |             | 1      |             | 1      | 60%          | 1        | 170/       | 1      | 720/       | 1     |
|                           | Type 7 - Chilled                          |  |                           |           | - 100%      | 2      | - 50%       | 2      | 60%<br>36%   | 2        | 47%<br>53% | 2      | 12%        | 1     |
|                           | Type 2 - Marainal                         | ,  |                           |           | -           | 2      | -           | 2      | -            | 2        | -          | 2      | -          | 2     |
|                           | Other                                     |  |                           |           | -           | 2      | 41%         | 2      | 4%           | 2        | 0%         | 2      | 15%        | 2     |
|                           |   |  |                           |           |             |        |             |        |              |          | 0,0        |        | 1010       |       |
|                           | Constructed Drain                         | Composite Rating for Length and Sensitivity  | (weighted equally)        | 1         | Net*Factor  | 3.00   | Net*Factor  | 3.00   | Net*Factor   | 3.00     | Net*Factor | 1.01   | Net*Factor | 1.41  |
|                           |   |  | Drain Length/ha:          |           |             |        |             |        |              |          |            |        |            |       |
|                           | Total Length                              | Total Length (m) in GA + 30 m Buffer -       | 0 = 3, 0-2 = 2, 2-        | 1         | 0.0         | 3      | 0.0         | 3      | 0.0          | 3        | 3.7        | 1      | 3.1        | 1     |
|                           |   | normalizea by total Area (m/na)              | 5 = 1, >5 = 0             |           |             |        |             |        |              |          |            |        |            |       |
|                           |   | -  |                           |           | _           |        |             |        |              |          |            |        |            |       |
|                           |   |  | Class A-C.E = 2. Class    |           |             |        |             |        |              |          |            |        |            |       |
|                           | Class / Review Process                    | Distribution of Total Length (%)             | D, NR = 1, Class F = 3    | 1         | Net*Factor  | 3.00   | Net*Factor  | 3.00   | Net*Factor   | 3.00     | Net*Factor | 1.01   | Net*Factor | 1.82  |
|                           |   |  | , ,                       |           |             | 2      |             | 2      |              | 2        | 10/        | 2      | 0.20/      |       |
|                           | Class A-C, E                              |  |                           |           | -           | 2      | -           | 2      | -            | 2        | 1%         | 2      | 82%        | 2     |
|                           | Class D, NR                               |  |                           |           | -           | 1      | -           | 1      | -            | 1        | 99%        | 1      | 18%        | 1     |
|                           | Cluss F                                   |  |                           |           | -           | 5      | -           | 5      | -            | 5        | -          | 5      | -          |       |
|                           |   | NHS area within Growth Area (ha / %)         |                           |           | 1           |        | 1           |        | 1            |          | 1          |        | 1          |       |
| . Natural Heritage System | New Niagara NHS                           | Not complete Cannot be assessed              | -                         | -         | -           | -      | -           | -      | -            | -        | -          | -      | -          | -     |
|                           | Natural Heritage Features and Areas       | Not complete. calmot be assessed.            |                           |           | -           | -      | -           | -      | -            | -        | -          | -      | -          | -     |
|                           | Other Natural Heritage Features and Areas |  |                           |           | -           | -      | -           | -      | -            | -        | -          | -      | -          | -     |
|                           | Supporting Features and Areas             |  |                           |           | -           | -      | -           | -      | -            | -        | -          | -      | -          | -     |
|                           | Enhancement Areas                         |  |                           |           | -           | -      | -           | -      | -            | -        | -          | -      | -          | -     |
|                           | Linkages                                  |  |                           |           | -           | -      | -           | -      |              | -        | -          | -      | -          | -     |
|                           |   |  |                           |           |             |        |             |        |              |          |            |        |            |       |
|                           |   | Natural Cover outside of the NHS (ba. (%)    |                           |           |             |        |             |        |              |          |            |        |            |       |
|                           | Natural Cover Outside NHS                 | Nuclear the contract of the NHS (IId / %) -  | -                         | -         |             | -      | -           | -      |              | -        | -          | -      | -          | -     |
|                           |   | NILLS NOT COMPLETE L 20000T DO 20000000      |                           |           |             |        |             |        |              |          |            |        |            |       |

| NWP (E) - Volum | e 3: Growth Analysis - Appe                 | ndix C-3   |  |             |            |        |            |        |              |          |             |        |            |          |
|-----------------|---|--|--|-------------|------------|--------|------------|--------|--------------|----------|-------------|--------|------------|----------|
| POTENTIAL GROWT | H AREA SCREENING MATRIX EV                  | ALUATION   |  |             |            |        |            |        |              |          |             |        |            |          |
| WATERSHED PLAN  | - EQUIVALENCY                               |  |  |             |            |        |            |        |              |          |             |        |            |          |
| CATEGORY        | FACTORS                                     | DESCRIPTION / MEASURE                                  | RATING   | WEIGHTING   |            |        |            |        | POTENTIAL GR | OWTH ARE | AS          |        |            |          |
|                 |   |  |  | FACTOR      | NF         | -2     | NF         | -3     | NF           | -4       | NF          | -5     | NF         | -6       |
|                 |   |  |  |             | Measure    | Rating | Measure    | Rating | Measure      | Rating   | Measure     | Rating | Measure    | Rating   |
|                 |   |  | -  | -           | -          |        |            |        | -            |          |             |        | -          |          |
|                 | Natural Features and Areas                  | Varies. Used in Place of NHS Metric due to<br>timing.  | 0 to 5 based on min,<br>max and quartile<br>values within each<br>factor element where<br>5=GA with least (i.e.,<br>best) and 0 = GA with<br>most (i.e., worst). | 2           | Net*Factor | 6.7    | Net*Factor | 7.0    | Net*Factor   | 4.8      | Net*Factor  | 4.8    | Net*Factor | 4.6      |
|                 | Significant Features                        | % Cover in GA  |  | 1.25        | 0%         | 5      | 2%         | 3      | 19%          | 1        | 22%         | 1      | 15%        | 2        |
|                 | Natural Cover                               | % Cover in GA  |  | 1.25        | 28%        | 3      | 14%        | 4      | 51%          | 2        | 57%         | 1      | 51%        | 2        |
|                 | Wetlands - Provincially Significant         | Area in GA (ha)  |  | 1.25        | 0.0        | 5      | 7.2        | 3      | 89.2         | 1        | 67.0        | 1      | 96.9       | 0        |
|                 | Wetlands - unevaluated                      | Area in GA (ha)  |  | 1           | 24.3       | 1      | 2.9        | 4      | 30.8         | 1<br>r   | 6.5         | 2      | 23.6       | 2        |
|                 | Wetlands - evaluatea-other<br>Woodlands     | Area in GA (ha)  |  | 1           | 41.3       | 2      | 1.9        | ן<br>2 | 0.0          | 5<br>1   | 0.0<br>80.6 | 5<br>1 | 0.0        | 5        |
|                 | Woodlands with Interior Habitat (>100m from |  |  | ,           | 00.7       | 2      | 22.5       | 5      | 55.1         |          | 00.0        |        | 132.2      | 0        |
|                 | edge)                                       | Count of features in GA                                |  | 1.25        | 1.0        | 4      | 1.0        | 4      | 3.0          | 1        | 2.0         | 1      | 2.0        | 1        |
|                 | Successional Habitats                       | Area in GA (ha)  |  | 0.75        | 25.5       | 1      | 18.3       | 2      | 21.5         | 2        | 22.1        | 2      | 64.8       | 0        |
|                 | Areas of Natural and Scientific Interest    | Area in GA (ha)  |  | 1.25        | 0.0        | 5      | 0.0        | 5      | 0.0          | 5        | 0.0         | 5      | 0.0        | 5        |
|                 | Communities                                 | Area in GA (ha)  |  | 1.25        | 0          | 5      | 0          | 5      | 0            | 5        | 0           | 5      | 0          | 5        |
|                 | connunces                                   |  |  |             |            |        | 1          |        | 1            |          |             |        | -          |          |
|                 | Impact Risk                                 |  | 0 to 5 based on min,<br>max and quartile<br>values within each<br>factor element where<br>5=GA with least (i.e.,<br>best) and 0 = GA with<br>most (i.e., worst). | 2           | Net*Factor | 6.7    | Net*Factor | 3.3    | Net*Factor   | 3.3      | Net*Factor  | 4.7    | Net*Factor | 3.3      |
|                 | Proximity of Signfiicant Features           | Count of features wtihin 120m of GA                    |  | 1           | 0          | 5      | 2          | 2      | 7            | 1        | 4           | 2      | 13         | 0        |
|                 | Edge to Area ratio                          | Ratio<br>Qualitative (0 (none), 1 (low), 2 (moderate), |  | 1           | 369.9      | 2      | 520.0      | 1      | 266.4        | 2        | 228.2       | 3      | 204.0      | 3        |
|                 |   | 3 (high)) - assigned for Risk of                       |  |             |            |        |            |        |              |          |             |        |            |          |
|                 | Fragmentation (qualitative)                 | fragmentation and potential Magnitude of               |  | 1           | 4          | 3      | 6          | 2      | 6            | 2        | 6           | 2      | 6          | 2        |
|                 |   | Fragmentation with a total potential value             |  |             |            |        |            |        |              |          |             |        |            |          |
|                 |   | of up to 6.  | I  |             | NIE        | -2     | NE         | -3     | NE           | .4       | NE          | -5     | NIE        | -6       |
|                 |   | TOTAL MATRIX EVALUATION (DRAFT)                        |  | Total Score | SCO        | DRE    | SCO        | RE     | SCO          | RE       | SCO         | RE     | SCO        | DRE      |
|                 |   | Water Resource Rating                                  |  | 22.0        | 16.        | .2     | 17.        | 5      | 15.          | 8        | 15.         | .1     | 15.        | .1       |
|                 |   |  |  |             |            |        |            |        |              |          |             |        |            |          |
|                 |   | Natural Heritage Rating                                |  | 20.0        | 13.        | .3     | 10.        | 4      | 8.2          | 2        | 9.          | 5      | 7.         | 9        |
|                 |   | Net Total Pating                                       |  | 42.0        | 20         | 6      | 27         | 9      | 24           | 0        | 24          | 6      | 22         | 0        |
|                 |   | Net Total Rating                                       |  | 72.0        | 29.        |        | 1 27.      | 5      | 24.          | 0        | 24.         |        | 23.        | <u> </u> |
|                 | Settlement Area B                           | oundary Review - Environmental Question                | n #3 - Impact Rating   |             | MODEST     | IMPACT | MODEST     | IMPACT | HIGH IN      | ИРАСТ    | HIGH IN     | ИРАСТ  | HIGH IN    | √РАСТ    |
|                 |   |  |  |             |            |        |            |        |              |          |             |        |            |          |

| NWP (E) - Volum                                    | e 3: Growth Analysis - Appe         | endix C-3  |  |               |                |                      |                 |                      |                |                       |               |                      |               |                      |
|--|-------------------------------------|--|--|---------------|----------------|----------------------|-----------------|----------------------|----------------|-----------------------|---------------|----------------------|---------------|----------------------|
| POTENTIAL GROWT                                    | H AREA SCREENING MATRIX EV          | /ALUATION  |  |               |                |                      |                 |                      |                |                       |               |                      |               |                      |
| WATERSHED PLAN                                     | - EQUIVALENCY                       |  |  |               |                |                      |                 |                      |                |                       |               |                      |               |                      |
| CATEGORY   | FACTORS                             | DESCRIPTION / MEASURE  | RATING                                     | WEIGHTING     |                | _                    |                 | F                    | OTENTIAL GR    | OWTH ARE              | AS            |                      |               | _                    |
|  |                                     |  |  | FACTOR        | NF-<br>Measure | • <b>7</b><br>Rating | PEL-<br>Measure | - <b>1</b><br>Rating | WEI<br>Measure | L- <b>1</b><br>Rating | WL<br>Measure | - <b>1</b><br>Rating | WL<br>Measure | - <b>2</b><br>Rating |
| Lesation / Watershed                               |                                     | I  |  |               |                |                      | I               |                      | 1              |                       | 1             |                      |               |                      |
| System   | Total GA Area                       | GA Only - Size in hectares (ha)                                    | N/A - Information                          | -             | 246 ł          | na                   | 91 h            | na                   | 45             | ha                    | 556           | ha                   | 687           | ha                   |
|  |                                     | GA + 30 m Buffer - Size in hectares (ha)                           |  |               | 280 I          | na                   | 111 h           | na                   | 54             | ha                    | 605           | ha                   | 738           | ha                   |
|  | Municipality                        | N/A - Informational Purposes.                                      | N/A - Information                          | -             | Niagara        | a Falls              | Pelha           | am                   | Welland, Por   | rt Colborne           | West L        | incoln               | West L        | incoln               |
|  |                                     |  |  | -             |                |                      |                 |                      |                |                       |               |                      |               |                      |
|  | Tertiary Watershed                  | Percentage of Growth Area in repective<br>Tertiary Watershed       | N/A - Information                          | -             | Niagara Riv    | er (100%)            | Niagara Riv     | ver (77%)            | Lake Ontar     | io (100%)             | Lake Ontar    | io (100%)            | Lake Ontar    | io (100%)            |
|  |                                     |  |  | 1             |                |                      | Lake Ontai      | 10 (23%)             |                |                       |               |                      |               |                      |
|  | Quaternamy Watershed                | Percentage of Growth Area in repective                             | N/A Information                            |               | Niagara Riv    | ver South            | Welland Ca      | nal North            | Welland Ca     | inal South            | Jordan Harbo  | our - Twenty         | Jordan Harbo  | our - Twenty         |
|  | Quaternary watersneu                | Quaternary Watershed   | N/A - Information                          | -             | (100           | %)                   | (239            | %)                   | (100           | )%)                   | Mile Cree     | k (100%)             | Mile Cree     | k (100%)             |
|  |                                     |  |  |               |                |                      | Welland River   | West (77%)           |                |                       |               |                      |               |                      |
|  |                                     |  |  |               |                |                      |                 |                      |                |                       |               |                      |               |                      |
|  | Subwatershed                        | Percentage of Growth Area in repective                             | N/A - Information                          | -             | SNF Niagara    | River 11C            | BDSC Welland    | Canal North          | CWR Welland    | Canal South           | TWEN Spring   | Creek (54%)          | TWEN North    | Creek (62%)          |
|  |                                     |  |  |               | SNF Usshers    | o,<br>Creek (60%)    | CWR Draper 0    | o,<br>Creek (77%)    | (100           | ,,,,,                 | TWEN Twent    | y Mile Creek         | TWEN Twent    | y Mile Creek         |
|  |                                     |  |  |               |                |                      | CWR Tow Path    | n Drain (3%)         |                |                       | (40           | ,0)                  | (50           | 70)                  |
|  |                                     |  |  | Information - |                |                      |                 |                      |                |                       |               |                      |               |                      |
|  | 1                                   |  | Sensitivity to                             |               | 1              |                      |                 |                      |                |                       |               |                      |               |                      |
|  |                                     | Coil Drainage Class & Consitivity                                  | Urbanization: Low                          |               |                |                      |                 |                      |                |                       |               |                      |               |                      |
| 1. Physical Conditions                             | Surficial Soils                     | Distribution in GA (%)   | = 3, Med = 2, High =<br>1. Unknown is Not  | 0.5           | Net*Factor     | 1.29                 | Net*Factor      | 1.19                 | Net*Factor     | 1.50                  | Net*Factor    | 1.26                 | Net*Factor    | 1.09                 |
|  |                                     |  | Rated.                                     |               | 00/            |                      | 1.20/           |                      | 09/            |                       | 20/           |                      | 150/          |                      |
|  | Unknown (-, VA)<br>High (R, W, MW)  |  |  |               | 8%<br>3%       | - 1                  | 12%<br>0%       | -<br>1               | 0%<br>0%       | -                     | 2%<br>2%      | -<br>1               | 7%            | -<br>1               |
|  | Medium (I)                          |  |  |               | 32%            | 2                    | 55%             | 2                    | 0%             | 2                     | 44%           | 2                    | 55%           | 2                    |
|  | Low (P, VP)                         |  |  |               | 57%            | 3                    | 33%             | 3                    | 100%           | 3                     | 52%           | 3                    | 23%           | 3                    |
|  |                                     |  | Constraint to                              | 1             | 1              |                      | 1               |                      |                |                       |               |                      |               |                      |
|  | Slopes/Topography                   | Surface Slopes Distribution in GA (%)                              | Development: Low<br>= 3, Med = 2, High =   | 0.5           | Net*Factor     | 1.40                 | Net*Factor      | 1.33                 | Net*Factor     | 1.49                  | Net*Factor    | 1.46                 | Net*Factor    | 1.34                 |
|  | Mild (0-2%)                         |  | 1  |               | 80%            | 3                    | 65%             | 3                    | 98%            | 3                     | 92%           | 3                    | 70%           | 3                    |
|  | Medium (2-10%)                      |  |  |               | 20%            | 2                    | 35%             | 2                    | 1%             | 2                     | 8%            | 2                    | 30%           | 2                    |
|  | Steep (>10%)                        |  |  |               | 0%             | 1                    | 0%              | 1                    | 0%             | 1                     | 0%            | 1                    | 1%            | 1                    |
| 2. Groundwater System &<br>Source Water Protection | Intake Protection Zone (Lake-Based) | Designated Area in GA & Drainage Systems                           | (weighted equally)                         | 1             | Net*Factor     | 0                    | Net*Factor      | 2.25                 | Net*Factor     | 2.25                  | Net*Factor    | 3                    | Net*Factor    | 3                    |
|  |                                     | Designated Area in GA (%)  | IPZ Occurrence: 0%<br>= 3, 0-5% = 2, 5-20% | 1             | 40%            | 0                    | -               | 3                    | -              | 3                     | -             | 3                    | -             | 3                    |
|  |                                     | IPZ Present in any of the Quaternary                               | = 1,>20% = 0                               | 1             | v              | _                    | v               | _                    | v              | _                     | N             | _                    | N             | _                    |
|  |                                     | Watersheds? (Y / N)<br>IPZ Present in any of the Subwatersheds? (Y | V = 0 $N = 1$                              | 1             |                | -                    | v               | -                    | v v            | -                     | / <b>N</b>    | -                    | N             | -                    |
|  |                                     | (/ N)  | 1 - 0, 11 - 1                              | ,             |                | 0                    | L '             | 0                    |                | U                     | /\            | ,                    | /*            | 1                    |

| NWP (E) - Volum          | e 3: Growth Analysis - Appe           | endix C-3  |                                       |           |               |              |              |              |              |               |                |                      |                |             |
|--------------------------|---------------------------------------|--|---------------------------------------|-----------|---------------|--------------|--------------|--------------|--------------|---------------|----------------|----------------------|----------------|-------------|
| POTENTIAL GROWT          | H AREA SCREENING MATRIX E             | /ALUATION  |                                       |           |               |              |              |              |              |               |                |                      |                |             |
| WATERSHED PLAN           | - EQUIVALENCY                         |  |                                       |           |               |              |              |              |              |               |                |                      |                |             |
| CATEGORY                 | FACTORS                               | DESCRIPTION / MEASURE  | RATING                                | WEIGHTING |               |              | 1            |              | POTENTIAL GR | OWTH ARE      | AS             |                      | I              | -           |
|                          |                                       |  |                                       | FACTOR    | NF<br>Measure | -7<br>Rating | Measure      | -1<br>Rating | Measure      | L-1<br>Rating | WL-<br>Measure | - <b>1</b><br>Rating | WL-<br>Measure | 2<br>Rating |
|                          |                                       | •  |                                       |           | measure       | rtating      | incusure     | Hating       | medsure      | Rating        | medsure        | Hating               | medsure        | Ruting      |
|                          |                                       |  | SGRA Occurrence:                      |           |               |              |              |              |              |               |                |                      |                |             |
|                          | Significant Groundwater Recharge Area | Quality & Quantity Sensitivity Distribution  | 0% = 3, 0-10% = 2, 10                 | 0.5       | Not*Eactor    | 1 5          | Not*Eactor   | 1            | Not*Eactor   | 1 5           | Not*Eactor     | 1 5                  | Not*Eactor     | 1 5         |
|                          | (SGRA)                                | in GA (%) Ranges   | 50% = 1, >50% = 0                     | 0.5       | Net Factor    | 1.5          | INEL FACIOI  | I            | Net Factor   | 1.5           | Net Factor     | 1.5                  | Net Factor     | 1.5         |
|                          |                                       |  | (1.5 for N/A)                         |           |               |              |              |              |              |               |                |                      |                |             |
|                          |                                       |  |                                       |           | -             | 3            | 5%           | 2            | -            | 3             | -              | 3                    | -              | 3           |
|                          |                                       |  |                                       |           | 1             |              | T            |              | 1            |               | 1              |                      | 1              |             |
|                          |                                       | Quality & Quantity Sensitivity Distribution  | = 3, 0-10% = 2, 10-                   |           |               |              |              |              |              |               |                |                      |                |             |
|                          | Highly Vulnerable Aquifer (HVA)       | in GA (%) Ranges   | 50% = 1, >50% = 0                     | 0.5       | Net*Factor    | 1            | Net*Factor   | 0            | Net*Factor   | 1             | Net*Factor     | 1                    | Net*Factor     | 0.5         |
|                          |                                       |  | (1.5 for N/A)                         |           |               |              |              |              |              |               |                |                      |                |             |
|                          |                                       |  |                                       |           | 0.1%          | 2            | 69%          | 0            | 0.02%        | 2             | 5%             | 2                    | 16%            | 1           |
|                          |                                       |  | 1                                     | [         | 1             |              | 1            |              | 1            |               | 1              |                      | 1              |             |
|                          |                                       | Hydrologic Stress Levels (Low, Moderate,<br>Significant) via respective Water Availability |                                       |           |               |              |              |              |              |               |                |                      |                |             |
|                          | Water Quantity Stress Level           | Study for primary "old watershed" (ref.  | N/A - Information                     | -         | Net*Factor    | NR           | Net*Factor   | NR           | Net*Factor   | NR            | Net*Factor     | NR                   | Net*Factor     | NR          |
|                          |                                       | AquaSource, 2010).   |                                       |           |               |              |              |              |              |               |                |                      |                |             |
|                          | Surface Water                         |  |                                       |           | Mode          | erate        | Moderate /   | Significant  | Mode         | erate         | Signifi        | cant                 | Signifi        | cant        |
|                          | Groundwater                           |  |                                       |           | Lo            | W            | Lo           | N            | Lo           | W             | Lov            | N                    | Lov            | V           |
|                          |                                       | 1  | FP Occurrence: 0%                     |           |               |              | 1            |              | 1            |               | 1              |                      | 1              |             |
| 3. Natural Hazards       | Regulatory Flood Plain                | Area Distribution in GA + 30 m Buffer (%)  | = 3, 0-5% = 2, 5-                     | 0.5       | Net*Factor    | 0.5          | Net*Factor   | 1            | Net*Factor   | 1.5           | Net*Factor     | 0.5                  | Net*Factor     | 0           |
|                          |                                       |  | 10% = 1, >10% =<br>0                  |           |               |              |              |              |              |               |                |                      |                |             |
|                          |                                       |  | , , , , , , , , , , , , , , , , , , , |           | 10%           | 1            | 1%           | 2            | -            | 3             | 8%             | 1                    | 12%            | 0           |
|                          |                                       |  | SL Occurrence: 0%                     | -         | 1             |              | T T          |              | 1            |               | 1              |                      | r              |             |
|                          | Degulated Chauslines                  | Area Distribution in $CA + 20 = Buffer (0)$  | = 3, 0-5% = 2, 5-                     | 0.5       | Not*⊑octor    | 1 Г          | Not*⊏o eto r | 1 Г          | Net*Fector   | 1 Г           | Not*Fostor     | 1 Г                  | Not*⊏o stor    | 1 Г         |
|                          |                                       | Area Distribution in GA + 30 m Burler (%)  | 10% = 1, >10% =                       | 0.5       | Net Factor    | 1.5          | ivel"Factor  | 1.5          | Nel"Factor   | 1.5           | Nel"Factor     | 1.5                  | Net"Factor     | 1.5         |
|                          |                                       |  | 0                                     |           | -             | 3            | -            | 3            | -            | 3             | -              | 3                    | -              | 3           |
|                          |                                       |  |                                       |           |               | -            |              | -            |              | -             |                | -                    |                | -           |
|                          |                                       | Area Distribution in CA + 20 m Buffer (9/)   | TOS Occurrence: 0%                    |           |               |              |              |              |              |               |                |                      |                |             |
|                          | Top-of-slope Allowance                | (range)  | = 3, 0-5% = 2, 5-<br>10% = 1, >10% =  | 0.5       | Net*Factor    | 1            | Net*Factor   | 1.5          | Net*Factor   | 1.5           | Net*Factor     | 1.5                  | Net*Factor     | 1           |
|                          |                                       | (  | 0                                     |           |               |              |              |              |              |               |                |                      |                |             |
|                          |                                       |  |                                       |           | 1%            | 2            | -            | 3            | -            | 3             | -              | 3                    | 1%             | 2           |
|                          |                                       |  | Karst Ossurransa:                     |           | 1             |              | T            |              | I            |               |                |                      | <b></b>        |             |
|                          |                                       |  | N/A = 3, Potential                    |           |               | _            |              | -            |              |               |                | -                    |                |             |
|                          | Karst                                 | Area Distribution in GA + 30 m Buffer (%)  | = 2, Inferred = 1,                    | 1         | Net*Factor    | 3            | Net*Factor   | 2            | Net*Factor   | 3             | Net*Factor     | 2                    | Net*Factor     | 2           |
|                          |                                       |  | Known = 0                             |           |               |              |              |              |              |               |                |                      |                |             |
|                          | N/A (none)                            |  |                                       |           | 100%          | 3            | 0%           | 3            | 101%         | 3             | 0%             | 3                    | 0%             | 3           |
|                          | Known (K)<br>Inferred (I)             |  |                                       |           | 0%<br>0%      | 1            | 0%           | 1            | 0%           | 1             | 0%<br>0%       | 1                    | 1%<br>0%       | 1           |
|                          | Potential (P)                         |  |                                       |           | 0%            | 2            | 100%         | 2            | 0%           | 2             | 100%           | 2                    | 99%            | 2           |
|                          | Back Dupps                            | N/A data gap   |                                       |           |               |              |              |              |              |               |                |                      | 1              |             |
|                          | Duck Dulles                           | IV/A - uulu gap  | -                                     | -         |               | -            | <u> </u>     | -            | <u> </u>     | -             |                | -                    | I -            | -           |
|                          | Meander Belt                          | N/A - data gap   | -                                     | -         | -             | -            | -            | -            | -            | -             | -              | -                    | -              | -           |
|                          |                                       | I  |                                       |           |               |              | 1            |              |              |               |                |                      | 1              |             |
| 4. Water Resource System | Headwater Drainage Feature            | N/A - data gap   | -                                     | -         | -             | -            | -            | -            | -            | -             | -              | -                    | -              | -           |

|              |  |  |   |           |                |              |            |                      |                                       |              |                                       |              |               | _ |
|--------------|--|--|---|-----------|----------------|--------------|------------|----------------------|---------------------------------------|--------------|---------------------------------------|--------------|---------------|---|
| HED PLAN     | I - EQUIVALENCY  |  |   |           |                |              |            |                      |                                       |              |                                       |              |               | - |
| TEGORY       | FACTORS  | DESCRIPTION / MEASURE                        | RATING  | WEIGHTING |                |              |            |                      | POTENTIAL GR                          | OWTH ARE     | AS                                    |              |               |   |
|              |  |  |   | FACTOR    | NF-<br>Measure | -7<br>Rating | Measure    | • <b>1</b><br>Rating | Measure                               | -1<br>Rating | WL-<br>Measure                        | -1<br>Rating | Measure       | L |
|              |  |  |   |           | measure        | Ruting       | measure    | Ruting               | Inicusture                            | Rating       | measure                               | Ruting       | medsure       |   |
|              |  |  |   |           |                |              | -          |                      |                                       |              |                                       |              | -             |   |
|              | Watercourse Length & Sensitivity   | Composite Rating for Length and Sensitivity  | (weighted equally)                            | 1         | Net*Factor     | 0.56         | Net*Factor | 1.01                 | Net*Factor                            | 3.00         | Net*Factor                            | 1.95         | Net*Factor    | - |
|              |  |  | W/C Length/ha: 0                              |           | 1              |              | 1          |                      | T                                     |              | T                                     |              | 1             |   |
|              | Total Length   | Total Length (m) in GA + 30 m Buffer -       | = 3, 0-5 = 2, 5-                              | 1         | 15.8           | 0            | 19.6       | 0                    | -                                     | 3            | 2.9                                   | 2            | 14.5          |   |
|              |  | normalized by total Area (m/ma)              | 15 = 1, >15 = 0                               |           |                |              |            |                      | <u> </u>                              |              | <u> </u>                              |              |               | _ |
|              | Total Sensitivity (3 Subcategories)  | Composite Rating for Sensitivity Subcategori | es (weighted equally)                         | 1         | Net*Factor     | 1 12         | Net*Factor | 2.02                 | Net*Factor                            | 3.00         | Net*Factor                            | 1.89         | Net*Factor    |   |
|              | Total Sensitivity (5 Subcategories)  | composite nating for sensitivity subcategori | es (weighted equally)                         | 1         | Net Factor     | 1.12         | Net ractor | 2.02                 | Net ractor                            | 5.00         | Net l'actor                           | 1.05         | Net l'actor   | Ì |
|              | Channel Type   | Distribution of Total Lenath (%)             | Natural = 1.5,                                | 1         | Net*Factor     | 1.51         | Net*Factor | 2.07                 | Net*Factor                            | 3.00         | Net*Factor                            | 1.75         | Net*Factor    |   |
|              | Constructed  |  | Constructed = 3                               |           | 10/            | 2            | 200/       | 2                    | 100%                                  | 2            | 160/                                  | 2            | 10/           |   |
|              | Natural  |  |   |           | 99%            | 3<br>1.5     | 38%<br>62% | 3<br>1.5             | -                                     | 3<br>1.5     | 16%<br>84%                            | 3<br>1.5     | 99%           |   |
|              |  |  |   |           |                |              |            |                      |                                       |              |                                       |              |               | ĺ |
|              |  |  | Permanency                                    | -         | N 45 1         | 0.01         | N          | 2.00                 | N. 145 1                              |              | N (1)5 (                              | 4.05         | N             |   |
|              | Permanency   | Distribution of Total Length (%)             | Constraint: $P = 0, P/I$<br>= 1 1/E = 2 1 = 3 | 1         | Net^Factor     | 0.81         | Net^Factor | 2.00                 | Net^Factor                            | NK           | Net^Factor                            | 1.95         | Net^Factor    |   |
|              | Permanent  |  | - 1, I/L -2, I - 3                            |           | 72%            | 0            | -          | 0                    | -                                     | 0            | 3%                                    | 0            | 38%           |   |
|              | Permanent or Intermittent  |  |   |           | -              | 1            | -          | 1                    | -                                     | 1            | -                                     | 1            | 48%           |   |
|              | Intermittent or Ephemeral  |  |   |           | 5%             | 2            | 100%       | 2                    | -                                     | 2            | 97%                                   | 2            | 14%           |   |
|              |  |  |   |           | 24%            | 3            | -          | 3                    | -                                     | 3            | -                                     | 3            | -             | i |
|              |  |  | Fish Habitat:                                 |           |                |              |            |                      |                                       |              |                                       |              |               |   |
|              |  |  | Туре 1 = 1,                                   | _         |                |              |            |                      |                                       |              |                                       |              |               |   |
|              |  | Distribution of Total Length (%)             | $Type \ 2 = 2,$                               | 1         | Net*Factor     | 1.04         | Net*Factor | 2.00                 | Net*Factor                            | NR           | Net*Factor                            | 1.97         | Net*Factor    |   |
|              | Fish Habitat (MNRF)  |  | Type 3 = 3 $\propto$<br>Other = 2 (ava)       |           |                |              |            |                      |                                       |              |                                       |              |               |   |
|              | Type 1 - Critical  |  |   |           | 96%            | 1            | -          | 1                    | -                                     | 1            | 3%                                    | 1            | 47%           |   |
|              | Type 2 - Important   |  |   |           | -              | 2            | 2%         | 2                    | -                                     | 2            | 97%                                   | 2            | 53%           |   |
|              | Type 3 - Marginal<br>Other   |  |   |           | - 4%           | 3            | - 98%      | 3                    | -                                     | 3            | - 0%                                  | 3            | -<br>0%       |   |
|              |  |  |   |           |                |              |            |                      | -                                     | _            |                                       | _            |               | l |
|              | Constructed Drain  | Composite Rating for Length and Sensitivity  | y (weighted equally)                          | 1         | Net*Factor     | 2.00         | Net*Factor | 3.00                 | Net*Factor                            | 3.00         | Net*Factor                            | 3.00         | Net*Factor    | - |
|              | Total Lenath   | Total Length (m) in GA + 30 m Buffer -       | Drain Length/ha:<br>0 - 3 0 - 2 - 2 - 2 - 2   | 1         | 01             | 2            | 0.0        | з                    | 11.4                                  | 0            | 0.0                                   | з            | 0.0           |   |
|              | iotal Length   | normalized by total Area (m/ha)              | 5 = 3, 5 = 2, 5 = 0                           | 1         | 0.1            | 2            | 0.0        | 5                    | 11.4                                  | Ū            | 0.0                                   | 5            | 0.0           |   |
|              |  |  |   |           | -              |              |            |                      |                                       |              |                                       |              |               |   |
|              | Class / Review Process   | Distribution of Total Length (%)             | Class A-C, E = 2, Class                       | 1         | Net*Factor     | 2 00         | Net*Factor | 3 00                 | Net*Factor                            | 3.00         | Net*Factor                            | 3 00         | Net*Factor    |   |
|              |  |  | D, NR = 1, Class F = 3                        |           |                | 2.00         |            | 5.00                 | i i i i i i i i i i i i i i i i i i i | 5.00         | i i i i i i i i i i i i i i i i i i i | 5.00         | i det i detoi |   |
|              | Class A-C, E   |  |   |           | 100%           | 2            | -          | 2                    | -                                     | 2            | -                                     | 2            | -             |   |
|              | Class D, NR<br>Class F   |  |   |           |                | 1            | -          | 1                    | -<br>100%                             | 1            | -                                     | 1<br>3       | -             |   |
|              | Clust  | •  |   |           | 1              |              | •          |                      | 10070                                 |              | _                                     |              | 1             | ĺ |
| ritage Syste | m New Niagara NHS  | NHS area within Growth Area (ha / %)         | -   | -         | -              | -            | _          | -                    | _                                     |              |                                       |              | -             | - |
| ituge byste  |  | Not complete. Cannot be assessed.            |   |           |                |              |            |                      |                                       |              |                                       |              |               |   |
|              | Natural Heritage Features and Areas<br>Other Natural Heritage Features and Δreas |  |   |           |                | -            | -          | -                    | -                                     | -            |                                       | -            |               |   |
|              | Supporting Features and Areas  |  |   |           | -              | -            | -          | -                    | -                                     | -            | -                                     | -            | -             |   |
|              | Enhancement Areas  |  |   |           | -              | -            | -          | -                    | -                                     | -            | -                                     | -            | -             |   |
|              | Linkages   |  |   |           | -              | -            | -          | -                    | - 1                                   | -            | <u> </u>                              | -            |               | j |
|              |  |  |   |           | 1              |              |            |                      | T                                     |              | T                                     |              |               | ļ |
|              | Natural Cover Outside NHS  | Natural Cover outside of the NHS (ha / %) -  | -   | -         | -              | -            | -          | -                    | -                                     | -            | -                                     | -            | -             |   |
|              |  | INHS not complete. Cannot be assessed.       | 1   |           | 1              |              | 1          |                      | 1                                     |              | 1                                     |              | 1             |   |

| NWP (E) - Volum | e 3: Growth Analysis - Appe                 | ndix C-3   |  |             |             |          |             |        |              |          |            |           |             |          |
|-----------------|---|--|--|-------------|-------------|----------|-------------|--------|--------------|----------|------------|-----------|-------------|----------|
| POTENTIAL GROWT | H AREA SCREENING MATRIX EV                  | ALUATION   |  |             |             |          |             |        |              |          |            |           |             |          |
| WATERSHED PLAN  | - EQUIVALENCY                               |  |  |             |             |          |             |        |              |          |            |           |             |          |
| CATEGORY        | FACTORS                                     | DESCRIPTION / MEASURE  | RATING   | WEIGHTING   |             |          |             |        | POTENTIAL GR | OWTH ARE | AS         |           |             |          |
|                 |   |  |  | FACTOR      | NF          | -7       | PEL         | 1      | WE           | L-1      | WL         | 1         | WL          | 2        |
|                 |   |  |  |             | Measure     | Rating   | Measure     | Rating | Measure      | Rating   | Measure    | Rating    | Measure     | Rating   |
|                 |   |  | •  | -           | -           |          | -           |        | -            |          | -          |           | -           |          |
|                 | Natural Features and Areas                  | Varies. Used in Place of NHS Metric due to timing.   | 0 to 5 based on min,<br>max and quartile<br>values within each<br>factor element where<br>5=GA with least (i.e.,<br>best) and 0 = GA with<br>most (i.e., worst). | 2           | Net*Factor  | 5.9      | Net*Factor  | 7.2    | Net*Factor   | 6.5      | Net*Factor | 4.3       | Net*Factor  | 6.6      |
|                 | Significant Features                        | % Cover in GA  |  | 1.25        | 6%          | 3        | 13%         | 2      | 44%          | 0        | 16%        | 1         | 6%          | 3        |
|                 | Natural Cover                               | % Cover in GA  |  | 1.25        | 51%         | 2        | 47%         | 2      | 92%          | 0        | 39%        | 3         | 17%         | 4        |
|                 | Wetlands - Provincially Significant         | Area in GA (ha)  |  | 1.25        | 14.1        | 2        | 12.1        | 3      | 19.9         | 2        | 81.1       | 1         | 38.5        | 2        |
|                 | Wetlands - unevaluated                      | Area in GA (ha)  |  | 1           | 4.9         | 3        | 7.5         | 2      | 0.9          | 4<br>E   | 5.8        | 3         | 4.6         | 3        |
|                 | Woodlands                                   | Area in GA (ha)<br>Area in GA (ha)   |  | 1           | 0.0<br>54 9 | 2        | 0.0<br>19.2 | 5<br>4 | 21.0         | 5<br>4   | 0.0        | э<br>1    | 0.0<br>61.7 | 2        |
|                 | Woodlands with Interior Habitat (>100m from |  |  | 1.25        | 2.0         | _        | 15.2        | -      | 21.0         |          | 5.0        |           | 2.0         | _        |
|                 | edge)                                       | Count of features in GA  |  | 1.25        | 3.0         | I        | 0.0         | 5      | 1.0          | 4        | 5.0        | I         | 2.0         | I        |
|                 | Successional Habitats                       | Area in GA (ha)  |  | 0.75        | 52.6        | 1        | 3.6         | 3      | 0.0          | 5        | 13.1       | 2         | 11.9        | 3        |
|                 | Areas of Natural and Scientific Interest    | Area in GA (ha)  |  | 1.25        | 0.0         | 5        | 0.0         | 5      | 0.0          | 5        | 7.3        | 0         | 0.0         | 5        |
|                 | Communities                                 | Area in GA (ha)  |  | 1.25        | 0           | 5        | 0           | 5      | 0            | 5        | 0          | 5         | 0           | 5        |
|                 |   |  |  |             | •           |          |             |        | •            |          | -          |           | <u>.</u>    |          |
|                 | Impact Risk                                 |  | 0 to 5 based on min,<br>max and quartile<br>values within each<br>factor element where<br>5=GA with least (i.e.,<br>best) and 0 = GA with<br>most (i.e., worst). | 2           | Net*Factor  | 6.7      | Net*Factor  | 4.7    | Net*Factor   | 9.3      | Net*Factor | 6.7       | Net*Factor  | 2.7      |
|                 | Proximity of Signfiicant Features           | Count of features wtihin 120m of GA  |  | 1           | 1           | 4        | 4           | 2      | 1            | 4        | 0          | 5         | 5           | 1        |
|                 | Edge to Area ratio                          | Ratio  |  | 1           | 247.9       | 3        | 312.1       | 2      | 71.3         | 5        | 209.1      | 3         | 417.6       | 1        |
|                 |   | 3 (high)) - assigned for Risk of   |  |             |             |          |             |        |              |          |            |           |             |          |
|                 | Fragmentation (qualitative)                 | fragmentation and potential Magnitude of   |  | 1           | 4           | 3        | 4           | 3      | 1            | 5        | 6          | 2         | 5           | 2        |
|                 |   | Fragmentation with a total potential value   |  |             |             |          |             |        |              |          |            |           |             |          |
|                 |   | of up to 6.  |  |             |             | 7        |             | 4      |              | 4        |            | 4         |             | 2        |
|                 |   | TOTAL MATRIX EVALUATION (DRAFT)  |  | Total Score | NF          | -1<br>DE | PEL         | L- I   | WE           | L-1      | WL         | - 1<br>DE | WL          | -2<br>DE |
|                 |   | Water Resource Ratina  |  | 22.0        | 12          | 8        | 15          | 8      | 21           | 2        | 18         | 7         | 16          | 1        |
|                 |   | The contract in the second sec |  |             | - 15        | -        | 1 13.       | -      | <u> </u>     | -        |            | -         | 1 70.       |          |
|                 |   | Natural Heritage Rating  |  | 20.0        | 12          | .6       | 11.         | .9     | 15.          | 9        | 11.        | .0        | 9.3         | 3        |
|                 |   |  |  |             |             |          |             |        |              |          |            |           |             |          |
|                 |   | Net Total Rating   |  | 42.0        | 26          | .3       | 27.         | .7     | 37.          | 1        | 29.        | .6        | 25.         | 3        |
|                 | Settlement Area B                           | oundary Review - Environmental Questior  | n #3 - Impact Rating   |             | MODEST      | IMPACT   | MODEST      | IMPACT | NEGLIGIBL    | E IMPACT | MODEST     | IMPACT    | MODEST      | IMPACT   |
|                 |   | •  | . ,  |             | •           |          |             |        | •            |          | •          |           | • • • • •   |          |