Durham Watershed Planning Project – Water Resources System

Kawartha Conservation
2020

KAWARTHA CONSERVATION

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About Kawartha Conservation

Who we are

We are a watershed-based organization that uses planning, stewardship, science, and conservation lands management to protect and sustain outstanding water quality and quantity supported by healthy landscapes.

Why is watershed management important?

Abundant, clean water is the lifeblood of the Kawarthas. It is essential for our quality of life, health, and continued prosperity. It supplies our drinking water, maintains property values, sustains an agricultural industry, and contributes to a tourism-based economy that relies on recreational boating, fishing, and swimming. Our programs and services promote an integrated watershed approach that balance human, environmental, and economic needs.

The community we support

We focus our programs and services within the natural boundaries of the Kawartha watershed, which extend from Lake Scugog in the southwest and Pigeon Lake in the east, to Balsam Lake in the northwest and Crystal Lake in the northeast – a total of 2,563 square kilometers.

Our history and governance

In 1979, we were established by our municipal partners under the *Ontario Conservation Authorities Act*. The natural boundaries of our watershed overlap the six municipalities that govern Kawartha Conservation through representation on our Board of Directors. Our municipal partners include the City of Kawartha Lakes, Region of Durham, Township of Scugog, Township of Brock, Municipality of Clarington, Municipality of Trent Lakes, and Township of Cavan Monaghan.

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Executive Summary

This report represents a centralized location that describes information related to defining and mapping Key Hydrologic Features (permanent and intermittent streams, lakes and their littoral areas, seepage areas and springs, and wetlands), and Key Hydrologic Areas (significant groundwater recharge areas, highly vulnerable aquifers, and significant surface water contribution areas), for the overlapping jurisdictions of Durham Region and Kawartha Conservation.

Key Hydrologic Features and Areas are important components of water resource related land use policies as guided by various provincial policy directives including the Provincial Policy Statement, Growth Plan for the Greater Golden Horseshoe, Greenbelt Plan, and Oak Ridges Moraine Conservation Plan.

This information provides planning staff with base information necessary to advance land use planning approvals and projects within scope of managing for functioning water resource systems.

The following recommendations were noted, to ensure this information is readily available and most applicable for land use planning purposes:

- present these findings to relevant technical staff and planning staff within local planning authorities;
- centralize this information in a digital manner and make available to all local planning authorities through an easy-to-use mapping tool;
- update the delineation of Key Hydrologic Features and Areas on a routine basis, particularly in areas with rapidly changing land use or areas that are scheduled for future development;
- undertake various works to fill gaps in current information with respect to Key Hydrologic Features; and,
- undertake various works to fill gaps in current information with respect to Key Hydrologic Areas.

Acknowledgements

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1.0 Introduction

The purpose of this report is to provide a summary of the most up-to-date technical information related to water resources, specifically Key Hydrologic Features and Key Hydrologic Areas, to assist the Regional Municipality of Durham (Durham Region) in implementing provincial policy and municipal land use planning projects.

Implementing provincial policy and municipal land use planning is a shared responsibility amongst planning authorities, which includes conservation authorities. Durham Region and Kawartha Conservation have an existing agreement whereby Kawartha Conservation provides advice and recommendations on matters related to the protection and management of water resources. This includes reviewing *Planning Act* related development applications (e.g., minor variances, plans of subdivisions, consent, etc.) for conformity to provincial policy directives.

Key provincial policies within scope of these responsibilities include those contained within the Provincial Policy Statement (2020), Growth Plan for the Greater Golden Horseshoe (2019), Greenbelt Plan (2017), and Oak Ridges Moraine Conservation Plan (2017). These plans outline the requirement for planning authorities to manage water resources, as exemplified by the following policy directive from the Greenbelt Plan:

> *All planning authorities shall provide for a comprehensive, integrated and long-term approach for the protection, improvement or restoration of the quality and quantity of water. Such an approach shall consider all hydrologic features, areas and functions and include a systems approach to the inter-relationships between and/or among key hydrologic features and key hydrologic areas.*

To assist local planning authorities in meeting these provincial policy requirements, Kawartha Conservation and Durham Region initiated a project in 2019 to verify and centralize existing information (and in certain instances obtain new information), pertaining to the identification and mapping of Key Hydrologic Features and Key Hydrologic Areas within the shared jurisdictions of both agencies. This jurisdictional overlap comprises 496 km^2, or one-fifth of the total jurisdictional area of each agency (Figure 1).

This information will help make the review of *Planning Act* applications faster and more consistent, while also contributing information that support more broad land use planning initiatives such as Envision Durham Municipal Comprehensive Review, development siting, and water resources management planning.

2.0 Provincial Planning and the Water Resources System

The province of Ontario sets out the legislative and policy framework which is then implemented by municipalities. This includes, among other major land uses (such as agriculture, transportation, aggregates, etc.), policies related to managing surface water and groundwater resources.

The Provincial Policy Statement provides overall policy directions on matters of provincial interest related to land use and development in Ontario (including the protection and efficient management of water resources), and applies to all areas of the province except where another provincial plan provides otherwise.

Within scope of this project there are three provincial plans that have the potential to 'provide otherwise', because they overlap in terms of geography. They include: Growth Plan for the Greater Golden Horseshoe, Greenbelt Plan, and Oak Ridges Moraine Conservation Plan.

Policies within the Growth Plan for the Greater Golden Horseshoe and Greenbelt Plan are applicable throughout the entire jurisdictional overlap between Durham Region and Kawartha Conservation, whereas policies within the Oak Ridges Moraine Conservation Plan are applicable only to 18% of this overlap (Figure 1).

All of these provincial planning directives contain policies that directly apply to development that could impact water resources. They also require municipalities to identify components that inform a water resource system:

> *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 hydrologic integrity of the watershed.*
> [Provincial Policy Statement]
>
> *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.*
> [Growth Plan for Greater Golden Horseshoe]
> [Greenbelt Plan]
>
> *A watershed plan shall include, as a minimum… criteria for evaluating the protection of water quality and quantity, hydrologic features and functions, including criteria for evaluating the impacts of proposed development and infrastructure projects within and outside the Plan Area on water quality and quantity and on hydrologic features and functions…*
> [Oak Ridges Moraine Conservation Plan]

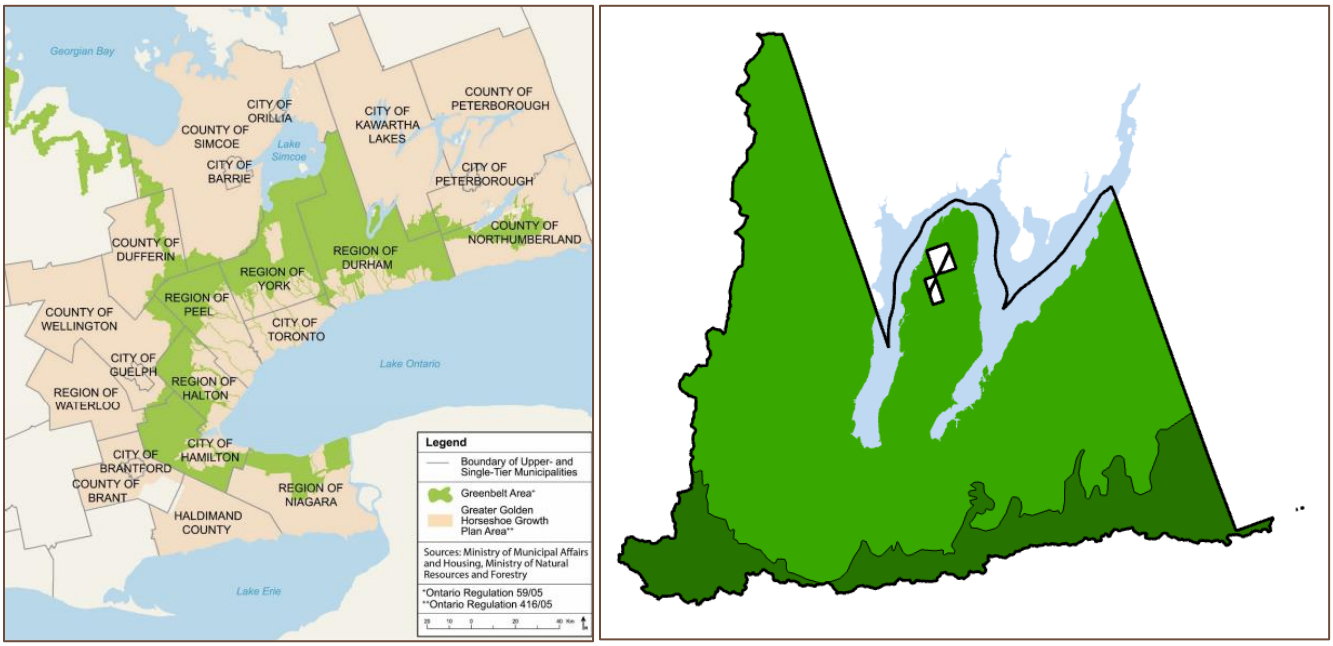

Figure 1: [Left] The geographic coverage of the Growth Plan for the Greater Golden Horseshoe (brown) and Greenbelt Plan (green) in Southern Ontario. [Right] The geographic coverage of the Greenbelt Plan (light green) and Oak Ridges Moraine Conservation Plan (dark green) in the overlapping jurisdictions of Durham Region and Kawartha Conservation. Lake Scugog is also shown (blue).

3.0 Key Hydrologic Features and Areas

Key Hydrologic Features and Key Hydrologic Areas are, according to provincial policy, fundamental components to a functioning water resource system. It is these Features and Areas that this report is focused on identifying and mapping.

Given that the Greenbelt Plan and Oak Ridges Moraine Conservation Plan are the most applicable provincial policy directives within the shared jurisdictional overlap of Durham Region and Kawartha Conservation, the definitions contained within these two Plans are most applicable.

Key Hydrologic Features are defined in the Greenbelt Plan as: permanent and intermittent streams, lakes (and their littoral zones), seepage areas and springs, and wetlands. They are defined in the Oak Ridges Moraine Conservation Plan as: permanent and intermittent streams, wetlands, kettle lakes, seepage areas and springs. There are no known kettle lakes in the jurisdictional overlap.

Key Hydrologic Areas are defined in the Greenbelt Plan as: significant groundwater recharge areas, highly vulnerable aquifers, and significant surface water contribution areas. In the Oak Ridges Moraine Conservation Plan, the term 'Key Hydrologic Areas' is not specifically referenced, however aquifers and recharge areas are considered in this Plan as 'hydrologic features' and have applicable policies.

The following section provides detailed information with respect to the definition, methodology for identification, and mapping results for the following Key Hydrologic Features and Areas:

- Permanent and intermittent streams;
- Lakes (and their littoral areas);
- Seepage areas and springs;
- Wetlands;
- Significant groundwater recharge areas;
- Highly vulnerable aquifers; and,
- Significant surface water contribution areas.

The subsequent chapters provide detailed information for each of these Key Hydrologic Features and Areas, within the following headings:

> Definitions: provided verbatim where available from the Provincial Policy Statement, Growth Plan for the Greater Golden Horseshoe, Greenbelt Plan, and/or Oak Ridges Moraine Conservation Plan.
>
> Mapping Methodology: a description of the approach used to collect and map the information.
>
> Key Findings: certain attributes of information that are particularly noteworthy.
>
> References and Additional Resources: a list of references cited within the information, as well as additional information regarding the Key Hydrologic Feature or Area of interest.

3.1 Permanent and Intermittent Streams

Definitions

Provincial Policy Statement: no definition provided.

Growth Plan for Greater Golden Horseshoe: no definition provided.

Greenbelt Plan:

> *"Permanent stream means a stream that continually flows in an average year.*
>
> *Intermittent stream means stream-related watercourses that contain water or are dry at times of the year that are more or less predictable, generally flowing during wet seasons of the year but not the entire year, and where the water table is above the stream bottom during parts of the year."*

Oak Ridges Moraine Conservation Plan: no definition is provided; however, a definition is provided in the Oak Ridges Moraine Technical Paper Series (Province of Ontario, 2007):

> Permanent stream: "*A stream which continually flows in an average year."*
>
> Intermittent stream:
>
> > *"Watercourses that contain water and are dry at times of the year that are more or less predictable. They generally flow during wet seasons of the year but not the entire year.*
> >
> > *The water table is above the stream bottom during parts of the year.*
> >
> > *Intermittent streams are distinguished from ephemeral or episodic streams, which contain water on a more or less unpredictable basis.*
> >
> > *Ephemeral streams generally flow only during and for short periods following precipitation or snow melt and flow in low areas that may or may not have well defined channels. Their stream bottoms are usually above the water table."*

Mapping Methodology

The approach to mapping permanent and intermittent streams involved two steps: verifying the existence of a surface water drainage feature (through which a stream would likely flow) and classifying the flow permanency of the verified drainage feature.

Verifying the existence of a surface water drainage feature was undertaken as a 'desktop' exercise, whereby geographic information systems (GIS) mapping was used to confirm the presence of streams. This was undertaken by overlaying 2018 aerial imagery with the Ontario Hydrologic Network (OHN) stream layer and Digital Elevation Model (DEM) layer and editing (e.g., keeping, adding, or removing) the 'blue-line' by hand digitizing at a scale of between 1:500 and 1:1,500. Streams that remain were given the following classification:

- Verified: streams are newly added features visible on the aerial imagery but not present on the OHN layer or DEM layer, and/or streams are confirmed by the aerial imagery and DEM or where segments of the stream are not completely visible and DEM is present, segments are traced to match the DEM.

- Not Verified: streams that have yet to be edited, or streams need to be field verified, as they are present on the base OHN layer but cannot be seen in whole on the air photo or DEM layer, and therefore may or may not exist.

Classifying the flow permanency was both a 'desktop' and a 'field' exercise. The desktop portion simply involved colour-coding the verified streams based on its existing Flow Permanency attribute in the OHN layer. The field component involved visiting all accessible road-stream crossings in the summer of 2019 under low flow conditions to visually assess for stream permanence. Each site was classified as permanent or intermittent based on the criteria below.

- Permanent: sites that were found to contain flowing water (obvious and continuous moving water) or standing water (pooled waters in isolated areas, not continuous flow).

- Intermittent: sites that were found to be dry (no water present at all) or saturated (wet soils in the bottom of a surface water drainage feature).

- Unknown: sites that could not be found or sites having no evidence of surface water drainage feature.

Key Findings

The following are key findings from the undertakings:

- There are approximately 769 km of streams, most of which (89%) have now been verified through this project (Figure 2, Table 1). Streams are ubiquitous within the study area, most of which flow into Lake Scugog.

- The flow permanency of all 769 km of streams has previously been discretized in the OHN layer, with most of the streams (90%) being permanent (Figure 3, Table 2).

- Of the 388 road-stream crossings visited, 47% were classified as (i.e., located on) permanent streams and 51% were classified as intermittent streams (Figure 3, Table 2).

- There is apparent discrepancy between the flow permanency classifications, with many more sites (and thus likely, more sections of streams) being considered intermittent through field sampling, as opposed to existing OHN mapping data. This discrepancy may be due in part to additional years of field sampling likely required to qualify these data as representative of an 'average year' as per provincial policy definition(s).

References and Additional Resources

MNRF (Ministry of Natural Resources and Forestry). 2019. Ontario Hydrologic Network data layer. Available at: Ontario GeoHub (www.geohub.lio.gov.on.ca).

OMNR (Ministry of Natural Resources). 2013. The stream permanency handbook for south-central Ontario. Available at: http://wbn.scholarsportal.info/node/12602.

Province of Ontario. 2007. ORMCP Technical Paper 12 - Hydrologic Evaluations for Hydrologically Sensitive Features. Available at: https://www.oakridgesmoraine.org/wp-content/uploads/2017/09/ORMCP-TP-12-Hydrological-Evaluations-for-Hydrologically-Sensitive-Features.pdf.

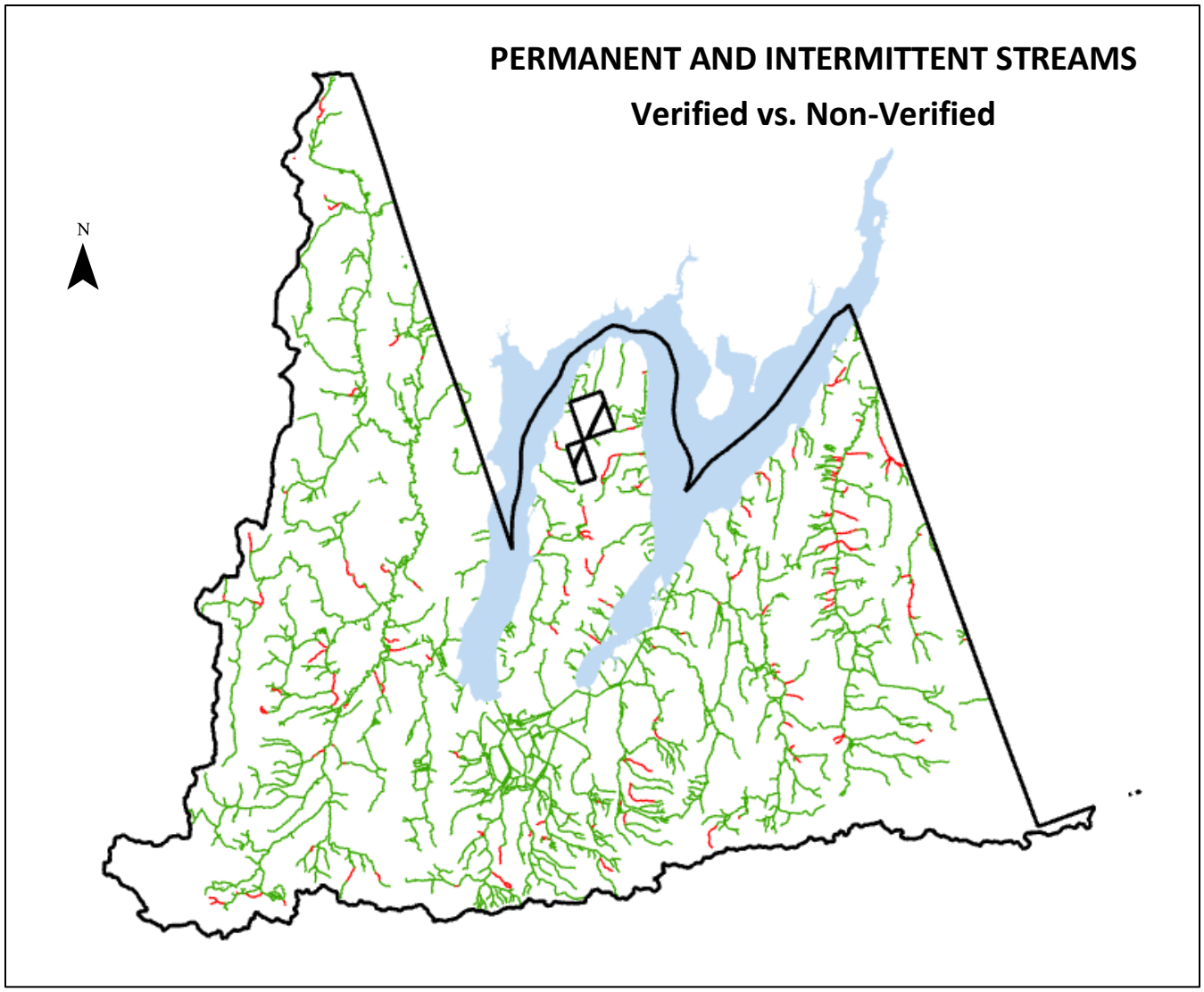

Figure 2: Permanent and intermittent streams. Green indicates verified streams and red indicates not verified streams.

Table 1: The amount of permanent and intermittent streams that have been verified through 'desktop' exercise.

Verification Status	**Length**
Verified	683 km (89%)
Not verified	86 km (11%)
TOTAL	**769 km (100%)**

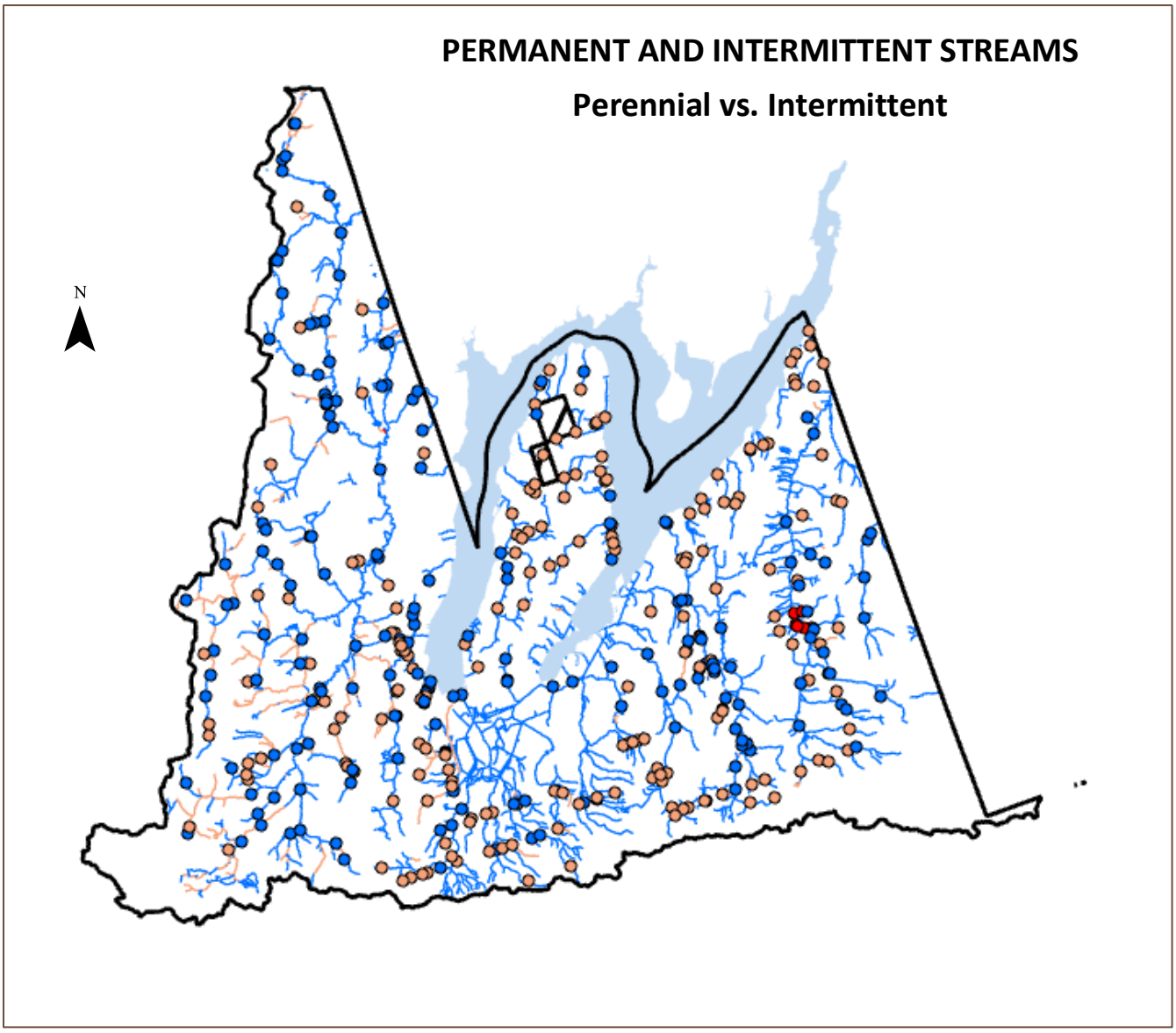

Figure 3: Permanent and intermittent streams. Blue indicates perennial streams and orange indicates intermittent streams, based on existing mapping (lines) and 2019 field sampling (dots).

Table 2: The number of locations that were classified as permanent or intermittent based on field sampling.

Flow Permanency	Field Status	Number of stream–road crossings
Permanent	Flowing	118 (30%)
	Standing	67 (17%)
Intermittent	Dry	169 (44%)
	Saturated	28 (7%)
Unknown	Unknown	6 (2%)
TOTAL		**388 (100%)**

Table 3: The amount of streams classified as permanent or intermittent based on existing mapping data.

Flow Permanency	Length
Permanent	689 km (90%)
Intermittent	80 km (10%)
TOTAL	**769 km (100%)**

3.2 Lakes and their Littoral Areas

Definitions

Provincial Policy Statement: no definition provided.

Growth Plan for Greater Golden Horseshoe: no definition provided.

Greenbelt Plan:

> *"Lake means any inland body of standing water, usually fresh water, larger than a pool or pond or a body or water filling a depression in the earth's surface.*"

Oak Ridges Moraine Conservation Plan: no definition provided.

Littoral areas are not defined in any Plan. Given that Lake Scugog is the only lake within the overlapping jurisdiction as per provincial policy, a littoral area is defined for the purposes of the report as:

> *"The shallow nearshore waters immediately adjacent to the shoreline of Lake Scugog*."

Mapping Methodology

Lake Scugog is the only inland lake within the project boundaries. The perimeter (shoreline) of Lake Scugog has been mapped by various sources including the provincial and federal governments. The layer used in this report is from the Ministry of Natural Resources and Forestry water polygon layer.

The littoral area was sampled by boat in late summer and fall of 2019 by Kawartha Conservation staff. Shoreline segments that had similar characteristics were delineated along the land/water interface (i.e., the normal summer operating water level). Aerial photography from 2018 was used to classify large tracts of natural shoreline that were time consuming to delineate by boat. In addition, secondary additional details along the same distinct shoreline segment were documented, including: the slope of the shoreline within the riparian area, the dominant land use within the riparian area, the substrate and aquatic plant characteristics within the nearshore area, and any other relevant comments that might assist in management efforts (e.g., potential stewardship potential, significant wildlife observations, etc.).

Segments are "newly delineated" when there is a distinct change in shore-water interface composition that extends along the shoreline for at least 15 metres. This size "limit" is given to speed up the classification process and to account for the limited accuracy of some older handheld Global Positioning System (GPS) units. The start and end of a segment was recorded by taking a GPS waypoint and a compass bearing (from 0 to 359 degrees) was taken in the direction towards shore of the start/end segment position.

The material along the shore-water interface (e.g., cobble, gravel, forest, etc.) was recorded as a percentage of the delineated segment (minimum of 5%). Due to time constraints, not all sections of the shoreline were classified.

Staff used the bearing and GPS information to delineate distinct shoreline segments, populate the lengths of each unique segment using GIS mapping, and attach this information to data from each unique segment. Shoreline segment composition, by length, is determined by populating the lengths of each segment according to the amount of shoreline composition indicated on field sheets.

Key Findings

The following are key findings from the undertakings:

- The surface area of Lake Scugog is 66.5 km^2, however only 38 km^2 (58% of total lake area) exists within overlapping jurisdictions.

- The total length of the shoreline (and thus littoral area) around Lake Scugog is 149.6 km, however only 82 km (55% of total shoreline length) exists within overlapping jurisdictions.

- 380 segments were delineated (most of which by boat), which comprises 98% of the shoreline within overlapping jurisdictions (Figure 4; Table 4).

- In terms of the primary shoreline attributes sampled in the delineated segments, along the shore-water interface:

    - Natural land use was the majority around the lake (78% naturally vegetated; 11% naturally unvegetated), most of which being marsh wetland (Figure 5 and Figure 6; Table 5 and Table 6).

    - Artificial land use exists along 11% of the lake, most of which being concrete and manicured lawn (Figure 5 and Figure 6; Table 5 and Table 6).

- In terms of the secondary shoreline attributes sampled in the delineated segments:

    - Most of the shorelines are low sloping (46%) whereas relatively few are high sloping (5%), however a substantial amount (31%) remain unassessed (Figure 7; Table 7). The unassessed are mostly likely low sloping, given they typically were adjacent to marsh wetland (i.e., lowland) areas.

    - Most of the nearshore substrates are silt or sand (51%), however a substantial amount (46%) remain unassessed (Figure 8; Table 8). The unassessed are mostly likely silt substrates, given they typically were adjacent to marsh wetland (i.e., lowland) areas.

    - Aquatic plants were dominant along 32% of the nearshore areas, however a substantial amount (46%) remain unassessed (Figure 9; Table 9).

    - The dominant land use above the shore-water interface was forest and manicured lawn (54%) (Figure 10, Table 10).

References and Additional Resources

Gartner Lee and French Planning Services. (2002). Shoreline Environmental Studies in Support of Official Plan Policies for the City of Kawartha Lakes. Lindsay, Ontario. Accessible at: https://www.city.kawarthalakes.on.ca/property-development-by-law/planning/studies-reviews/report.pdf

Lee, H. T., Bakowsky, W. D., Riley, J., Valleyes, J., Puddister, M., Uhlig, P. and McMurray, S. 1998. Ecological land classification system for southern Ontario: first approximation and its application. Ministry of Natural Resources, Southcentral Science Section, Science Development and Transfer Branch.

MNRF (Ministry of Natural Resources and Forestry). 2019. Water Polygon data layer. Available at: Ontario GeoHub (www.geohub.lio.gov.on.ca).

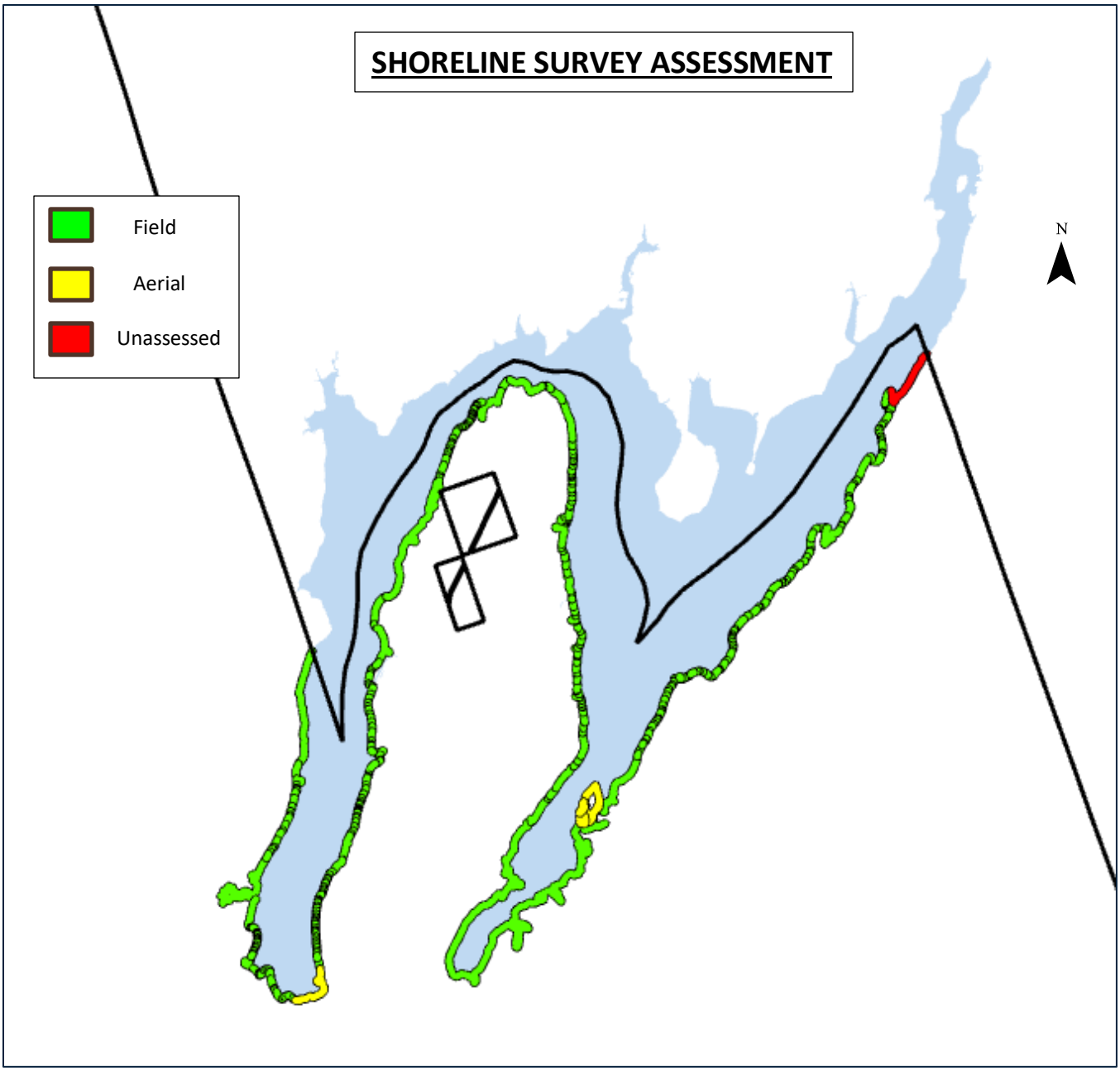

Figure 4: Lakes and their littoral areas. Several distinct shoreline segments (black) were delineated through field (green) and aerial (yellow) surveys; red is unassessed.

Table 4: The amount of shoreline sampled in 2019.

Survey Type	**Length**
Field (boating)	75.3 km (92%)
Aerial (imagery)	5.1 km (6%)
Unassessed	1.6 km (2%)
TOTAL	**82.0 km (100%)**

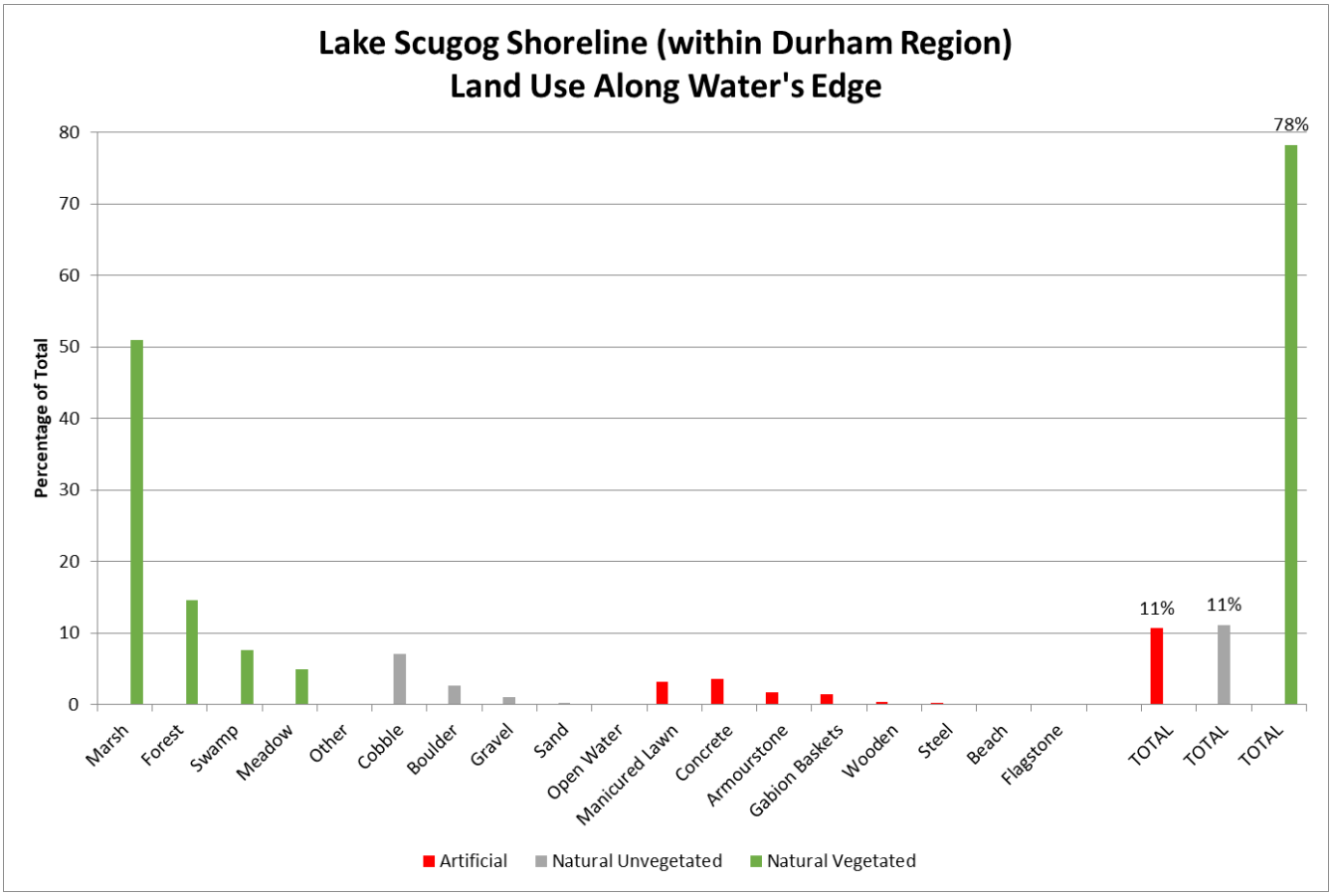

Figure 5: Lake and their littoral areas. Land-water interface land use categories.

Table 5: Land-water interface land use categories.

	Artificial		Natural Unvegetated		Natural Vegetated	
	%	km	%	km	%	km
Marsh					51.0	40.9
Forest					14.6	11.7
Swamp					7.7	6.1
Meadow					4.9	3.9
Other					<0.1	<0.1
Cobble			7.0	5.6		
Boulder			2.7	2.2		
Gravel			1.0	0.8		
Sand			0.2	0.2		
Open Water			0.1	0.1		
Concrete	3.6	2.9				
Manicured Lawn	3.2	2.6				
Armourstone	1.7	1.4				
Gabion Baskets	1.5	1.2				
Wooden	0.4	0.3				
Steel	0.2	0.2				
Beach	<0.1	<0.1				
Flagstone	<0.1	<0.1				
TOTAL	**10.7**	**8.6**				
TOTAL			**11.1**	**8.9**		
TOTAL					**78.2**	**62.8**

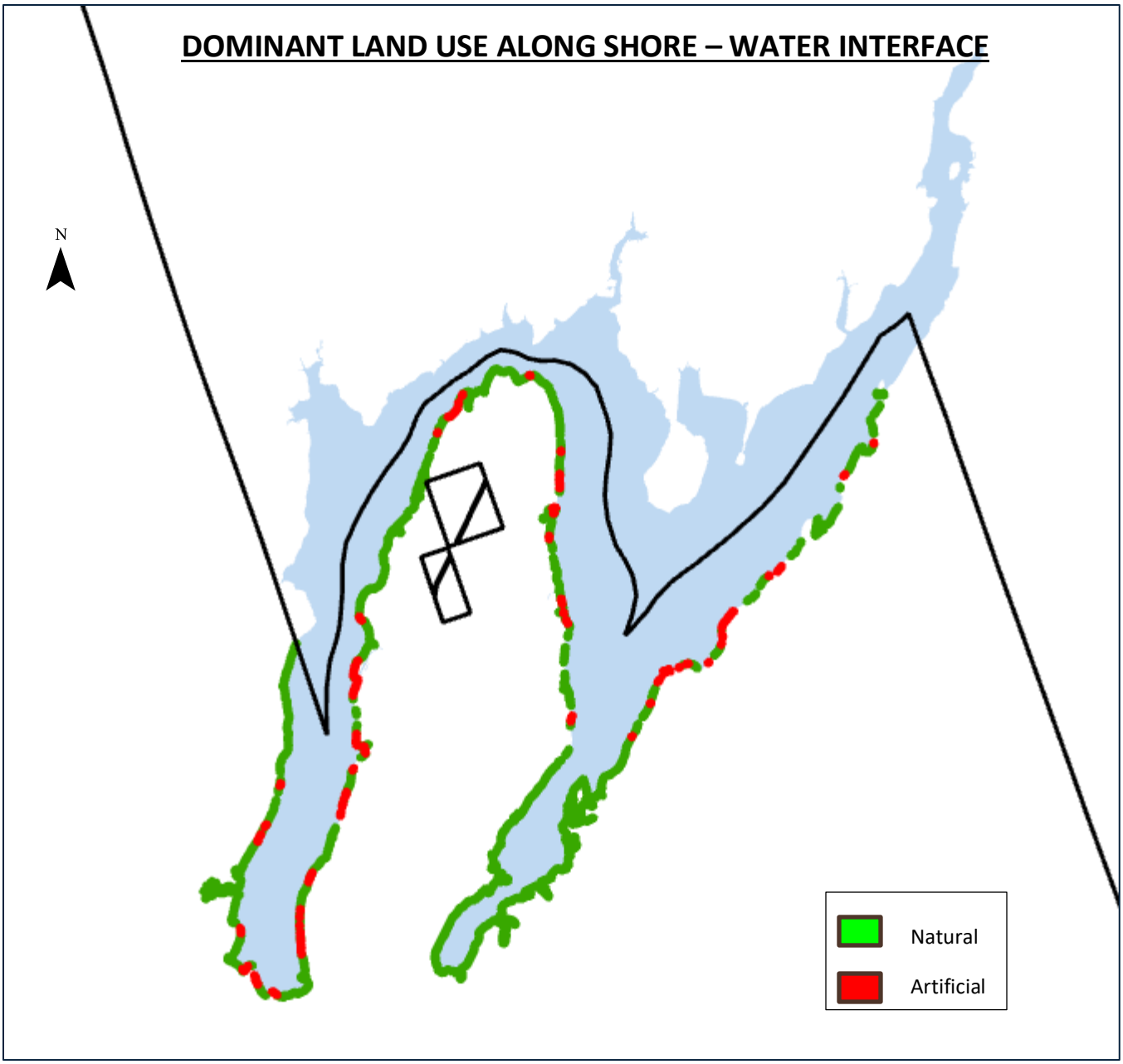

Figure 6: Lakes and their littoral areas. Dominant land use along the shore-water interface, categorized as artificial (red) or natural (green).

Table 6: Major land use types along the land-water interface.

Shore-water Interface	**Length**
Natural (Vegetated or Unvegetated)	71.7 km (89%)
Artificial	8.6 km (11%)
TOTAL	**80.3 km (100%, or 98% of total shoreline)**

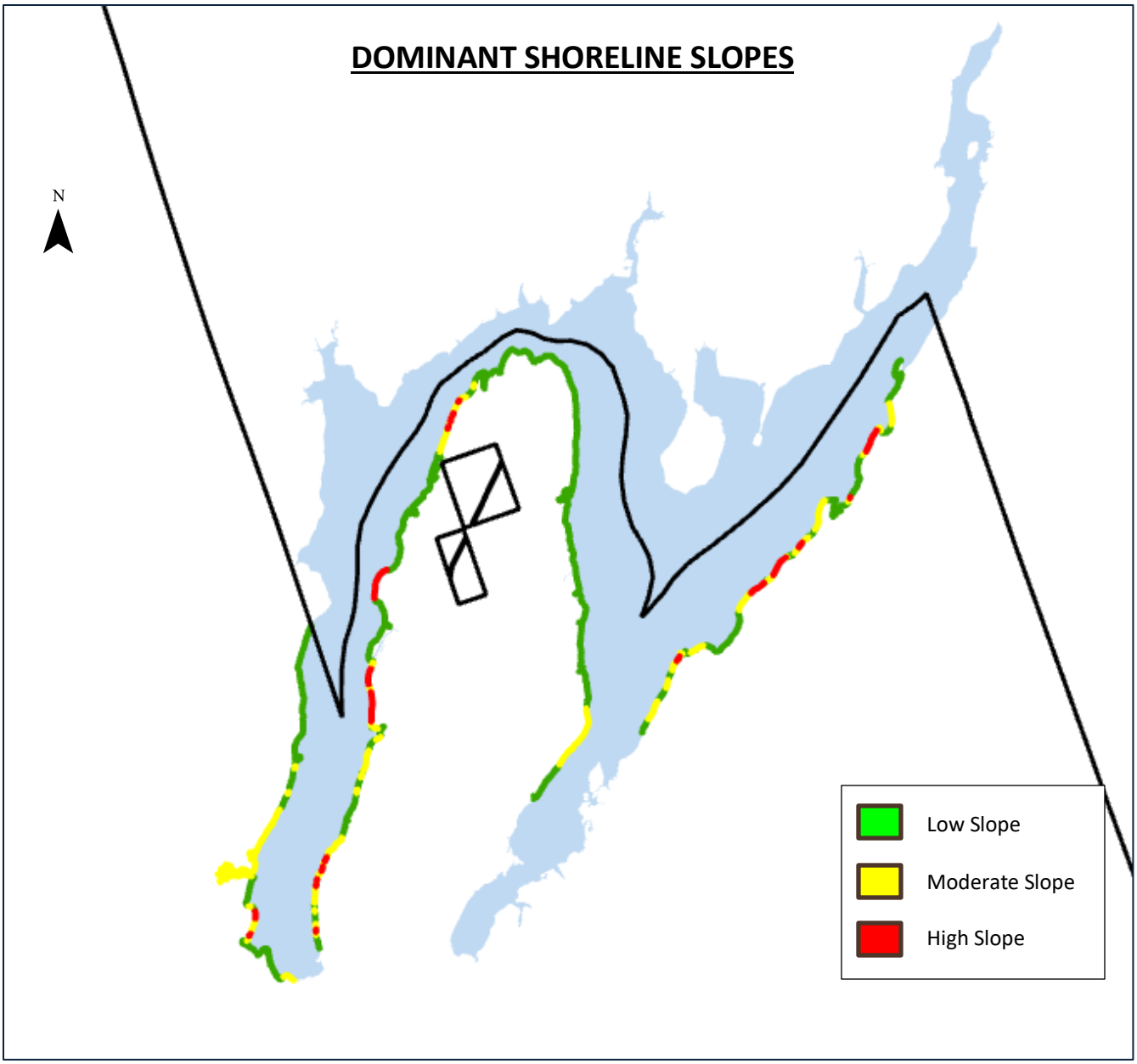

Figure 7: Lakes and their littoral areas. Dominant shoreline slopes categorized as low (green), moderate (yellow), or high (red).

Table 7: The amount of riparian slopes along the shoreline.

Riparian Slope	**Length**
Low slope	37.8 km (46%)
Moderate slope	14.4 km (18%)
High slope	4.0 km (5%)
Unassessed	25.7 km (31%)
Total	**82.0 km (100%)**

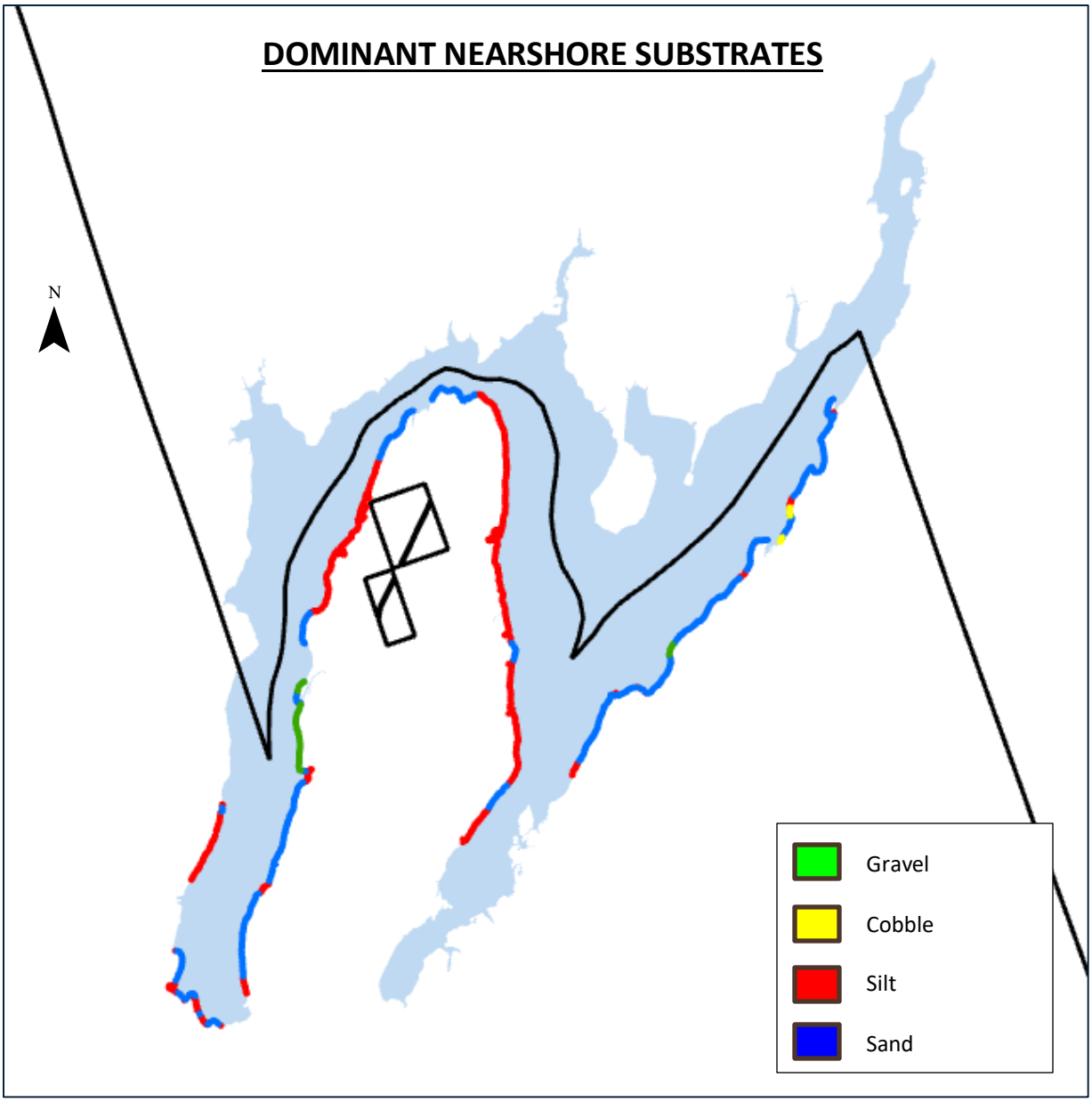

Figure 8: Lakes and their littoral areas. Dominant nearshore substrates categorized as silt (red), sand (blue), gravel (green), or cobble (yellow).

Table 8: The amount of nearshore substrate along the shoreline.

Nearshore Substrate	Length
Silt	22.2 km (27%)
Sand	19.9 km (24%)
Gravel	1.9 km (2%)
Cobble	0.3 km (<1%)
Unassessed	37.7 km (46%)
TOTAL	**82.0 km (100%)**

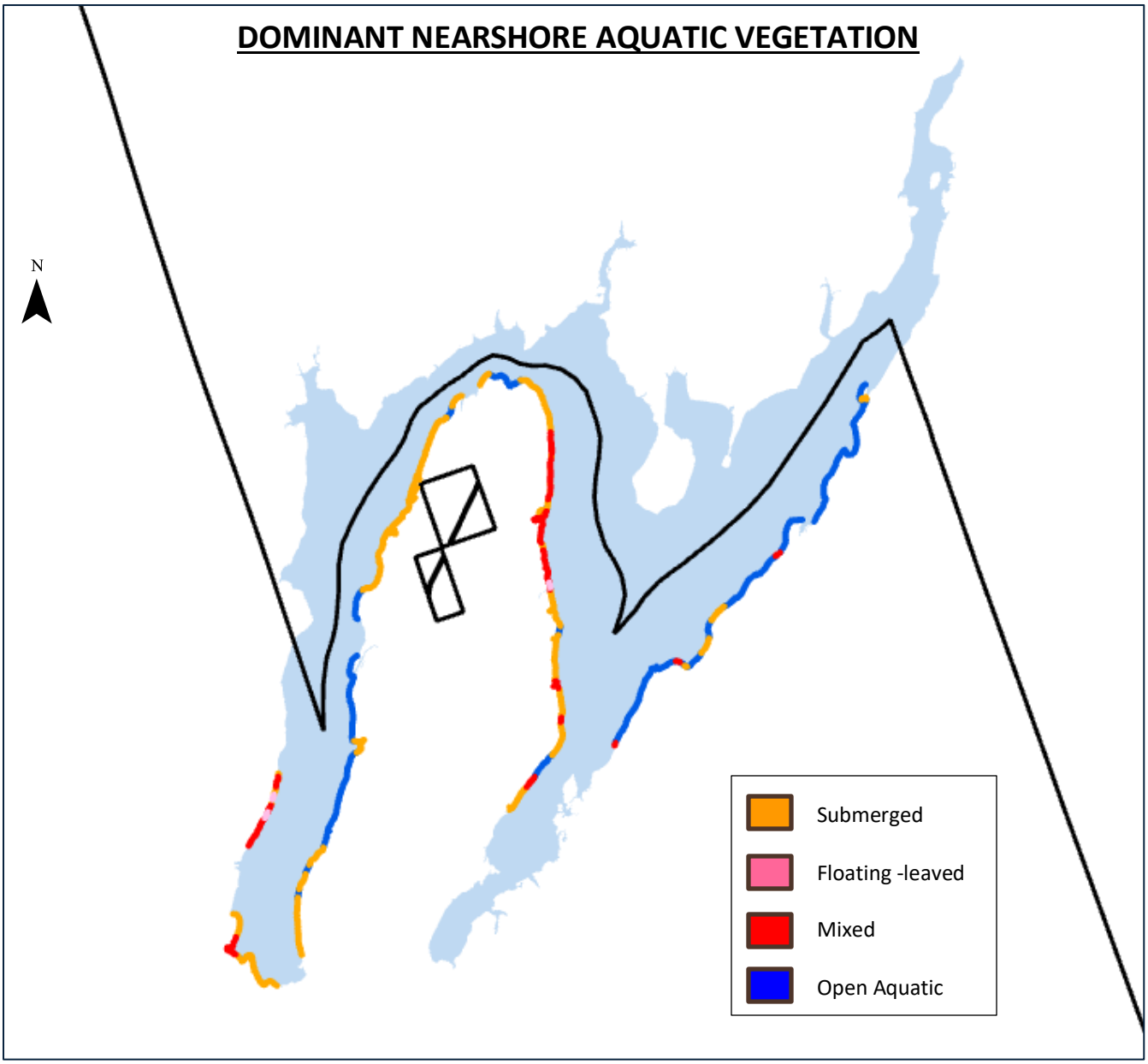

Figure 9: Lakes and their littoral areas. Dominant nearshore aquatic vegetation categorized as submerged (orange), open aquatic (blue), mixed (red), and floating-leaved (pink).

Table 9: The amount of nearshore aquatic vegetation along the shoreline.

Nearshore Aquatic Vegetation	**Length**
Submerged	20.3 km (25%)
Open aquatic (none)	17.7 km (22%)
Mixed	5.9 km (7%)
Floating-leaved	0.4 km (<1%)
Unassessed	37.7 km (46%)
TOTAL	**82.0 km (100%)**

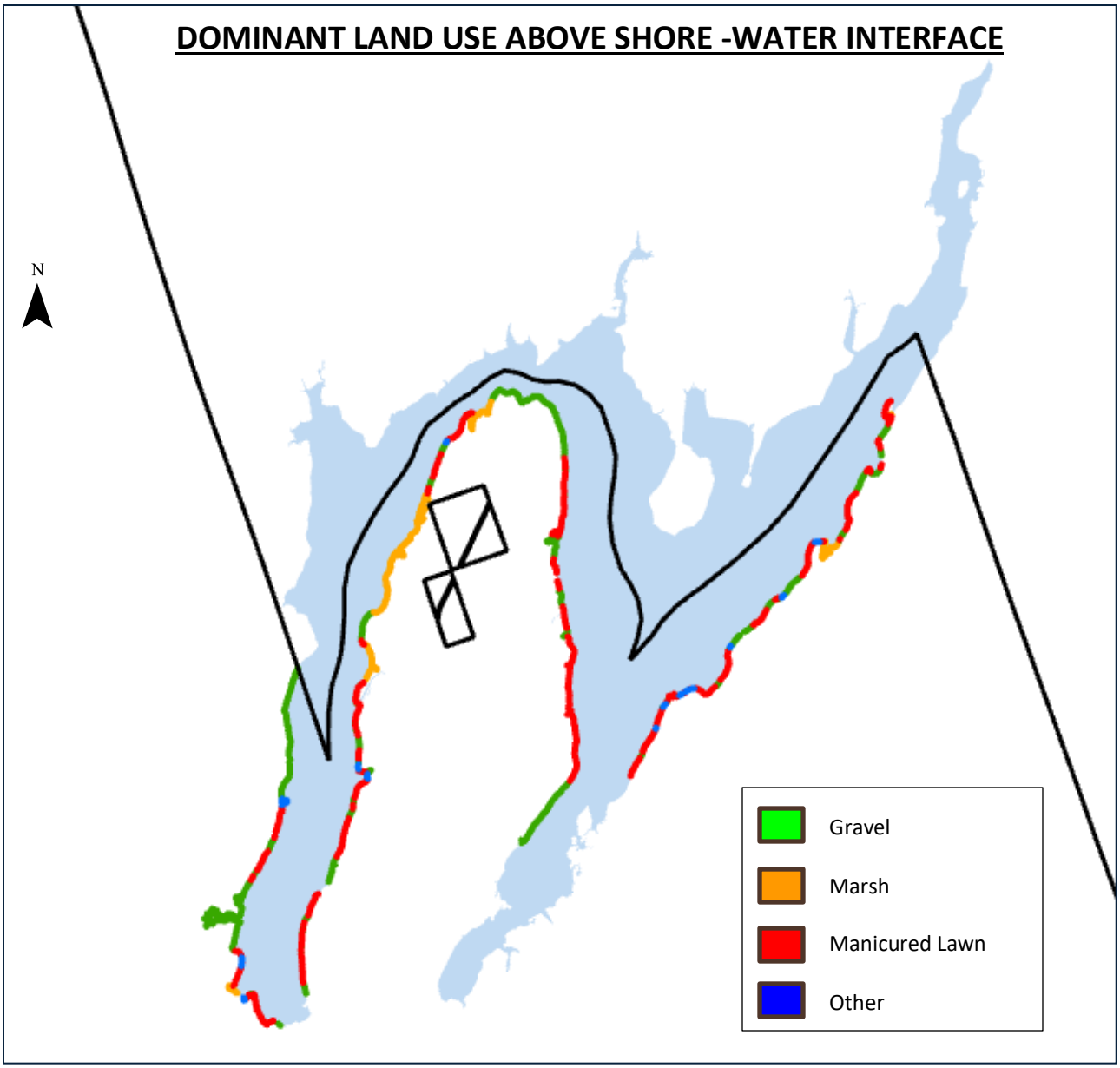

Figure 10: Lakes and their littoral areas. Dominant land use above the shore-water interface categorized as forest (green), manicured lawn (red), marsh (orange), and other (blue).

Table 10: The amount of riparian land use along the shoreline.

Riparian Land Use	**Length**
Forest	22.6 km (28%)
Manicured lawn	21.4 km (26%)
Marsh	9.3 km (11%)
Other (impervious, cropland, or meadow)	2.7 km (3%)
Unassessed	26 km (32%)
TOTAL	**82.0 km (100%)**

3.3 Seepage Areas and Springs

Definitions

Provincial Policy Statement: no definition provided.

Growth Plan for Greater Golden Horseshoe:

> *"Seepage Areas and Springs means sites of emergence of groundwater where the water table is present at the ground surface."*

Greenbelt Plan: same definition as provided in the Growth Plan for Greater Golden Horseshoe.

Oak Ridges Moraine Conservation Plan: no definition is provided in this plan; however, a definition is provided in the Oak Ridges Moraine Technical Paper Series (Province of Ontario, 2007):

> *"Sites of emergence of groundwater where the water table is present at the ground surface. Seepage areas are defined as areas where groundwater emerges from the ground over a diffuse area. Springs are defined as points of natural, concentrated discharge of groundwater."*

Mapping Methodology

Information on seepage areas and springs was obtained from existing mapping (Land Information Ontario): Oak Ridges Moraine Springs layer (MNRF, 2019). No field component was undertaken to map new or verify existing data.

Key Findings

The following are key findings from the undertakings:

- 17 locations of seepage areas and springs have been identified through existing mapping, all of which occur in the south section of the jurisdictional overlap, within the Oak Ridges Moraine Conservation Plan area.

References and Additional Information

MNRF (Ministry of Natural Resources and Forestry). 2019. ORM Springs layer. Available at: Ontario GeoHub (www.geohub.lio.gov.on.ca).

Province of Ontario. 2007. ORMCP Technical Paper 12 - Hydrologic Evaluations for Hydrologically Sensitive Features. Available at: https://www.oakridgesmoraine.org/wp-content/uploads/2017/09/ORMCP-TP-12-Hydrological-Evaluations-for-Hydrologically-Sensitive-Features.pdf.

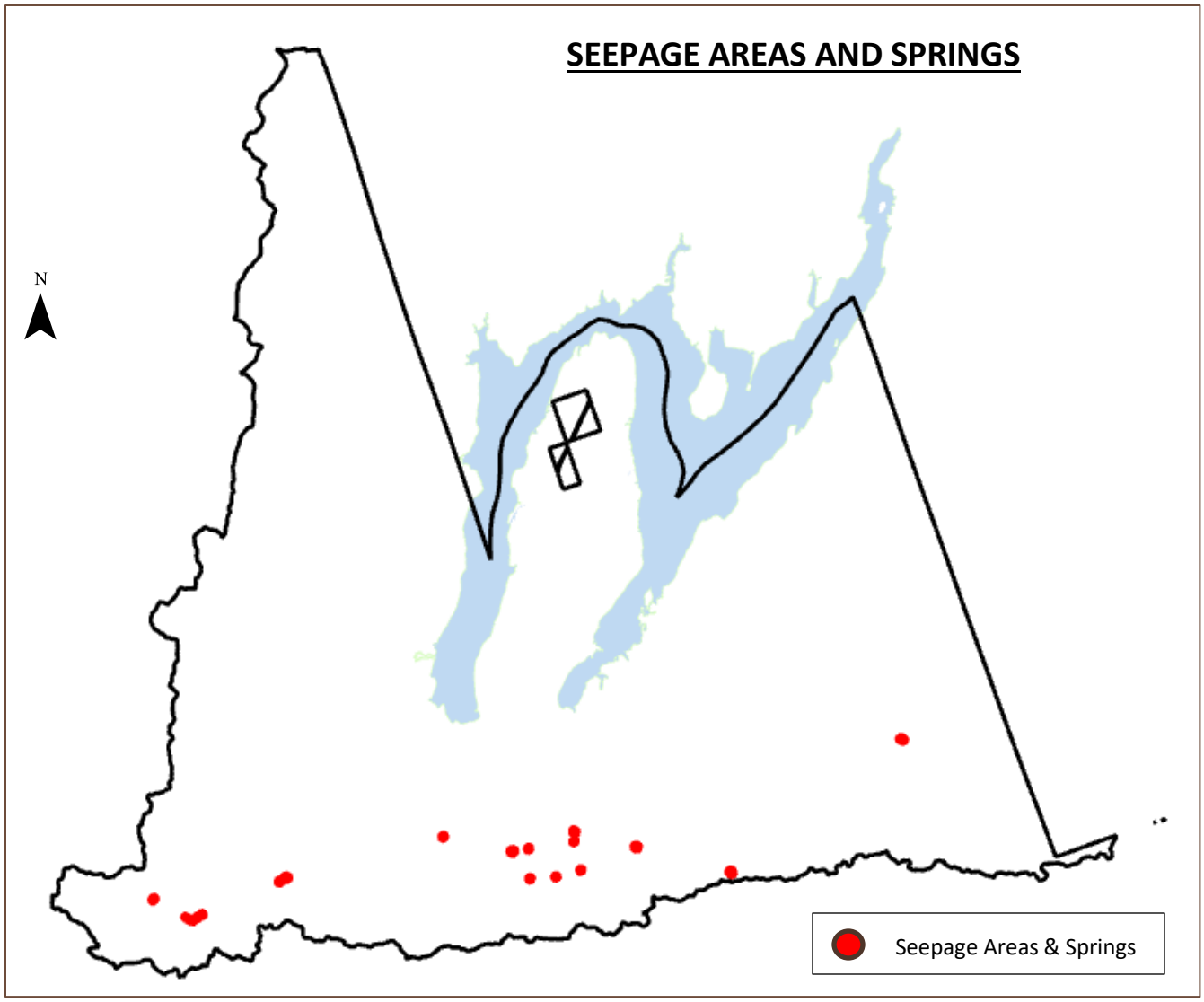

Figure 11: Seepage areas and springs. The location of known seepage areas and springs.

3.4 Wetlands

Definitions

Provincial Policy Statement:

> *"Wetlands means lands that are seasonally or permanently covered by shallow water, as well as lands where the water table is close to or at the surface. In either case the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic plants or water tolerant plants. The four major types of wetlands are swamps, marshes, bogs and fens.*
>
> *Periodically soaked or wet lands being used for agricultural purposes which no longer exhibit wetland characteristics are not considered to be wetlands for the purposes of this definition."*

Growth Plan for Greater Golden Horseshoe:

> Same definition as provided in the Provincial Policy Statement, with the addition of: *"Wetlands are further defined, by the Ministry of Natural Resources and Forestry or by any other person, according to evaluation procedures established by the Ministry of Natural Resources and Forestry, as amended from time to time."*

Greenbelt Plan: Same definition as provided in the Growth Plan for Greater Golden Horseshoe.

Oak Ridges Moraine Conservation Plan:

> *"Wetland means land such as a swamp, marsh, bog or fen (not including land that is being used for agricultural purposes and no longer exhibits wetland characteristics) that,*
>
> *(a) is seasonally or permanently covered by shallow water or has the water table close to or at the surface,*
>
> *(b) has hydric soils and vegetation dominated by hydrophytic or water tolerant plants, and*
>
> *(c) has been further identified, by the Ministry of Natural Resources and Forestry or by any other person, according to evaluation procedures established by the Ministry of Natural Resources and Forestry, as amended from time to time."*

Mapping Methodology

Information on wetlands was obtained from existing mapping, which included three primary methods through two information sources:

- Ministry of Natural Resources and Forestry: information was generated through two primary sources, including:
    - Southern Ontario Land Resources Information System (SOLRIS): a compilation of data from numerous sources including: provincial base data (woodland/ wetland perimeters, hydrology, built up areas, Ontario road network), satellite imagery and digital elevation models. Computer modelling, visual interpretation with high resolution aerial photos and field validation were used to create a seamless inventory for Southern Ontario (MNRF, 2015).

    - Wetland Evaluation System: through the Ontario Wetland Evaluation System process, aerial imagery was utilized in combination with ground truthing to evaluate the status of wetlands according to a defined protocol (MNR, 2002). Large or high priority wetlands were inventoried through this system and classified as either 'provincially significant' or 'evaluated non-provincially significant' (these are often referred to as locally significant).

- Kawartha Conservation: Ecological Land Classification (ELC) methodology was used to interpret land cover as shown in 2018 aerial imagery, according to a community-series level of detail (Lee et al., 1998).

A verification process was undertaken in the summer of 2019 to confirm the presence (not boundaries) of existing wetlands that were not evaluated through the Ontario Wetland Evaluation System process. These included those identified through ELC and SOLRIS methodology that exist outside of evaluated wetlands. This was undertaken through roadside surveys and visually confirming presence or absence of wetlands on the landscape. Adjustments to existing boundaries from this exercise are being contemplated and are not yet reflected in the wetland mapping presented in Figure 12.

Key Findings

The following are key findings from the undertakings:

- There are 141 km^2 of wetlands, which comprises 28% of the total land area within the jurisdictional overlap.

- Evaluated wetlands comprise 59% of all mapped wetlands (55% of which are considered provincially significant and 4% are considered locally significant).

- In 2019, 103 unevaluated wetlands were field verified; 81% were confirmed existing, 14% were confirmed as not existing, and the remaining 5% could not be confirmed. Changes to existing mapping (e.g., removal, boundary change, etc.) based on these data are currently being contemplated.

References and Additional Resources

Lee, H. T., Bakowsky, W. D., Riley, J., Valleyes, J., Puddister, M., Uhlig, P. and McMurray, S. 1998. Ecological land classification system for southern Ontario: first approximation and its application. Ministry of Natural Resources, Southcentral Science Section, Science Development and Transfer Branch. SCSS Field Guide FG-02.

MNR (Ministry of Natural Resources). 2002. Ontario Wetland Evaluation System, Southern Manual. Third Edition NEST Technical Manual TM-002.

MNR (Ministry of Natural Resources). 2015. Southern Ontario Land Resource Information System (SOLRIS) Version 2.0: Frequently Asked Questions. Available at: https://www.sse.gov.on.ca/sites/MNR-PublicDocs/EN/CMID/SOLRIS%20v2.0%20-%20FAQ.pdf

MNRF (Ministry of Natural Resources and Forestry). 2019. MNR Wetlands data layer. Available at: Ontario GeoHub (www.geohub.lio.gov.on.ca).

Province of Ontario. 2007. ORMCP Technical Paper 12 - Hydrologic Evaluations for Hydrologically Sensitive Features. Available at: https://www.oakridgesmoraine.org/wp-content/uploads/2017/09/ORMCP-TP-12-Hydrological-Evaluations-for-Hydrologically-Sensitive-Features.pdf.

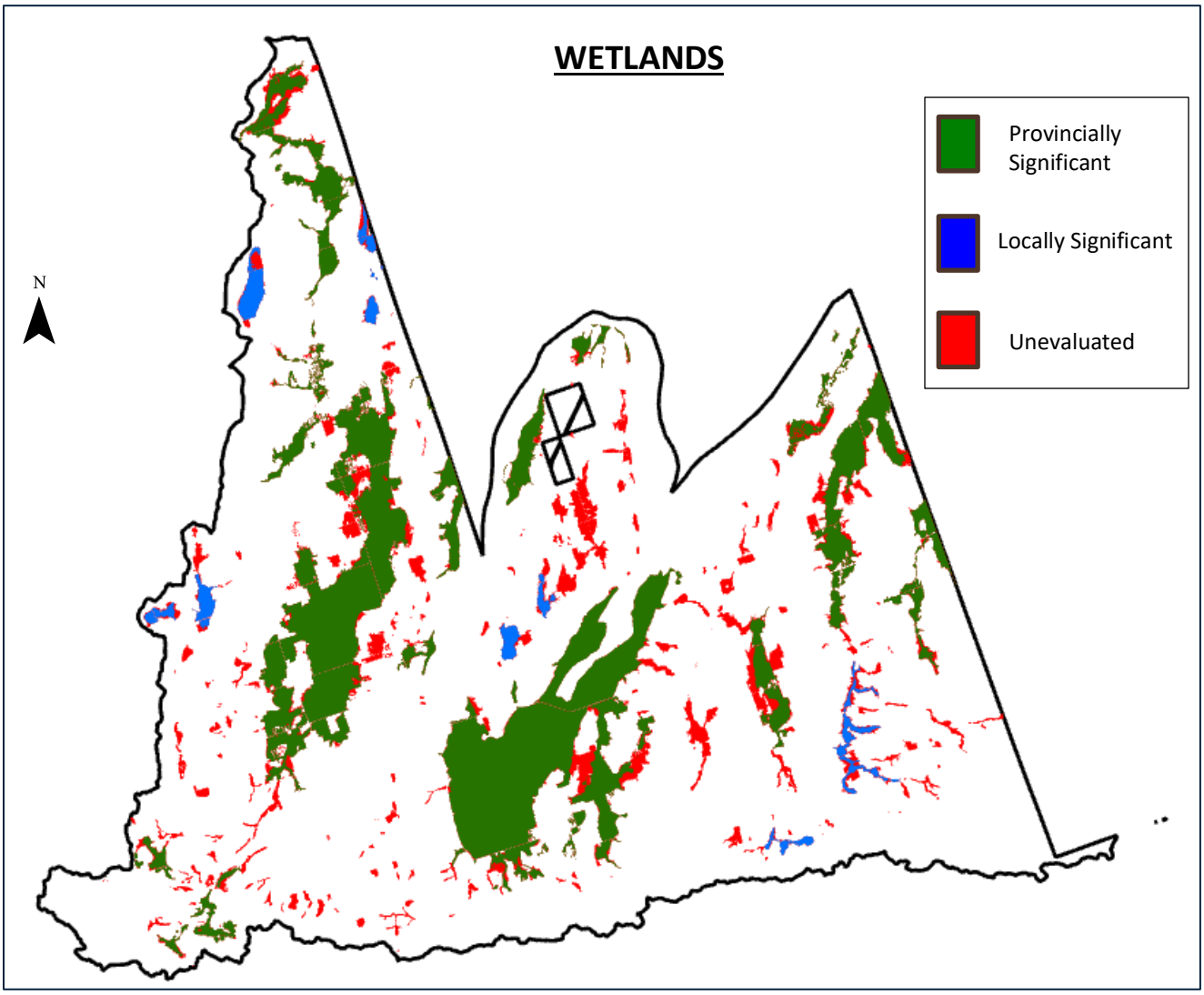

Figure 12: Wetlands. Locations of Provincially Significant Wetlands (green), Locally Significant Wetlands (blue), and unevaluated wetlands (red).

Table 11: The amount of wetland within each category.

Category	Surface Area	Data Source
Provincially Significant	77 km^2 (55%)	MNRF
Locally Significant	5 km^2 (4%)	MNRF
Unevaluated	59 km^2 (42%)	MNRF and Kawartha Conservation
TOTAL	**141 km^2 (100%)**	**MNRF and Kawartha Conservation**

3.5 Significant Groundwater Recharge Areas

Definition

Provincial Policy Statement: no definition provided.

Growth Plan for Greater Golden Horseshoe:

> *"An area that has been identified:*
> *a) as a significant groundwater recharge area by any public body for the purposes of implementing the Provincial Policy Statement;*
> *b) as a significant groundwater recharge area in the assessment report required under the Clean Water Act, 2006; or*
> *c) as an ecologically significant groundwater recharge area delineated in a subwatershed plan or equivalent in accordance with provincial guidelines.*
>
> *For the purposes of this definition, ecologically significant groundwater recharge areas are areas of land that are responsible for replenishing groundwater systems that directly support sensitive areas like coldwater streams and wetlands."*

Greenbelt Plan: same definition as provided in the Growth Plan for Greater Golden Horseshoe.

Oak Ridges Moraine Conservation Plan: no definition provided.

Mapping Methodology

The delineation of significant groundwater recharge areas is from the Trent Assessment Report (TCCSPC, 2019), the mapping of which was completed by the Conservation Authorities Moraine Coalition as documented in the Trent Source Water Protection Study Recharge Study (CAMC-YPDT, 2009). The following is an excerpt from the Trent Assessment Report:

> *"Significant groundwater recharge areas in the source protection region were delineated using the water budget surplus method (areas where the annual recharge volume is at least 55% of the annual water budget surplus). The delineation process consisted of an analysis of climate, estimation of recharge rates, and calculation of the water budget surplus and threshold recharge volume. In addition, Significant groundwater recharge areas were assigned a vulnerability score of 6, 4, or 2 using the landscape-scale groundwater vulnerability analysis discussed above. A higher vulnerability score means that the aquifer is more susceptible to contamination."*

Ecologically significant groundwater recharge areas have not been mapped in the jurisdictional overlap of Durham Region and Kawartha Conservation. However, these have been delineated in other parts of Durham Region for example in Central Lake Ontario Conservation (Earthfx, 2004), and Lake Simcoe Region Conservation (Earthfx, 2013). Currently Durham Region, as indicated by Neville (2019), is working towards a consistent approach for delineating these areas using guidance as per Marchildon et al. (2015).

Key Findings

The following are key findings from the undertakings:

- Significant groundwater recharge areas comprise 35% (173 km^2) of the total jurisdictional overlap.

Reference and Additional Resources

CAMC-YPDT (Conservation Authorities Moraine Coalition – York Peel Durham Toronto). 2009. Trent Source Water Protection Study Recharge Study.

Earthfx. 2004. Ecologically Significant Groundwater Recharge Area Delineation in the Central Lake Ontario Conservation Authority Area

Earthfx. 2013. Ecologically Significant Groundwater Recharge Area Assessment for the Oro North, Oro South, and Hawkestone Creeks Subwatersheds. Available at: https://www.lsrca.on.ca/Shared%20Documents/reports/esgra_orocreeks.pdf.

Marchildon, Mason & Thompson, Peter & Cuddy, Shelly & Wexler, E.J. & Howson, Katie & Kassenaar, Dirk. (2015). A methodology for identifying ecologically significant groundwater recharge areas. Canadian Water Resources Journal / Revue canadienne des ressources hydriques. 41. 1-13. 10.1080/07011784.2015.1080125.

Neville, C. 2019. Durham Region Groundwater Modelling Update to Meet Source Protection Requirements Progress Update Meeting #4 October 28, 2019. MS Powerpoint Presentation.

TCCSPC (Trent Conservation Coalition Source Protection Committee). 2019. Approved Trent Assessment Report. Available at: http://trentsourceprotection.on.ca/resources/reports-legislation/assessment-reports.

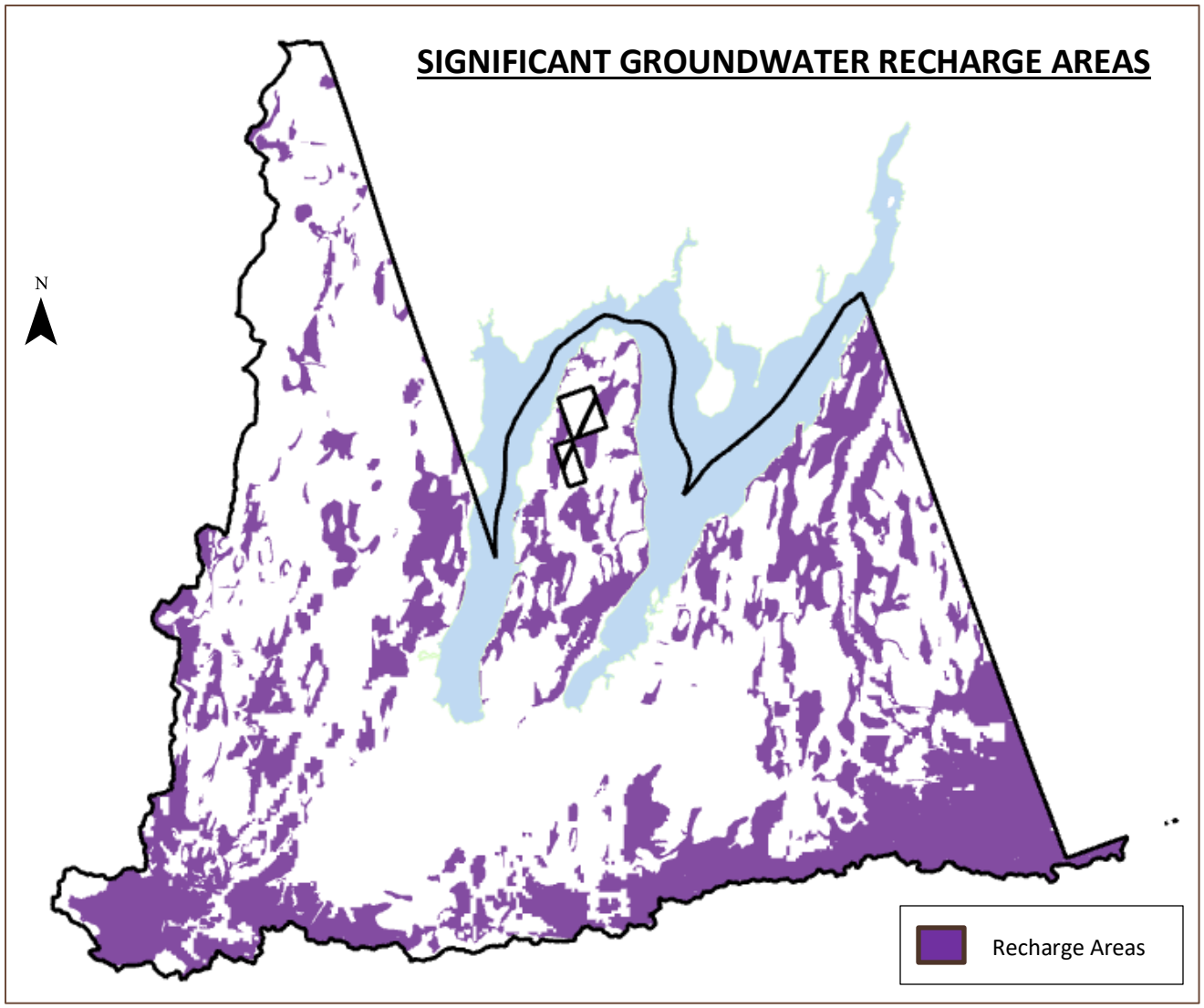

Figure 13: Significant groundwater recharge areas.

3.6 Highly Vulnerable Aquifers

Definition

Provincial Policy Statement: no definition provided.

Growth Plan for Greater Golden Horseshoe:

> *"Aquifers, including lands above the aquifers, on which external sources have or are likely to have a significant adverse effect."*

Greenbelt Plan: same definition as provided in the Growth Plan for Greater Golden Horseshoe.

Oak Ridges Moraine Conservation Plan: definition provided for 'aquifer vulnerability' only:

> *"Aquifer vulnerability means an aquifer's intrinsic susceptibility, as a function of the thickness and permeability of overlying layers, to contamination from both human and natural impact on water quality."*

Mapping Methodology

The delineation of highly vulnerable aquifers was undertaken through the following two programs: the Ontario Drinking Water Source Protection Program, and the Oak Ridges Moraine Conservation Plan. Durham Region has adopted in their Official Plan the approach taken by the Oak Ridges Moraine Conservation Plan. Both methodologies are described below.

The Oak Ridges Moraine Conservation Plan delineation initiative identified highly vulnerable aquifers for land within the Oak Ridges Moraine planning area as well as for Durham Region. The methodology for which has been documented in the Oak Ridges Moraine Aquifer Vulnerability Mapping Report (Province of Ontario, 2004):

> *"The rationale for the mapping method is linked to time of travel of water and the contaminants that move in the water (usually in a dissolved state) from the surface to an aquifer. The vulnerability is tied to the arrival of a contaminant at the water table and/or the shallowest aquifer. The mapping method was not geared to assess a specific contaminant, contaminant group or human activity. This method assessed vulnerability with limited consideration of the specific attributes of the hydrogeological system or the behavior of contaminants. The two key attributes considered were the depth to water table and the hydraulic conductivity (K) of geologic material in the unsaturated zone (or above a confined aquifer)."*

The Ontario Drinking Water Source Protection Program delineated highly vulnerable aquifers for the entire overlapping jurisdiction, the methodology of which has been documented in the Trent Assessment Report (TCCSPC, 2019):

> *"Groundwater vulnerability was assessed at a landscape scale in the Trent source protection areas. The analysis focused on the uppermost aquifer from which the majority of domestic wells draw their water. The analysis was based on databases of well records that included spatial and geological data for thousands of wells in the source protection region. The analysis was performed using VIEWLOG (a borehole data management and visualization software package) and a geographic information system. Because of the significant variation in groundwater vulnerability and data availability across the source protection region, a combination of the Intrinsic Susceptibility Index and Aquifer Vulnerability Index methods was used to assign the vulnerability. In general, the aquifers in the Precambrian area (north)*

were found to be highly vulnerable, and the vulnerability of the aquifers in the Paleozoic (south) was more variable. Maps of the landscape-scale vulnerability and highly vulnerable aquifers (areas with a vulnerability score of 6) are provided…"

Key Findings

The following are key findings from the undertakings:

- Highly vulnerable aquifers comprise approximately 33% (165 km^2) of the total jurisdictional overlap. Kawartha Conservation will need to obtain digital layers from Durham Region (Official Plan Schedule B) and add to their mapping.

References and Additional Resources

AECOM Canada Ltd. 2009. Trent Conservation Coalition Groundwater Vulnerability Assessment – TCC Source Protection Region.

Durham Region. 2017. Durham Region Official Plan. Schedule B, Map B2, High Aquifer Vulnerability and Wellhead Protection Areas.

Province of Ontario. 2004. Oak Ridges Moraine Aquifer Vulnerability Mapping. Accompanying Document to the Reference Map for Ontario Regulation 140/02 (Oak Ridges Moraine Conservation Plan). Available at: http://www.mah.gov.on.ca/Asset3763.aspx.

TCCSPC (Trent Conservation Coalition Source Protection Committee). 2019. Approved Trent Assessment Report. Available at: http://trentsourceprotection.on.ca/resources/reports-legislation/assessment-reports.

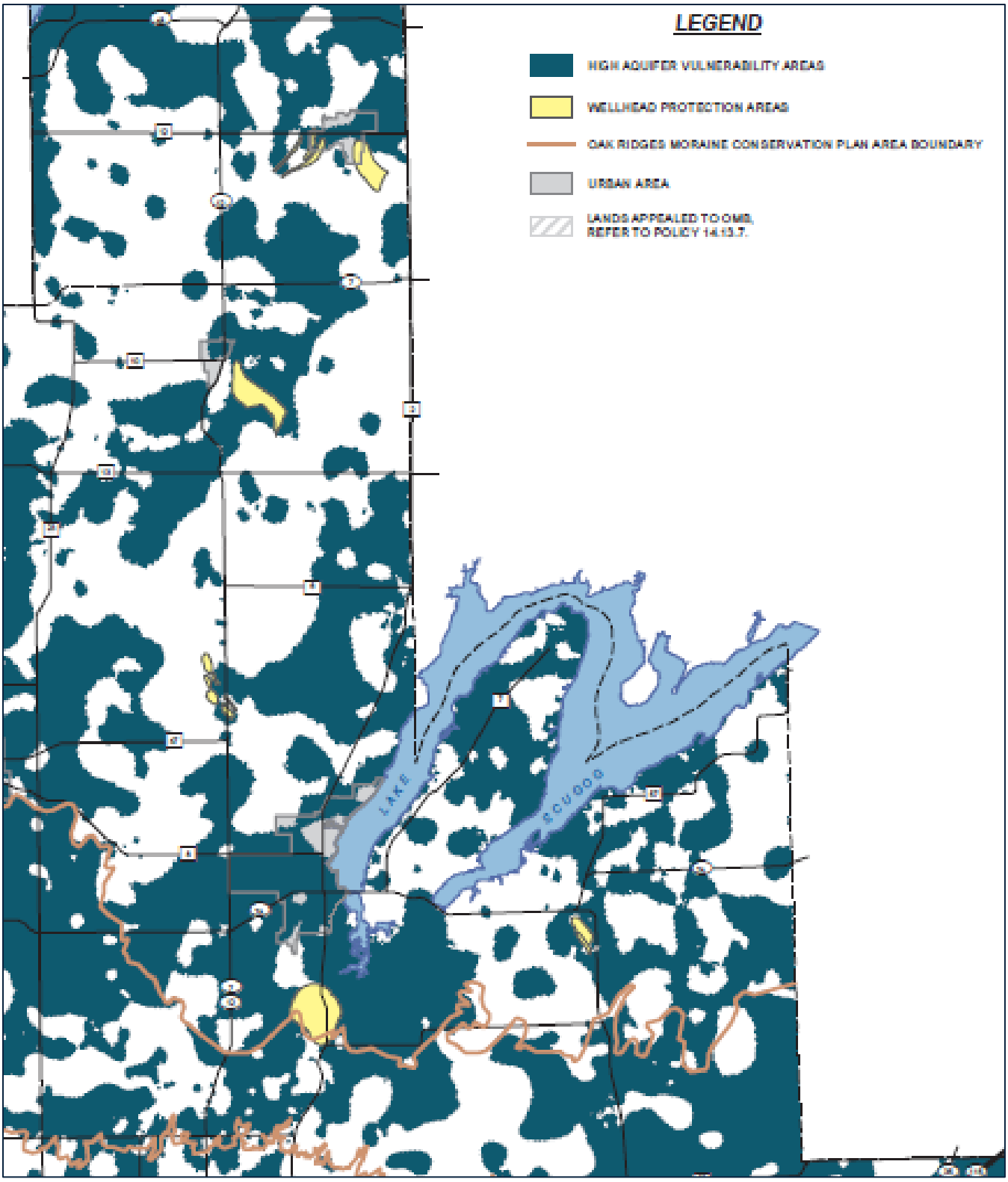

Figure 15: Highly Vulnerable Aquifers (blue) from Schedule B of Durham Region's Official Plan (2017). The jurisdictional overlap between Kawartha Conservation and Durham Region is not shown.

3.7 Significant Surface Water Contribution Areas

Definition

Provincial Policy Statement: no definition provided.

Growth Plan for Greater Golden Horseshoe:

> *"Means areas, generally associated with headwater catchments, that contribute to baseflow volumes which are significant to the overall surface water flow volumes within a watershed."*

Greenbelt Plan: same definition as provided in the Growth Plan for Greater Golden Horseshoe.

Oak Ridges Moraine Conservation Plan: no definition provided.

Mapping Methodology

Significant surface water contribution areas were delineated based on flow sampling undertaken in 2019 at road-stream crossings, which generally followed the sampling approach described in Hinton (2005). Flow was measured once at each site in the summer when instream flows approximated low flow conditions (i.e., when flow contributions from precipitation was negligible). The upstream catchments for each sample point were then delineated using Arc Hydro tool (ESRI, 2020).

Net flow per unit area was then calculated on a catchment basis and reported as being either non-existent (less than 0 downstream net flow contributions between sampled catchments), low (bottom 1/3rd percentile of all flow contributions greater than 0), moderate (middle 3rd percentile), or high (top 1/3rd percentile) contribution as relative to all flow data. The 'high' contribution' catchments are considered significant contribution areas.

The approach taken was developed by Kawartha Conservation and represents one (of many) potential ways to delineate significant surface water contribution areas. As noted by TRCA (2019) there are various methods that could be employed, none of which has been formally accepted by the province as a standardized approach.

Key Findings

The following are key findings from the undertaking:

- There were 304 surface water contribution areas assessed, which comprise 68% (335 km^2) of jurisdictional overlap.

- There were 23 significant surface water contribution areas identified, which comprise 8% (39 km^2) of the total jurisdictional overlap.

- Net discharge values for significant surface water contribution areas ranged from 4.4 to 22.7 litres/sec/km^2.

References and Additional Information

ESRI (Environmental Systems Research Institute). 2020. Arc Hydro Terrain Preprocessing Tool.

Hinton, M.J. 2005. Methodology for measuring the spatial distribution of low streamflow within watersheds. Geological Survey of Canada, 62.

TRCA (Toronto and Region Conservation Authority). 2019. Determining a Common Approach for Identifying and Delineating Significant Surface Water Contribution Areas.

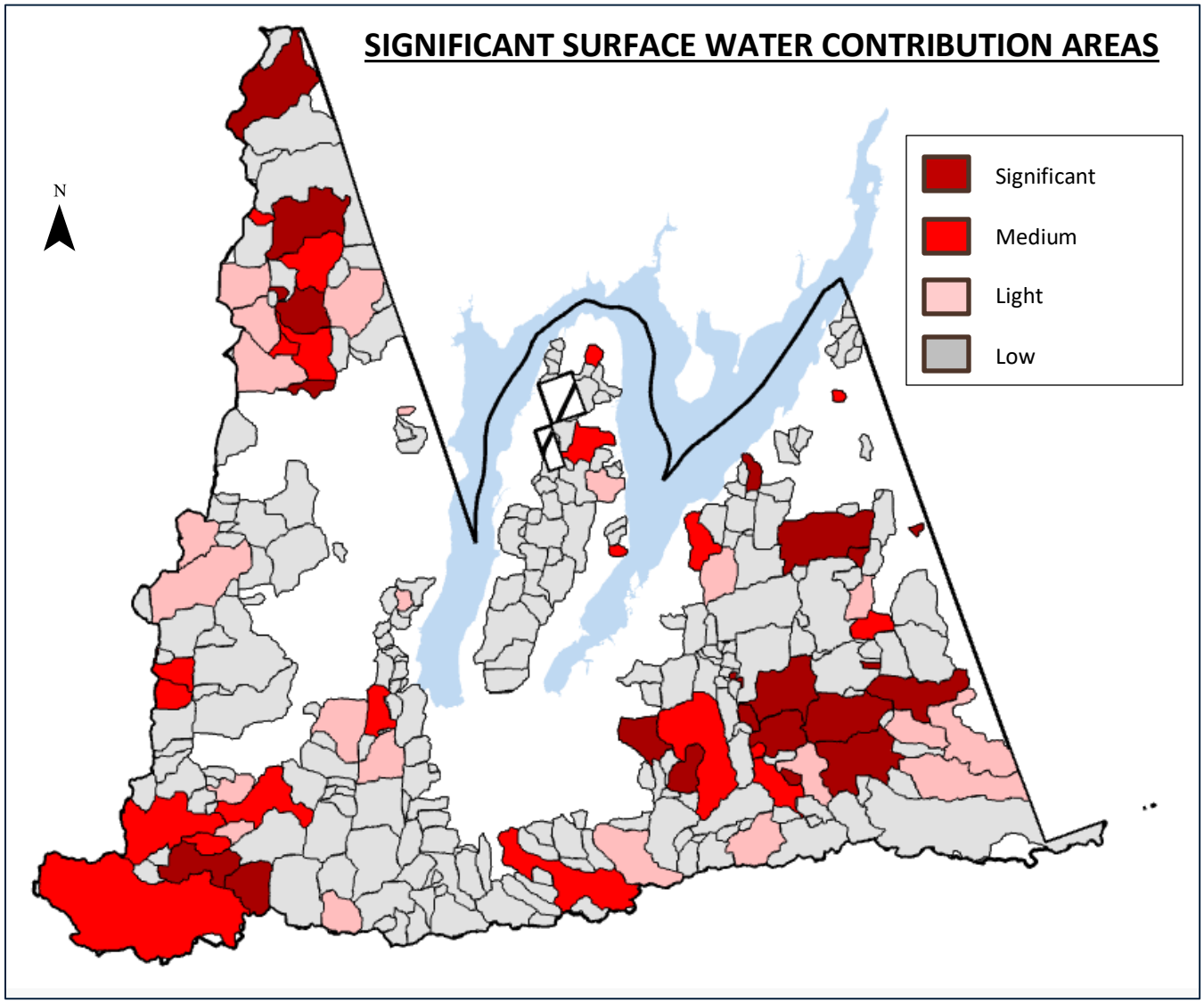

Figure 16: Significant surface water contribution Areas. Dark red catchments are significant; medium red catchments are moderate; light red catchments are low; and grey catchments have no contributions.

Table 12: Size and discharge values for surface water contribution areas.

Contribution Area	Surface Area	Net Discharge Range
High (significant)	39.1 km^2 (7.9%)	Greater than 4.4 l/s/km^2
Moderate	48.4 km^2 (9.8%)	Between 1.4 and 4.4 l/s/km^2
Low	46.9 km^2 (9.5%)	Between 0 and 1.4 l/s/km^2
None	201.1 km^2 (40.5%)	0 l/s/km^2 or less
Unassessed	160.5 km^2 (32%)	N/A
TOTAL	**496 km^2 (100%)**	**-11.1 to 22.7 l/s/km^2**

4.0 Conclusion and Recommendations

This report represents a centralized location that describes information related to defining and mapping Key Hydrologic Features and Key Hydrologic Areas, as guided by various provincial policy directives, for the overlapping jurisdictions of Durham Region and Kawartha Conservation.

Key Hydrologic Features and Areas were delineated using a blend of existing mapping (e.g., provincially available datasets) and new mapping (e.g., field sampling in 2019). This information provides planning staff with base information necessary to advance land use planning approvals and projects within scope of managing for functioning water resource systems.

The following is a list of recommendations to make this information readily available and most applicable:

1. Present these findings to relevant technical and planning staff within local planning authorities (e.g., Durham Region, Scugog Township, Brock Township, Kawartha Conservation).

2. Centralize this information in a digital manner (e.g., using geographic information systems), and make available to all local planning authorities through an easy-to-use mapping tool.

3. Update the delineation of Key Hydrologic Features and Areas on a routine basis, particularly in areas with rapidly changing land use or areas that are scheduled for future development.

4. Undertake the following to fill gaps in current information with respect to Key Hydrologic Features.

   Permanent and Intermittent Streams.
   i. Ground-truth the existence of streams that are currently classified as 'not-verified'.
   ii. Reclassify the flow permanency status of verified streams, using the road-crossing sampling data from 2019, given their apparent discrepancy.
   iii. Consider multiple years worth of flow permanency data in an effort to better characterize conditions as per an 'average year'.

   Lakes and their Littoral Areas
   iv. Develop a consistent definition and methodology for determining the specific location of 'littoral areas'.

   Seepage Areas and Springs
   v. Seek out existing information regarding seepage areas and springs, beyond the Oak Ridges Moraine Conservation Plan area.

   Wetlands
   vi. Update existing wetland mapping using 2019 ground-truthing information.
   vii. Undertake an evaluation of the 'unevaluated' wetlands to determine their significance (e.g., provincially or locally significant, etc.).

5. Undertake the following to fill gaps in current information with respect to Key Hydrologic Areas.

   Significant Groundwater Recharge Areas
   i. Delineate Ecologically Significant Groundwater Recharge Areas by reviewing recent mapping by Durham Region for data gaps and methodology.

ii. Ground-truth the location of coldwater streams and wetlands to help facilitate the accurate delineation of Ecologically Significant Groundwater Recharge Areas.

Significant Surface Water Contribution Areas

iii. Fill data gaps to increase coverage, with a focus on catchments that drain relatively deep unwadeable streams.
iv. Work with local planning authorities (particularly municipalities and conservation authorities) and the province to confirm an approach for identifying Significant Surface Water Contribution Areas.