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NIAGARA OFFICIAL PLAN

NEW NIAGARA OFFICIAL PLAN

Natural Environment Work Program: Mapping Discussion Paper

September 19, 2019

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SUSTAINABLE REGION

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1.0 Introduction

Niagara Region initiated a process to develop a new Niagara Official Plan (N.O.P.). As part of developing the new official plan, the natural environment mapping and policies are being developed to reflect the current vision, goals and objectives for Niagara Region. A key element of which will be policies and mapping that incorporate Provincial requirements on natural environment planning.

The Region's Planning and Development Services (P.D.S.) staff report had initially proposed the Natural Environment Work Program (P.D.S. 6-2018) include the following components:

1. Project Initiation Phase including preparing and finalizing the detailed framework
2. Completion of the natural environment background study
3. Consideration of options for the Region's Natural Heritage System (N.H.S.)
4. Development of a Regional N.H.S.
5. Development of Official Plan policies and finalize mapping
6. Other implementation tools (e.g., updated E.I.S. Guidelines, etc.)

Through consultation with area municipalities, the Niagara Peninsula Conservation Authority (N.P.C.A.) and stakeholders the in-scope items initially identified in staff report P.D.S. 6-2018 were refined to include:

- Natural Heritage Features:
    - All features as identified in the Provincial Policy Statement (P.P.S.) and Provincial Plans including significant woodlands, provincially significant wetlands, significant wildlife habitat, habitat of endangered and threatened species, fish habitat, significant valleylands, etc.
- Hydrologic Features:
    - All features as identified in the P.P.S. and Provincial Plans including streams, seepage areas, wetlands, etc.
    - The significant work recently completed on the Region's watercourse identification and mapping project (known as the "contemporary mapping of watercourses")
- Water Resource Systems:
    - Groundwater systems
    - Surface water systems
- Natural Hazards:
    - All features as identified in the P.P.S. and Provincial Plans including flooding hazards, erosion hazards, and dynamic beach hazards, etc.
    - Wildland Fires as per Section 3.1.8 of the P.P.S.
- Provincial Natural Heritage Systems:
    - Greenbelt Natural Heritage System and Urban River Valley designation
    - Natural Heritage System for the Growth Plan
- Niagara Escarpment Plan as it relates to the municipal planning process

1.1 Public Partner Consultation

Early consultation, including one-on-one meetings were held with area municipal planning staff and staff from the N.P.C.A. in February 2018. In addition, presentations were made to the Area Planners group in January and March of 2018. Through this early consultation, input on the natural environment mapping identified that the current Regional N.H.S. mapping was out-of-date and difficult to use. Concerns around the mapping mostly related to the age and accuracy of mapping. It was also identified that there is a need to have reliable, up-to-date mapping to support local planning. Furthermore, it was suggested the Region review the policies related to providing flexibility to allow refinements to natural environment mapping based on field verification.

In consideration of the importance of natural environment mapping to regional and local planning processes, and concerns raised through early consultation, it was determined that a Mapping Discussion Paper would be an appropriate first step in assessing current mapping and potential options for new mapping.

1.1.1 Mapping Work Group

In order to ensure concerns regarding natural environment mapping were adequately addressed, the Region established a mapping working group consisting of representatives from the area municipalities and the N.P.C.A. The purpose of the working group was to:

- work with the consulting team to better understand, and plan for natural environment mapping at a Regional scale;
- expand on concerns that have previously been provided;
- provide context, experience, and site-specific issues; and
- ensure awareness of all mapping and data that is currently available

The goal of the mapping working group was to:

- have a common understanding on the basis and approach to mapping the natural environment moving forward; and
- receive assistance in educating and communicating key messages to other stakeholders such as the Technical Advisory Group (T.A.G.), Area Planners, Councils, etc.

The first mapping working group meeting included a presentation by the Region to:

1. review the natural environment work program including the purpose of the mapping discussion paper
2. review the role of the mapping working group
3. provide an overview of the Natural Heritage System for the Growth Plan and repercussions for the Region; and

4. provide an opportunity for the representatives from the area municipalities to identify issues and opportunities related to Regional mapping of the natural environment.

The general comments/input received from partner agencies regarding Regional natural environment mapping included:

- mapping of some components of the natural environment is inaccurate;
- there is a need in policy to recognize mapping is imperfect; policies need to provide for refinement at the local level without requiring an official plan amendment (O.P.A.);
- a mechanism needs to be in place to ensure that if mapping refinements are approved (e.g., through an approved study), the mapping is updated; and
- if locally derived (i.e. through the area municipality) mapping data has a higher accuracy it should be used to update map features and be incorporated into the Region's dataset.

The second mapping working group meeting included a presentation by the consultant team of finding from the initial review, including:

1. an overview of mapping requirements from the Provincial Plans;
2. review of Region's current schedules and mapping, and policies that refer to refinements to mapping;
3. a review of other Regional natural environment mapping approaches, including the availability and functionality of on-line G.I.S. mapping tools; and
4. a brief review of data currently used by the Region in natural environment mapping.

The meeting also included breakout groups that discussed the following questions:

- What can the Region's agency partners do to support regular updates in mapping?
- How should the Region present mapping recognizing limitations (e.g., accuracy, age of data, etc.)?
- How should refinements be permitted and what tests need to be met?

The general comments/ input received from partner agencies through the presentation and breakout group discussions included:

- overlay vs. designation of natural environment systems:
    - suggestion that an overlay approach for mapping the natural environment systems and components is a better approach than a designation, when features have not been ground-truthed / verified, and; accurately delineated features can be designated where appropriate;
    - alternatively, consider a tiered approach that addresses rural vs. urban areas distinctly (e.g., designated in urban areas, overlay in rural areas);

- data accuracy was a primary concern raised, specific comments related to:
    - the approach to mapping, whether overlay or designation, needs to be carefully considered and ensure designated features have been confirmed through ground truthing and are 'fixed' in space;
    - ground-truthing data vs. staking feature boundaries – differences between approaches and when each is appropriate or required to allow for options for different levels of effort associated with ground-truthing to suit the location, feature, etc.
    - there is a need for consideration of overlay vs. designation as it relates to triggering policies (e.g., Natural Heritage System for the Growth Plan) and implementation through zoning if designated;
- grouping of natural environment components into Environmental Conservation Area (E.C.A.) and Environmental Protection Area (E.P.A.) can be both helpful and confusing. It was discussed that the E.C.A. and E.P.A. designations are a Niagara-specific approach;
- all approval agencies need to have the same mapping to be consistent in screening and interpretation – mapping should be standardized;
- consideration should be given to existing N.P.C.A. data and any proposed or planned work that would produce new or update existing mapping (e.g. potential for Natural Area Inventory update);
- an O.P.A. should not be required for data updates where approved through site-specific studies; and
- options for the natural environment system need to be presented to Regional Council.

1.2 Overview of Mapping Discussion Paper

The purpose of this Mapping Discussion Paper is to review existing mapping data, consider the range of mapping options, recommend methods that could be used to support the continual update and accuracy of mapping, and provide recommendations for mapping the natural environment system(s) and policies related to mapping refinements. This discussion paper is organized into the following sections:

- **Section 2.0** - Overview: Provincial Natural Environment System Requirements – Provincial Plans
- **Section 3.0** - Guidance for Natural Environment Mapping
- **Section 4.0** - Review of Regional Mapping
- **Section 5.0** - Planning Considerations for Natural Environment Mapping – Provincial Direction
- **Section 6.0** - Natural Environment Mapping in Niagara Region
    - Overview of Existing Data and Mapping
    - Assessment of Natural Environment Mapping – Gap Analysis
- **Section 7.0** - Natural Environment Mapping for New N.O.P.

  - Options and criteria to evaluate options for updating natural environment datasets
  - Managing and Updating Region's Natural Environment Datasets
- **Section 8.0** - Summary of Recommendations and Conclusions

The Mapping Discussion Paper, along with the Watershed Planning Discussion Paper (being completed concurrently) will be summarized in, and contribute to, the discussion in the Technical Report #1: Natural Environment Background Study.

2.0 Overview: Provincial Natural Environment System Requirements

The preparation of the new Niagara Official Plan is being carried out pursuant to the Planning Act.

The Planning Act establishes the basic framework for making land use planning decisions in Ontario. **Section 1.1** of the Act states that the purposes of the Act are:

a) To promote sustainable economic development in a healthy natural environment within the policy and by the means provided under this Act;
b) To provide for a land use planning system led by provincial policy;
c) To integrate matters of provincial interest in provincial and municipal planning decisions;
d) To provide for planning processes that are fair by making them open, accessible, timely and efficient;
e) To encourage co-operation and co-ordination among various interests;
f) To recognize the decision-making authority and accountability of municipal councils in planning.

Sub-section (a) above is intended to support sustainable economic development while providing for a healthy natural environment. Sub-section (b) clearly articulates the Provincial requirement that the 'land use planning system' in Ontario be 'led by Provincial policy'. In this regard, Provincial policies clearly set out the requirements for the establishment of a natural heritage system (N.H.S.). Sub-section (c) builds upon sub-section (b) by indicating that matters of Provincial interest should be integrated into Provincial and municipal planning decisions.
Sub-section (d) provides for open planning process while sub-section (e) encourages co-operation among various interests. Lastly, sub-section (f) recognizes the decision-making authority and accountability of municipal councils in making planning decisions.

Section 2 of the Planning Act sets out the responsibilities of the Council of a municipality and the Ontario Municipal Board. Below is the full list of those Provincial interests with those that are particularly relevant to the development of a natural heritage system policy framework and mapping underlined:

"The Minister, the council of a municipality, a local board, a planning board and the Municipal Board, in carrying out their responsibilities under this Act, shall have regard to, among other matters, matters of provincial interest such as,

(a) The protection of ecological systems, including natural areas, features and functions;

(b) The protection of the agricultural resources of the province;

(c) The conservation and management of natural resources and the mineral resource base;

(d) The conservation of features of significant architectural, cultural, historical, archaeological or scientific interest;

(e) The supply, efficient use and conservation of energy and water;

(f) The adequate provision and efficient use of communication, transportation, sewage and water services and waste management systems;

(g) The minimization of waste;

(h) The orderly development of safe and healthy communities;

(h.1) The accessibility for persons with disabilities to all facilities, services and matters to which this act applies;

(i) The adequate provision and distribution of educational, health, social, cultural and recreational facilities;

(j) The adequate provision of a full range of housing, including affordable housing;

(k) The adequate provision of employment opportunities;

(l) The protection of the financial and economic well-being of the province and its municipalities;

(m) The co-ordination of planning activities of public bodies;

(n) The resolution of planning conflicts involving public and private interests;

(o) The protection of public health and safety;

(p) The appropriate location of growth and development;

(q) The promotion of development that is designed to be sustainable, to support public transit and to be oriented to pedestrians;

(r) The promotion of built form that,

(i) Is well-designed,

(ii) Encourages a sense of place, and

(iii) Provides for public spaces that are of high quality, safe, accessible, attractive and vibrant.

(s) The mitigation of greenhouse gas emissions and adaptation to a changing climate."

Section 3(5) of the Planning Act requires that decisions 'in respect of the exercise of any authority that affects a planning matter' shall be consistent with the Provincial Policy Statement (P.P.S.) and conform to Provincial Plans. In the case of Niagara Region, the Provincial Plans that apply are the Growth Plan, the Greenbelt Plan and the Niagara Escarpment Plan. Each of these plans was updated in 2017.

The P.P.S. and the three Provincial Plans contain detailed policies on natural heritage and water resources that will need to be considered in the update of the Regional Official Plan. The P.P.S., the Growth Plan and the Greenbelt Plan also require that natural heritage systems be identified in Official Plans and in the case of the Growth Plan and the Greenbelt Plan, the Province has prepared mapping that is required to be included within Official Plans. With the P.P.S., while there is also a requirement to identify a natural heritage system, it is up to the Region to identify the extent of the natural heritage system.

Further details on what is required to be mapped and/or otherwise dealt with in an Official Plan in accordance with Provincial policy and Provincial Plans is found in **Section 5.0** of this report.

The overall context for decision making in this regard is established in the first two paragraphs of the Part 1 Preamble to the P.P.S.

> "The Provincial Policy Statement provides policy direction on matters of provincial interest related to land use planning and development. As a key part of Ontario's policy-led planning system, the Provincial Policy Statement sets the policy foundation for regulating the development and use of land. It also supports the provincial goal to enhance the quality of life for all Ontarians.
>
> The Provincial Policy Statement provides for appropriate development while protecting resources of provincial interest, public health and safety, and the quality of the natural and built environment. The Provincial Policy Statement supports improved land use planning and management, which contributes to a more effective and efficient land use planning system."

The matters of Provincial interest mentioned in the first paragraph above are included within Section 2 of the Planning Act, as discussed above.

In accordance with the definitions related to 'natural heritage systems' in the P.P.S. and definitions in the 2019 'A Place to Grow: Growth Plan for the Greater Golden Horseshoe' (Growth Plan) for 'natural heritage system' and 'natural heritage features and areas', the natural heritage system may also include the following components:

- federal and provincial parks and conservation reserves
- other natural heritage features and areas
- lands that have been restored or have the potential to be restored to a natural state
- associated areas that support hydrologic functions
- working landscapes that enable ecological functions to continue.
- life science areas of natural and scientific interest
- wetlands (i.e. non-significant wetlands)
- permanent streams and intermittent streams
- inland lakes and their littoral zones
- seepage areas and springs

3.0 Guidance for Natural Environment Mapping

Consideration should be given to factors that influence mapping of features within the context of the Regional Official Plan (R.O.P.). The R.O.P. is the formal planning document for guiding land use planning undertaken by area municipalities and development proponents. It is also the document that members of the public look to for regional planning direction, policies and mapping. Its intended use must inform what is mapped and how it is mapped with respect to the Natural Heritage and Water Resource Systems. However, despite the reliance that is often placed on it, it must be recognized that feature mapping will always be incomplete because data do not exist for all natural and water features. Where it is available, data will become dated as new information is made available and/or the status of species and communities is revised. For these reasons, mapping should be put in the context of being the base approximation of features available at the time of mapping, and that it is intended to illustrate the areas to which the policies for the system, networks and components apply.

As discussed further in section 5.1.1 of this report, the P.P.S. requires the identification and protection of both a Natural Heritage and Water Resource System. Minimum expectations for features to be protected are outlined in the P.P.S. However, the P.P.S. in of itself does not provide criteria or guidelines for the identification/selection of features that would meet the test of significance; nor does it provide methods for the mapping of features. Partially because of this, several documents have been developed by the province that correspond with the various Provincial plans. Some of these corresponding to earlier iterations of the P.P.S. and the Provincial Plans but still contain relevant guidance with respect to identification of key natural heritage features. These documents include:

- **Natural Heritage Resource Manual** (Second Edition, 2010) prepared in support of the natural heritage policies of the 2005 Provincial Policy Statement;
- **Technical Definitions and Criteria for Key Natural Heritage Features in the Natural Heritage System of the Protected Countryside Area** (2012) prepared in support of the 2005 Greenbelt Plan; and

- **The Regional Natural Heritage System for the Growth Plan for the Greater Golden Horseshoe: Technical Report on Criteria, Rationale and Methods** (2018) prepared in support of the 2017 Growth Plan (now 'A Place to Grow: Growth Plan for the Greater Golden Horseshoe' (2019)).

The Natural Heritage Reference Manual (N.H.R.M.) (M.N.R.F. 2010) provides technical guidance, including rationale and potential criteria for the identification of features and implementation of natural heritage policies of the 2005 P.P.S. Criteria and guidance were developed with the intent of being applicable across the province through appropriate planning documents and/or studies. However, the N.H.R.M. is not a policy document and does not have to be followed providing other approaches achieve the same goal. The N.H.R.M. has not been revised to reflect the 2014 P.P.S., however, it is still relevant as a guidance document since the same natural features and functions are addressed in both the 2005 and 2014 P.P.S. No similar guidance documents exist to provide technical guidance for the implementation of the Water Resource System components of the 2014 P.P.S.[1].

Similar to the N.H.R.M., the technical papers produced for the Greenbelt Plan focuses on rationale and criteria for the identification of key natural heritage features that collectively make up the natural heritage systems within the plan area. Like the N.H.R.M., the intent is to provide direction for the identification, delineation and mapping of these features so that they are in conformity with the policies of the Plan(s). Updated technical paper(s) (revisions to, or new) have not been released to address the updated Greenbelt Plan released in 2017.

The **Technical Report on Criteria, Rationale and Methods** was prepared to provide transparency of methods used in the generation of natural heritage system mapping within the Growth Plan area. Where earlier documents (as noted above) provided detailed rationale and criteria for identifying key natural heritage features but did not provide methods used for the mapping shown on Plan schedules, the 2018 Growth Plan technical report provides detailed methods for how the N.H.S. for the Growth Plan was mapped. For the purposes of the N.H.S. for the Growth Plan, land cover was refined and used to identify 'core areas' as a proxy for individually mapping of key natural heritage features and applies landscape resistance theory (using linkage mapper – circuitscape) to identify 'highest likelihood' linkages between core areas. This report thus makes it clear that much of the provincial N.H.S. was delineated using a modelling approach rather than being based on field-based evidence. Definitions for key natural heritage features are intended to be consistent with existing criteria as set out in earlier provincial technical papers and guidance documents for the P.P.S. and the Greenbelt Plan.

The Natural Heritage Systems for each plan area were developed at a small scale, covering substantive areas within southern Ontario. Use of a small scale is appropriate for developing a Provincial scale N.H.S., but becomes increasingly inaccurate as the

[1] Note: for the purposes of the current document, Source Water Protection is excluded from discussion. It is beyond the scope of the current project and is addressed through relevant policies and programs.

scale increases. Thus, the level of accuracy of the Provincial N.H.S. is appropriate for its intended use but declines at increasingly larger scales (i.e., as you 'zoom in' on an area). In other words, at a broad scale, the N.H.S. mapping may be quite reasonable and appropriate, but when examined closely, may overlap with non-natural features (e.g., infrastructure, housing, etc.,) that are unintended. Policies within each plan (ORMCP, GBP, GP) have provision(s) for refinements of key natural heritage features / natural heritage system mapping to address mapping scale accuracy issues, feature boundary refinements, etc. in recognition of the declining accuracy at increasingly finer scales of use.

The requirement for a Water Resource System was established through the 2014 P.P.S. Because the existing technical papers and guidance documents are for an earlier version of the P.P.S., they do not provide direction for identifying all components that will make up a W.R.S. Some feature types are captured explicitly (e.g., watercourses) while others will not be adequately captured through existing criteria and supporting rationale. Until such time as guidance is provided for implementation of the W.R.S. policies of the 2014 P.P.S., direction will need to be established by municipalities to ensure conformity through M.C.R. / O.P.A. initiatives.

Over and above the criteria, guidelines and minimum requirements for natural feature identification and mapping guided by provincial plans and guidance documents, consideration for what and how these features and systems are mapped in the municipal context relies on several considerations. Specifically, these include:

- Confidence;
- Accuracy; and
- Sensitivity.

3.1 Confidence

In the context of natural environment features mapping within a regional official plan, confidence refers to the degree to which the regulating authority (the Region) is confident that the mapping appropriately represents the features it is intended to capture. Specifically, this refers to two primary areas:

- capturing an acceptable proportion of the feature type such that the mapping is representative of their presence and distribution; and
- where features are mapped, there is an accepted degree of confidence that the mapping accurately reflects existing conditions, even if the significance of the feature has not been determined.

Official Plan mapping represents a 'point in time' and is not subject to updates on a high frequency schedule (e.g. monthly, quarterly, etc.). As such, mapping provided within Official Plans will become out of date as more, or refined feature information comes available through various project processes (e.g., a Subwatershed Study, E.I.S., etc.). In recognition of this, an acceptable degree of error or uncertainty must be identified and acknowledged owing to scale of mapping, feature type and update

frequency. With respect to online mapping, accuracy will be based on the selected approach to developing, managing and updating data, which can collectively be used to manage the level of uncertainty to meet minimum standards set by the Region. Achieving complete accuracy of all data across the broad range of feature types is not a reasonable objective and the limitations of the data and processes put in place should be identified and acknowledged.

Options to address variation in confidence may include:

1. decisions to map or not map some feature types on O.P. schedules;
2. provide additional and more detailed feature class mapping through on-line portals where revisions and updates can be easily conducted;
3. assign confirmed vs. candidate feature classifications;
4. address uncertainty through O.P. text that qualifies the accuracy of the mapping (i.e., mapping based on the most accurate data available at the time of mapping); and
5. policies that set out guidance with respect to the method and frequency of mapping updates, as appropriate.

A key repercussion of the confidence concern is that there needs to be flexibility provided in policies to allow for the refinement of mapping.

3.2 Accuracy

Accuracy of regional mapping is noted as a key consideration and a known concern for users and stakeholders. Accuracy of mapped feature types will be dependent on a variety of factors including:

- how current and/or accurate datasets are/were in generating feature mapping;
- the age of the data;
- purpose for which data were originally collected;
- scale at which dataset was generated; and
- availability of, or ability to undertake field confirmation/validation.

These in turn will be influenced by data availability, cost and resourcing and timeline and need. Each factor is explored in this context below.

3.2.1 Underlying Accuracy

Natural environment feature mapping for official plans is most often based on existing data sets provided by the province and/or local conservation authorities with minimal to no field verification. If anything, relatively few mapping refinements may be undertaken through a consultation process and/or resolving comments from stakeholders on draft mapping. Existing data sources are often used to provide consistency, reduce costs, resourcing, and time. In addition, these mapping sources are generally sufficiently accurate at a scale suitable for region-wide mapping.

As noted above, mapping developed at provincial or other small-scales (e.g., 1:10,000), is most likely completed for the purpose of viewing at provincial or regional scales.

However, there are provincial data exceptions, such as mapping of P.S.W.s, which may be accurately delineated in large-scale (e.g., 1:2000) mapping, depending on when the wetland was evaluated and the extent of field work involved. Conversely, datasets built from field assessments (e.g., woodland drip-line surveys) provide a high degree of accuracy on a site-level and can be used at a range of scales (large to small). This degree of accuracy is required for site-level use, however as scale decreases (i.e., looking at a larger area in the context of an official plan), the need for a high degree of accuracy declines.

Accuracy concerns may be resolved through updates or refinements to data based on field verification. However, the decision to undertake these efforts needs to be based on a cost-benefit assessment of undertaking the refinements and what level of accuracy is to be achieved, versus leaving the data 'as-is'. Moreover, even field-verified data and mapping becomes inaccurate over time, especially when it involves species or population occurrences (e.g., significant wildlife habitat mapping). It is more efficient to map known resources as accurately as possible, provide the appropriate qualifiers and allow for refinements in policy when more accuracy is needed for site-specific land use planning. In order to make these determinations, a decision must be made with respect to the intended use of the mapping and what is the appropriate scale and level of accuracy to achieve the intended use.

3.2.2 Intended Use

The intended use of regional natural environment mapping is a significant factor in determining what is an appropriate level of accuracy – both in terms of data confidence and feature limit/alignment. As noted above, accuracy can be addressed, however the cost to gain increasing degrees of accuracy escalates quickly – both in terms of logistics (e.g., site access, field seasons, staff time, etc.) and cost (e.g., contracts, staff salary, processing, etc.).

Some end users (e.g., Regional staff, area municipalities, development community) have an interest in achieving a high level of accuracy. This can be achieved through a combination of several factors: addressing policy implementation, screening, application reviews, etc. These are driven by the ability of current technologies (e.g., on-line mapping viewers) to 'drill-down' on mapping and data from the small scale (e.g., region-wide maps) to the large-scale (e.g., site level or smaller) and the expectation of accuracy across this spectrum.

With respect to regional mapping, it is recommended that the Region decide the intended use (e.g., at what scale, etc.) to place accuracy requirements for natural environment features into context, identify responsibilities for refinement, and inform next steps. It is understood that Niagara is considering both O.P. mapping and online mapping tool(s) for internal and potentially external use. Mapping provided on O.P. schedules will be updated from time to time through O.P.A.'s and / or through scheduled review periods but will generally have a lower level of accuracy due both to scale and timing of updates. Online mapping tools provide opportunities for more frequent or ongoing updates and may require a higher level of accuracy with respect to feature

limits, etc. Consideration should be given in policy and / or implementation tools how data will be made available to the Region to complete updates and ensure completed works (e.g., feature limit delineations) can be incorporated through a regular process. Additionally, consideration should be given to scale limits for online mapping (i.e., setting a minimum scale that a dataset / layer can be viewed at). Appropriate scales will be based on data accuracy and the scale at which is was produced.

3.2.3 In-Field Validation

In-field validation can range with respect to level of effort. It may range from high-level 'wind-shield' or roadside surveys to confirm feature presence or absence through to detailed inventories and assessments that allow more analysis including determination of feature significance. This higher level of in-field validation requires site access and, in most cases, longer time periods to complete. As a result, the ability to complete in-field validation of all natural environment feature types is not feasible at the regional scale.

Data that provide a high degree of accuracy (e.g., results from Environmental Impact Studies, etc.) will only be available inconsistently across the Region. Thus, the ability and need to integrate this information into regional-scale mapping (i.e., O.P. schedules) needs to be considered. This data does provide higher accuracy for the specific sites where it was undertaken, which merits consideration for use and incorporation into datasets. It should be noted, use of this data introduces inconsistency across the Region, which may be undesirable and leads to other issues (e.g., an assumption of high accuracy across all areas); however this data serves to reflect accepted limits arrived at through planning processes and should be managed, maintained and used internally and/or through online portals. Consideration should be given to consistency of the data, validation (i.e., has it been confirmed and accepted), attribute data and metadata.

Implications for mapping or not mapping individual feature types and/or integration of site-level data on official plan schedules are dependent on a desired threshold for confidence in the data and the level of accuracy required (Per sections 3.1 and 3.2).

3.3 Sensitivity

Some natural environment information is 'sensitive', such as Species at Risk observation locations and/or habitat areas for some species prone to picking (plants) or poaching (many species of wildlife). Thus, although locational information may be known, it may not be suitable for mapping and may be limited or restricted from display in publicly available documents.

In these instances, consideration of its use and implications for the identification of natural heritage and/or water resource system(s) will influence several criteria for mapping and/or displaying this data on official plan mapping. Determination of data sensitivity should be made in consultation with the appropriate governing agency.

4.0 Review of Regional Mapping Approaches

To assess some of the current best practices for mapping natural heritage features in official plans and to assist in evaluating potential options for mapping in Niagara Region, a comparison and review of approaches to natural environment mapping was undertaken for three municipalities: Region of Waterloo, Halton Region and the City of Hamilton. City of Hamilton is a single-tier municipality and as such, represents a slightly different set of requirements, however a review of their approach provides good context since they are a neighbouring municipality, and like Niagara Region subject to the Growth Plan, Greenbelt Plan and the Niagara Escarpment Plan.

To facilitate a comparative review, mapping for each municipality is considered under the following headings:

- Overview of Mapped Features and Official Plan Mapping
- Treatment: Overlay vs. Land Use Designation
- Data Accuracy and Confidence
- Alternative Access: Natural Environment Mapping

As a result of the timing for the development of official plans and/or updates, and the policies, plans, and other documents. in force and current practice at the time of their preparation, variation exists in policy and nomenclature. These differences are not explored in this paper; the focus is on the approach to mapping across several upper or single-tier municipalities to provide a cross section of approaches for consideration.

Note: Information has been solicited from staff at each municipality to confirm or further inform our assessment/understanding of the approach to mapping of natural environment features.

4.1 Region of Waterloo

The Natural Heritage System within the Region of Waterloo is referred to as the Greenlands Network. Terminology used within the Waterloo Regional Official Plan (R.O.P.) is used herein for consistency. The R.O.P. was developed before the requirement for a Water Resource System (W.R.S.) was established in the 2014 P.P.S. As such, there are no policies or mapping that specifically pertains to this system. Several natural environment features that may be considered part of a W.R.S. are included on natural heritage mapping and/or policies as part of the Greenlands System and/or Source Water Protection mapping.

4.1.1 Overview of Mapped Features & OP Schedules

The Greenlands Network is comprised of Landscape Level Systems, Core Environmental Features, Fish Habitat, Supporting Environmental Features, the **linkages** among these feature classes and the Greenbelt Plan Natural Heritage System (Policy 7.A.1). Major rivers are shown on mapping but are not identified as part of the

Greenlands Network. Within these feature classes, individual feature types include the following:

- Core Environmental Features:
    - Significant Habitat for Endangered or Threatened Species
    - Provincially Significant Wetlands (P.S.W.)*
    - Environmentally Sensitive Policy Areas (E.S.P.A.)*
    - Significant Woodlands (mapped as Regional Forests and Forests greater than 4 ha)*
    - Significant Valley Features*
    - Areas of Natural and Scientific Interest (A.N.S.I.s)

  Asterisks (*) indicate those features listed on R.O.P. Map 4.

- Landscape Level systems:
    - Significant Valleys (Grand, Speed and Nith Rivers only)
    - Environmentally Sensitive Landscapes
    - Provincial Greenbelt Natural Heritage System
    - Regional Recharge Areas

As noted above, several features are not identified as part of these feature classes, but considered part of the Greenlands Network through its policies, including:

- Fish Habitat
- Significant Wildlife Habitat (SWH)
- Habitat for Endangered and Threatened Species
- Linkages
- Supporting Environmental Features

Buffers and set-backs are addressed through policies, but not explicitly considered part of the Greenlands Network. A minimum width is provided, and appropriate zoning and protection (e.g., through a Conservation Easement[2])is required, but they are not mapped in the OP.

Map 4 depicts the Greenlands Network. All Landscape Level Systems are mapped as individual feature types; Core Environmental Features (CEF) are mapped as a single feature type (i.e. consolidated feature). Feature mapping is maintained internally by the Region with individual features types updated on an ongoing basis as additional information and refinements become available through provincial datasets, and works undertaken by the Region, area municipalities and/or the Grand River Conservation

[2] "Conservation easements are voluntary legal agreements between heritage property owners and the Ontario Heritage Trust that protect significant features of a property. The terms of the easement are registered on the property title and apply to the easement donor and all future owners of the property. Easements allow the Trust to protect a heritage site without owning it. They also offer conservation-minded Ontarians an opportunity to permanently protect the heritage value of their property while continuing to enjoy it" (Ontario Heritage Trust, 2019).

Authority (GRCA) (e.g., technical updates or studies, such as environmental impact studies, subwatershed studies, etc.).

The Region of Waterloo is currently in the early stages of a municipal comprehensive review. Through this process, current policies and mapping, including those for the Greenlands Network, will be reviewed and updated, as appropriate (e.g., bringing them into conformity with current provincial policies, most notably the Growth Plan). In discussion with Regional staff, there is consideration being given to providing maps that show individual feature types through this review process, but no decisions in this regard have been made.

4.1.2 Data Accuracy and Confidence

Mapped feature types were developed using a variety of sources and methods. Some datasets were developed and are updated by external agencies. Provincially Significant Wetland mapping is obtained from the M.N.R.F. Updates to wetland limits established through appropriate studies within the Region (e.g., environmental impact study, subwatershed study) are provided to the M.N.R.F. by the GRCA; accepted revisions to these boundaries are then reflected through updates to provincial data. Stable top of bank and/or slope hazard information was used to define the mapped significant valleylands on Map 4 of the R.O.P.; this data was obtained from and is maintained by the GRCA.

Other mapping was developed and is maintained internally. Woodland/forest mapping was originally developed in-house through orthoimage interpretation and has been updated and refined internally on a periodic basis, ranging from 2-5 year intervals, as updated imagery came available and/or to meet specific requirements. Similarly, several other mapped feature types were developed and are maintained internally to the Region such as E.S.P.A.s, Regional Forests, Environmentally Sensitive Landscapes, etc.

Data accuracy and confidence varies across the Region and feature type. Feature datasets are generated initially using an existing dataset or generated through aerial photograph interpretation. Wherever possible, information (confirmation of meeting criteria, feature limits, etc.) is updated to reflect refined ‘in-field’ conditions. This information is generally made available through a range of studies including subwatershed studies, environmental assessments and/or environmental impact studies. One exception is an enhanced level of confidence in the presence and limits of E.S.P.A.s. Many of these features were developed based on knowledge of the ecological form and function of a feature, or group of features and were established starting in the 1970s; well in advance of the development a comprehensive Natural Heritage System.

4.1.3 Treatment: Overlay vs. Land Use Designation

The Greenlands Network is referred to as a ‘designation’ under the R.O.P. policies; however, it is not treated as a designation – i.e. the Greenlands Network is not mapped as mutually exclusive to other land uses and is not shown on land use schedule(s).

This approach acknowledges and seeks to address several key considerations with respect to mapping:

- not all components of the Greenlands Network are mapped (e.g., Significant Wildlife Habitat);
- additional features that constitute components of the Greenlands Network per the OP policies may be identified that are not currently mapped (e.g., designation as a Provincially Significant Wetland); and
- feature boundaries may require refinement or confirmation through detailed study.

Chapter 10 of the R.O.P. provides direction with respect to interpretation and implementation of the R.O.P. Section 10.C provides direction for the interpretation of policies and mapping, and several sections have specific bearing for the interpretation of Greenlands Network policies and mapping and their relationship with other policies and maps.

With respect to policy interpretation, Section 10.C.6 provides clarity for addressing overlapping designations, indicating that the more restrictive policies shall prevail:

> 10.C.6 "Where a parcel of land is subject to one or more designations shown on a map in this Plan, development applications will be reviewed in accordance with all the policies of the applicable designations. Where conflict exists between such policies, the more restrictive policies will prevail to the extent of the conflict except where application of the more restrictive policy would result in an outcome not consistent with the goals and objectives of this Plan."

Policies to guide boundary interpretations are provided under Section 10.C of the R.O.P. With respect to the Greenlands Network and its composite components:

> (c) "the environmental land use designations as shown on Map 4, except for the Provincial Greenbelt Natural Heritage System, are based on more detailed mapping contained in the Technical Appendix for Landscape Level Systems and Core Environmental Features. The interpretation of these boundaries will be in accordance with the provisions set out in Chapter 7. The boundary of the Provincial Greenbelt Natural Heritage System will be interpreted in accordance with the provisions of the Provincial Greenbelt Plan; and
>
> (d) the boundaries of the various natural resource areas as shown on Maps 6a to 6g, Map 7 and Map 8 will be interpreted through the development review process."

As noted previously, the Greenlands Network is presented on Map 4 of the R.O.P.; it is not shown on other R.O.P. mapping, with two exceptions: the Protected Countryside (Landscape Level Feature) is shown as an overlay on Countryside Maps (7-series), and Regional Recharge Areas are also shown on Map 6g (Other Source Water Protection Areas). It is not shown on land use mapping.

Per policy 7.A.2 of the R.O.P., area municipalities are responsible for the designation and zoning of Landscape Level Systems and Core Environmental Features in their official plans and zoning by-laws to regulate use of land within these areas in conformity with the Greenlands Network policies contained in the R.O.P.

4.1.4 Alternative Access: Natural Environment Mapping

Individual feature types are not provided on OP mapping and are not made available to the public through their online GIS portal at the time this paper was prepared. An online portal has been supported historically, which provided users access to view the Greenlands Network at a small scale (i.e., at the area municipality level). Users cannot 'zoom in' to a larger scale, such as an individual property. Notwithstanding the above it is noted that Wellhead Protection Sensitivity areas are accessible using the online GIS portal.

Access to and use of these data may be granted through a data sharing / license agreement for municipal partners and/or other users (e.g., landowners, consultants, etc.).

4.2 Halton Region

In Halton Region, the Natural Heritage System consists of the Greenbelt Natural Heritage System and Regional Natural Heritage System. The R.O.P. was developed before the requirement for a Water Resource System (W.R.S.) was established in the 2014 P.P.S. As such, there are no policies or mapping that specifically pertains to this system. Several natural environment features that may be considered part of a W.R.S. are included on mapping and/or policies as part of the Natural Heritage System, Section 144 related to 'Water', and/or Municipal Wellhead Protection Zones.

4.2.1 Overview of Mapped Features & OP Schedules

Map 1G, Key Features within the Greenbelt and Regional Natural Heritage Systems, illustrates Key Features Enhancement Areas, Linkages and Buffers (Enhancement Areas, Linkages and Buffers are mapped as one layer and not distinguished between), Greenbelt N.H.S., and Prime Agricultural Areas in N.H.S. Enhancements/Linkages/Buffers. Section 115 of the R.O.P. lists the components of the Regional Natural Heritage System, which consist of:

- Areas designated on Map 1 (that may include other areas than those listed below)
- The shoreline along Lake Ontario and Burlington Bay

- Significant habitats of endangered species and threatened species not included in the designation on Map 1
- Key features
    - Significant habitat of endangered and threatened species
    - Significant wetlands
    - Significant coastal wetlands
    - Significant woodlands
    - Significant valleylands
    - Significant wildlife habitat
    - Significant areas of natural and scientific interest
    - Fish habitat
- Enhancements to the Key Features including Centres for Biodiversity
- Linkages
- Buffers
- Watercourses that are within a Conservation Authority Regulation Limit or that provide a linkage to a wetland or a significant woodland
- Wetlands other than those considered significant
- Escarpment Natural Area and Escarpment Protection Area as identified in the Niagara Escarpment Plan
- Regulated Flood Plains as determined by the Conservation Authority
- "Parts of the Agricultural System, being those areas of the Regional Natural Heritage System outside the 'Key Features' or where the only 'Key Feature' is a significant earth science area of natural and scientific interest, where agricultural operations are promoted and supported as compatible and complementary uses in the protection of the Regional Natural Heritage System in accordance with the policies of the Agricultural System"

Buffers are mapped in most areas of the Region, including the rural area, but are generally not mapped in urban areas. It is noteworthy that in Halton, 30m buffers are a component of the R.N.H.S. and subject to the policies that protect it, rather than being added to the R.N.H.S. They can be refined through site-specific studies.

4.2.2 Data Accuracy and Confidence

Mapped feature types were developed using a variety of sources and methods. Data acquired from Conservation Halton included wetlands, floodplains, watercourses, waterbodies, and fish habitat. Conservation Halton maintains and updates these data including Provincially Significant Wetlands as approved and updated by the M.N.R.F. Woodland mapping was developed using a combination of aerial photography interpretation, ground-truthing through early Environmentally Significant Areas studies, Halton's Natural Areas Inventory and site-specific studies (e.g., Environmental Impact Assessments). The woodland data layer is updated internally. Enhancement areas and linkages were identified through the completion of studies undertaken as part of the last comprehensive R.O.P. update (known as "Sustainable Halton" as concepts were developed, and subsequently R.O.P.A. 38).

Data accuracy and confidence varies across the Region and feature type. Datasets are generally not updated on ongoing basis.

4.2.3 Treatment: Overlay vs. Land Use Designation

Below the Niagara Escarpment, the Regional Natural Heritage System area is mapped as a designation as illustrated on Map 1 and Map 1G. Above the Niagara Escarpment the Greenbelt Natural Heritage System is identified as an overlay and is not a designation. Although the Regional Natural Heritage System does not extend into the Greenbelt above the Niagara Escarpment, Key Features and their buffers are shown within the Greenbelt N.H.S. on Map 1G. Below the Escarpment Brow, the Greenbelt Natural Heritage System is entirely within the R.N.H.S. Above the Escarpment Brow, the Greenbelt Natural Heritage System overlaps with the Agricultural Area, which is also a designation in the R.O.P.

Section 118 (1) of the Regional of Halton OP Requires "local Official Plans and Zoning By-laws to recognize the Regional Natural Heritage System as identified in this Plan and include policies and maps to implement policies of this Plan and to incorporate any refinements made thereto through Section 116.1". Section 118 (1.1) goes further to "require Local Municipalities, when undertaking the preparation of Area-Specific Plans, Zoning By-law amendments and studies related to development and/or site alteration applications, to protect, through their Official Plans and Zoning By-laws, the Key Features listed in Section 115.3(1) but not mapped on Map 1G in accordance with policies of this Plan". This policy recognizes that not all key features may be identified on Map 1G and that additional features may be identified through site-specific studies. Regarding refinements to the Regional Natural Heritage System, the boundaries may be refined, with additions, deletions and/or boundary adjustments, through appropriate studies accepted by the Region, without the need for an Official Plan Amendment.

4.2.4 Alternative Access: Natural Environment Mapping

Individual feature types (e.g., wetlands, woodlands, etc.) are not provided on OP mapping and are not made available to the public through their online GIS portal at the time this paper was prepared. Customized maps, topographic maps, and aerial photography can be requested from the Region at a cost. Access to and use of GIS data may be granted through a data sharing / license agreement for municipal partners and/or consultants working on projects for the Region.

4.3 City of Hamilton

As noted in Section 2.5, the City of Hamilton is a single-tier municipality; as such, its mapping and approach to Natural Heritage and Natural Environment Mapping will differ from that of an upper tier municipality in some areas. The City of Hamilton has two in-force Official Plans – the Urban Hamilton Official Plan (UHOP) and the Rural Hamilton Official Plan (RHOP).

As with the Regions of Waterloo and Halton, Hamilton's Official Plans were developed and came into force before the 2014 P.P.S. and the requirement for identifying a Water

Resources System (W.R.S.). However, the City of Hamilton recognizes protection of **Water Resources** through policies in their plans at a watershed or sub-watershed scale. Some feature types that may be included under a W.R.S. are addressed through Natural Heritage System and other mapping (e.g., Source Water Protection) but are not comprehensively identified as a W.R.S.

4.3.1 Overview of Mapped Features & OP Schedules

Criteria for identifying Core Areas differ slightly depending on whether they are within or outside the Greenbelt Plan area, and whether they are in the rural or urban areas. However, generally they are comprised of the same types of key natural heritage features and key hydrological features:

- Core Areas
    - Life Science Areas of Natural and Scientific Interest (A.N.S.I.s)
    - Significant Woodlands
    - Alvar & Prairie Habitats (rural only)
    - Wetlands
    - Lakes & Littoral Zones
    - Environmental Sensitive Areas (E.S.A.)
    - Earth Science A.N.S.I.
    - Fish Habitat
    - Significant Wildlife Habitat
    - Habitat for Endangered and Threatened Species
    - Significant Valleylands
- Streams
- Linkages
- Vegetation Protection Zones

With respect to mapping in the Official Plans, all individual feature types are mapped with the exception of Fish Habitat, Significant Wildlife Habitat and Habitat for Endangered and Threatened Species. A consolidated Natural Heritage System, Linkages and Streams are shown on Map B; a sub-set of maps (B1-B8) illustrate individual feature types. Vegetation Protection Zones are incorporated into limits mapped on feature maps where appropriate. Minimum vegetation protection zones are prescribed in Official Plan natural heritage policies, where not determined through an alternative study (e.g., a subwatershed study, etc.). Some linkages are mapped, while others are to be determined through studies. Provincial plan areas (Greenbelt Protected Countryside, Greenbelt Natural Heritage System and Niagara Escarpment Plan Area) are shown as overlays on Natural Heritage System mapping.

4.3.2 Source Data & Verification

Natural Heritage mapping was developed using a combination of Land Information Ontario data, Conservation Authority data and aerial photography. Base data (e.g., woodlands) were verified/updated against recent (at the time of OP preparation) aerial photography/satellite imagery to refine accuracy at scales determined to be appropriate for the OP.

Environmentally Significant Areas (E.S.A.s) were delineated by the City using aerial photography and the Natural Area Inventory (N.A.I.) completed by the Hamilton Naturalists' Club.

Field verification varies within the City's Urban and Rural areas. Natural heritage features within the urban area and those visited during N.A.I. field investigations have been field-verified to varying degrees. Depending on the nature of the works completed, feature limits may or may not be verified/confirmed; however, feature type (e.g., wetland, woodland) and some ecological information would generally be collected. Fewer natural heritage features in the Rural Area have been field verified compared to the Urban Area. This is in part due to property access, development pressures and public access. Features on public lands in the rural area are more likely to have been field verified than those that are in private ownership.

4.3.3 Treatment: Overlay vs. Land Use Designation

The City of Hamilton treats the Natural Heritage System as an overlay in both the RHOP and UHOP. However, natural heritage features are designated through Secondary Plan and Rural Area Plan processes. In accordance with this, the N.H.S. is shown as an overlay and presented on the Schedule B-series mapping. Mapped Core Areas (excluding those features not mapped, as discussed above), become designated as Natural Open Space on Secondary and Area Plans and are shown on their respective schedules/maps within the OP.

Natural heritage feature limits that form the Natural Open Space designation are determined using available datasets (LIO, CA data, City data, etc.) and/or N.H.S. studies completed as part of the planning process. Watercourses and any associated buffers that may be required through Natural Heritage Policies are not reflected on land use mapping. At the Plan of Subdivision level, natural feature boundaries may be confirmed or refined, as appropriate and are appropriately zones (features plus any associated buffers) in the zoning by-law.

4.3.4 Mapping Updates

Updates to natural heritage mapping datasets is undertaken internally. The Planning Section within the City of Hamilton updates mapping based on Environmental Assessment Reports, Environmental Impact Studies, Subwatershed Studies, and other studies, as available (e.g., N.A.I. updates).

Major changes to mapping (i.e., additions or deletions) require an Official Plan Amendment (O.P.A.). Minor changes, which include refinements to a natural area boundary based on finer-scale information (e.g., through an E.I.S.) do not require an O.P.A. and are done through the development application and/or re-zoning process. Most often, these minor types of refinements are not visible at the scale of Official Plan Schedule mapping and would not warrant an O.P.A.

4.3.5 Alternative Access: Natural Environment Mapping

Hamilton hosts an interactive web-mapping tool. Provincial plan areas are available for viewing as well as numerous other high-level layers and features. Detailed information on natural heritage features (e.g., significant woodlands) is not available through the interactive mapping tool.

5.0 Planning Considerations for Natural Environment Mapping

Official plans at both the Regional and local level are intended to reflect the respective council's directions for guiding land use planning decisions including:

- managing growth and the economy;
- protecting the natural environment, resources and agricultural land; and
- providing infrastructure.

Niagara's Official Plan provides the objectives and policies for various land uses. Policies provide for orderly growth and development, and compatibility between the many different uses of land within the Municipality. While the objectives and policies in the Official Plan primarily relate to the physical development, they also include objectives related to social, economic and environmental matters. These are implemented through polices related to such things as housing, residential intensification, the location of community facilities and open space.

Maps, or schedules, are intended to illustrate, where data exists and where deemed appropriate to map, the areas to which policies for systems, networks, and components apply. Land use maps or schedules indicate the land use designations and overlays. A land use designation describes the predominant type of development planned for an area, such as residential, although certain other types of uses are also often permitted and are described in policies. Other maps identify flood plains and environmental features, the transportation network etc. These maps or schedules are a critical component of an official plan that inform land use planning decisions, and thus natural environment mapping is essential to assist in interpreting and implementing policies related to the natural environment. The approach to mapping can vary depending on the type of feature/system/component and is determined through policy (i.e., the content and approach to the policy structure should dictate the mapping approach content, not vice versa). Some of this direction for the approach to mapping (e.g., overlay vs. land-use designation) is determined through provincial plan requirements; otherwise the approach to mapping is determined through the policies and up to the discretion of the municipality.

5.1 Provincial Direction for Official Plan Mapping of Natural Environment Systems

The P.P.S., Growth Plan, and Greenbelt Plan all require municipalities to map a natural heritage system in their official plans. Likewise, there is a requirement to identify the water resource system by the P.P.S., Growth Plan and Greenbelt Plan. How the natural heritage system and water resource system are mapped can vary, as discussed below.

5.1.1 Provincial Policy Statement

Natural Heritage policies are provided in Section 2.1 of the Provincial Policy Statement (P.P.S.). The P.P.S. provides for the protection of natural heritage features through maintaining, restoring, or where possible, improving the diversity and connectivity of natural features and the long-term ecological function and biodiversity of natural heritage systems, "recognizing the linkages between and among natural heritage features and areas, surface water features, and ground water features" (Policy 2.1.2, MMAH 2014). This policy recognizes the connection between the natural heritage system and water resources (surface and ground water) system.

Natural Heritage Systems (N.H.S.) are defined in the P.P.S. as:

> "a system made up of natural heritage features and areas, and linkages intended to provide connectivity (at the regional or site level) and support natural processes which are necessary to maintain biological and geological diversity, natural functions, viable populations of indigenous species, and ecosystems. These systems can include natural heritage features and areas, federal and provincial parks and conservation reserves, other natural heritage features, lands that have been restored or have the potential to be restored to a natural state, areas that support hydrologic functions, and working landscapes that enable ecological functions to continue. The Province has a recommended approach for identifying natural heritage systems, but municipal approaches that achieve or exceed the same objective may also be used" (p. 45, MMAH 2014).

The first sentence in the definition of natural heritage systems in the P.P.S. indicates that the N.H.S. **is** "a system made up of natural heritage features and areas, and linkages". 'Natural heritage features and areas' include:

- significant wetlands and significant coastal wetlands
- significant woodlands
- significant valleylands
- significant wildlife habitat
- significant areas of natural and scientific interest
- other coastal wetlands
- fish habitat
- habitat of endangered species and threatened species

In addition to the N.H.S. being “a system made up of natural heritage features and areas, and linkages”, the definition of ‘natural heritage system’, also notes that the system “can” include:

- natural heritage features and areas
- federal and provincial parks and conservation reserves
- other natural heritage features
- lands that have been restored or have the potential to be restored to a natural state
- areas that support hydrologic functions
- working landscapes that enable ecological functions to continue

It is interesting to note that the definition both states the natural heritage system is “made up of natural heritage features and areas” and “can include natural heritage features and areas”, amongst other areas and features. While this implies that the natural heritage system is expected to include natural heritage features, it also implies not all natural heritage features and areas are expected to be included or mapped as part of the natural heritage system. This provides some discretion for the municipality on how the natural heritage system will be identified, so long as it follows the “recommended approach for identifying natural heritage systems” by the Province, or achieves or exceeds the same objectives as recommended by the Province. Not withstanding the approach to mapping the natural heritage system, natural heritage features and areas that are not mapped or included as part of the system are still subject to applicable Provincial and municipal policies.

With respect to mapping of natural heritage systems, the P.P.S. requires that “Natural heritage systems shall be identified in Ecoregions 6E & 7E, recognizing that natural heritage systems will vary in size and form in settlement areas, rural areas, and prime agricultural areas” (policy 2.1.3, MMAH 2014). It is noted that the words 'shall be identified' does not specifically require the mapping of natural heritage systems in an Official Plan. However, Section 4.7 of the P.P.S. (reproduced below) does require that Official Plans identify Provincial interests and set out appropriate land use designations and policies:

> “The official plan is the most important vehicle for implementation of this Provincial Policy Statement. Comprehensive, integrated and long-term planning is best achieved through official plans.
>
> Official plans shall identify provincial interests and set out appropriate land use designations and policies. To determine the significance of some natural heritage features and other resources, evaluation may be required.
>
> Official plans should also coordinate cross-boundary matters to complement the actions of other planning authorities and promote mutually beneficial solutions. Official plans shall provide clear, reasonable and attainable policies to protect provincial interests and direct development to suitable areas.

> In order to protect provincial interests, planning authorities shall keep their official plans up-to-date with this Provincial Policy Statement. The policies of this Provincial Policy Statement continue to apply after adoption and approval of an official plan" (MMAH 2014).

Given that the P.P.S. requires that prime agricultural areas be 'designated', this means that there is some flexibility on how natural heritage systems can be identified, and that the natural heritage system could be identified as an overlay in an Official Plan as opposed to it being a designation.

With respect to water resource systems, policy 2.2.1 c) notes,

> "Planning authorities shall protect, improve or restore the quality and quantity of water by:" … "identifying water resource systems consisting of ground water features, hydrologic functions, natural heritage features and areas, and surface water features including shoreline areas, which are necessary for the ecological and hydrological integrity of the watershed".

The comments made above about the identification of natural heritage systems apply to water resource systems as well. Therefore, the P.P.S. also gives clear direction for identifying the water resources system.

According to the 2014 P.P.S. the water resource system will consist of the following components:

- Ground water feature
  - Recharge/discharge areas
  - Water tables
  - Aquifers and unsaturated zones that can be defined by surface and subsurface hydrogeologic investigations
- Hydrologic functions
  - "means the functions of the hydrological cycle that include the occurrence, circulation, distribution and chemical and physical properties of water on the surface of the land, in the soil and underlying rocks, and in the atmosphere, and water's interaction with the environment including its relation to living things" (MMAH 2014).
- Surface water features
  - Shoreline areas which are necessary for the ecological and hydrological integrity of the watershed
  - Headwaters
  - Rivers
  - Stream channels
  - Inland lakes
  - Seepage areas
  - Recharge/discharge areas
  - Springs
  - Wetlands

- Associated riparian lands that can be defined by their soil moisture, soil type, vegetation or topographic characteristics.

With respect to mapping, the P.P.S. requires planning authorities identify water resource systems (policy 2.2.1.c., MMAH 2014). Policy 2.2.1 e., states that it is the planning authorities are responsible for "implementing necessary restrictions on development and site alteration to:

- protect all municipal drinking water supplies and designated vulnerable areas; and
- protect, improve or restore vulnerable surface and ground water, sensitive surface water features and sensitive ground water features, and their hydrologic functions". (MMAH 2014).

This means a municipality may designate some components of the water resource system while others may be treated as an overlay.

Natural hazards such as dynamic beach, erosion, flooding, and climate change are addressed through Policy 3.1. Flooding and erosion hazards are typically delineated on the landscape and in some cases are mapped in Official Plans (with input from Conservation Authorities); development in the hazard area is mostly prohibited and a setback is typically required that includes an access allowance, and/or accommodates a buffer zone for erosion and/or flood control.

Management of natural hazards is administered by conservation authorities through the provincial Conservation Authorities Act (R.S.O. 1990 c. C.27, as amended 2018, c. 16, s.3). Through the Act, Conservation Authorities regulate natural hazards associated with erosion, flooding as well as works that could interfere with the protection of health and safety associated with these hazards (e.g., "Development, Interference with Wetlands and Alterations to Shoreline and Watercourses" Regulation). Through these regulations, Conservation Authorities regulate wetlands, shorelines and inter-connecting channels, inland lakes, etc.

The regulatory floodline that delineates flood hazards, erosion setbacks from riverine systems, and the channel corridor (i.e., meander belt) that contains the natural tendency of river/creek migration can become part of the natural heritage system and provide linkage and connectivity to terrestrial features.

Natural hazards that may be considered as part of the natural environment system and therefore included in the natural heritage system can include (based on best practices):

- 'Flooding hazards' and/or erosion hazards adjacent to river, stream and small inland lake systems;
- 'Dynamic beach hazard';
- 'Defined portions of the flooding hazard along' the Niagara River; and
- a 'floodway'.

5.1.2 Growth Plan

The Growth Plan for the Greater Golden Horseshoe, including the Greenbelt Plan, the Oak Ridges Moraine Conservation Plan, and the Niagara Escarpment Plan, "builds on the Provincial Policy Statement (P.P.S.) to establish a unique land use planning framework for the GGH that supports the achievement of complete communities, a thriving economy, a clean and healthy environment, and social equity" (Section 1.1, MMAH 2019). The 2019 Growth Plan notes in Section 4.2.2, Natural Heritage System, that:

> "A Natural Heritage System for the Growth Plan has been mapped by the Province to support a comprehensive, integrated, and long-term approach to planning for the protection of the region's natural heritage and biodiversity. The Natural Heritage System for the Growth Plan excludes lands within settlement area boundaries that were approved and in effect as of July 1, 2017" (Section 4.2.2.1, MMAH 2019).

The Natural Heritage System for the Growth Plan is made up of the following component features per the definition of 'natural heritage system' in the 2019 Growth Plan:

> "A system made up of natural heritage features and areas, and linkages intended to provide connectivity (at the regional or site level) and support natural processes which are necessary to maintain biological and geological diversity, natural functions, viable populations of indigenous species, and ecosystems. The system can include key natural heritage features, key hydrologic features, federal and provincial parks and conservation reserves, other natural heritage features and areas, lands that have been restored or have the potential to be restored to a natural state, associated areas that support hydrologic functions, and working landscapes that enable ecological functions to continue. (Based on P.P.S., 2014 and modified for this Plan)" (MMAH 2019).

Based on the above, the natural heritage system will include "natural heritage features and areas, and linkages", where 'natural heritage features and areas' include:

- significant wetlands
- significant coastal wetlands, other coastal wetlands in Ecoregions 5E, 6E and 7E
- fish habitat
- significant woodlands and significant valleylands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Marys River)
- habitat of endangered species and threatened species
- significant wildlife habitat
- significant areas of natural and scientific interest, which are important for their environmental and social values as a legacy of the natural landscapes of an area

Consistent with the 2014 P.P.S., the definition of ‘natural heritage system’ indicates that the natural heritage system “can” include:

- key natural heritage features
- key hydrologic features
- federal and provincial parks and conservation reserves
- other natural heritage features and areas
- lands that have been restored or have the potential to be restored to a natural state
- associated areas that support hydrologic functions
- working landscapes that enable ecological functions to continue.

It should be noted that the 2019 Growth Plan definition for ‘natural heritage system’ has replaced the term ‘natural heritage feature and area’ from the P.P.S. with 'key natural heritage features'. Key natural heritage features are defined as follows:

> “Habitat of endangered species and threatened species; fish habitat; wetlands; life science areas of natural and scientific interest (A.N.S.I.s), significant valleylands, significant woodlands; significant wildlife habitat (including habitat of special concern species); sand barrens, savannahs, and tallgrass prairies; and alvars” (MMAH 2019).

The additional items included as key natural heritage features (beyond those identified in the 'natural heritage features and areas' definition) are:

- wetlands (i.e., those not identified as Provincially Significant Wetlands); and
- life science areas of natural and scientific interest

The implication of the above is that there is some discretion as to whether the additional features listed are included in the natural heritage system.

Notwithstanding distinction made in the definition between 'natural heritage features and areas' and 'key natural heritage features', the remainder of the policies in Section 4.2.3 and 4.2.4 refer only to 'key natural heritage features'.

In terms of incorporating the Natural Heritage System for the Growth Plan in Official Plans, Section 4.2.2.5 of the Growth Plan states:

> "Upper- and single-tier municipalities may refine provincial mapping of the Natural Heritage System for the Growth Plan at the time of initial implementation in their official plans. For upper-tier municipalities, the initial implementation of provincial mapping may be done separately for each lower-tier municipality. After the Natural Heritage System for the Growth Plan has been implemented in official plans, further refinements may only occur through a municipal comprehensive review."

The above means that a Municipal Comprehensive Review is not required if an upper-tier or a single-tier municipality decides to incorporate the Natural Heritage System for the Growth Plan without modification. Once included in an Official Plan, the boundaries of the Natural Heritage System for the Growth Plan cannot be modified.

Section 4.2.2.6 provides additional guidance regarding the identification and protection of the natural heritage system and natural heritage features and areas outside of the Growth Plan Natural Heritage System:

> Beyond the Natural Heritage System for the Growth Plan, including within settlement areas, the municipality:
>
> a) will continue to protect any other natural heritage features and areas in a manner that is consistent with the P.P.S.; and
> b) may continue to protect any other natural heritage system or identify new systems in a manner that is consistent with the P.P.S.

The above policy means that those components identified as natural heritage features and areas outside of the Growth Plan Natural Heritage System will continue to be subject to the policies of the P.P.S. and/or policies that are consistent with the P.P.S – they are not subject to the policies of the Growth Plan Natural Heritage System.. Furthermore, outside of the Growth Plan Natural Heritage System municipalities may (i.e., at their discretion) continue to protect or identify a natural heritage system that is consistent with the P.PS. This suggests that it is not a requirement that an natural heritage system be identified outside of the Growth Plan Natural Heritage System.

While there is a Growth Plan requirement to identify the natural heritage system as an overlay (Section 4.2.2.2), there is no similar Growth Plan requirement to map key natural heritage features in an Official Plan. It is noted that there is no distinction between upper and single tier municipalities in this section, which means that all official plan are required to include the natural heritage system as an overlay.

The Growth Plan defines a Water Resource System as “a system consisting of ground water features and areas and surface water features (including shoreline areas), and hydrologic functions, which provide the water resources necessary to sustain healthy aquatic and terrestrial ecosystems and human water consumption. The water resource system will comprise key hydrologic features and key hydrologic areas. (P.P.S., 2014)” (MMAH 2019).

There are two elements of the water resource system as defined by the Growth Plan:

Key Hydrologic Features

- permanent streams and intermittent streams
- inland lakes and their littoral zones
- seepage areas and springs
- wetlands

Key Hydrologic Areas

- significant groundwater recharge areas
- highly vulnerable aquifers
- significant surface water contribution areas that are necessary for the ecological and hydrologic integrity of a watershed.

The components of the water resource system are extensive and in many cases have not been mapped. In recognition of this, Section 4.2.1.3 also indicates that the spatial extent of a water resource system will be informed by watershed plans and other available information, which means that only those features that are known to exist should be identified in an Official Plan. While the Growth Plan provides direction on what the elements of a water resource system are, a Provincial map identifying the location of the water resource system has not been provided.

With respect to the identification of a Water Resource System, section 4.2.1.3 states "Watershed planning or equivalent will inform" …"a) the identification of water resource systems" (MMAH 2019).

5.1.3 Greenbelt Plan

The Greenbelt Plan is made up of two primary designations - Protected Countryside and Urban River Valleys. The Protected Countryside is composed of an Agricultural System and a Natural System, together with a series of settlement areas. The Greenbelt also encompasses lands within the Niagara Escarpment Plan Area. The Natural System is made up of the Natural Heritage System and Water Resource System.

Section 3.2.1 recognizes that "the Natural Heritage System and a Water Resource System often coincide given ecological linkages between terrestrial and water-based functions" (pg. 21, MMAH 2017a). Like the Growth Plan N.H.S., the Natural Heritage System and Water Resource System in the Greenbelt are considered separate, but connected systems.

The Natural Heritage Systems within the Greenbelt Plan is within the boundaries of the Growth Plan area, but is governed by the policies of the Greenbelt Plan as opposed to the Growth Plan policies for N.H.S.

The Greenbelt N.H.S.:

> "includes core areas and linkage areas of the Protected Countryside"… and …"builds upon the natural systems contained in the N.E.P. [Niagara Escarpment Plan] and the ORMCP [Oak Ridges Moraine Conservation Plan] and will connect with the Natural Heritage System that will be issued pursuant to the Growth Plan. Together, these systems will comprise and function as a connected natural heritage system" (pg. 21, MMAH 2017a).

The definition of 'natural heritage system' and 'core areas' is not included in Section 7, Definitions of the 2017 Greenbelt Plan. Although there is no definition of 'core areas' in the 2017 Greenbelt Plan or technical papers for the Greenbelt Pan, the Growth Plan Regional N.H.S. Mapping – Technical Report (O.M.N.R.F. 2018) does state, "in the Greenbelt, core areas were identified using the expert opinion approach, but were based on ecological integrity and the inclusion of existing protected areas and public lands" (p. 5, O.M.N.R.F. 2019). In the Growth Plan technical report core areas are considered "The building blocks of an N.H.S. and should be the most enduring natural areas within the landscape. They are usually the least disturbed and largest of remaining natural areas" (O.M.N.R.F. 2018).

The Greenbelt Plan restricts development within the natural heritage system and provides protection to 'key natural heritage features' and 'key hydrologic features' contained within the natural heritage system.

Key natural heritage features include:

- Habitat of endangered species and threatened species;
- Fish habitat;
- Wetlands;
- Life Science Areas of Natural and Scientific Interest (A.N.S.I.s);
- Significant valleylands;
- Significant woodlands;
- Significant wildlife habitat (including habitat of species concern species);
- Sand barrens, savannahs and tallgrass prairies; and
- Alvars.

Key hydrologic features include:

- Permanent and intermittent streams;
- Lakes (and their littoral zones);
- Seepage areas and springs: and
- Wetlands.

The Greenbelt Plan (Section 5.3, MMAH 2017a) indicates that municipal Official Plans must include:

> "…map(s) showing the boundaries of the Greenbelt Area, the Protected Countryside, the Natural Heritage System and the agricultural land base. Municipalities shall provide a map showing known key natural heritage features and key hydrologic features and any associated minimum vegetation protection zones identified in this [the Greenbelt] Plan."

It is noted that there is a distinction in the above policy between including a map showing the boundaries of the Greenbelt Area, the Protected Countryside, the Natural Heritage System and the agricultural land base and a map showing known key natural

heritage features and key hydrologic features and any associated minimum vegetation protection zones. This differs from the requirement of the P.P.S. and Growth Plan that do not specify key features or vegetation protection zones be identified in N.H.S. mapping.

Section 1.4.2 of the Greenbelt Plan is clear that:

> "The Natural Heritage System is not a designation in and of itself with a list of permitted uses. Rather, it is an overlay on top of the prime agricultural area, including specialty crop areas, and rural lands designations contained in official plans. As such, permitted uses are those set out within the prime agricultural area and rural lands policies of this Plan and designations of official plans, subject to the Natural System policies of this Plan" (MMAH 2017a).

The Greenbelt Plan states that the:

> "The Water Resource System is made up of both ground and surface water features and areas and their associated functions, which provide the water resources necessary to sustain healthy aquatic and terrestrial ecosystems and human water consumption. The areas to which these plans apply contain primary recharge, headwater and discharge areas, together with major drinking water aquifers, within the Greenbelt" (pg. 21, MMAH 2017a).

Also important to the water resource system are areas considered of hydrological significance within the Protected Countryside, including:

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

Like the Growth Plan, the Water Resource System consists of key hydrologic features and key hydrologic areas. Key hydrologic features are defined above. Section 3.2.4 notes that:

> "key hydrologic areas are areas which contribute to the hydrologic functions of the Water Resource System. These areas maintain ground and surface water quality and quantity by collecting, storing and filtering rainwater and overland flow, recharge aquifers and feed downstream tributaries, lakes, wetlands and discharge areas. These areas are also sensitive to contamination and feed key hydrologic features and drinking water sources" (MMAH 2017a).

Consistent with the Growth Plan, key hydrologic areas include: significant groundwater recharge areas, highly vulnerable aquifers, and significant surface water contribution areas.

Consistent with the Growth Plan, the Greenbelt Plan Section 3.2.3.3 also requires identification of the W.R.S.:

> "Water Resource Systems shall be identified, informed by watershed planning and other available information, and the appropriate designations and policies shall be applied in official plans to provide for the long-term protection of key hydrologic features, key hydrologic areas and their functions" (MMAH 2017b).

Furthermore, Section 5.3 states,

> "Building on watershed planning, key hydrologic areas shall be identified and the appropriate designations and policies will be applied in official plans to provide for their long-term protection" (MMAH 2017a).

Therefore, the water resource system mapping may include components that are designated and others mapped as an overlay. This is identical to the direction provided in the Growth Plan.

Section 3.2.6.2 notes that:

> "the river valleys that run through existing or approved urban areas and connect the Greenbelt to inland lakes and the Great Lakes, including areas designated as Urban River Valley, are a key component of the long-term health of the Natural System" (MMAH 2017a). "Urban River Valley designation as shown on Schedule 1 applies to lands within the main corridors of river valleys connecting the rest of the Greenbelt to the Great Lakes and inland lakes. The lands in this designation comprise river valleys and associated lands and are generally characterized by being:
>
> - Lands containing natural and hydrologic features, including coastal wetlands; and/or
> - Lands designated in official plans for uses such as parks, open space, recreation, conservation and environmental protection" (Section 6.1, MMAH 2017a).

The Greenbelt Plan also notes that Urban River Valley policies only apply to lands in public ownership and that the remainder of the lands so identified as subject to the upper and lower tier Official Plans that apply. While not part of the Protected Countryside or N.H.S., Urban River Valley Systems are part of the Greenbelt in recognition of their importance in connecting Lake Ontario to other natural features in the Provincial N.H.S. To be in line with the Provincial N.H.S., it seems appropriate that the Urban River Valley be shown as an overlay on municipal official plans.

Within Niagara, only one Urban Valley System associated with Twelve-Mile Creek and Martindale Pond is identified on Greenbelt Plan Mapping.

5.1.4 Niagara Escarpment Plan ('N.E.P.')

In 2017, the N.E.P. was significantly revised and released along with updates to the Oak Ridges Moraine Conservation Plan, the Growth Plan and the Greenbelt Plan. One of the intents of the recent update was to ensure that the policy on natural heritage, water resources and agriculture were generally consistent with each other and aligned with the other Provincial Plans.

One of the other significant differences between the N.E.P. and the Greenbelt Plan is that the N.E.P. does not include a natural heritage system. Instead, the N.E.P. contains a number of policies on the individual natural features that are found within the N.E.P. area. These features include stream valleys, wetlands and related natural areas and cultural features. Mention is also made in the N.E.P. to forest lands and wooded areas.

There are two designations within the N.E.P. where most of natural heritage features are located: the Escarpment Natural Area and Escarpment Protection Area designations from the N.E.P. Section 1.3 states the following with respect to the Escarpment Natural Area designation:

> "Escarpment features that are in a relatively natural state and associated valleylands, wetlands and woodlands that are relatively undisturbed are included within this designation. These areas may contain important cultural heritage resources, in addition to wildlife habitat, geological features and natural features that provide essential ecosystem services, including water storage, water and air filtration, biodiversity, support of pollinators, carbon storage and resilience to climate change. These are the most sensitive natural and scenic resources of the Escarpment. The policies aim to protect and enhance these natural areas" (NEC 2017).

Section 1.4 of the N.E.P. then states the following with respect to the Escarpment Protection Area designation:

> "Escarpment Protection Areas are important because of their visual prominence and their environmental significance, including increased resilience to climate change through the provision of essential ecosystem services. They are often more visually prominent than Escarpment Natural Areas. Included in this designation are Escarpment Related Landforms and natural heritage and hydrologic features that have been significantly modified by land use activities, such as agriculture or residential development, as well as lands needed to buffer Escarpment Natural Areas and natural areas of regional significance. The policies aim to protect and enhance natural and hydrologic features and the open landscape character of the Escarpment and lands in its vicinity" (NEC 2017).

The following are key hydrologic features per Section 2.6.1 of the N.E.P.:

- Permanent and intermittent streams;
- Lakes (and their littoral zones);
- Seepage areas and springs; and
- Wetlands.

The following are key natural heritage features per Section 2.7.1 of the N.E.P.:

1. Wetlands
2. Habitat of endangered species and threatened species
3. Fish habitat
4. Life Science Areas of Natural and Scientific Interest
5. Earth Science Areas of Natural and Scientific Interest
6. Significant valleylands
7. Significant woodlands
8. Significant wildlife habitat
9. Habitat of special concern species in Escarpment Natural and Escarpment Protection areas

Unlike the P.P.S., Growth Plan and Greenbelt Plan, there are no specific policies in the N.E.P. requiring the mapping of the natural heritage system in an Official Plan - however, the Growth Plan does contain this requirement. It is also important to note that the policies of the N.E.P. are generally implemented by the Niagara Escarpment Commission, which is different than the Growth Plan and Greenbelt Plan, which are implemented by municipalities.

5.1.5 Summary of Provincial Natural Environment Systems

The provincial plans that apply to Niagara Region recognize the need to protect the natural environment by providing policies to protect natural features and ecological functions. The Growth Plan and Greenbelt Plan have both identified a natural heritage system with the objective of providing an interconnected system as “a long-term approach to planning for the protection of the region’s natural heritage and biodiversity” (p. 40, MMAH 2019). As a separate, but connected system, a water resource system must also be identified in addition to a natural heritage system as required by the Provincial Policy Statement (2014). To be consistent with Provincial Plans and to follow requirements for identification of a natural environment system, Niagara Region should identify natural environment systems, including a natural heritage system and water resource system as distinct systems, while recognizing the connections between them. The benefit of identifying two distinct, but connected systems, is to allow policies to be developed that address the systems separately in order to achieve the goals and objectives for each system. Table 1. provides a summary of the natural environment system(s) and potential components as identified in the respective Provincial policies.

Table 1. Summary of the natural environment system(s) and components as identified in the Provincial plans.

Feature/Area	P.P.S. 2014	Growth Plan 2019	Greenbelt Plan 2017
Natural Heritage System			
Significant wetlands, significant coastal wetlands	X	X	X
Significant woodlands	X	X	X
Significant valleylands	X	X	X
Significant wildlife habitat	X	X	X
Significant A.N.S.I.s	X	X	X
Coastal wetlands	X	X	X
Fish habitat	X	X	X
Habitat of endangered species and threatened species	X	X	X
Linkages	X	X	X
Life Science A.N.S.I.			X
Permanent and intermittent streams			X
Lakes (and their littoral zones)			X
Seepage areas and springs			X
Wetlands			X
Water Resource System			
Ground water features	X		
Hydrologic functions	X		
Shoreline areas necessary for the ecological and hydrological integrity of the watershed	X		

Feature/Area	P.P.S. 2014	Growth Plan 2019	Greenbelt Plan 2017
Headwaters	X		
Rivers	X		
Stream channels	X		
Inland lakes	X		
Recharge/discharge areas	X		
Associated riparian lands	X		
Significant groundwater recharge areas		X	X
Highly vulnerable aquifers		X	X
Significant surface water contribution areas		X	X
Permanent streams		X	X
Intermittent streams		X	X
Inland lakes and their littoral zones		X	X
Seepage areas and springs	X	X	X
wetlands	X	X	X

5.2 Additional Planning Considerations for Mapping Natural Environment System(s)

Although this discussion paper focuses on mapping related matters, policies related to protection of components of the natural environment will inform the approach to mapping.

Section 4.2.3 of the Growth Plan (MMAH 2019) contains a general prohibition on development and site alteration within 'key hydrologic features' and 'key natural heritage features' but does provide for several exemptions.

Sub-section e) exempts the following:

> "Expansions to existing buildings and structures, accessory structures and uses, and conversions of legally existing uses which bring the use more into conformity with this Plan, subject to demonstration that the use does not expand into the key hydrologic feature or key natural heritage feature or vegetative protection zone unless there is no other alternative, in which case any expansion will be limited in scope and kept within close geographical proximity to the existing structure" (M.M.A.H. 2019).

Sub-section e) deals with all other types of buildings not dealt with in sub-section f) (discussed below) and the conversion of other legally existing uses. In this regard, there will be a need for a planning process to determine how the 'unless there is no alternative test' can be satisfied on a case-by-case basis. A key consideration in such a process is where the key natural heritage or key hydrologic feature is and how it is mapped (or not) in an Official Plan.

Sub-section f) then exempts the following:

> “Expansions or alterations to existing buildings and structures for agricultural uses, agriculture-related uses, or on-farm diversified uses and expansions to existing residential dwellings if it is demonstrated that:
> - There is no alternative, and the expansion or alteration in the feature is minimized and, in the vegetation protection zone, is directed away from the feature to the maximum extent possible; and
> - The impact of the expansion or alteration on the feature and its functions is minimized and mitigated to the maximum extent possible” (M.M.A.H. 2019).

Sub-section f) deals specifically with expansions or alterations to existing buildings and structures for agricultural uses, agriculture-related uses, on-farm diversified uses and expansions to existing residential dwellings.

The implication of the above is that new buildings are not permitted in key natural heritage features and key hydrologic features (this is later confirmed by Section 4.2.4).

Since the Growth Plan specifically mentions 'buildings' in the context of this policy, the only way this Growth Plan policy can be implemented is if key natural heritage features and key hydrologic feature are zoned in a manner that prohibits new buildings, since a zoning by-law is considered to be applicable law for the purposes of considering applications for building permit. It is recognized that this will have an impact on existing development 'rights' in some cases.

In order to establish such a prohibition in a zoning by-law, the lands that would be subject to the prohibition should also be identified in an Official Plan and whether this is identified in an upper tier or lower tier Official Plan is discussed later.

In order to fully implement sub-sections e) and f) as they relate to the expansion of existing buildings, there is also a need to understand where the key hydrologic features and key natural heritage features are located. In addition, and for both sub-sections e) and f) there is a need for a policy framework that establishes a planning process under which the criteria can be applied to implement the Growth Plan. This is because both sub-sections e) and f) use the word “demonstrate”, which implies that a review (e.g., Environmental Impact Study) is undertaken to determine conformity with the Growth Plan. In this regard, these policies should also provide the ability to review the spatial extent of the key feature and allow for its refinement based on site-specific information.

However, one challenge with the above is that even if the boundaries of the key feature can be refined without the need to amend the Official Plan, refining the boundary of the key feature in a zoning by-law is not feasible without formally amending the zoning by-law.

There is also a need to consider how to trigger the required environmental impact assessment process to apply the policies of the Growth Plan. This is because the criteria listed in sub-section f) imply that a process is required to determine how the policy could be satisfied on a case-by-case basis since there is a need to demonstrate that there is 'no alternative', the expansion into the feature is 'minimized' and the development is 'directed away from the feature to the maximum extent possible'. Impacts are also expected to be minimized and mitigated to the extent possible, which assumes that some impact can be considered. All of the above can only be assessed if there was a Planning Act process initiated to trigger consideration of the above.

Given that there are specific prohibitions on the expansion of and development of new buildings within and adjacent to key features, there is a need to map the key features in an Official Plan (upper tier or lower tier or both) and potentially map these same key features in the zoning by-law.

5.2.1 Review of Approaches for Mapping Key Features in Official Plans

With respect to mapping known key features in an Official Plan, there are five basic mapping approaches, as set out below:

- Designate key features in a separate mutually exclusive land use designation that is shown on an operative Official Plan schedule and allow for refinements to key feature boundaries and the addition of new key features and the deletion of key features without requiring an Official Plan Amendment;
- Designate key features in a separate mutually exclusive land use designation that is shown on an operative Official Plan schedule and allow for only 'minor' refinements to key feature boundaries without an Official Plan Amendment and require an Official Plan Amendment for the addition of new key features and the deletion of key features;
- Identify key features as a potential 'constraint to development' on an operative Official Plan schedule and allow for refinements without requiring an Official Plan Amendment (meaning that the key features would be an overly designation that 'sits on top' of other designations);
- Identify key features as a potential 'constraint to development' in an appendix to the Official Plan and allow for refinements without requiring an Official Plan Amendment;
- Identify key features in a companion document that is not part of the Official Plan.

There are a number of factors to consider in determining which of the five options above should be implemented and they are below (Table 2):

Table 2. Review of factors to consider in five approaches to key feature mapping in Official Plan.

Factors to consider	Approaches to Key Feature Mapping				
	Designate key features in new N.O.P. and allow for refinements, additions and deletions without O.P.A. (option 1)	**Designate key features in new N.O.P. and require major refinements and all additions and deletions to be supported by O.P.A. (option 2)**	**Identify key features as an overlay in new N.O.P. and allow for refinements, additions and deletions without O.P.A. (option 3)**	**Identify key features in new N.O.P. Appendix (option 4)**	**Identify key features in companion document (option 5)**
Accuracy of information	A high degree of confidence in the information would be required when the feature is designated initially	A high degree of confidence in the information would be required when the feature is designated initially	There would be less of a need for confidence since features are not being 'designated'	There would be less of a need for confidence than Option 3 since information not being included within statutory document (but it is still part of the O.P. document)	There would be even less of a need for confidence than Option 4 since information not being included within the O.P. document

Factors to consider	Approaches to Key Feature Mapping				
	Designate key features in new N.O.P. and allow for refinements, additions and deletions without O.P.A. (option 1)	**Designate key features in new N.O.P. and require major refinements and all additions and deletions to be supported by O.P.A. (option 2)**	**Identify key features as an overlay in new N.O.P. and allow for refinements, additions and deletions without O.P.A. (option 3)**	**Identify key features in new N.O.P. Appendix (option 4)**	**Identify key features in companion document (option 5)**
Ability to update information	Since refinements, additions and deletions would not require an O.P.A., new information comes into effect when the change is made.	Minor refinements would come into effect when they are made. Major refinements requiring an O.P.A. and additions and deletions would not come into effect until O.P.A. approved	Since refinements, additions and deletions would not require an O.P.A., new information comes into effect when the change is made	Since refinements, additions and deletions would not require an O.P.A., new information can be considered when information becomes available or is known.	Since refinements, additions and deletions would not require an O.P.A., new information can be considered when information becomes available or is known.

Factors to consider	Approaches to Key Feature Mapping				
	Designate key features in new N.O.P. and allow for refinements, additions and deletions without O.P.A. (option 1)	**Designate key features in new N.O.P. and require major refinements and all additions and deletions to be supported by O.P.A. (option 2)**	**Identify key features as an overlay in new N.O.P. and allow for refinements, additions and deletions without O.P.A. (option 3)**	**Identify key features in new N.O.P. Appendix (option 4)**	**Identify key features in companion document (option 5)**
Fairness and transparency when new N.O.P. is developed	Landowners can challenge designation of key features through N.O.P. process and require Region to justify designation (however, landowners cannot appeal new N.O.P. to L.P.A.T.)	Landowners can challenge designation of key features through N.O.P. process and require Region to justify designation (however, landowners cannot appeal new R.O.P. to L.P.A.T.)	Landowners can challenge identification of key features through N.O.P. process and require Region to justify their identification (however, landowners cannot appeal new N.O.P. to L.P.A.T.)	While landowners can challenge the information provided, the information is not included in the statutory document	While landowners can challenge the information provided, the information is not included in the statutory document

Fairness and transparency after N.O.P. is in effect	Refinements, additions and deletions made after N.O.P. is in effect would not be subject to statutory process - however, it is noted that if refinement, addition or deletion was being considered as part of Planning Act process, neighbouring landowners would be aware of refinement, addition or deletion through the Planning Act notice provisions.	Minor refinements made after N.O.P. is in effect would not be subject to statutory process as per Option 1. Major refinements, additions and deletions would be subject to statutory public process.	Refinements, additions and deletions made after N.O.P. is in effect would not be subject to statutory process - however, it is noted that if refinement, addition or deletion was being considered as part of Planning Act process, neighbouring landowners would be aware of refinement, addition or deletion through the Planning Act notice provisions.	Refinements, additions and deletions made after N.O.P. is in effect would not be subject to statutory process - however, it is noted that if refinement, addition or deletion was being considered as part of Planning Act process, neighbouring landowners would be aware of refinement, addition or deletion through the Planning Act notice provisions.	Refinements, additions and deletions made after N.O.P. is in effect would not be subject to statutory process - however, it is noted that if refinement, addition or deletion was being considered as part of Planning Act process, neighbouring landowners would be aware of refinement, addition or deletion through the Planning Act notice provisions.
Impacts on planning process	If no O.P.A. required for refinements, additions and deletions, there would be no impact on planning process.	Major refinements not otherwise requiring an O.P.A. would require an O.P.A. if refinement was major - may have an impact on the length of the planning	If no O.P.A. required for refinements, additions or deletions, there would be no	If no O.P.A. required for refinements, additions or deletions, there would be no	If no O.P.A. required for refinements, additions or deletions, there would be no

Factors to consider	Approaches to Key Feature Mapping				
	Designate key features in new N.O.P. and allow for refinements, additions and deletions without O.P.A. (option 1)	**Designate key features in new N.O.P. and require major refinements and all additions and deletions to be supported by O.P.A. (option 2)**	**Identify key features as an overlay in new N.O.P. and allow for refinements, additions and deletions without O.P.A. (option 3)**	**Identify key features in new N.O.P. Appendix (option 4)**	**Identify key features in companion document (option 5)**
		process. Requiring an O.P.A. for additions and deletions would also have impact on length of planning process.	impact on planning process	impact on planning process.	impact on planning process

Factors to consider	Approaches to Key Feature Mapping				
	Designate key features in new N.O.P. and allow for refinements, additions and deletions without O.P.A. (option 1)	**Designate key features in new N.O.P. and require major refinements and all additions and deletions to be supported by O.P.A. (option 2)**	**Identify key features as an overlay in new N.O.P. and allow for refinements, additions and deletions without O.P.A. (option 3)**	**Identify key features in new N.O.P. Appendix (option 4)**	**Identify key features in companion document (option 5)**
Ease of access to information	Most accessible - Information on key features shown as designation on primary O.P. schedule showing land use designations at the time N.O.P. is prepared and afterwards when mapping is updated	Most accessible - Information on key features shown as designation on primary O.P. schedule showing land use designations at the time N.O.P. is prepared and afterwards when mapping is updated either through minor refinement process or through O.P.A. process for major refinements and all additions and deletions	Less accessible - information provided on secondary O.P. schedule showing constraints to development	Less accessible - information provided on Appendix to O.P., which may be missed by users	Less accessible - since separate document needs to be obtained
Defensibility of Approach	A high level of accuracy / confidence in mapping is recommended since features would be designated in a manner	A high level of accuracy / confidence in mapping is recommended since features would be	A moderate level of accuracy / confidence is recommended since features that	Same as Option 3, except the appendix does not have the same impact on	This option has less of an impact on decision making than Option 4.

Factors to consider	Approaches to Key Feature Mapping				
	Designate key features in new N.O.P. and allow for refinements, additions and deletions without O.P.A. (option 1)	**Designate key features in new N.O.P. and require major refinements and all additions and deletions to be supported by O.P.A. (option 2)**	**Identify key features as an overlay in new N.O.P. and allow for refinements, additions and deletions without O.P.A. (option 3)**	**Identify key features in new N.O.P. Appendix (option 4)**	**Identify key features in companion document (option 5)**
	that prohibits development. If sufficient information was not available to support the designation of the feature, some areas that may be sensitive to development would not be designated and therefore protected. However, since this option provides for refinements, additions and deletions without an OPA, new information could easily be relied upon used to make changes later.	designated in a manner that prohibits development. If sufficient information was not available to support the designation of the feature, some areas that may be sensitive to development would not be designated and therefore protected. In addition, the significance of features would also be determined through Planning Act processes, which means that features not designated initially	do not meet the criteria for designation in Options 1 and 2 could be mapped. This could provide an additional level of protection to some features since they would be identified on an operative schedule to the Official Plan, albeit in an overlay. This approach would conform to provincial policies since areas where development prohibited would	decision making as the information shown on operative schedules to the Official Plan. This approach would conform to provincial policies since areas where development prohibited would be clearly identified - however, there would be a need to ensure that the implementing zoning by-law prohibited	Approach would not conform with Provincial policies since mapping not included in a statutory document.

Factors to consider	Approaches to Key Feature Mapping				
	Designate key features in new N.O.P. and allow for refinements, additions and deletions without O.P.A. (option 1)	**Designate key features in new N.O.P. and require major refinements and all additions and deletions to be supported by O.P.A. (option 2)**	**Identify key features as an overlay in new N.O.P. and allow for refinements, additions and deletions without O.P.A. (option 3)**	**Identify key features in new N.O.P. Appendix (option 4)**	**Identify key features in companion document (option 5)**
	In addition, the significance of features would also be determined through Planning Act processes, which means that features not designated initially would be studied and protected if warranted. This approach would conform to provincial policies since areas where development prohibited would be clearly identified and process to protect other features exists as new information becomes available.	would be studied and protected if warranted. The main difference between Options 1 and 2 is that there would be a delay in imposing development prohibitions on lands that are later identified as being the site of a key feature since OPA required to implement the new information. This approach would conform to provincial policies since areas where development prohibited would be clearly identified and process to protect	be clearly identified - however, there would be a need to ensure that the implementing zoning by-law prohibited development in key features to ensure approach is defensible.	development in key features to ensure approach is defensible. .	

Factors to consider	Approaches to Key Feature Mapping				
	Designate key features in new N.O.P. and allow for refinements, additions and deletions without O.P.A. (option 1)	**Designate key features in new N.O.P. and require major refinements and all additions and deletions to be supported by O.P.A. (option 2)**	**Identify key features as an overlay in new N.O.P. and allow for refinements, additions and deletions without O.P.A. (option 3)**	**Identify key features in new N.O.P. Appendix (option 4)**	**Identify key features in companion document (option 5)**
		other features exists as new information becomes available - however, there may be an implementation time-lag as per the above since OPA required to protect features not designated initially.			

The determination of whether the upper tier or lower Official Plan (or both Official Plans) should map key features in some way (per options 1 to 5 described above) is somewhat dependent on:

- which level of government is the approval authority for applications;
- who is responsible for the mapping of key features; and,
- which level of government has the resources to review natural heritage evaluations (or Environmental Impact Studies) and make informed decisions/recommendations on impacts and key feature boundaries.

Another factor to ultimately consider is how key features are to be dealt with in local zoning by-laws. Given the very specific language used in the Growth Plan, there is a need to clearly prohibit development in certain key features and establish some type of Planning Act process to trigger required natural heritage evaluations. One of the challenges to consider as well is that while Official Plan mapping can be easily modified without going through a formal amendment process, the same cannot be said for zoning by-laws.

5.2.2 Refinement of Key Feature Boundaries

Typically, refinements to the boundary of a key feature are triggered by a Planning Act application or when there is an MCR, at which point any recent studies, revised datasets, etc. can be incorporated into revised mapping.

If the lands affected are within the Growth Plan N.H.S., the Growth Plan contains very specific prohibitions on development within and adjacent to key features. However, the actual determination of the boundary of the key feature can usually be determined on the basis of further study by a qualified professional. Once the boundary of the key feature is determined, the Growth Plan prohibitions apply.

On lands not within the Growth Plan N.H.S., Greenbelt Plan N.H.S., or Niagara Escarpment Plan area, the P.P.S. applies which also contains a number of development prohibitions including that the 'no negative impact test' be applied if development is proposed within certain features (such as significant woodlands) and within a certain distance of all features. The first step in carrying out such an analysis in this case is the same as the above - meaning that a qualified professional would first determine the boundary so that the policies can be applied.

6.0 Natural Environment Mapping in Niagara Region

6.1 Overview of Existing Data and Mapping

The current R.O.P. natural environment mapping is illustrated on Schedule C, ‘Core Natural Heritage’. Schedule C includes the following natural environment mapping components:

- Environmental Protection Area
- Environmental Conservation Area
- Greenbelt Plan Natural Heritage System
- Earth Science A.N.S.I.
- Fish Habitat (polygon)
- Fish Habitat (line)
- Municipal Drain
- Potential Natural Heritage Corridor

Although not all mapped, the **Environmental Protection Areas** include:

a) Provincially significant wetlands
b) Provincially significant Life Science Area of Natural and Scientific Interest (A.N.S.I.s)
c) Significant habitat of endangered and threatened species
d) Within Greenbelt Natural Heritage System:
    a. Wetlands
    b. Significant valleylands
    c. Significant woodlands
    d. Significant wildlife habitat
    e. Habitat of species of concern
    f. Publicly owned conservation lands
    g. Savannahs and tallgrass prairies
    h. Alvars

Similarly, not all **Environmental Conservation Areas** are mapped; this component of the Core Natural Heritage System includes:

- Significant woodlands
- Significant wildlife habitat
- Significant habitat of species of concern
- Regionally significant Life Science A.N.S.I.s
- Other evaluated wetlands
- Significant valleylands
- Savannahs and tallgrass prairies
- Alvars
- Publicly owned conservation lands

Table 3 provides an overview of the components of Core Natural Heritage System to identify what is mapped in the current O.P. schedule, data layers used for mapping, source(s) of data, date updated, and if the feature is referred to in a Provincial Plan or in the current R.O.P. Appendix 1 provides a more comprehensive review of the data layers used in the current R.O.P. schedules.

Table 3. Summary of GIS data used to map the current R.O.P. Core Natural Heritage system on Schedule C.

Core Natural Heritage Component	Features/Layers	Plan	Mapped in Current R.O.P.
Environmental Protection Area	Significant Wetlands (Provincially Significant Wetlands)	P.P.S., R.O.P.	Yes
	Provincially Significant Life Science A.N.S.I.'s	P.P.S., R.O.P.	Yes
	Habitat of Endangered species and threatened species	P.P.S., R.O.P.	No
Environmental Protection Area - in Greenbelt Natural Heritage System	Significant Valleylands	P.P.S., R.O.P.	Yes
	Significant Woodlands	P.P.S., R.O.P.	Yes
	Significant Wildlife Habitat	GBP	No
	Publicly Owned or Conservation lands	R.O.P.	Yes
	Sand barrens, Savannahs and Tallgrass Prairies (layer also includes WMAs)	Greenbelt Plan	Partial
	Alvars	Greenbelt Plan	Partial
	Habitat of Species of Concern	R.O.P.	No
	Wetlands (Provincially Significant & Other Evaluated)	P.P.S., R.O.P.	Yes
Environmental Conservation Area	Wetlands (Other Evaluated Wetlands)	P.P.S., R.O.P.	Yes
	Significant Valleylands	P.P.S., R.O.P.	Yes
	Significant Woodlands	P.P.S., R.O.P.	Yes
	Significant Wildlife Habitat	P.P.S., R.O.P.	Partial
	Significant Areas of Natural and Scientific Interest (Regionally Significant Life Science A.N.S.I.'s)	P.P.S., R.O.P.	Yes

Core Natural Heritage Component	Features/Layers	Plan	Mapped in Current R.O.P.
	Publically Owned or Conservation lands	R.O.P.	Yes
	Sand barrens, Savannahs and Tallgrass Prairies (layer also includes WMAs)	Greenbelt Plan	Partial
	Alvars	Greenbelt Plan	Partial
	Significant Habitat of Species of Concern - outside GBP	P.P.S., R.O.P.	No
Fish Habitat	Fish habitat - polyline (C.N.H. layer)	P.P.S., R.O.P.	Yes
	Fish habitat - polygon (C.N.H. layer)	P.P.S., R.O.P.	Yes
Municipal Drains	Municipal Drain (C.N.H. Layer)	n/a	As Fish Hab & M. Drains
Greenbelt Plan N.H.S. Area	Greenbelt Natural Heritage System Area (2005)	Greenbelt Plan	Yes
Potential Natural Heritage Corridors	Potential Natural Heritage Corridors (Regional Core N.H.S.)	R.O.P.	Yes
Other	Earth Science A.N.S.I.	R.O.P.	Yes
	Constructed Drains	n/a	Some
Other GB N.H.S. Key Feature	C.N.H. E.P.A. Other Greenbelt N.H.S. Key Feature	Greenbelt/R.O.P.	Yes

6.1.1 Additional data layers available for consideration in future mapping

In addition to the data layers that are used to illustrate the Region's Core Natural Heritage System, the Region has additional datasets that can be considered in future mapping, whether new components/features for consideration in natural environment mapping, or to replace current datasets used in Schedule C. Table 4 provides an overview of the additional data layers including source(s), date, and which Provincial Plan they correspond with. Appendix 1 provides a more comprehensive review of the data layers used in the current R.O.P. schedules.

Table 4. Additional data layers currently available to the Region for consideration in future mapping.

Data Layers	Plan	Original Source	Date
Growth Plan Natural Heritage System Area (2018)	Growth	M.N.R.	2018
Hazardous forest types for Wildland Fire	P.P.S.	M.N.R.	2014
Growth Plan Agricultural System (2018)	Growth	O.M.A.F.R.A.	2018
Greenbelt Urban River Valley Connections (2018)	Greenbelt Plan	M.N.R.	2005
Old Growth Forest	none	N.P.C.A.	2002/ 2003
Carolinian Canada Identified Rare Tree, Plant, or Animal Species	none	Carolinian Canada	Pre 2005
Significant Groundwater Recharge Areas (K.H.A.)	Greenbelt Plan	N.P.C.A.	2010
Highly Vulnerable aquifers (K.H.A.)	Greenbelt Plan	N.P.C.A.	2010
Flooding hazard lands, Erosion hazard lands, Dynamic beach hazard lands (Natural Hazard)	Greenbelt Plan	N.P.C.A.	
N.P.C.A. Natural Areas Inventory (N.A.I.) Data	none	N.P.C.A.	2006-2009
Town of Fort Erie Natural Areas Inventory (N.A.I.)	none	Dougan & Associates Ecological Consulting	2002-2003

Data Layers	Plan	Original Source	Date
Contemporary Mapping of Watercourses (2016)	none	Region/N.P.C.A.	2018

6.2 Assessment of Natural Environment Mapping

An assessment of current data and mapping for natural environment features will inform potential opportunities for future mapping and identify deficiencies to be addressed through the Municipal Comprehensive Review (MCR) process. The assessment has been divided into two key components:

- Provincial requirements; and
- Regional requirements.

The provincial plans identify what features/components comprise the natural environment systems. Although all plans specify that the natural environment systems must be identified by municipalities, the direction for the mapping of the features/components within these systems varies between the provincial plans. However, it is recognized and applied through current mapping of natural environment systems that features are to be mapped where information exists and is deemed appropriate by the municipality. The assessment herein considers whether current R.O.P. mapping is in conformity with existing minimum provincial requirements.

Municipalities can go beyond the requirements set out by the province where the intent of the provincial policies is maintained. In this discussion paper, 'regional requirements' assess the ability of existing mapping to meet industry and/or supported standards, policy implementation, and meet the intended use for facilitating land use planning within Niagara Region. To facilitate this, evaluation criteria have been developed against which data for mapping of features within the region can be assessed.

6.2.1 Provincial Requirements and Considerations

Preceding sections outline provincial requirements for mapping natural environment systems and what features could comprise the natural heritage system and water resource system. There are several requires for mapping natural environment systems within a municipality:

- the P.P.S. (2014) requires that both the natural heritage system and water resource system be identified. It does not specify that key features be mapped individually as part of the system.
- the Growth Plan requires the Natural Heritage System for the Growth Plan be mapped as an overlay on Official Plan mapping. There is no requirement for mapping key natural heritage features within the Natural Heritage System for the Growth Plan.
- the Greenbelt Plan requires that "key natural heritage features and key hydrologic features and any associated minimum vegetation protection zones" be

mapped where possible within the Greenbelt Plan area (policy 5.3, p. 52, M.M.A.H. 2017a).

This section provides a brief assessment of existing mapping within Niagara Region that can be used to identify the natural environment system (Table 5). Consideration is also given to common practice and rationale for mapping or not mapping features and why, for some features, there may be variability at the regional scale. Potential gaps or deficiencies are identified and briefly outlined following Table 5.

Table 5: Assessment of potential features to be mapped in natural environment systems and existing Niagara Region Official Plan mapping.

Feature/Area	Mapped Niagara Official Plan	Common Mapping Practice	
		Commonly Mapped	Rationale
Natural Heritage System	X	Y	
Significant wetlands, significant coastal wetlands	X	Y	Provincially managed dataset, available to municipalities for mapping.
Significant woodlands	X	Y	Typically, a municipal dataset. Definable feature limits.
Significant valleylands	X	Varies	Challenges in generating mapping for all features that may constitute significant valleylands. Not mapped by all municipalities and where mapped, is done to varying degrees using different approaches.
Significant wildlife habitat	D	N	Represents an incomplete dataset for most areas, which can be problematic for O.P. mapping. Requires sufficient field assessment data to identify.
Significant A.N.S.I.	X	Y	Provincially significant features mapped by the Province. Others (Regionally significant) dependent on those identified by the Province.
Coastal wetlands	X	Varies	Where assessed by Province (i.e. non-P.S.W.), available for mapping. Otherwise generally dependent on Conservation Authority mapping.
Fish habitat	X	Varies	Permanent watercourses and waterbodies often used as a proxy. Fish habitat mapping data may be available for some areas through specific datasets.
Habitat of endangered species and threatened species	D	N	Sensitive data. Not to be mapped on O.P. mapping. Incomplete dataset as it is based on known occurrence records and habitat mapping by the Province (i.e. no data doesn't mean 'not present').
Linkages	X	Varies	Mapping of linkages varies in approach and if mapped on R.O.P. schedules.
Life Science A.N.S.I.	X	Y	Provincially significant features mapped by the Province. Others (Regionally significant) dependent on those identified by the Province.
Buffers / Vegetation Protection Zone		Varies	Buffers often not mapped as part of the N.H.S. to maintain flexibility to increase beyond minimum set-back requirements where warranted based on field conditions and feature sensitivities. Minimum Vegetation Protection Zones are required to be mapped for key features in Greenbelt Plan N.H.S.
Significant groundwater recharge areas		Y	Often mapped through source water protection work.
Highly vulnerable aquifers		Y	Often mapped through source water protection work.
Significant surface water contribution areas		N	Generally represent headwater drainage catchments. Not typically mapped on O.P. schedules to date.
Permanent streams	X*	Y	Often as a single layer as 'watercourses'. Permanent vs. intermittent may not be differentiated. Requires enhanced feature knowledge.
Intermittent streams	X*	Y	
Inland lakes and their littoral zones	X*	N	Indirectly mapped as waterbodies. Littoral zones not typically mapped as a distinct feature class.
Seepage areas and springs		N	Not easily identified or consistently available information. At the Regional scale, these are small features that may not be well illustrated. May be integrated into other feature types (e.g., wetlands, significant wildlife habitat)
Wetlands	X	Varies	P.S.W.s are mapped; other wetlands may not be mapped at the Regional Scale, but are typically mapped
Water Resource System			
Ground water features		n/a	Assumed to be a composite of more specific features types and as such is mapped indirectly.
Hydrologic functions		n/a	Assumed to be a composite of more specific features types and as such is mapped indirectly.
Shoreline areas necessary for the ecological and hydrological integrity of the watershed		n/a	Unclear how defined. Assumed to be a composite of specific feature types that would define the limits of the area.
Headwaters		N	Headwater drainage features have not typically been mapped in Official Plans to date. Value of these features and need to map and manage them has increased and they may be an important feature to consider moving forward.
Rivers	X*	Y	Indirectly mapped through line and polygon water features (watercourses and waterbodies).
Stream channels	X*	Varies	Indirectly mapped through watercourse feature mapping. Permanent streams generally mapped; intermittent sometimes mapped.

Feature/Area	Mapped Niagara Official Plan	Common Mapping Practice	
		Commonly Mapped	Rationale
Inland lakes	X*	Y	Indirectly mapped through line and polygon water features (watercourses and waterbodies).
Recharge/discharge areas		Varies	As noted above, recharge areas often mapped through source water protection mapping. Discharge areas are not mapped as frequently; these features are often ill-defined and difficult to delineate. Some wetlands may provide an indication or area of discharge but cannot be used as a proxy.
Associated riparian lands		N	Not well defined. Associated riparian lands may include floodplain areas and/or could be interpreted as lands immediately adjacent to a watercourse or waterbody that directly support a watercourse or waterbody. Lack of clearly defined parameters and difficulty in consistent mapping are an issue.
Significant groundwater recharge areas		Y	Same as above. Often mapped through source water protection work.
Highly vulnerable aquifers		Y	Same as above. Often mapped through source water protection work.
Significant surface water contribution areas		N	Same as above. Often mapped through source water protection work.
Permanent streams	X*	Y	Same as above. Often as a single layer as 'watercourses'. Permanent vs. intermittent may not be differentiated. Requires enhanced feature knowledge.
Intermittent streams	X*	Y	
Inland lakes and their littoral zones	X	N	Same as above. Indirectly mapped as waterbodies. Littoral zones not typically mapped as a distinct feature class.
Seepage areas and springs		N	Same as above. Not easily identified or consistently available information. At the Regional scale, these are small features that may not be well illustrated. May be integrated into other feature types (e.g., wetlands, significant wildlife habitat)
Wetlands	X	Varies	Same as above. P.S.W.s are mapped; other wetlands may not be mapped at the Regional Scale, but are typically mapped
Other Features / Areas			
Greenbelt Plan Natural Heritage System (overlay)	X	Y**	Dependent on period of last mapping update by municipality. Data managed and provided by the province and is an identified layer.
Growth Plan Natural Heritage System (overlay)		Y**	Recently generated. Data is managed and provided by the province and is a mapped layer.
Urban River Valley System		Y**	Mapped as part of the Greenbelt Plan mapping. Data is managed and provided by the province and is a mapped layer.

D – indicates dataset is available, but not mapped.
* - indicates the feature is indirectly (e.g., permanent and intermittent streams using 'watercourse' layer) or effectively mapped (e.g., proxy) by mapping a similar or associated feature type.
** - System / Area mapping updated through updated provincial policies released in 2017/2018. Updated mapping to be incorporated into Official Plans as updated.

Natural Heritage System Mapping Gaps

Current mapping includes a combination of Core Natural Areas (represented as Environmental Protection Area and Environmental Conservation Area), potential Natural Heritage Corridors (i.e. linkages) connected the Core Natural Areas, and fish habitat. The combination of these components comprise the Core Natural Heritage System.

With respect to provincial mapping requirements, the Core Natural Heritage System meets minimum requirements from the P.P.S. for identification of the natural heritage system. The Growth Plan requires the provincially derived natural heritage system be shown as an overlay in O.P. mapping. Given the recent release of this mapping, Regional schedules do not illustrate the Growth Plan natural heritage system at this time.

The Greenbelt Plan requires municipalities "provide a map showing known key natural heritage features and key hydrologic features and any associated minimum vegetation protection zones" (Section 5.3, p. 52, M.M.A.H. 2017a). The Greenbelt natural heritage system overlay and key features are illustrated on the current R.O.P. mapping. The provincial dataset was used for this layer. Minimum vegetation protection zones are not mapped on O.P. schedules.

Water Resource System Mapping Gaps

The existing Regional Official Plan does not map a consolidated water resource system. As such, it does not meet the current minimum provincial requirement to identify a water resource system.

With respect to features that comprise a water resource system, some are represented in existing natural environment mapping as they overlap / correspond with features identified as part of the existing core natural heritage system. These include wetlands, watercourses, and water bodies.

Gaps with respect to the identification of hydrologic and hydrogeologic features/areas within a water resource system include:

- groundwater features
- shoreline areas necessary for the ecological and hydrological integrity of the watershed
- headwaters
- recharge/discharge areas
- associated riparian lands
- significant groundwater recharge areas
- highly vulnerable aquifers
- significant surface water contribution areas
- seepage areas and springs

Features for which data is not available and potential opportunities to fill data gaps are discussed below. Limitations with respect to existing datasets (e.g., accuracy) are explored in Section 6.0.

Other Features / Areas

The Greenbelt Plan N.H.S., current to the 2005 Plan, is mapped on the Niagara R.O.P. The 2017 update includes revisions to the N.H.S. which will need to be updated to reflect current mapping.

Both the Growth Plan N.H.S. and the Urban River Valley System were established through recent Plan updates (Growth Plan 2017; Greenbelt Plan 2017) and are new mapping requirements. These systems will need to be mapped as part of the new Niagara Official Plan.

Minimum Components for Inclusion in Natural Environment Mapping

Based on the review of provincial plans, policies, and upon review of comparator municipal approaches to mapping natural environment systems, the following components should be mapped at a minimum as part of the natural environment systems:

Natural Heritage System

- Provincially significant wetlands
- Other wetlands
- Significant woodlands
- Linkages
- Life Science Area of Natural and Scientific Interest (A.N.S.I.)
- Earth Science A.N.S.I.
- Permanent and intermittent streams

Water Resource System

- Provincially significant wetlands
- Other wetlands
- Waterbodies
- Permanent and intermittent streams
- Rivers
- Important/significant recharge/discharge areas
- Highly vulnerable aquifers

Through future technical reports and consultation with stakeholders and the public additional components may be considered as minimum components to include in mapping of the natural environment systems. The component features that have not been identified as minimum components to include in natural environment system mapping will still require policies in the new Regional O.P. providing protection of those component features to confirm with provincial plans.

Addition Components for considerations in Natural Environment System Mapping

The previous sections reviewed current Regional natural environment mapping including available datasets. There are features/areas described in Provincial plans, either as key natural heritage features, key hydrologic features or features/areas that "can" be considered for inclusion in natural environment systems, which the Region does not currently map. Table 6 provides recommendations for potential data sources that could be used to map natural environment system component features should these components be selected for inclusion in mapping the natural environment systems.

Table 6: Potential data sources for natural environment system component features that may be considered for mapping as part of the Region's natural environment system.

Feature/Area	Provincial Plan Components			Potential Sources of Data
	P.P.S.	GP	GBP	
Natural Heritage System				
Permanent streams			X	• Region/N.P.C.A. - Contemporary Mapping of Watercourses layer (2016) – recent dataset with higher level of accuracy and confidence
Intermittent streams			X	
Inland lakes and their littoral zones			X	• Region/N.P.C.A. - Contemporary Mapping of Watercourses layer (2016)
Seepage areas and springs			X	• Could be partially inferred from N.P.C.A. Groundwater Discharge Mapping (2005) • Compilation of data from watershed/subwatershed plan, site specific studies
Conservation reserves*	X	X		•Ontario Ministry of Natural Resources (O.M.N.R.) Fundamental Dataset (2002-2013)
Other natural heritage features and areas*	X	X		• Unknown dataset (could include meadows, shrub thickets)
Lands that have been restored or have the potential to be restored to a natural state*	X	X		• Unknown dataset (N.P.C.A. could have mapping for areas where restoration has occurred)
Associated areas that support hydrologic functions*	X	X		• Unknown (not defined)
working landscapes that enable ecological functions to continue*	X	X		• Could include sports fields, agricultural system, storm water management ponds and other LID infrastructure

Feature/Area	Provincial Plan Components			Potential Sources of Data
	P.P.S.	GP	GBP	
Water Resource System				•
Ground water features	X			• Compilation of data from watershed/subwatershed plans, site specific studies • N.P.C.A. Groundwater Study (2005) • Highly Vulnerable Aquifers (N.P.C.A. 2013)
Hydrologic functions	X			• Captured in hydrologic features
Shoreline areas necessary for the ecological and hydrological integrity of the watershed	X			• Combine hazard mapping (shoreline flood and erosion) from N.P.C.A. with natural heritage feature mapping to identify naturally vegetated shorelines
Headwaters	X			• Contemporary Mapping of Watercourses dataset contains headwater features • Update data from site specific studies (e.g., watershed/subwatershed study, E.I.S.)
Rivers	X			• Region/N.P.C.A. - Contemporary Mapping of Watercourses layer (2016)
Stream channels	X			• Region/N.P.C.A. - Contemporary Mapping of Watercourses layer (2016)
Inland lakes	X			• Region/N.P.C.A. - Contemporary Mapping of Watercourses layer (2016)
Recharge/discharge areas	X			• Recharge areas partially identified as Key Hydrologic Areas in Greenbelt Plan Area; • Could be partially inferred from N.P.C.A. Groundwater Discharge Mapping (2005)

Feature/Area	Provincial Plan Components			Potential Sources of Data
	P.P.S.	GP	GBP	
				• N.P.C.A. Source Water Protection mapping • Compilation of data from watershed/subwatershed plan, site specific studies
Associated riparian lands	X			• can use wetland layer (N.P.C.A.) to identify those continuous with watercourses/waterbodies (Contemporary Mapping of Watercourses), and floodplain mapping (N.P.C.A.) to identify associated riparian areas for consideration in water resource system
Significant surface water contribution areas		X	X	• New mapping to be developed illustrating headwater catchment areas .. Based on identified headwater drainage features
Permanent streams		X	X	• Region/N.P.C.A. - Contemporary Mapping of Watercourses layer (2016)
Intermittent streams		X	X	• Region/N.P.C.A. - Contemporary Mapping of Watercourses layer (2016)
Inland lakes and their littoral zones		X	X	• Region/N.P.C.A. - Contemporary Mapping of Watercourses layer (2016)
Seepage areas and springs		X	X	• New mapping to be developed based on data/mapping provided through site specific studies (e.g., watershed/subwatershed studies, E.I.S.)

6.2.2 Evaluation of Regional Mapping Data

Evaluation Criteria

The guidance and considerations set out in **sections 3** and **4** of this discussion paper have been used to develop criteria for assessing current environment features data / mapping within Niagara Region. Data confidence and accuracy were two key concerns raised through the Mapping Working Group meetings and are the focus of this assessment. Evaluation criteria to support this assessment include: functional data scale, age of data, review/update frequency and data validation (method, coverage, etc.) as they are proxies/indicators for confidence and level of accuracy of the data. For the purposes of the assessment of existing data, these criteria are defined as follows:

Update Frequency: This criterion identifies the frequency with which the dataset is currently reviewed / updated. This criterion is linked to age of data and may identify opportunities to address deficiencies in data updates (external) and review and updates to internal datasets. Where review/update frequency is lower than the age of data parameters, it is identified as a concern.

Age of Data: The influence of age will vary depending on the potential for that feature to change over time and the amount of development/alteration within a given area (e.g., urban area experiencing rapid growth). For the purposes of completing an assessment through a site-specific study (e.g., environmental impact study), natural heritage data related to vegetation type and wildlife habitat is generally accepted to be 'current' for 5 years from the time of collection (e.g., City of Guelph 2017, Conservation Halton 2017, Toronto and Region Conservation Authority 2014, Grand River Conservation Authority 2005). Similarly, features that are located within areas undergoing development have the potential to change over relatively short temporal periods, particularly in urbanizing and near-urban areas.

The period for municipal official plan review may also be a consideration for the period over which updates to data may be warranted or desired. Updates to the official plan are to occur within 10 years of a new comprehensive official plan, or every five years after an update done through an amendment to the plan.

For the purposes of this assessment, we have used three categories for age and consider the potential impact on each feature type. Generally, data that is <5 yrs old is considered 'current'. Data between 5 and 10 years old may be less accurate for some vegetation communities and wildlife habitat and is evaluated based on feature type. Data greater than 10 years old is considered potentially less accurate; some exceptions may apply and are identified in the assessment table.

It is understood that for those feature datasets that are prepared and managed by external agencies (e.g., the province), age of data may be beyond the Region's control, with the exception of checking for updates in the appropriate data warehouse locations (e.g., Land Information Ontario).

Ground Accuracy: This criterion flags known or identified issues with respect to accuracy of a dataset / feature class in reflecting 'on-the-ground' feature limits. It relies on pre-existing identification of issues and may not represent all accuracy issues with respect to how well the mapping represents the location and/or limits of features. Where features have ill-defined limits and/or high accuracy is not integral to the use and function of the feature dataset, 'accuracy' is considered to be 'not applicable' (n/a).

Field Verification: In the context of this assessment, data validation refers to field verification. Field verification may range from confirmation that a feature is still present on the landscape (i.e. reconnaissance level field verification), boundary confirmation (e.g., woodland dripline staking) or detailed field inventories (e.g., inventory and detailed field work). This criterion may not apply to all features types and may vary geographically for a single feature type.

Criteria Summary

Table 7 provides a summary of the regional feature mapping assessment criteria, the measure by which the criteria is assessed. A description / conclusion of the assessment for each dataset will also be provided in the assessment.

Table 7: Evaluation criteria to assess data for use at Regional scale.

Criteria	Measure	Outcome
Update Frequency	Frequency of reviews to confirm accuracy / validity and/or updates to dataset based on available data.	As Available* As Needed <5 yrs >5 yrs >10 yrs Unknown n/a
Age of Data	Date since created or updated; considered in context of feature type it represents.	<5 yrs 5-10 yrs >10 yrs Unknown
Ground Accuracy	Known or inferred degree of accuracy of feature mapping relative to alignment/limits of feature 'on the ground'.	Low Moderate High Unknown n/a
Field Verification	Level of in-field validation for the feature type. Applicability will vary with feature type.	Complete Near Complete (>75%) Variable (25-75%) Limited (<25%) No Verification Unknown

* Refers to datasets managed/housed by other agencies/groups and upon which updates are dependent (i.e. updates are out of the Region's direct control)

Additional Considerations

The criteria assessment provides a general evaluation of data quality. To better understand potential limitations to using each dataset, additional factors should be considered, including:

- **Data ownership**: Numerous datasets (e.g., Provincially Significant Wetlands) are managed and updated by external agencies (e.g., M.N.R.F., N.P.C.A.). As such, it is beyond the Region's control for how and when updates to the dataset is undertaken. Potential deficiencies in these datasets are to be considered in the method of their implementation and use but does not preclude the ability to use the data for mapping or screening purposes.
- **Influence of scale**: The scale at which the data was produced can affect the accuracy of the feature when viewed at a small scale (i.e., 'zoomed in'). Inaccuracies for some feature limits (e.g., watercourse alignments) may not be discernable at the regional scale (e.g., 1:100,000), but may become apparent at the site scale (e.g., <1:10:000). This has been considered in the evaluation of 'ground accuracy'.
- **Other uses**: Beyond data quality for mapping is the potential use of data for other purposes (screening, historic reference of existing conditions, etc.). Even out of date data or datasets with known mapping inaccuracies may be of beneficial use where newer or more accurate data is not readily available for preliminary screening/constraints identification or for historic reference on diversity, species of conservation concern, changes in feature extents/alignments, etc.

These factors are taken into consideration in developing recommendations for use in mapping.

Table 8. Recommended Use Assessment Values and Descriptions

Value	Description
Y	Recommended for use
Y*	Confirmation / Update Required; recommended for use recognizing limitations in data accuracy
X	Requires further review to determine if update is appropriate to address identified deficiencies or if new dataset is required/warranted.
N	Not recommended for use
H	Historic / background data

Mapping Dataset Gap Analysis

The Region's natural environment datasets were assessed against the criteria and additional criteria set out above to identify potential gaps, issues and opportunities, and provide preliminary recommendations for use.

Through the evaluation of data provided in Table 9, a colour has been assigned to each criterion; an 'evaluation outcome' is then assigned based on the cumulative assessment of the criteria. Rationale supporting the evaluation outcome is also provided. Generally, green indicates that the dataset meets a criterion; amber indicates caution should be used and/or that there are some potential limitations or issues for a dataset with respect to a criterion; red indicates that the dataset does not meet the requirements of the criterion. Where there is not sufficient information to make a determination for a criterion, it is identified as 'Unknown' and coloured amber. Some criterion did not apply to all datasets; where this occurred 'n/a' is entered in the assessment table and no colour is assigned.

Datasets that are or could be used to map features to be included in the Region's natural environment system(s) were assessed against the criteria set out above to identify potential gaps, issues and opportunities.

Results from the gap analysis are presented in Table 9, including:

- A summary of key outcomes with respect to suitability of each dataset for use in mapping; and
- Preliminary considerations for use of the dataset to address data gaps.

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Table 9. Gap analysis of Region's datasets for natural environment mapping.

Features/Layers	Update Frequency	Age of Data	Ground Accuracy	Field Validation	Evaluation Outcome	Rationale	Suitability for Use in Mapping (Legend: Table 8)	Preliminary Considerations for Use of Dataset
Fish habitat - polyline (C.N.H. layer)	No Updates	>10	Low	Limited		Ecological data is >10yrs old and has known accuracy issues (e.g. fish habitat identified where no water is present).	X	Known issues include: accuracy of 'fish habitat' identification and watercourse alignments. Updates may resolve issues to sufficient scale for O.P. schedule mapping. May not resolve issues for smaller scale (e.g. site scale) mapping or review. May consider replacement with Contemporary Mapping of Watercourses (C.W.M.) - pending review of C.W.M. dataset. Transfer / verification of fish habitat potential required.
Fish habitat - polygon (C.N.H. layer)	No Updates	>10	Low	Limited		Ecological data is >10yrs old and has known accuracy issues (e.g. fish habitat identified where no water is present).	X	Known issues include: accuracy of 'fish habitat' identification and watercourse alignments. Updates may resolve issues to sufficient scale for O.P. schedule mapping. May not resolve issues for smaller scale (e.g. site scale) mapping or review. May consider replacement with Contemporary Mapping of Watercourses (C.W.M.) - pending review of C.W.M. dataset. Transfer / verification of fish habitat potential required.
Significant Wetlands (Provincially Significant Wetlands)	As Available	5-10[3]	Moderate	Variable		Represents the official dataset of P.S.W.s. Updates to the dataset to reflect updated information is undertaken by the Province.	Y*	Confirm current provincial mapping is used in dataset. Establish standard period to update dataset based on provincial data warehouse(s). Accuracy will decline with increased scale, but valuable for preliminary constraint mapping/identification.
Wetlands (Other Evaluated Wetlands)	As Available	5-10	Moderate	Variable		Represents the official dataset of wetlands evaluated by the Province as not meeting requirements for designation as P.S.W. Updates to the dataset to reflect updated information is undertaken by the Province.	Y*	Confirm current provincial mapping is used in dataset. Establish standard period to update dataset based on provincial data warehouse(s). Accuracy will decline with increased scale, but valuable for preliminary constraint mapping/identification.

[3] The Age of Data is reflective of the information in the current Official Plan mapping dataset. For purposes of screening, policy implementation, etc. Up-to-date wetland data, based on information available through LIO is used by the Region.

Features/Layers	Update Frequency	Age of Data	Ground Accuracy	Field Validation	Evaluation Outcome	Rationale	Suitability for Use in Mapping (Legend: Table 8)	Preliminary Considerations for Use of Dataset
Significant Valleylands	No Updates	>10	Low	No Verification		Data generated by the Region using a simple proxy exercise. Does not accurately reflect on-the-ground conditions; dataset is now >10yrs old and did not undergo field verification.	N	Do not use current layer. If mapping of feature type is desired, new approach to mapping is required.
Significant Woodlands	As Needed	>10	Low	Variable		Dataset is >10yrs old and has low ground accuracy. Known issues within dataset with respect to accurate limit delineation, separation/combined feature assessments, landscape changes not reflected in dataset.	X	Substantial update / verification effort or generation of a new dataset is required based on known issues with existing dataset. Updates may resolve key issues (feature presence, size-based preliminary assessment of significance, etc.) for O.P. schedule mapping. Revisions may be sufficient for site-scale mapping - pending re-assessment. NOTE: updated criteria and methods should be developed and evaluated through an appropriate process in advance of any updates occurring.
Significant Wildlife Habitat	As Needed	>10	Low	Variable		Significant wildlife habitat is now identified based on site specific information and assessment using provincially determined criteria (e.g., Eco-region Schedules). With the current dataset >10 yrs old, the coverage and mapping of SWH lacks recent information and may not meet current criteria. It is also noted that this feature type is difficult to map consistently in an Official Plan context and is often not mapped.	X	Should not be used for mapping until updated based on current information and following current provincial criteria. It is considered part of the N.H.S. and should be used for screening and planning decision purposes. To be used with caution as it is an incomplete dataset. Consider updates - bringing in mapped SWH from existing studies, etc.
Significant Areas of Natural and Scientific Interest (Regionally Significant Life Science A.N.S.I.'s)	As Available	5-10	Moderate	Unknown		Dataset information indicates that these are produced by the Province. Delineation of these features would generally be based on the ecological features (e.g. vegetation units) or other defined feature limits that comprise or define the area of significance.	Y*	Confirm current provincial mapping used in dataset. Establish standard period to update dataset based on provincial data warehouse(s).
Significant Areas of Natural and Scientific Interest (Provincially Significant Life Science A.N.S.I.'s)	As Available	5-10	Moderate	Unknown		Represents the official dataset derived by the Province. Updates to the dataset are undertaken by the Province.	Y*	Confirm current provincial mapping used in dataset. Establish standard period to update dataset based on provincial data warehouse(s). Suitable for mapping in O.P. schedules (pending confirmation dataset is up to date). Generally suitable for preliminary constraint mapping/identification at site scale.

Features/Layers	Update Frequency	Age of Data	Ground Accuracy	Field Validation	Evaluation Outcome	Rationale	Suitability for Use in Mapping (Legend: Table 8)	Preliminary Considerations for Use of Dataset
Potential Natural Heritage Corridors (Regional Core N.H.S.)	No Updates	>10	Low	No Verification		Dataset is out of date (>10yrs old). Dataset may not meet current feature information, proposed policy framework and best practices at time of preparation of the updated Official Plan. Upon review, may be determined to meet current standards and practices.	X	If the Region chooses to identify linkages in addition to those identified as part of the Growth plan NHS, a new dataset should be created. Review against current land use, updated feature mapping and best practices. Updated criteria and methods should be developed and evaluated through an appropriate process to identify corridors / linkages. Specific consideration should be given to the requirement for identifying corridors outside of / in addition to those mapped as part of the Growth Plan N.H.S. Corridors are generally conceptual and mapping of corridors at site-scale should be refined through detailed studies approved by the Region.
Publicly Owned or Conservation lands	As Needed	>10	Unknown	n/a		> 10 yrs old. Property ownership of publicly owned or conservation lands does not change frequently.	Y*	Review / update based on current ownership to confirm existing parcels and add parcels if / as appropriate. Suitable for use in O.P. Schedule mapping and site-scale mapping to identify properties.
Earth Science A.N.S.I.	As Available	5-10	Unknown	Unknown		Represents the official dataset derived by the Province. Updates to the dataset are undertaken by the Province.	Y*	Confirm current provincial mapping used in dataset. Establish standard period to update dataset based on provincial data warehouse(s). Suitable for mapping in O.P. schedules (pending confirmation dataset is up to date). Generally suitable for preliminary constraint mapping/identification at site scale.
Greenbelt Natural Heritage System Area (2005)	No Updates	>10	n/a	Unknown		This layer has been replaced by the 2017 Greenbelt N.H.S.	N	Should not be used - has been replaced by 2017 Greenbelt N.H.S. mapping. Retain for historic purposes.
Greenbelt Natural Heritage System Area (2017)	No Updates	<5	Unknown	n/a		Represents the current Greenbelt N.H.S. derived by the Province.	Y	Should be used for mapping as an overlay to be consistent with Plan requirements.
Core Natural Heritage Municipal Drains	As Needed	>10	Unknown	Unknown		Sub-set of OMAFRA data. Does not appear to have been updated to reflect more recently released updates to OMAFRA municipal drain classification/mapping. Data is out of date (>10yrs old).	X	May consider replacement with Contemporary Mapping of Watercourses (C.W.M.) - pending review of C.W.M. dataset.

Features/Layers	Update Frequency	Age of Data	Ground Accuracy	Field Validation	Evaluation Outcome	Rationale	Suitability for Use in Mapping (Legend: Table 8)	Preliminary Considerations for Use of Dataset
Growth Plan Natural Heritage System Area (2018)	No Updates	<5	n/a	n/a		Current Growth Plan N.H.S. mapping from the Province.	Y	Provincially managed dataset. For use as overlay. Note that municipalities have the opportunity to request revisions to the Provincial N.H.S. to reflect known conditions; Niagara to review and request revisions, as appropriate, in advance of use in Official Plan Mapping.
Hazardous forest types for Wildland Fire	As Available	<5	Unknown	Unknown		Provincial dataset identifying forest types prone to wildfire. Accuracy of dataset is unknown at this time.	N	Provincially managed dataset. Appears very inaccurate. May be of value as a screening tool to assess potential natural hazard, but requires additional consideration prior to use.
Growth Plan Agricultural System (2018)	No Updates	<5	n/a	n/a		Current Growth Plan Agricultural System mapping from the Province.	Y	Provincially managed dataset. For use as overlay.
Greenbelt River Valley Connections	No Updates	<5	n/a	n/a		Provincial dataset identifying Urban River Systems that connect with the Greenbelt.	Y	Provincially managed dataset. For use as overlay.
Sand barrens, Savannahs and Tallgrass Prairies (layer also includes WMAs)	No Updates	>10	Unknown	Unknown		Data is out of date (>10 yrs). Unknown feature limit accuracy.	X	Review and update of dataset (e.g., supplement with data from site specific studies) may resolve sufficiently to use for mapping at various scales. Can be used to compile significant wildlife habitat data set. Can be used for internal screening purposes (e.g. screening for candidate Significant Wildlife Habitat).
Alvars	No Updates	>10	Unknown	Unknown		Data is out of date (>10 yrs). Unknown feature limit accuracy.	X	Review and update of dataset (e.g., supplement with data from site specific studies) may resolve sufficiently to use for mapping at various scales. Can be used to compile significant wildlife habitat data set. Can be used for internal screening purposes (e.g. screening for candidate Significant Wildlife Habitat).
Habitat of Endangered species and threatened species	As Available	>10	Low	Complete		Data is out of date (>10 yrs). Sensitive data.	N	Data is generally considered sensitive and should not be mapped. Updated data may be obtainable from M.N.R.F. for use in screening exercises. Release of data is managed by M.N.R.F.

Features/Layers	Update Frequency	Age of Data	Ground Accuracy	Field Validation	Evaluation Outcome	Rationale	Suitability for Use in Mapping (Legend: Table 8)	Preliminary Considerations for Use of Dataset
Habitat of Species of Concern	As Available	>10	Low	Complete		Data is out of date (>10 yrs). May contain sensitive data. Incomplete dataset. Updates to mapping through M.N.R.F., N.H.I.C., N.P.C.A., Region to identify species occurrences. There may be lack of clarity for mapping habitat for some species.	X	Review and update of dataset (e.g., supplement with data from site specific studies, N.H.I.C., N.P.C.A. data) may resolve sufficiently to use for mapping at various scales. May be used to compile significant wildlife habitat data set if verified to contain accurate information. If data updated and verified, may be used to screen for candidate significant wildife habitat.
Old Growth Forest	No Updates	>10	Unknown	Variable		Data is of date (>10 yrs), unknown accuracy and no updates since creation.	N	Review of data to update / confirm conditions and outcomes of the dataset may provide benefit to updating significant woodlands dataset.
Carolinian Canada Identified Rare Tree, Plant, or Animal Species	No Updates	>10	Unknown	Unknown		Out of date. Unclear based on information available potential planning implications of this dataset and value in updating or using for screening purposes.	N	Typically not mapped. Not to be used in mapping. Little value for internal screening. No update recommended.
Significant Groundwater Recharge Areas (K.H.A.)	As Required	5-10	25 m	No		Updates are made as required. 2010 is the most recent update. Ground accuracy of the data is identified as 25m. Data was not field verified / validated.	Y*	Review dataset to determine suitability for use of multiple mapping scales and for screening. Preliminary information indicates that there is potential for use to map these features.
Highly Vulnerable aquifers (K.H.A.)	As Required	5-10	50 m	No		Updates are made as required. 2010 is the most recent update. Ground accuracy of the data is identified as 50m. Data was not field verified / validated.	Y*	Review dataset to determine suitability for use of multiple mapping scales and for screening. Preliminary information indicates that there is potential for use to map these features.
Flooding hazard lands, Erosion hazard lands, Dynamic beach hazard lands (Natural Hazard)	As Required / As Available	5-10	1 m	Variable		N.P.C.A. regularly updates floodplain and other hazard mapping. Limited information available to confirm age of dataset through this assessment.	Y*	Updated information / dataset should be obtained from N.P.C.A. Regular updates to this dataset will be managed by N.P.C.A. and should be identified for regular comparison / update internal to the Region.

Features/Layers	Update Frequency	Age of Data	Ground Accuracy	Field Validation	Evaluation Outcome	Rationale	Suitability for Use in Mapping (Legend: Table 8)	Preliminary Considerations for Use of Dataset
N.P.C.A. Natural Areas Inventory (N.A.I.) Data	No Updates	>10	High	Near Complete		Datasets focus on ecological and natural heritage data. Older dataset (>10 yrs). Due to near complete field verification, dataset for use in defining feature limits and for screening purposes still valuable, pending confirmation / update.	Y*	Data has value to inform mapping (e.g., ELC communities for wetlands and woodlands) in O.P. Schedules, prepare preliminary constraint mapping at site scale, and undertake screening. Feature limits should be more accurately delineated through site specific studies. If this dataset were to be updated (e.g. via airphoto interpretation, ELC, etc.) it could be considered for use as a mapping base for preliminary feature identification and mapping/delineation.
Town of Fort Erie Natural Areas Inventory (N.A.I.)	Unknown	>10	Unknown	Variable		Datasets focus on ecological and natural heritage data. Older dataset (>10 yrs). Due to partial field verification, dataset for use in defining feature limits and for screening purposes still valuable, pending confirmation / update.	Y*	Data has value to inform mapping (e.g., ELC communities for wetlands and woodlands) in O.P. Schedules, prepare preliminary constraint mapping at site scale, and undertake screening. Feature limits should be more accurately delineated through site specific studies. Note that this data may overlap with N.P.C.A. N.A.I. data; consideration should be given to cost-benefit of updating N.P.C.A. data and influence of this dataset on that process.
Constructed Drains	As Available	<5	Moderate	Unknown		Uses provincial dataset (OMAFRA), some potential issues with repect to accuracy and unknown field verification.	X	Resolution between various watercourse and fish habitat data layers is required prior to moving forward. May consider replacement with Contemporary Mapping of Watercourses (C.W.M.) - pending review of C.W.M. dataset.
Major Streams	As Needed	5-10	1 m	Variable		Larger watercourses should not vary substantially over moderate time horizons. Depending on the size of stream captured, potential concerns may be minimized. Additional information is required to refine assessment.	Y*	Review to confirm completeness and that any available data updates be incorporated. May consider replacement with Contemporary Mapping of Watercourses (C.W.M.) - pending review of C.W.M. dataset.
Contemporary Mapping of Watercourses	Unknown	<5	High	Variable		Higher data confidence, recently produced.	Y	Most recent and accurate dataset containing watercourse and water body features. Should be considered for use in mapping and screening pending confirmation through consolidated review.

Criteria Assessment Results Summary

Results of applying criteria to assess the Region's dataset for mapping natural environment systems were used to generate an evaluation outcome for each dataset. The evaluation outcome provides an indication on the overall quality of each dataset in consideration of the cumulative set of criteria.

Within the datasets assessed, a total of 8 (18%) were identified as meeting all or most criteria (green), 30 (68%) were identified as having moderate scores in several key criteria, and 6 (14%) were identified as having low scores in several key criteria (red). This indicates that the majority of the natural environment data set requires moderate to major improvements if they are chosen as layers for use in development of the Region's natural environment systems. It is important to note that many of the layers assessed may not be carried forward for use in developing the natural environment systems; the assessment included consideration of layers available to the Region in their current database only. Additional data may be generated or obtained to supplement datasets reviewed in Table 9. A brief overview of performance by criteria is provided below.

Update Frequency was used as a general measure for keeping data 'current'. Overall, there was limited data to identify the absolute frequency (e.g., every 2 years) and/or if a regular or scheduled mechanism to update internal data or obtain updated layer(s) from sources (e.g., M.N.R.F., N.P.C.A.) in place. Based on available information, update frequency was identified as: As Needed – no/unknown if set minimum schedule, but updated as data comes available an/or when required, As Available – reliant on updates by original source (e.g., M.N.R.F.), no known schedule for checking for updates, No Updates – no known updates are made to the dataset, or Unknown. It should be noted that with respect to layers obtained from L.I.O., the Region regularly updates layers used for internal review and screening to ensure currently available data is utilized. Similarly, N.P.C.A. data that is core to their mandate (i.e. Hazard Lands, Floodlines, etc.) are shared with the Region through a data sharing agreement on a regular / as needed basis.

Age of Data considered the last known date that the data was updated and provides a general indication of the limitations for data to represent current standards, practices and current 'on the ground' conditions. The potential impact of this criterion on data accuracy will vary based on the dataset being assessed and the potential for the features to change over time. Additionally, age of data is not an absolute indicator – data that is 'out of date' may still provide value to the region and area municipalities. Overall, the almost half (21/44 (47%)) of datasets assessed are over 10 years old.

A key issue raised through the consultation process was how accurately the datasets represent on-the-ground conditions. The **Ground Accuracy** criterion is a reflection of known or identified potential concerns with respect to data accuracy in representing existing conditions. It is important to note that a detailed review of data (e.g., air photo interpretation or field verification) was beyond the scope of this assessment. Rather, this criterion was evaluated based in part through input from Regional staff and staff from the N.P.C.A. and area municipalities. Ground accuracy was represented as Low, Moderate, High or Unknown. Ground accuracy may not apply to all datasets as a useful

measure of data quality; for these datasets 'n/a' is entered in the table. A total of 9 (20%) were identified of having Low, 5 (11%) have Moderate and 2 (5%) has High ground accuracy. A majority of datasets did not have sufficient information to assess ground accuracy (22; 50%) and were labelled Unknown or were identified as 'n/a' for this criterion (6, 14%).

Field Validation is a companion indicator to ground accuracy. While ground accuracy may be affected by age and landscape change over time, field validation is an indication of the extent of 'ground truthing' or visual confirmation to inform the delineation of the feature reflected in mapping. This criterion only applies to those features for which distinct feature limits can be identified in the field. It does not speak to other forms of validation for datasets developed through interpolation of modelling and/or those features that do not have easily distinguished geographic limits (e.g., floodplain, groundwater recharge, etc.). A total of 4 (9%) datasets had no verification, 2 (5%) have limited verification, 8 (18%) had some (variable) verification, 3 (7%) were complete or near complete. Of the remainder, 20 (45%) were unknown and for 7 (16%) the criterion was determined to be not applicable (n/a).

Summary of Recommendations for Use of Data in Mapping

A summary of recommendations for use from Table 9 is provided below to identify a consolidated list of current gaps in datasets and to assist in the identification of potential options for addressing gaps (**Section 8**).

A total of 5 datasets were recommended for use 'as is' ('Y'):

- Greenbelt Natural Heritage System Area
- Growth Plan Natural Heritage System
- Growth Plan Agricultural System
- Greenbelt River Valley Connections
- Contemporary Mapping of Watercourses

Largely as a result of data age and/or to confirm the most updated dataset is being used in the Regional database, 12 datasets were identified as requiring confirmation or updates but are otherwise anticipated to be suitable for use ('Y*'). These include:

- Significant Wetlands (Provincially Significant Wetlands)
- Wetlands (Other Evaluated Wetlands)
- Significant Areas of Natural and Scientific Interest (Regionally Significant Life Science A.N.S.I.'s)
- Significant Areas of Natural and Scientific Interest (Provincially Significant Life Science A.N.S.I.'s)
- Publicly Owned or Conservation lands
- Earth Science A.N.S.I.
- Significant Groundwater Recharge Areas (K.H.A.)
- Highly vulnerable aquifers (K.H.A.)

- Flooding hazard lands, Erosion hazard lands, Dynamic beach hazard lands (Natural Hazard)
- N.P.C.A. Natural Areas Inventory (N.A.I.) Data
- Town of Fort Erie Natural Areas Inventory (N.A.I.)
- Major Streams

A total of 10 datasets were identified for further review to determine if an update is sufficient to address identified deficiencies or if new dataset is required/warranted. ('X'). These include:

- Fish habitat - polyline (C.N.H. layer)
- Fish habitat - polygon (C.N.H. layer)
- Significant Woodlands
- Significant Wildlife Habitat
- Potential Natural Heritage Corridors (Regional Core N.H.S.)
- Core Natural Heritage Municipal Drains
- Sand barrens, Savannahs and Tallgrass Prairies (layer also includes WMAs)
- Alvars
- Habitat of Species of Concern
- Constructed Drains

Datasets not recommended for use in mapping ('N') generally include those that have been replaced with more current layers, are comprised of sensitive data, have significant deficiencies or limitations that cannot be easily addressed or are generally not a mapped feature type. These include:

- Significant Valleylands
- Greenbelt Natural Heritage System (2005)
- Habitat of Endangered species and Threatened species
- Old Growth Forest
- Hazardous forest types for wildlife fire
- Carolinian Canada Identified Rare Trees, Plants, or Animal Species

Summary of Preliminary General Recommendations to Address Known Issues with Mapping

Issues with Regional mapping previously noted by Regional staff and agency partners primarily concerned the accuracy of datasets. Through the review of the available datasets for consideration in mapping, accuracy (or lack thereof) was determined to be a result of a combination of the following:

- method used to identify/map features (e.g., aerial interpretation vs. field validation)
- age of dataset; related to when it was developed or date when last updated (particularly relevant for external datasets, such as those produced by the Province)

- base layers used/combined to make feature dataset that could result in mis-alignment of features

Preliminary recommendations to address issues related to accuracy of data were provided in Table 9, and include:

- using an alternate data set (e.g., Contemporary Mapping of Watercourses layer in place of other watercourse layers and fish habitat)
- updating the dataset by incorporating more recent information from other sources (e.g., mapping data from approved site-specific studies, watershed/subwatershed studies, N.H.I.C., M.N.R.F., N.P.C.A.)
- obtaining the most recent dataset from official external source (e.g., Provincial datasets: provincially significant wetlands, A.N.S.I.s; N.P.C.A.: unevaluated wetlands, floodplain, erosion hazard, etc.)
- generating a new dataset through conventionally acceptable approaches to more precisely map features, such as delineating features using orthoimagery at a large scale (e.g., 1:2,000) or by ground truthing

As previously mentioned, several of the datasets assessed may not be carried forward for use in developing the natural environment systems. Where the current dataset was not recommended for use, additional data will need to be generated or obtained to map those components of the natural environment system if their inclusion in the natural environment system(s) is deemed necessary. In addition, while not all components may be mapped, the new N.O.P. will at a minimum need to develop policies that list those components listed in provincial plans, and the protection of those components will need to at least confirm with the policies of the provincial plans.

7.0 Natural Environment Mapping for New N.O.P.

The following section carries forward the discussion and evaluation of Regional natural environment mapping data (Section 7) to review potential options to be evaluated and considered for the development of natural environment mapping to support the new N.O.P..

7.1 Options

Preliminary recommendations to improve the current Regional natural environment mapping dataset were summarized at the end of Section 6.2.2, including:

- the use of an alternate data set where the current data is considered insufficient for natural environment mapping;
- updating data with more recent information from other sources;
- obtaining the most recent dataset from official external source; and
- generation of a new dataset through conventionally acceptable approaches.

Table 9 provides a review of data that may be considered for mapping natural environment features identified in provincial plans and the current R.O.P., and considers the following:

- options for development a new dataset or improving the current dataset;
- staff resources (i.e., public agency staffing or consultant) to update/develop dataset;
- approximate costs (initial cost to develop dataset, and/or cost to update dataset with more recent site-specific data); and
- frequency of update to maintain dataset based on more recent site-specific data.

It should be noted that table 10 does not make a recommendation on what features should be mapped; rather it provides options on what dataset(s) to use (existing in the Region's data library or to be obtained) or how datasets can be developed for mapping potential features to be included in the new N.O.P. natural environment mapping.

Table 10. Review of available datasets and options to map natural environment features for new N.O.P.

Feature/Area (Provincial and Regional)	Data Recommended for Use (last updated)	Options for Developing New Dataset or improving Current Dataset(s)	Resources (staffing)	Approximate Costs	Frequency of Update
Natural Heritage System					
Significant wetlands, significant coastal wetlands	1.M.N.R.F. (2018)	**Options to update dataset(s):** 1. Updates are undertaken by the Province. Regularly scheduled data downloads from Land Information Ontario (LIO) for updated dataset is recommended to ensure current data is in use. **Options for new dataset(s):** None. The province is responsible for designating Provincially Significant Wetlands and maintaining and updating the dataset.	• Regional staff	**Updates to Existing:** 1. Small internal cost as part of regularly database / data library updates. **New Dataset:** n/a	As updated by the Province. Internal download of current provincial data – annual.
Significant woodlands	1. Update to Regional layer 2.Newly created dataset	**Options to update dataset(s):** 1. Refine and update woodland layer through orthoimage interpretation across the Region to refine limits; and/or 2. Refine and update woodland layer using existing mapping and incorporate results of site-specific studies (e.g., E.I.S., subwatershed studies). May be considered for studies <5 years old, as appropriate / available. **Options for new dataset(s)**: 1. Use an existing dataset (e.g., M.N.R.F. Wooded Areas) as a base layer and apply revised woodland criteria (where feasible – e.g. minimum size criterion) to refine layer to reflect 'candidate significant' features. <u>Additional Options</u>: Use orthoimage interpretation of woodlands combined with reconnaissance-level field survey (if / as appropriate) to verify presence and refine feature limits in: a) settlement areas where there is increased development pressure; or b) the entire Region. 2. Update of ELC dataset to community series (e.g., deciduous forest (FOD)) across the Region using a combination of orthoimage interpretation and field verification. The ELC dataset would include all vegetation community areas (i.e., more than woodlands) and therefore will be of use for other considerations (e.g., assessment of natural system holistically across habitat types, etc.). Significance criteria can be applied (as above) to identify preliminary / candidate significant woodlands. **Note**: Moving forward, provision and subsequent incorporation of feature delineation data from site-specific studies (e.g., E.I.S.) should	• Regional staff • Agency partners (e.g., N.P.C.A.) • Consultant	**Updates to Existing**: 1. $5,000-$10,000 2. $15,000-$20,000 **New Dataset:** 1. <$5,000 a) $25,000-$30,000 b) $55,000-$65,000 2. $75,000-$80,000 **Ongoing Updates**: Internal costs (Region) for ongoing updates.	Revisions/updates from site-specific studies – annual, or quarterly. Full update / review – 5-year cycle.

Feature/Area (Provincial and Regional)	Data Recommended for Use (last updated)	Options for Developing New Dataset or improving Current Dataset(s)	Resources (staffing)	Approximate Costs	Frequency of Update
		become part of a **regularly scheduled update protocol** is recommended for all identified options.			
Significant valleylands	• N.P.C.A. has a draft dataset that should be evaluated for use in Region's natural heritage system mapping.	**Options to update dataset(s):** Review N.P.C.A. valleyland dataset to determine if appropriate for use in Region's natural environment system mapping. **Options for new dataset(s)**: 1. N.P.C.A. has a draft significant valleyland dataset that could be reviewed and considered for use. 2. Use a combination of datasets to approximate boundary • Digital elevation model; and/or • Contour mapping (≤ 1m contours); and • Contemporary Mapping of Watercourses; and • Floodplain (minimum size threshold); and • Slope erosion hazard limit.	• Regional staff • N.P.C.A. staff • Consultant	**Updates to Existing:** n/a **New Dataset:** 1. n/a 2. $20,000 - $25,000 **Ongoing Updates**: Internal costs (Region) for ongoing updates.	Revisions/updates from site-specific studies – annual, or quarterly. Full update / review – 10-year cycle.
Significant wildlife habitat	• Regional SWH layer	**Options to update dataset(s):** 1. Review existing data against current landscape (e.g., through orthoimage interpretation) to remove features / areas no longer valid; add data based on available data from available sources: a) N.P.C.A. b) Site-specific studies (E.I.S.), as appropriate and available. As noted in previous row, a cap should be placed to include only data <5 years old, as available / appropriate. c) N.H.I.C. (M.N.R.F.) d) Updated rare vegetation community data (e.g. sand barrens, savannah's, etc.) **Note**: consideration must be given to accuracy of the datasets being used and age of that data to determine if all, or a portion of the data may be of value in updating the existing SWH layer. 2. Independent of, or combined with #1, apply current Ecoregion Criterion Schedules to existing dataset to identify current candidate SWH. It would be recommended that consideration of current Ecoregion criteria be applied to ensure accurate identification of habitats (candidate or confirmed). **Options for new dataset(s)**: 1. Accrue SWH data from site-specific reports as they are submitted under revised processes (i.e., data submission requirements set through the new N.O.P.) to build a new dataset over time. This may be combined with validation of existing data (i.e., application of SWH criteria) as a starting base, or be started 'from scratch'. This limits availability of the data in the short term but is lower effort / cost. This option also avoids broader identification of	• Regional staff • N.P.C.A. staff • Consultant	**Updates to Existing**: 1. $10,000-$15,000 2. $5,000-$10,000 **New Dataset:** 1. <$5,000 2. $20,000-$25,000 **Ongoing Updates**: Internal costs (Region) for ongoing updates.	Revisions/updates from site-specific studies – annual, or quarterly. Full update / review – 5-year cycle.

Feature/Area (Provincial and Regional)	Data Recommended for Use (last updated)	Options for Developing New Dataset or improving Current Dataset(s)	Resources (staffing)	Approximate Costs	Frequency of Update
		'candidate' habitat but would represent a small portion of potential SWH within the Region (i.e., only those areas where site-specific studies occur). 2. Build a candidate SWH dataset using ELC and the application of ecoregion criteria; revise the layer over time through site-specific data, as submitted. This requires updated and consistent natural cover data (e.g. ELC) for the Region to be available. The outcome can be used to validate existing mapping and identify candidate areas for screening purposes, or it can be used as a new dataset. It is important to note that substantive areas may be identified as 'candidate' and consideration must be given with respect to mapping the natural environment system and in policy for candidate areas. As noted above, use of ELC data in combination with the Ecoregion Criterion Schedules can be used to develop a new base layer of candidate habitat. Refinements to this can be made based on confirmed existing data, or through site-specific studies through which surveys are conducted to make these determinations and / or refine mapping.			
Significant A.N.S.I.	• M.N.R. (2016)	**Options to update dataset(s):** 1. Updates are undertaken by the Province. Regularly scheduled data downloads from Land Information Ontario (LIO) for updated dataset is recommended to ensure current data is in use. **Options for new dataset(s):** None. The province is responsible for designating Provincially Significant A.N.S.I. and maintaining and updating the dataset.	• Regional staff	**Updates to Existing:** 1. Small internal cost as part of regularly database / data library updates. **New Dataset:** n/a	As updated by the Province. Internal download of current provincial data – annual.
Coastal wetlands	• M.N.R.F. (2018)	**Options to update dataset(s):** 1. Updates are undertaken by the Province. Regularly scheduled data downloads from Land Information Ontario (LIO) for updated dataset is recommended to ensure current data is in use. **Options for new dataset(s):** None. The province is responsible for designating Provincially Significant Wetlands and maintaining and updating the dataset.	• Regional staff	**Updates to Existing:** 1. Small internal cost as part of regularly database / data library updates. **New Dataset:** n/a	As updated by the Province. Internal download of current provincial data – annual.
Fish habitat	• Updated M.N.R.F. Fish Monitoring Data ("Fish Dots") or N.P.C.A. Fish Monitoring Data • Contemporary Mapping of Watercourses (2016)	**Options to update dataset(s):** 1. Obtain updated M.N.R.F. Fish Monitoring data or N.P.C.A. fish monitoring data (point data). This can be overlain with watercourse mapping for screening purposes to identify fish habitat potential. It is important to note that fish monitoring data is point data and as such does not define fish habitat reaches that correspond with watercourse mapping. Interpretation of this data will therefore require additional knowledge and awareness by internal users.	• Regional staff • N.P.C.A. staff • Consultant	**Updates to Existing:** 1. Internal cost as part of regularly database / data library updates. 2. $1,500-$3,000. Updates to layer using M.N.R.F. data, as updated / available. This could be done internally to avoid consulting costs.	Revisions/updates from site-specific studies – annual, or quarterly. Obtain updated M.N.R.F. or N.P.C.A. data – annually or

Feature/Area (Provincial and Regional)	Data Recommended for Use (last updated)	Options for Developing New Dataset or improving Current Dataset(s)	Resources (staffing)	Approximate Costs	Frequency of Update
		2. Use 'Fish Habitat M.N.R.' layer in Contemporary Mapping of Watercourses for screening purposes and a preliminary indication of fish habitat. Note that this data will require periodic updates to ensure the layer reflects currently available M.N.R.F. data. 3. Use permanent and intermittent streams identified in Contemporary Mapping of Watercourses as a proxy for high and moderate potential for fish habitat. 4. Updates to fish habitat information may be available through site specific studies for which aquatic community sampling is undertaken. This data may be integrated into existing datasets (vector, not point). This would be an ongoing update as part of site-specific data collection and integration. **Options for new dataset(s):** None.		3. No cost. Dataset exists and no inherent updates associated with using this as a proxy for fish habitat. **New Dataset:** None. **Ongoing Updates**: Internal costs (Region) for ongoing updates.	more frequently, as appropriate. Full update / review – 5-year cycle.
Habitat of endangered species and threatened species	• Update to Regional layer	**Options to update dataset(s):** 1. The MECP is responsible for identifying and mapping habitat for endangered and threatened species. This is generally not made available in digital format. N.H.I.C. occurrence mapping may be downloaded (i.e. 1km squares) and used for preliminary screening. This data would be downloaded on a regular schedule to ensure up to date data is used in screening assessment. This data is not recommended for use in mapping natural environment system(s). **Options for new dataset(s):** 1. The Region may consider maintaining an internal dataset of known / mapped locations of endangered and threatened species through site-specific studies. This could be used to inform natural environment system limits (if / as appropriate) and / or screening. It is important to note that this data would require appropriate access restriction and consideration for data sensitivity. The data should not be made available to the public, proponents, etc. as management of the information is the responsibility of the MECP.	• Regional staff	**Updates to Existing:** 1. Small internal cost as part of regularly database / data library updates. **New Dataset:** 1. Internal cost associated with incorporation of site-specific study data. **Ongoing Updates**: Internal costs (Region) for ongoing updates.	As updated by Province (N.H.I.C. occurrence squares). Internal download of current provincial data – annual. Revisions/updates from site-specific studies – annual, or quarterly.
Linkages	• Growth Plan N.H.S.; and/or • New dataset	**Options to update dataset(s):** None. **Options for new dataset(s):** 1. The Region could consider employing the Growth Plan N.H.S. without further alteration or identification of additional region-	• Regional staff • NPCA • Consultant	**Updates to Existing:** n/a **New Dataset:** 1. Internal cost associated with obtaining and updating	As updated by Province (Provincial N.H.S.). Internal download of current provincial data – annual.

Feature/Area (Provincial and Regional)	Data Recommended for Use (last updated)	Options for Developing New Dataset or improving Current Dataset(s)	Resources (staffing)	Approximate Costs	Frequency of Update
		specific linkages. The Region must include this as an overlay at a minimum. 2. In addition to those linkages identified within the Growth Plan N.H.S., use updated / new linkage criteria (N.O.P.) and generate a new "Regional" linkage dataset. This would be done through GIS analysis, modelling (e.g., circuit theory) and / or visual assessment and professional judgement. Generally, these could be shown as conceptual connections that are currently existing (maintain, enhance) or new to restore connectivity within the natural environment system, as appropriate and in accordance with the new N.O.P. policies and criteria for linkages. Additional detail / specifics could be generated, but quickly increase scope of work and cost to complete.		provincial dataset and periodic updates. 2. $10,000-$15,000. Cost will vary with approach used to generate linkages, expectation for number and scale of linkage generation and level of detail required (e.g. conceptual vs. assigned widths, target species, etc.) **Ongoing Updates**: Internal costs (Region) for ongoing updates.	Revisions/updates from site-specific studies – annual, or quarterly.
Life Science A.N.S.I.	• M.N.R. (2016)	**Options to update dataset(s):** 1. Updates are undertaken by the Province. Regularly scheduled data downloads from Land Information Ontario (LIO) for updated dataset is recommended to ensure current data is in use. **Options for new dataset(s):** None. The province is responsible for designating Provincially Significant A.N.S.I. and maintaining and updating the dataset.	• Regional staff	**Updates to Existing:** 1. Small internal cost as part of regularly database / data library updates. **New Dataset:** n/a	As updated by Province. Internal download of current provincial data – annual.
Vegetation Protection Zones (VPZ)	• None available	**Options to update dataset(s):** None. VPZ are not currently mapped by the Region. **Options for new dataset(s):** 1. The Growth Plan N.H.S. has integrated VPZ's. By showing as an overlay, minimum VPZ mapping is addressed for the areas associated with / overlapping with the province's N.H.S. 2. In addition to 1, generate Region-specific VPZ layer(s). Generate minimum VPZ layer in GIS based on criteria set out in the N.O.P. and through applicable provincial plans (e.g. Greenbelt Plan N.H.S. Key Features to be 'buffered' by 30m; Regionally-defined features 'buffered' by their prescribed minimum VPZs per new N.O.P. policy). NOTE: it may be valuable to maintain the above as separate layers (up to 3 separate layers) *and* as a combined VPZ layer. This may allow for easier edits based on site-specific outcomes. As a note, it would generally be the larger of the VPZ's that would apply.	• Regional staff • Consultant	**Updates to Existing:** n/a **New Dataset:** 1. Small internal cost as part of regularly database / data library updates. 2. $2,500-$10,000. Cost will vary based on the number of VPZ 'groupings' to be made, how 'clean' the base feature data is (e.g. slivers, merged or unmerged internal boundaries, etc.). **Ongoing Updates**: Internal costs (Region) for ongoing updates.	As updated by Province (Provincial N.H.S.). Internal download of current provincial data – annual. Revisions/updates from site-specific studies – annual, or quarterly.

Feature/Area (Provincial and Regional)	Data Recommended for Use (last updated)	Options for Developing New Dataset or improving Current Dataset(s)	Resources (staffing)	Approximate Costs	Frequency of Update
Significant groundwater recharge areas	• N.P.C.A. Source Water Protection (SWP) mapping	**Options to update dataset(s):** 1. N.P.C.A. Source Water Protection mapping could be supplemented / updated with: • Watershed and Subwatershed Studies • Hydrogeological Investigations Consideration of the data with respect to applicable policy for assessment / identification of *significant* groundwater recharge areas would be required. Note: Form of data may not be directly transferrable – i.e., it may require interpretation and/or interpolation before use. It would also be appropriate to maintain any modified mapping (with metadata and attribute data) as a separate layer to ensure any revisions can be identified and tracked. **Options for new dataset(s):** None.	• Regional staff • N.P.C.A. staff • Consultant	**Updates to Existing:** 1. $1,000-$5,000. Cost will vary based on number of reports reviewed, type of data and analysis required for integration. **New Dataset:** n/a **Ongoing Updates**: Internal costs (Region) for ongoing updates.	SWP mapping is updated annually; update layer as available, approximately annually in alignment with mapping release. Revisions/updates from site-specific studies – annual, or quarterly.
Highly Vulnerable Aquifers (HVA)	• N.P.C.A. Source Water Protection mapping	**Options to update dataset(s):** 1. N.P.C.A. Source Water Protection mapping could be supplemented / updated with: • Watershed and Subwatershed Studies • Hydrogeological Investigations Consideration of the data with respect to applicable policy for assessment / identification of *significant* groundwater recharge areas would be required. Note: Form of data may not be directly transferrable – i.e., it may require interpretation and/or interpolation before use. It would also be appropriate to maintain any modified mapping (with metadata and attribute data) as a separate layer to ensure any revisions can be identified and tracked. **Options for new dataset(s):** o None.	• Regional staff • N.P.C.A. staff • Consultant	**Updates to Existing:** 1. $1,000-$5,000. Cost will vary based on number of reports reviewed, type of data and analysis required for integration. **New Dataset:** n/a **Ongoing Updates**: Internal costs (Region) for ongoing updates.	SWP mapping is updated annually; update layer as available, approximately annually in alignment with mapping release. Revisions/updates from site-specific studies – annual, or quarterly.
Significant surface water contribution areas	• None available	**Options to update dataset(s):** None. **Options for new dataset(s):** 1. Develop new mapping illustrating headwater catchment areas: • Use identified headwater drainage features as base data. • Build on work already completed in Contemporary Mapping of Watercourses dataset. • Updated with site-specific studies, as available.	• Regional staff • N.P.C.A. staff • Consultant	**Updates to Existing:** n/a **New Dataset:** 1. $2,500-$5,000 to develop base; $500-$1,000 to update based on data from each site-specific study. **Ongoing Updates**:	Revisions/updates from site-specific studies – annual, or quarterly. Full update / review – 5-year cycle.

Feature/Area (Provincial and Regional)	Data Recommended for Use (last updated)	Options for Developing New Dataset or improving Current Dataset(s)	Resources (staffing)	Approximate Costs	Frequency of Update
				Internal costs (Region) for ongoing updates.	
Permanent streams	• Contemporary Mapping of Watercourses (Region, 2016)	**Options to update dataset(s):** 1. Use watercourse layers with attribute of 'permanent streams' flow regime from Contemporary Mapping of Watercourses dataset. 2. In addition to 1 and upon more in-depth review, consider using 'Permanent or Intermittent' category as well. Use of this category will be based on degree of knowledge of streams and 'risk tolerance' for conservative identification of features. Consideration could be given to mapping *potential* features differently. 3. Data may be obtained from site-specific studies to refine watercourse mapping (e.g. realignments, altered alignments mapped through detailed site studies, etc.). These could be used to update the dataset through ongoing updates. **Options for new dataset(s):** None.	• Regional staff	**Updates to Existing:** Internal costs only. **New Dataset:** n/a **Ongoing Updates**: Internal costs (Region) for ongoing updates.	As determined through updates to primary data source. Assume similar approach to preceding feature datasets: maximum 5-year full review cycle with updates site-specific study updates annually. Revisions/updates from site-specific studies – annual, or quarterly.
Intermittent streams	• Contemporary Mapping of Watercourses (Region, 2016)	**Options to update dataset(s):** 1. Use watercourse layers with attribute of 'intermittent streams' flow regime in Contemporary Mapping of Watercourses dataset. 2. In addition to 1 and upon more in-depth review, consider using 'Intermittent or ephemeral' category as well. Use of category will be based on degree of knowledge of streams and 'risk tolerance' for conservative identification of features. Consideration could be given to mapping *potential* features differently. 3. Data may be obtained from site-specific studies to refine watercourse mapping (e.g. realignments, altered alignments mapped through detailed site studies, etc.). These could be used to update the dataset through ongoing updates. **Options for new dataset(s):** None.	• Regional staff	**Updates to Existing:** Internal costs only. **New Dataset:** n/a **Ongoing Updates**: Internal costs (Region) for ongoing updates.	As determined through updates to primary data source. Assume similar approach to preceding feature datasets: maximum 5-year full review cycle with updates site-specific study updates annually. Revisions/updates from site-specific studies – annual, or quarterly.
Inland lakes and their littoral zones	• Contemporary Mapping of Watercourses (Region, 2016)	**Options to update dataset(s):** 1. Provincially available waterbody dataset. 2. If available, use bathymetric mapping to establish depth to identify littoral zones; combined with water quality studies of lake. **Options for new dataset(s):**	• Regional staff • N.P.C.A. staff • Consultant	**Updates to Existing:** 1. Minimum internal cost to Region. 2. $2,500-$5,000. Cost to search for supplementary data, integrate with existing	As determined through updates to primary data source.

Feature/Area (Provincial and Regional)	Data Recommended for Use (last updated)	Options for Developing New Dataset or improving Current Dataset(s)	Resources (staffing)	Approximate Costs	Frequency of Update
		None.		dataset. Cost varies by amount of information available and effort required to integrate into existing data. No update costs have been identified as will require minimal updates. **New Dataset:** n/a	
Seepage areas and springs	• None available	**Options to update dataset(s):** None. **Options for new dataset(s):** 1. Collect & identify data that can be used directly or from which seep & spring locations can be identified / inferred (e.g. SWH data, if / as available). N.P.C.A. does not maintain a seeps & springs dataset. It is anticipated that this will not produce substantive information. 2. Combined with, or independent of 1: develop mapping based on data / mapping provided through site specific studies (e.g., watershed/subwatershed studies, E.I.S.) or inferred based on geology or similar studies.	• Regional staff • N.P.C.A. staff • Consultant	**Updates to Existing:** n/a **New Dataset:** 1. $1,500-$3,000. Effort to collect, synthesize data into a new layer. 2. $5,000-$20,000. Effort to review documentation up to 5yrs old and synthesize information. Inference from geology, etc. Method would influence cost and level of effort.	Revisions/updates from site-specific studies – annual, or quarterly.
Wetlands	• N.P.C.A. wetland dataset	**Options to update dataset(s):** 1. The best dataset for mapping 'Other' (i.e. non P.S.W.) wetlands may be available through N.P.C.A. (in place of M.N.R.F. 'other evaluated wetland' and unevaluated wetland mapping). N.P.C.A. regularly updates their wetland mapping (and provides mapping updates to M.N.R.F.). No further edits to this layer are required with periodic updates from N.P.C.A. integrated into Region mapping. **Options for new dataset(s):** None.	• Regional staff • N.P.C.A. staff	**Updates to Existing:** n/a **New Dataset:** Internal cost to update (N.P.C.A.) and obtain data (Region) **Ongoing Updates**: Internal costs (Region) for ongoing updates (note: costs to region are to obtain and update database; N.P.C.A. updates dataset)	Obtain N.P.C.A. data on an annual, or more frequent basis, as appropriate / required. Update timing and frequency may be dictated by update frequency from N.P.C.A.
Water Resource System					
Ground water features	• none available	**Options to update dataset(s):** None.	• Regional staff • N.P.C.A. staff • Consultant	**Updates to Existing:** n/a	As defined by primary data sources.

Feature/Area (Provincial and Regional)	Data Recommended for Use (last updated)	Options for Developing New Dataset or improving Current Dataset(s)	Resources (staffing)	Approximate Costs	Frequency of Update
		Options for new dataset(s): 1. Generate a new dataset by combining the following data layers: • Significant groundwater recharge areas (see above) • Highly vulnerable aquifers (see below) • Water tables (some information available from hydrogeologic investigations, such as from N.P.C.A. Groundwater Study (2005)) • Aquifers and unsaturated zones - can be in part informed from hydrogeologic investigations and Ontario Geological Survey maps and reports		**New Dataset:** 1. $1,000-$3,000 to integrate datasets and conduct quality review.	
Hydrologic functions	n/a	n/a	n/a	n/a	n/a
Shoreline areas necessary for the ecological and hydrological integrity of the watershed	• none available	**Options to update dataset(s):** None. **Options for new dataset(s):** 1. Combine hazard mapping (shoreline flood and erosion) from N.P.C.A. with natural heritage feature mapping (e.g. ELC) to identify naturally vegetated shorelines. This process would be aided by the development of an updated ELC layer for the Region.	• Regional staff • N.P.C.A. staff • Consultant	**Updates to Existing:** n/a **New Dataset:** 1. $2,000 - $4,000. Assumes availability of ELC, or similar data. **Ongoing Updates**: Internal costs (Region) for ongoing updates.	Update on a 5-year cycle.
Headwaters	• Contemporary Mapping of Watercourses (Region, 2016)	**Options to update dataset(s):** 1. Contemporary Mapping of Watercourses dataset contains headwater features and can be used as base data to map headwater features. Update data from site specific studies (e.g., watershed/subwatershed study, E.I.S.) as part of regularly scheduled update(s). **Options for new dataset(s):** None.	• Regional staff	**Updates to Existing:** Minimum internal cost to Region. Dataset already developed. Update costs based on regularly scheduled updates from site-specific studies (internal to Region) **New Dataset:** n/a **Ongoing Updates**: Internal costs (Region) for ongoing updates.	As determined through updates to primary data source.
Rivers	• Contemporary Mapping of Watercourses (Region, 2016)	**Options to update dataset(s):** 1. Use ‘Waterbody – River’ layer identified in Contemporary Mapping of Watercourses dataset to map these larger, permanent features. Updates will be minimal for large riverine features. Watercourse	• Regional staff	**Updates to Existing:** Minimum internal cost to Region. Dataset already developed.	As determined through updates to primary data source.

Feature/Area (Provincial and Regional)	Data Recommended for Use (last updated)	Options for Developing New Dataset or improving Current Dataset(s)	Resources (staffing)	Approximate Costs	Frequency of Update
		alignment updates will be achieved through updates to the Contemporary Mapping of Watercourse dataset. **Options for new dataset(s):** None.		**New Dataset:** n/a	
Stream channels	• Contemporary Mapping of Watercourses (Region, 2016)	**Options to update dataset(s):** 1. Use 'Stream/Creek' layer identified in Contemporary Mapping of Watercourses dataset. This layer will include permanent watercourses, which will have defined channels. **Options for new dataset(s):** None.	• Regional staff	**Updates to Existing:** Minimum internal cost to Region. Dataset already developed. **New Dataset:** n/a	As determined through updates to primary data source.
Inland lakes	• Contemporary Mapping of Watercourses (Region, 2016)	**Options to update dataset(s):** 1. Provincially available waterbody dataset. **Options for new dataset(s):** None.	• Regional staff	**Updates to Existing:** Minimum internal cost to Region. **New Dataset:** n/a	As determined through updates to primary data source
Recharge/discharge areas	• N.P.C.A. Source Water Protection mapping	**Options to update dataset(s):** 1. N.P.C.A. Source Water Protection mapping could be supplemented/updated with: • Watershed and Subwatershed studies • Hydrogeological investigations **Options for new dataset(s):** None.	• Regional staff • N.P.C.A. staff • Consultant	**Updates to Existing:** 1. $1,000-$5,000. Cost will vary based on number of reports reviewed, type of data and analysis required for integration. **New Dataset:** n/a	SWP mapping is updated annually; update layer as available, approximately annually in alignment with mapping release. Revisions/updates from site-specific studies and/or review of linkages – annual.
Associated riparian lands	• None available	**Options to update dataset(s):** 1. Use wetland layer (N.P.C.A.) to identify those continuous with watercourses/waterbodies (Contemporary Mapping of Watercourses), and floodplain mapping (N.P.C.A.) to identify associated riparian areas for consideration in water resource system **Options for new dataset(s):** None.	• Regional staff • N.P.C.A. staff • Consultant	**Updates to Existing:** 1. $2,000-$5,000. This may be done internally to avoid consulting costs. Estimate includes GIS analysis and quality review. **New Dataset:** n/a	Update on a 5-year cycle.

Feature/Area (Provincial and Regional)	Data Recommended for Use (last updated)	Options for Developing New Dataset or improving Current Dataset(s)	Resources (staffing)	Approximate Costs	Frequency of Update
Significant groundwater recharge areas	• N.P.C.A. Source Water Protection mapping	**Options to update dataset(s):** 1. N.P.C.A. Source Water Protection mapping could be supplemented / updated with: • Watershed and Subwatershed Studies • Hydrogeological Investigations Consideration of the data with respect to applicable policy for assessment / identification of *significant* groundwater recharge areas would be required. Note: Form of data may not be directly transferrable – i.e., it may require interpretation and/or interpolation before use. It would also be appropriate to maintain any modified mapping (with metadata and attribute data) as a separate layer to ensure any revisions can be identified and tracked. **Options for new dataset(s):** ○ None.	• Regional staff • N.P.C.A. staff • Consultant	**Updates to Existing:** 1. $1,000-$5,000. Cost will vary based on number of reports reviewed, type of data and analysis required for integration. **New Dataset:** n/a	SWP mapping is updated annually; update layer as available, approximately annually in alignment with mapping release. Revisions/updates from site-specific studies and/or review of linkages – annual.
Intake Protection zones (IPZ)	Refer to earlier entry.				
Highly Vulnerable Aquifers (HVA)	Refer to earlier entry.				
Significant surface water contribution areas	Refer to earlier entry.				
Permanent streams	Refer to earlier entry.				
Intermittent streams	Refer to earlier entry.				
Inland lakes and their littoral zones	Refer to earlier entry.				
Seepage areas and springs	Refer to earlier entry.				
Wetlands	Refer to earlier entry.				
Other Features / Areas					
Greenbelt Plan Natural Heritage System (overlay)	• M.N.R.F. (2018)	**Options to update dataset(s):** 1. Updates are undertaken by the Province. Regularly scheduled data downloads from Land Information Ontario (LIO) for updated dataset is recommended to ensure current data is in use. **Options for new dataset(s):** None. The province is responsible for maintaining and updating the dataset.	• Regional staff	**Updates to Existing:** 1. Small internal cost as part of regularly database / data library updates. **New Dataset:** n/a	As updated by the Province. Internal download of current provincial data – annual.
Growth Plan Natural Heritage System (overlay)	• M.N.R.F. (2018)	**Options to update dataset(s):** 1. Updates are undertaken by the Province. Regularly scheduled data downloads from Land Information Ontario (LIO) for updated dataset is recommended to ensure current data is in use. **Options for new dataset(s):**	• Regional staff	**Updates to Existing:** 1. Small internal cost as part of regularly database / data library updates. **New Dataset:** n/a	As updated by the Province. Internal download of current provincial data – annual.

Feature/Area (Provincial and Regional)	Data Recommended for Use (last updated)	Options for Developing New Dataset or improving Current Dataset(s)	Resources (staffing)	Approximate Costs	Frequency of Update
		None. The province is responsible for maintaining and updating the dataset.			
Urban River Valley System	• M.N.R.F. (2018)	**Options to update dataset(s):** 1. Updates are undertaken by the Province. Regularly scheduled data downloads from Land Information Ontario (LIO) for updated dataset is recommended to ensure current data is in use. **Options for new dataset(s):** None. The province is responsible for maintaining and updating the dataset.	• Regional staff	**Updates to Existing:** 1. Small internal cost as part of regularly database / data library updates. **New Dataset:** n/a	As updated by the Province. Internal download of current provincial data – annual.

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7.1.1 Determining Approximate Costs

The costs provided for each of the options are based on preliminary assumptions of anticipated effort to undertake the update / development of the dataset. It is anticipated that expertise would be required from a GIS technician, the discipline related to the dataset (e.g., ecologist for significant wildlife habitat, water resources engineer for significant groundwater recharge areas) and an environmental planner from the Region.

Where costs are 'internal' to the Region, dollar values have not been applied. Where external effort (e.g., Consultants) may be employed to conduct updates or generate new data approximate costs were provided. It is important to note that some tasks with costs associated with consultant fees may be avoided where work can be undertaken by the Region – costs for consultant fees are provided for general consideration.

Costs presented, unless otherwise specified, are stand-alone costs – i.e., the cost assumes the work may be completed as an individual project / task. Some updates are dependent on others having been completed; where known, these dependencies have been identified in Table 10 (e.g., Region-wide ELC dataset for use in generating candidate SWH). It is expected that efficiencies in both time and level of effort could be gained by combining associated, interrelated or similar tasks under a single project or effort.

7.1.2 Frequency of Updating Region's Natural Environment Datasets

The recommended frequency of updating datasets is related to the availability of new data to update a specific dataset. For example, through site specific studies the boundaries of features may be more accurately delineated through a feature staking exercise (e.g., dripline, wetland boundary) with the reviewing agencies. These studies occur more regularly and would inform the frequency for which the Region should update the feature dataset. However, once identified/delineated, some features will remain static for a long period of time (e.g., inland lake, vulnerable aquifer, significant groundwater recharge areas). The need to revisit the dataset of these features is limited and may only be necessary if criteria have changed which identify a feature, or if new methodology has been developed that more accurately maps a feature.

7.1.3 Analyses and Technologies

Although the options presented for updating or developing datasets suggest a method (e.g., orthoimage interpretation), it is not intended to limit or prescribe the methods and approaches used to update, refine or generate new datasets. As the broad decisions to update or generate new data are made, further consideration should be given to new, novel or different approaches to analysis and mapping. These may include:

- **UAV/Drones**: drones are being used in a broad range of applications and are very effective at collecting imagery, reconnaissance, etc. that limits person time in the field, etc.
- **Circuit Theory**: circuit theory, the theory of electrical resistance and paths of least resistance, has been applied in an ecological context for identifying potential and likelihood of use for wildlife movement by applying the electrical

theory to habits in wildlife movement. This analysis can be used to identify potential movement corridors as part of a robust systems-approach.

- **Lidar**: lidar provides high resolution data that provides a 3-dimensional image of the target area being surveyed. This high-resolution data can be used to generate highly accurate topographic information, assess tree height, etc. Potential applications would be readily available for both natural heritage and water resource feature types (e.g. valleylands).
- **Image Classification – Supervised and Object-Based**: These are well-established image analysis methods used in remote sensing. With respect to natural environment systems, they have been used to identify vegetation types, saturated soils (e.g. wetlands), etc. Different processes (i.e. supervised vs object-based) have different benefits and limitations that would be explored base don the feature type being considered and objectives of the activity.
- **Change Detection**: This is another image interpretation analysis tool. Change detection can be used to identify where change is occurring on a landscape over time. This can be used for broader scale-updates, to identify potential infractions (e.g., tree cutting), and for long-term monitoring programs.

7.2 Criteria to evaluate options for updating natural environment datasets

The evaluation of the Region's current dataset(s) available to produce the natural environment mapping identified issues requiring either updates, or a need to develop new datasets (Table 10). Furthermore, datasets do not exist for several components identified in Provincial Plans as part of natural environment systems. Table 10 lists options for developing new datasets or improving current datasets, including suggesting approximate costs to undertake the update / development of datasets.

Each option has benefits and limitations; these may be associated with data availability, accuracy, cost, etc. Consideration of the objectives for both the dataset, the natural environment system, policy implementation, costs and timeline will be important in selecting the preferred options for the Region.

To assist the option evaluation process, the following set of criteria have been prepared for consideration when reviewing the options for updating the current dataset or developing new datasets for the new N.O.P. natural environment mapping:

1. **Requirement/need for dataset**
   The datasets reviewed in Table 10 is a comprehensive list of those features/components of the natural environment system that are identified in Provincial Plans as required components (although not necessarily required to be mapped). The requirement for a dataset to be updated/produced will in part be informed by the 'Natural Environment Background Report' to be prepared to support the development of policies and mapping for the new N.O.P. The Natural Environment Background Report will in part be informed by the evaluation of current natural environment datasets in Table 10 which identified

gaps in the datasets and evaluated the accuracy of the datasets and appropriateness to consider use of data in natural environment mapping. The following considerations can be applied to the review each dataset following forthcoming work to inform the natural environment system component of the new N.O.P.:

- features that are regularly included in N.O.P. natural environment system mapping and are required to achieve a systems approach vs. those that are occasionally mapped
- features that require accurate delineation vs. those can be delineated more generally

2. **Ease of implementation**
   The ability to update or produce a dataset will in part be determined by the availability of existing information or the ease of obtaining data to inform the development of the dataset.

3. **Cost/resources**
   The cost to the Region and agency partners to update a current dataset can range from nil (e.g., for those datasets entirely maintained by the Province) to tens of thousands of dollars to develop a new dataset.

4. **Ability to phase update/develop**
   With each of the options to update/develop the dataset, the ability to phase updating in order to spread the costs over a longer period of time should be factored into the selection of options. This may in part be informed by identifying areas where having an updated dataset is considered a high priority.

5. **Time to update/develop**
   The time to collect data to update/develop the dataset should be considered in the evaluation of options. Some data is currently available and can be incorporated into an existing dataset to complete the update, whereas, collecting some data that requires field work or ground verification can take one to several years (e.g., hydrogeological assessment).

6. **Prioritization**
   The priority of a dataset to be updated/developed will in part be informed by the following factors:

- Value of dataset to agency staff to inform land use planning decisions and undertake resource management
- The need to have more accurate data within a given jurisdictional boundary, such as a settlement areas experiencing development pressure or those areas identified as future growth areas

7.3 Managing and Updating Region's Natural Environment Datasets

The Region has the ability to internally manage the natural environment dataset and ensure datasets are updated on a regular basis. Having a clear and defined process to ensure the updates are regularly completed and well documented is critical. The following should be considered by the Region when developing a data management protocol:

- data received from outside sources should be immediately catalogued and saved in appropriate digital folder:
    - receipt of data should be confirmed with supplier of data;
- Region's internal dataset to be updated at regular intervals (based on recommended frequency), with data from outside sources previously saved in appropriate digital folder;
- metadata file to be updated providing details of dataset including any changes;
- dataset attribute field to contain fields to record date of change, type of change, process from which change occurred, source of change, etc.; and
- Upon update of dataset distribute to agency partners.

8.0 Summary of Recommendations and Conclusions

The purpose of this Mapping Discussion Paper was to review relevant provincial guidance for natural environment mapping, review the Region's existing mapping data, and identify mapping options to meet provincial requirements and where possible, identify options that provide an enhanced level of accuracy and quality to reflect the needs and interests of the Region, local area municipalities and stakeholders. This section provides a brief overview of key outcomes, recommendations and conclusions.

8.1 Provincial Direction

The P.P.S., Growth Plan, Greenbelt Plan and the Niagara Escarpment Plan all require the identification and protection of natural heritage features and functions, as defined therein. While not all explicitly identify a 'water resource system', all similarly require identification and protection of water resources features and their functions.

With respect to mapping of natural environment systems (natural heritage and water resource systems), direction from provincial plans varies; however, with the exception of the Niagara Escarpment Plan, provincial plans and policies require that a natural heritage system and water resource system be mapped and included in Official Plans. The Greenbelt Plan also requires that a map showing key natural heritage features be mapped in addition to the natural heritage system. Where provided (e.g., natural heritage system for the Growth Plan), provincial systems are to be shown as overlays on Official Plan mapping.

Where both the natural heritage system and water resource system are described in provincial plans, there are separate policies that apply to these systems. While not explicitly required, mapping these systems as discrete systems rather than a single system allows the policies for each system to be more easily implemented

There is recognition that not all features and functions are or can be readily mapped in their entirety. This variability and limitation are to be built into the policies and criteria for the identification of system features. To the extent feasible, features are to be mapped and systems developed. The outcome of the mapping process(es) may be shown as overlays or be designated.

8.1.1 Recommendations & Conclusions

1. Mapping of the natural environment system within Niagara Region should identify a natural heritage system and a water resource system, as separate systems. This will allow for both provincial and municipal policies that apply to these systems individually to be more easily implemented.
2. In accordance with provincial direction, N.O.P. mapping should include natural environment system mapping and mapping of key natural heritage and water resource system features and functions. The ability of the Region to identify and map these features will be based on the availability of data, quality and accuracy of available data and/or the ability to generate new mapping if / as required.
3. The Provincial natural heritage systems should be mapped as an overlay.

8.2 Municipal Planning Considerations

The new Regional O.P. will need to provide the criteria by which key natural heritage and key water resource features are identified within the Region. These will form the basis for mapping of key features and the systems that will comprise Niagara Region's natural environment system.

In addition to criteria and policies with respect to the identification and protection of the natural environment system and component features, it will be important for the N.O.P. policies to determine how the environmental impact assessment process is triggered and how to integrate and apply the policies of the Growth Plan (e.g. local zoning by-laws). For example, it may be necessary to require the lifting of a holding provision or a minor variance to ensure that Provincial policy regarding the siting of new buildings and building additions in relation to key features is implemented.

The new N.O.P. policies should continue to provide the ability to review the spatial extent of the key feature and allow for minor refinements based on site-specific information without an Official Plan Amendment. Consideration must be given to the mechanism(s) through which natural environment system mapping is updated. It is well understood that natural system mapping will change over time with alterations in land use, development, etc. Ensuring that mapping can be easily modified without going through a formal amendment process will be important to implementation as well as maintaining 'current' mapping.

8.2.1 Recommendations & Conclusions

1. Criteria for the identification of key natural environment features should be develop through the Regional O.P. review process. These will be used to inform analyses and mapping to develop the natural heritage and water resource systems within the Region.
2. The new N.O.P. policies should include a trigger for when the environmental impact study process is triggered and how to integrate and apply the policies of the Growth Plan.
3. The new Regional O.P. should include clear policies to continue to provide the ability to review the spatial extent of the key feature and allow for minor refinements based on site-specific information without an Official Plan Amendment.
4. The Region should have a clear process/mechanism(s) through which natural environment system mapping is updated internally to ensure datasets managed by the Region remain 'current'.

8.3 Natural Environment System Mapping – Components, Datasets, and Evaluating Options

This discussion paper reviewed component features that are listed in provincial plans that are to be considered for inclusion in a natural heritage system and water resource system, including: key natural heritage features, key hydrological features, key hydrologic areas, and natural heritage features and areas. Through Section 6, the mapping discussion paper assessed existing natural environment datasets in the Region's data library to determine what datasets were available to map the component features of the natural environment systems. Consideration was given to the suitability of each layer with respect to use for O.P. mapping, site-specific mapping and as a screening tool for internal use (e.g., to assist in scoping an environmental impact assessment).

The majority of the natural environment datasets assessed require moderate to major updates, should be replaced (e.g., with updated layers or with newly generated data) or were identified as not suitable for use in mapping the natural environment system.

To inform decision-making in establishing an approach for natural environment system mapping, options were proposed for each feature type (natural heritage and water resource) that considered data updates, replacement and / or generation. Wherever possible options were given for both updates to existing dataset (e.g., modifications or replacement) and for generating a Region-specific dataset. Brief notes are provided for options to identify anticipated key opportunities and constraints.

While preliminary cost estimates to undertake each option are provided (Table 10), it is important to note that cost will be heavily influenced by data availability, data quality, and methods proposed or selected (internally or by a consultant) to undertake the

option. Efficiencies in cost for some options may be gained by combining multiple feature updates into a single work program.

8.3.1 Recommendations & Conclusions

Natural Environment System – Component Features for Mapping

Based on a review of provincial plans, policies, and upon review of comparator municipal approaches to mapping natural environment systems, the following components are recommended to be mapped at a minimum as part of the natural environment systems:

Natural Heritage System

- Provincially significant wetlands
- Other wetlands
- Significant woodlands
- Linkages
- Life Science Area of Natural and Scientific Interest (A.N.S.I.)
- Earth Science A.N.S.I.
- Permanent and intermittent streams

Water Resource System

- Provincially significant wetlands
- Other wetlands
- Waterbodies
- Permanent and intermittent streams
- Rivers
- Important/significant recharge/discharge areas
- Highly vulnerable aquifers

Through future technical reports prepared to inform the development of the natural environment system mapping and policies, and in consultation with stakeholders and the public additional components may be considered as minimum components to include in mapping of the natural environment systems. The component features that have not been identified as minimum components to include in natural environment system mapping will still require policies in the new Regional O.P. providing protection of those component features to confirm with provincial plans.

Datasets for use in Mapping the Natural Environment Systems

The mapping discussion paper provided a review of existing datasets and recommendations for updating/obtaining datasets for use in mapping the natural environment systems. Table 11 provides a summary of the recommended datasets to map component features, and which datasets require updates/creation.

Table 11. Summary of the recommended dataset to map the feature/area, and options for developing new datasets or improving available datasets. A * denotes a feature/area that has been recommended at a minimum to be included in the natural environment mapping.

Feature/Area	Recommended Dataset for Continued Use	Recommendations to Create New Dataset or improve Current Dataset(s)
Natural Heritage System		
*Significant wetlands, significant coastal wetlands	M.N.R.F. (2018)	Regularly scheduled data downloads from Land Information Ontario (LIO) for updated dataset.
*Significant woodlands	none	1. Refine/update current dataset. 2. Create Ecological Land Classification dataset to produce new woodland dataset. 3. Create a new dataset using combination of existing M.N.R.F. woodland dataset.
Significant valleylands	N.P.C.A. has a draft dataset that should be evaluated for use in Region's natural heritage system mapping	Review N.P.C.A. valleyland dataset and apply criteria developed by region to identify significant valleylands.
Significant wildlife habitat	none	1. Update Regional SWH layer 2. Create new layer using data from site specific studies
*Significant A.N.S.I.	M.N.R.F. (2016)	Regularly scheduled data downloads from Land Information Ontario (LIO) for updated dataset is recommended to ensure current data is in use.
*Coastal wetlands	M.N.R.F. (2018)	Regularly scheduled data downloads from Land Information Ontario (LIO) for updated dataset is recommended to ensure current data is in use.
Fish habitat	none	Create dataset using M.N.R.F. and N.P.C.A. fish data (point data), Contemporary Mapping of Watercourses watercourse layers and other site specific study data.

Feature/Area	Recommended Dataset for Continued Use	Recommendations to Create New Dataset or improve Current Dataset(s)
		1. Use 'Fish Habitat M.N.R.F.' layer in Contemporary Mapping of Watercourses dataset. 2. Use permanent and intermittent watercourses layer from Contemporary Mapping of Watercourses dataset as proxy for fish habitat.
Habitat of endangered species and threatened species	None – data should not be mapped in Regional OP	Create internal dataset of known / mapped locations of endangered and threatened species through site-specific studies.
*Linkages	Growth Plan N.H.S.	1. Use the Growth Plan N.H.S. without further alteration or identification of additional region-specific linkages. 2. Using updated / new linkage criteria (N.O.P.), generate a linkage dataset that identifies linkages in addition to those within the Growth Plan NHS.
*Life Science A.N.S.I.	M.N.R. (2016)	Regularly scheduled data downloads from Land Information Ontario (LIO) for updated dataset is recommended to ensure current data is in use.
Vegetation Protection Zones (VPZ)	None	Generate minimum VPZ layer in GIS based on criteria set out in the N.O.P. and through applicable provincial plans (e.g. Greenbelt Plan N.H.S. Key Features to be 'buffered' by 30m; Regionally-defined features 'buffered' by their prescribed minimum VPZs per new N.O.P. policy).
Significant groundwater recharge areas	N.P.C.A. Source Water Protection (SWP) mapping	N.P.C.A. Source Water Protection mapping could be supplemented / updated with datasets from subwatershed studies and hydrogeological investigations.
Highly Vulnerable Aquifers (HVA)	N.P.C.A. Source Water Protection mapping	N.P.C.A. Source Water Protection mapping could be supplemented / updated with datasets from subwatershed studies and hydrogeological investigations
Significant surface water contribution areas	None	Develop new mapping illustrating headwater catchment areas: • Use identified headwater drainage features as base data.

Feature/Area	Recommended Dataset for Continued Use	Recommendations to Create New Dataset or improve Current Dataset(s)
		• Build on work already completed in Contemporary Mapping of Watercourses dataset. • Updated with site-specific studies, as available.
*Permanent streams	Contemporary Mapping of Watercourses (Region, 2016)	Use 'stream/creek' layer with attribute of 'permanent streams' flow regime from Contemporary Mapping of Watercourses dataset.
*Intermittent streams	Contemporary Mapping of Watercourses (Region, 2016)	Use 'stream/creek' layer with attribute of 'intermittent streams' flow regime in Contemporary Mapping of Watercourses dataset.
Inland lakes and their littoral zones	one	1. Update Contemporary Mapping of Watercourses dataset to identify lakes. 2. If available, use bathymetric mapping to establish depth to identify littoral zones; combined with water quality studies of lake.
Seepage areas and springs	none	Develop mapping based on data / mapping provided through site specific studies (e.g., watershed/subwatershed studies, E.I.S.) or inferred based on geology/soils or similar studies.
*Wetlands	N.P.C.A. wetland dataset	Ensure receiving regular updates to wetland layer from N.P.C.A.
Water Resource System		
Ground water features	none	Generate a new dataset by combining the following data layers: • Significant groundwater recharge areas (see above) • Highly vulnerable aquifers (see below) • Water tables (some information available from hydrogeologic investigations, such as from N.P.C.A. Groundwater Study (2005)) • Aquifers and unsaturated zones - can be in part informed from hydrogeologic investigations and Ontario Geological Survey maps and reports
Hydrologic functions	n/a	n/a

Feature/Area	Recommended Dataset for Continued Use	Recommendations to Create New Dataset or improve Current Dataset(s)
Shoreline areas necessary for the ecological and hydrological integrity of the watershed	none	Combine hazard mapping (shoreline flood and erosion) from N.P.C.A. with natural heritage feature mapping (e.g. ELC) to identify naturally vegetated shorelines.
Headwaters	Contemporary Mapping of Watercourses (Region, 2016)	Contemporary Mapping of Watercourses dataset contains headwater features and can be used as base data to map headwater features. Update data from site specific studies (e.g., watershed/subwatershed study, E.I.S.) as part of regularly scheduled update(s).
*Rivers	Contemporary Mapping of Watercourses (Region, 2016)	Use 'Waterbody – River' layer identified in Contemporary Mapping of Watercourses dataset to map these larger, permanent features. Updates will be minimal for large riverine features. Watercourse alignment updates will be achieved through updates to the Contemporary Mapping of Watercourse dataset.
*Stream channels	Contemporary Mapping of Watercourses (Region, 2016)	Use 'Stream/Creek' layer identified in Contemporary Mapping of Watercourses dataset. This layer will include permanent watercourses, which will have defined channels.

Minimum Recommendations to Update Region's Dataset

1. Based on the identification of features/areas that should be mapped at a minimum, and evaluation of suitable datasets for mapping the significant woodland dataset will require an update. If the Region chooses to identify linkages in addition to those identified in the Growth Plan NHS, a new linkage dataset will be required.

Criteria to Evaluate Options for Mapping Component Features

Criteria by which the Region can assess the options to map component features of the natural environment systems have been provided in Section 7.2. These include:

- Requirement / need for dataset;
- Ease of implementation;
- Cost / resources;
- Ability to phase update / development;
- Time to update / develop;
- Prioritization.

1. It is recommended that the Region consider the identified component features using these criteria as a comparison tool to assist in decision making / option selection.
2. It is recommended that each feature and option be considered in the context of the vision, goals and objectives of the N.O.P. and the natural environment system. If an option does not assist the Region in meeting its objectives, then it may not merit extensive assessment and mapping.

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Appendix 1: Review of data layers available and considered for potential use in the Region's natural environment mapping

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Appendix 1. Data layers currently available and reviewed for potential use in the Region's natural environment mapping.

Features/Layers	Plan	Mapped in Current R.O.P.	Data Source Creation Date	Publication Date - RMN server	Source Originally	Suggested Scale for Usage	Coordinate System	Updates schedule or mechanism	Imbedded information (In Spatial Layer)
Fish habitat - polyline (C.N.H. layer)	P.P.S., R.O.P.	Yes	2000-2001 (2000- Original Local M.N.R. NRVIS Mapping)	18/11/2008	N.P.C.A. - identified by M.N.R.	1:10000	NAD 83 UTM zone 17	Not at Region - N.P.C.A. layer?	TYPE 1,2,3
Fish habitat - polygon (C.N.H. layer)	P.P.S., R.O.P.	Yes	2000-2001 (2000- Original Local M.N.R. NRVIS Mapping)	12/11/2008	N.P.C.A. - identified by M.N.R.	1:10000	NAD 83 UTM zone 17	Not at Region - N.P.C.A. layer?	TYPE 1,2,3
Significant Wetlands (Provincially Significant Wetlands)	P.P.S., R.O.P.	Yes	2005 (for RPPA 187 mapping) - updated in schedule C by at least 2010	12/11/2008	M.N.R.	1:100000	NAD 83 UTM zone 17	As Needed - if updates to Niagara occur	Name/Size
Wetlands (Other Evaluated Wetlands)	P.P.S., R.O.P.	Yes	2005 (for RPPA 187 mapping) - updated in schedule C by at least 2010	12/11/2008	M.N.R.	1:100000	NAD 83 UTM zone 17	As Needed - if updates to Niagara occur	Name, Size, Type
Significant Valleylands	P.P.S., R.O.P.	Yes	Pre 2005 (Valley_Shoreline_Buffer)	12/11/2008	Region/N.P.C.A.? -unconfirmed	1:100000	NAD 83 UTM zone 17	As Needed	Type (Shoreline/ Valleyland)
Significant Woodlands	P.P.S., R.O.P.	Yes	2002-2003 Developed - Refined in 2006 for RPPA 187 Mapping	12/11/2008	Region/M.N.R.	1:100000	NAD 83 UTM zone 17	As Needed	Criteria - 10
Significant Wildlife Habitat	P.P.S., R.O.P.	Yes	2002 - Compilation of datasets to make this layer - revised for RPPA 187 policies	12/11/2008	Region – (compiled from M.N.R. layers)	1:100000	NAD 83 UTM zone 17	As Needed	Feature, Size
Significant Areas of Natural and Scientific Interest (Regionally Significant Life Science A.N.S.I.'s)	P.P.S., R.O.P.	Yes	Pre 2005 (Original Provided by M.N.R.)	12/11/2008	M.N.R.	1:100000	NAD 83 UTM zone 17	As Needed - M.N.R. data has been updated	Name, Size
Significant Areas of Natural and Scientific Interest (Provincially Significant Life Science A.N.S.I.'s)	P.P.S., R.O.P.	Yes	Pre 2005 (Original Provided by M.N.R.)	12/11/2008	M.N.R.	1:100000	NAD 83 Transverse Mercator	As Needed - M.N.R. data has been updated	Name, Size
Potential Natural Heritage Corridors (Regional Core N.H.S.)	R.O.P.	Yes	2003 - first record of creation	12/11/2008	Region	1:10000	NAD 83 UTM zone 17	As Needed	None
Publicly Owned or Conservation lands	R.O.P.	Yes	2002 layer created with 2000 data - (no apparent updates since - 60 places)	12/11/2008	Region - combined various layers	1:10000	NAD 83 UTM zone 17	As Needed	Feature (Public & Conservation Lands), Size
Earth Science A.N.S.I.	R.O.P.	Yes	2013 revision (1988 boundaries version was in 2010 R.O.P. schedule)	12/11/2008	M.N.R.	1:10000	NAD 83 Transverse Mercator	As Needed	Designation, Status, Name, Size
Greenbelt Natural Heritage System Area (2005)	Green belt Plan	Yes	2005	01/01/2005	M.N.R.	unknown	NAD 83	2018-03-23 Last Revision- Now encompasses Growth Plan area	Area type (linkage/area)
ECA Regional Local Amendments	R.O.P., P.P.S.	Yes	2005	12/11/2008	Region	1:100000	NAD 83 UTM zone 17	As Needed	Designation, Source, Size

Features/Layers	Plan	Mapped in Current R.O.P.	Data Source Creation Date	Publication Date - RMN server	Source Originally	Suggested Scale for Usage	Coordinate System	Updates schedule or mechanism	Imbedded information (In Spatial Layer)
E.P.A. Regional Local Amendments	R.O.P., P.P.S.	Yes	unknown	12/11/2008	Region	1:100000	NAD 83 UTM zone 17	As Needed	Designation, Source, Size
Core Natural Heritage Municipal Drains		Yes	pre 2005	12/11/2008	N.P.C.A.	1:10000	NAD 83 UTM zone 17	As Needed	Drain Name
C.N.H. E.P.A. Other Greenbelt N.H.S. Key Feature	Green belt/ R.O.P.	Yes	pre 2005	12/11/2008	Region	1:100000	NAD 83 UTM zone 17	As Needed	Designation, Name, Feature, Size
Growth Plan Natural Heritage System Area (2018)	Growth Plan	No	2018	unknown	M.N.R.	unknown	NAD 83	2018-03-23 update - All of Growth Plan area minus settlement areas	Area type (linkage/area)
Hazardous forest types for Wildland Fire	P.P.S.	No	20/02/2014	unpublished	M.N.R.	raster	NAD 83 CSRS Ontario M.N.R. Lambert	Last updated in 2017	Value
Growth Plan Agricultural System (2018)	Growth Plan	No	09/02/2018	unknown	OMAFRA	unknown	M.N.R. Lambert Conformal Conic	Complete	Specialty Crop, Prime Agricultural, Candidate
Greenbelt River Valley Connections	P.P.S.	No	28/02/2005	unknown	M.N.R.	unknown	NAD 83	2017-07-01 Last Revision	
Sand barrens, Savannahs and Tallgrass Prairies (layer also includes WMAs)	Green belt Plan	Partial	2002-2003	unknown	M.N.R.	unknown	NAD 83 UTM zone 17 - sig wildlife, Original file is same	No	Feature
Alvars	Green belt Plan	Partial	2002	unknown	M.N.R.	1:10000	NAD 83 UTM zone 17 - sig wildlife, Original file unknown	No	unknown
Habitat of Endangered species and threatened species	P.P.S., R.O.P.	No	Pre 2005	unpublished	M.N.R.	unknown	unknown	Data as needed available from M.N.R. by license	unknown
Habitat of Species of Concern	R.O.P.	No	Pre 2005	unpublished	M.N.R.	unknown	unknown	Data as needed available from M.N.R. by license	unknown
Old Growth Forest		No	2002/2003	unpublished	N.P.C.A.	1:10000	NAD 83 UTM zone 17	No	unknown
Carolinian Canada Identified Rare Tree, Plant, or Animal Species		No	pre 2005	unpublished	Carolinian Canada	unknown		No	None
E.S.A.		No	From a CAD file - year 2000	unpublished	Unclear	unknown	NAD 83 UTM zone 17 -	None	None

Features/Layers	Plan	Mapped in Current R.O.P.	Data Source Creation Date	Publication Date - RMN server	Source Originally	Suggested Scale for Usage	Coordinate System	Updates schedule or mechanism	Imbedded information (In Spatial Layer)
							alignment issues		
Permanent and Intermittent Streams (KHF)	Green belt Plan	No	unknown	unknown	Region	1.430555556	NAD83(CSRS) UTM Zone 17	unknown	unknown
Lakes (and their littoral zones) (KHF)	Green belt Plan	No	unknown	unknown	Region	1.430555556	NAD83(CSRS) UTM Zone 17	unknown	unknown
Seepage Areas and Springs (K.H.F.)	Green belt Plan	No	unknown	unknown	unknown	unknown	unknown	unknown	Unknown
Significant Groundwater Recharge Areas (K.H.A.)	Green belt Plan	No	2010?	03/06/2010	N.P.C.A.	1:25000	NAD 83 UTM zone 17	As Needed	Unknown
Highly Vulnerable aquifers (K.H.A.)	Green belt Plan	No	2010?	03/06/2010	N.P.C.A.	1:50000	NAD 83 UTM zone 17	As Needed	Unknown
Significant surface water contribution areas (K.H.A.)	Green belt Plan	No	unknown	unknown	unknown	unknown	unknown	unknown	unknown
Flooding hazard lands, Erosion hazard lands, Dynamic beach hazard lands (Natural Hazard)	Green belt Plan	No	unknown	unpublished	N.P.C.A.	1.430555556	NAD 83 UTM zone 17	unknown	unknown
N.P.C.A. Natural Areas Inventory (N.A.I.) Data		No	2006-2009	unpublished	N.P.C.A.	1:2,000	NAD83(CSRS) UTM Zone 17	No	Code, Tract Name, Site Name
Town of Fort Erie Natural Areas Inventory (N.A.I.)		No	2002-2003	unknown	unknown	unknown	unknown	unknown	unknown
E.S.A. (Unofficial N.P.C.A.)		No	unknown	unpublished	N.P.C.A.	1:100,000	NAD 83 UTM zone 17	Unclear	Source, Description, Trees, Wildlife, Species
Constructed Drains		Some	01/01/1990	20??	OMAFRA	1:25,000	NAD 83 UTM zone 17	OMAFRA updates regularly (2018 updates)	Darin Id, Name, Legal Status, Type, Bylaw #, Drain Class
Major Streams		As Fish Hab & M. Drains	Approx. 2000	01/05/2003	N.P.C.A.	1:10000	NAD 83 UTM zone 17	As Needed	Flow Class, Fish Hab, Some Names
Contemporary Mapping of Watercourses		No	2013-2016	2016	Region/N.P.C.A.	1:2,000	AD83(CSRS) UTM Zone 17	None at this time	Various Characterizations
Welland deferral C.N.H. mapping layers									
M.N.R. Fish habitat - clipped to Welland		Yes	2013 created?	unpublished	Welland		undefined		Type

Features/Layers	Plan	Mapped in Current R.O.P.	Data Source Creation Date	Publication Date - RMN server	Source Originally	Suggested Scale for Usage	Coordinate System	Updates schedule or mechanism	Imbedded information (In Spatial Layer)
E.C.A. - Clipped to Welland Boundary		Yes	2013 created?	unpublished	Welland		undefined		Feature (some), Size
E.P.A. - Clipped to Welland Boundary		Yes	2013 created?	unpublished	Welland		undefined		Feature, Source, Size
Refined Corridors - Clipped to Welland		Yes	19-04-2010	unpublished	Welland		undefined		None