A Natural Heritage Plan for the Land Conservancy of Kingston, Frontenac Lennox and Addington

Prepared for LC-KFLA

Date: November 2017

North-South Environmental Inc.

35 Crawford Crescent, Suite U5
P.O. Box 518
Campbellville, Ontario
L0P 1B0

This page intentionally left blank

Project Team

North-South Environmental Inc.
Sarah Mainguy: reporting
Richard Czok: mapping review

LC-KFLA
Mapping Committee
Land Conservancy for Kingston, Frontenac, Lennox and Addington
Dr. Kathleen Laird, Chair
Adam Clow, GIS Specialist
Dale Dilamarter
Paul Mackenzie
Vicki Schmolka

Lesley Rudy, project management support

Acknowledgement
The project administrators gratefully acknowledge financial support from the Ontario Trillium Foundation.

Ontario Trillium Foundation
Fondation Trillium de l'Ontario
An agency of the Government of Ontario
Un organisme du gouvernement de l'Ontario

Cover Photo: a stormy wetland (top) and a rapid in the Salmon River (bottom), Natural Heritage Plan area. Photo credits: Mary Alice Snetsinger, Paul Mackenzie

This page intentionally left blank

Executive Summary

This is the Land Conservancy for Kingston, Frontenac, Lennox and Addington (LC-KFLA)'s Natural Heritage Plan (the Plan), setting a strategy for land acquisition and stewardship activities in the County of Frontenac, the County of Lennox and Addington, and the rural part of the City of Kingston.

The Plan presented here provides guidance for identification of core areas and primary corridors throughout the LC-KFLA study area. The focus is on habitats south of Provincial Highway 7, as the Land Conservancy works collaboratively with the Mississippi Madawaska Land Conservancy which is active in the area north of Highway 7. The purpose of the Plan is to guide Land Conservancy habitat protection activities as well as providing information that may be useful to other conservation partners.

The Plan covers an area rich in habitats and species. The study area includes two ecoregions, the Limestone Plain and the Canadian Shield. Four watersheds drain this area. Specialized habitats such as coastal wetlands and forests, alvars, the Frontenac Arch and the contact zone between the Canadian Shield and the Limestone Plain add to the biodiversity. Non-governmental Organizations that have interest in protection and stewardship of the region include the Nature Conservancy of Canada, the Land Between, and stewardship groups associated with Lennox and Addington Counties, Frontenac County, and several watersheds, such as the Friends of the Salmon and Napanee Rivers.

Guidance from Environment Canada and the Ontario Ministry of Natural Resources has been the principal reference informing priorities for habitat protection. Size criteria for identifying core areas was different between the Limestone Plain and the Canadian Shield because of the differences in the amount of habitat: the Canadian Shield is heavily forested, with highly connected wetlands and waterbodies and fewer roads and built-up areas. The Limestone Plain is much more sparsely forested, with habitats more isolated by farmland and roads. Criteria for core areas included provincially significant wetlands in both areas, large wetlands, waterbodies, Lake Trout Lakes, and forests (with the size criterion higher in the Canadian Shield, taking into account the differences in landscape), interior forests and watercourses. Criteria also included protected lands; as well as habitats within 50m-120 m of these features. Other features were identified that may eventually help inform priorities within the region: alvars, priority areas identified by NCC and The Land Between, and coastal habitats. In time, other sources of information may help refine priorities, such as additional identification of significant habitats, areas where density of roads is lowest, and identification of priority areas on a watershed scale.

Criteria were weighted, as when weighting was not applied, mapping did not discriminate sufficiently to distinguish priorities. In the Canadian Shield, the highest weighting was applied to significant wetlands, interior forests, and areas within 100 m of protected lands. On the Limestone Plain, the highest weighting was applied to significant wetlands and protected lands.

The preliminary criteria were presented at a series of meetings to twenty-two area organizations, involving 40 individuals that have an interest in conservation within Kingston, Frontenac, Lennox and Addington. The consultation resulted in some large-scale changes: for example, it led to the increase in weighting of Lake Trout Lakes, mapping of headwater areas and mapping of interior forest criteria and changes to their weighting. Many of the organizations were interested in sharing data and potentially identifying ways to partner in stewardship.

The resulting cumulative scores were divided into three categories based on the standard deviation around the raster score: Low, Medium, and High. The final mapping indicated that priority areas in the Canadian Shield were concentrated in headwater areas: highlighting connections between Frontenac Provincial Park and Cataraqui Region Conservation lands. On the Limestone Plain, high priorities were indicated around provincially significant wetlands; identifying a broad area in a band approximately 2-3 km south of the Canadian Shield boundary. On the Canadian Shield, without headwater areas, a band along the eastern part of the Canadian Shield boundary was highlighted. Additional studies that may inform priorities in the future were sponsored by KFLA, including a study on using remote sensing techniques to identify additional features, and a study that looked at land cover change in the past and future as a result of climate change.

Ultimately, prioritization for acquisition will be on three levels: areas indicated by the Plan, areas that best meet the objectives of LC-KFLA and its partners, and areas that are at high risk. Areas of exclusion were identified near built up areas, major roads and quarries that may be of lower priority for acquisition.

Table of Contents

List of Tables

List of Figures

List of Appendices

This page intentionally left blank

1.0 Introduction

This is the Land Conservancy for Kingston, Frontenac, Lennox and Addington (LC-KFLA)'s Natural Heritage Plan (the Plan), setting a strategy for land acquisition and stewardship activities in the County of Frontenac, the County of Lennox and Addington, and the rural part of the City of Kingston. The Plan presented here provides guidance for identification of core areas and primary corridors throughout the LC-KFLA study area. The focus is on habitats south of Provincial Highway 7, as the Land Conservancy works collaboratively with the Mississippi Madawaska Land Conservancy which is active in the area north of Highway 7. However, the boundaries of the Plan are influenced by watershed boundaries of the Cataraqui, Quinte, Rideau Valley and Mississippi Valley Conservation Authorities.

The purpose of the Plan is to guide Land Conservancy habitat protection activities as well as providing information that may be useful to other conservation partners – municipalities, conservation authorities, conservation organizations, lake associations, and other groups and individuals concerned with ecosystem health in this part of southeastern Ontario.

The Plan covers an area rich in biodiversity. The UNESCO designated Frontenac Arch Biosphere runs through the counties and some of the area incorporates "The Land Between", land where the habitats of the Canadian Shield blend with the habitats of the Limestone Plain. The Nature Conservancy of Canada has a priority protection plan for the southeastern portion of Frontenac County, with the Algonquin to Adirondack (A2A) Collaborative working on conservation projects through the A2A corridor. The Nature Conservancy of Canada is also working to identify, protect, and monitor globally, nationally and provincially rare alvar and savannah communities in the Limestone Plain. The NCC is continually adding to this network of conserved lands. Both Frontenac County and Lennox and Addington County have active stewardship groups.

The Plan identifies key habitat attributes from available source data and from natural heritage plans that cover the Land Conservancy region of focus (LC-KFLA 2015, pers. comm.). It is guided by the Province of Ontario's Natural Heritage Reference Manual (MNRF 2010) and Environment Canada's "How Much Habitat is Enough?" (Environment Canada 2013). The Plan was developed in consultation with conservation partners in the region, to get feedback on the selected priorities and to strengthen connections with other organizations with an interest in stewardship and protection of natural heritage.

After compiling and analyzing the available data and maps and considering the areas covered by other organizations' acquisition strategies, the Land Conservancy has identified several areas as critical for conservation activity to conserve vital habitat.

This document describes the process and the analysis that led to this conclusion. The Plan should be regarded as a living document, as it is intended to be fluid within the context of the availability of additional information, analyses and interests of future partnerships.

1.1 Land Conservancy for Kingston, Frontenac, Lennox and Addington

The mission of the LC-KFLA is "to preserve natural sites and landscapes" in the Ontario counties of Frontenac and Lennox and Addington, providing vital habitat for the diverse plant and animal species here. The LC-KFLA's region is based on county boundaries; whereas in the Natural Heritage Plan watersheds are the basis for analysis, with the focus area primarily south of Highway 7.

The LC-KFLA is an all-volunteer, not-for-profit charity established in 2004. It currently protects eight properties, six owned and two through conservation easement agreements, conserving a total area of 220 hectares (540 acres) and providing habitats for 19 species at risk. To preserve these habitats, most Land Conservancy properties are not open to the public. They are nature reserves for the purpose of conservation. The Land Conservancy has one public access property, the Depot Creek Nature Reserve, near Bellrock.

To cover the ongoing costs of property ownership and conservation easement management, the LC-KFLA invests in its Natural Areas Protection Fund, a fund endowed with the Community Foundation for Kingston & Area. The Fund and a stewardship account generate annual income to cover property taxes, property insurance, and other expenses related to property responsibilities.

2.0 Approach

The purpose of a Natural Heritage Plan, and LC-KFLA's goal, is to identify priority areas for conservation and potential land acquisition or partnership with other groups. Part of LC's approach is 1) to identify valuable habitat for conservation and 2) to focus on areas where other groups are not 'on the ground as much' - thus filling in gaps.

The Plan identifies core areas, both those with provincially significant natural heritage features (see below) and those with other features that provide important functions in the landscape though they do not carry a provincial significance designation.

> *Natural heritage features and areas: means features and areas, including significant wetlands, significant coastal wetlands, fish habitat, significant woodlands south and east of the Canadian Shield, significant valleylands south and east of the Canadian Shield, significant habitat of endangered species and threatened species, significant wildlife habitat, and 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.* (Provincial Policy Statement 2014)

The Plan also identifies connections (also called corridors or linkages) between core areas so that the core areas' functions are not eroded through isolation. However, connections are identified according to existing features (i.e. rather than, for example, identifying areas of intervening farmed landscape that could be modified to restore connections between features): as this is more in keeping with the LC-KFLA's approach to conservation. The Plan has followed the Provincial Policy Statement and supporting materials that guide which features are considered significant, but goes beyond this to protect features that are worthy of protection in a regional context.

The Plan focuses on identifying additional areas that are most likely to support high biodiversity, for instance, areas adjacent to watercourses and wetlands, or lands that provide critical habitat for some species, such as large interior woodlands.

Two types of criteria serve the purpose of this Plan:

- Those that specify features that should be included in the NHP so that it would be a functioning natural heritage system in the face of landscape change; and
- Those that add weight to individual patches of land to indicate which patches should be prioritized for acquisition or stewardship.

The application of the criteria to a Geographic Information System analysis has provided the foundation that led to the conclusions in this Plan. The criteria and weighting used in the Plan were developed as a preliminary draft (see Appendix 1) and then refined through consultation, which is described in Section 7.

3.0 Study Area Context

The study area boundary shows the LC-KFLA focus area for the NHP (Figure 1). The study area south of Highway 7 is based primarily on the boundaries of Kingston, Frontenac, Lennox and Addington, but excludes the area where Mississippi Madawaska Land Trust (MMLT) is active. North of Highway 7 the study area includes the Salmon River watershed (which is excluded by the MMLT). Figure 1 provides an aerial photograph that shows the broad differences between the northern and southern parts of the study area. The northern part of the study area lies within the Canadian Shield, an area of granite bedrock. The southern part lies within the Limestone Plain, where the bedrock is composed of limestone. The differences between northern and southern regions also relate to climate and vegetation. The way vegetation responds to interacting substrate type, climate and terrain has been classified in Ontario through its delineations of different Ecoregions (subdivided into finer classifications of Ecodistricts). Ontario is divided into eight Ecoregions (Crins et al. 2009). Figure 2 shows Ecoregions 5 and 6 straddle the study area (with sub-divided boundaries representing finer Ecodistricts within each Ecoregion).

Differences between the northern and southern parts of the study area are reflected in differences in climate and vegetation as well as bedrock. In Ecoregion 6E, the climate is mild and moist. The mean annual temperature range is 4.9 to 7.8°C, the mean length of the

growing season is 205 to 230 days, the mean annual precipitation is 759 to 1,087 mm, and the mean summer rainfall is 198 to 281 mm (Crins et al. 2009). The vegetation is relatively diverse. Hardwood forests dominated by sugar maple, American beech, white ash, eastern hemlock, and numerous other species are found where substrates are well developed on upland sites. Lowlands, including rich floodplain forests, contain green ash, silver maple, red maple, eastern white cedar, yellow birch, balsam fir, and black ash. Peatlands (some quite large) occur along the northern edge and in the eastern portion of the ecoregion, and these contain fens, and rarely bogs, with black spruce and tamarack. Some of the best examples of North American alvar vegetation (a globally, nationally and provincially rare community) are located in this ecoregion (Crins et al. 2009).

Contrasting with this is the climate and vegetation within Ecoregion 5E (as summarized from Crins et al. 2009). The climate is cool-temperate and humid. The mean annual temperature range is 2.8 to 6.2˚C, and the mean length of the growing season is between 183 to 219 days. Mean annual precipitation ranges between 771 and 1,134 mm, and the mean summer rainfall is between 204 and 304 mm. Vegetation is characterized by a mixture of elements from both the south and the north, but Great Lakes–St. Lawrence forest species such as eastern white pine, red pine, eastern hemlock, and yellow birch are frequent throughout. On sites with intermediate or somewhat-dry soils, sugar maple is a dominant species, with other hardwoods such as American beech, wild black cherry, American basswood, and white ash. Boreal species such as black spruce, white spruce, balsam fir, jack pine, and tamarack are more localized and grow on moist or cooler-than-normal sites. Balsam fir often is found in the understories, or as a lesser component in the canopies, of many forest stands (Crins et al. 2009).

There is one important exception to the “north versus south” division in bedrock and vegetation. The Frontenac Axis is an area of special interest in Ecodistrict 6E-10 (Westport) as shown in Figure 2. The Frontenac Axis is the only area in Ecoregion 6E where the granitic bedrock of the Canadian Shield extends into southern Ontario (it is mapped as part of the Canadian Shield in Figure 1). It is mapped by MNRF as part of Ecoregion 6E (which is generally dominated by limestone bedrock) because it is within the climatic zone of the southern ecoregion, and local pockets of moderate to low lime loam, silt and clay are interspersed with areas of shallow soil over the bedrock.

Table 1 provides statistics on the differences between land cover in the Canadian Shield and on the Limestone Plain within the Plan area. Farming was difficult on the Canadian Shield because of the close proximity of bedrock to the surface, and the cooler climate, so less of the land was developed for agriculture. Farming was more prevalent on the Limestone Plain, and the warmer climate meant that more of this area could be developed for agriculture, so less of the original forest vegetation remains than in the north. The statistics show that more than 60% of the north is wooded (including woodlands and wooded wetlands), whereas woodlands occupy a much lower percentage in the south. Wetlands occupy about the same proportion of the landscape on the Canadian Shield as they do in the Limestone Plain, but they are generally more isolated within the landscape. Built up areas make up nearly 4% of the land base in the Limestone Plains, and less than

half a percent in the north. The Canadian Shield is generally a well-connected landscape which offers few barriers to animal and plant dispersal, with large woodlands and wetlands, while in the south, the landscape is less connected, and animals and plants would be able to disperse less readily. With the exception of the City of Kingston, much of the landscape matrix in between patches of habitat in the southern part of the study area consists of "working landscapes": cropland, pasture and abandoned farmland that are altered by human activity but may allow dispersal to some extent. However, these working landscapes are interrupted by extensive road networks in the south, and to a lesser extent in the north, which create hazardous conditions for animals that need to disperse to complete their life cycles.

Table 1. Proportion of woodland, wetland, and human activities: Canadian Shield and Limestone Plain within the LC-KFLA Plan area

	Canadian Shield (Total Area 225,451)		Limestone Plain (Total Area 205,442)	
	Area	**Percent**	**Area**	**Percent**
Wetlands and Water Bodies	42,777	19%	39,630	20%
Woodlands	146,468	65%	64,004	31%
Pits and Quarries	1,623	0.7%	2,200	1.0%
Built-up Areas	417	0.2%	7,829	3.8%
Roadways (length)	1,494	0.6 km per ha	2,867	1.4 km per ha

This page intentionally left blank

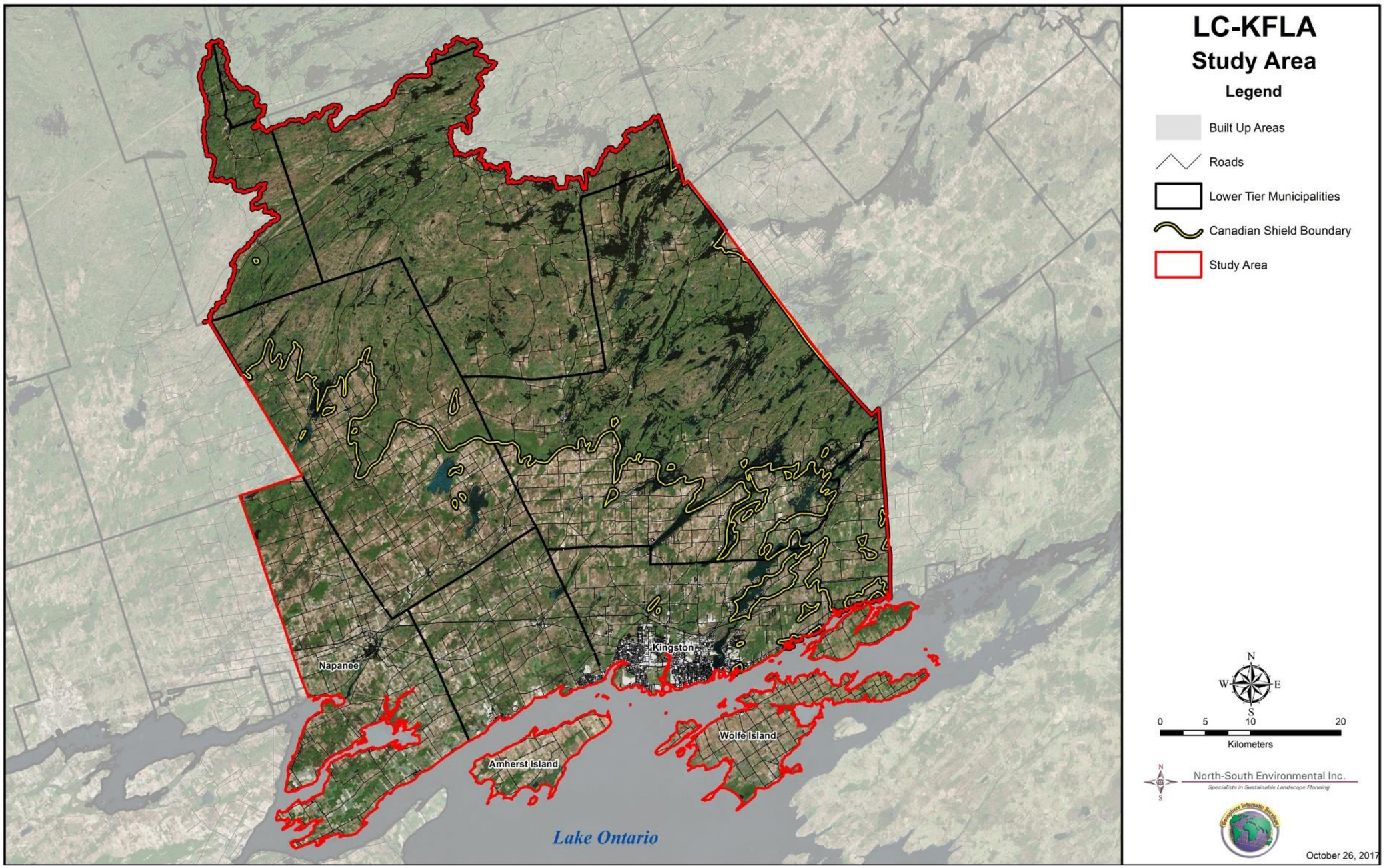

Figure 1. Aerial photograph of the LC-KFLA Study Area

This page intentionally left blank

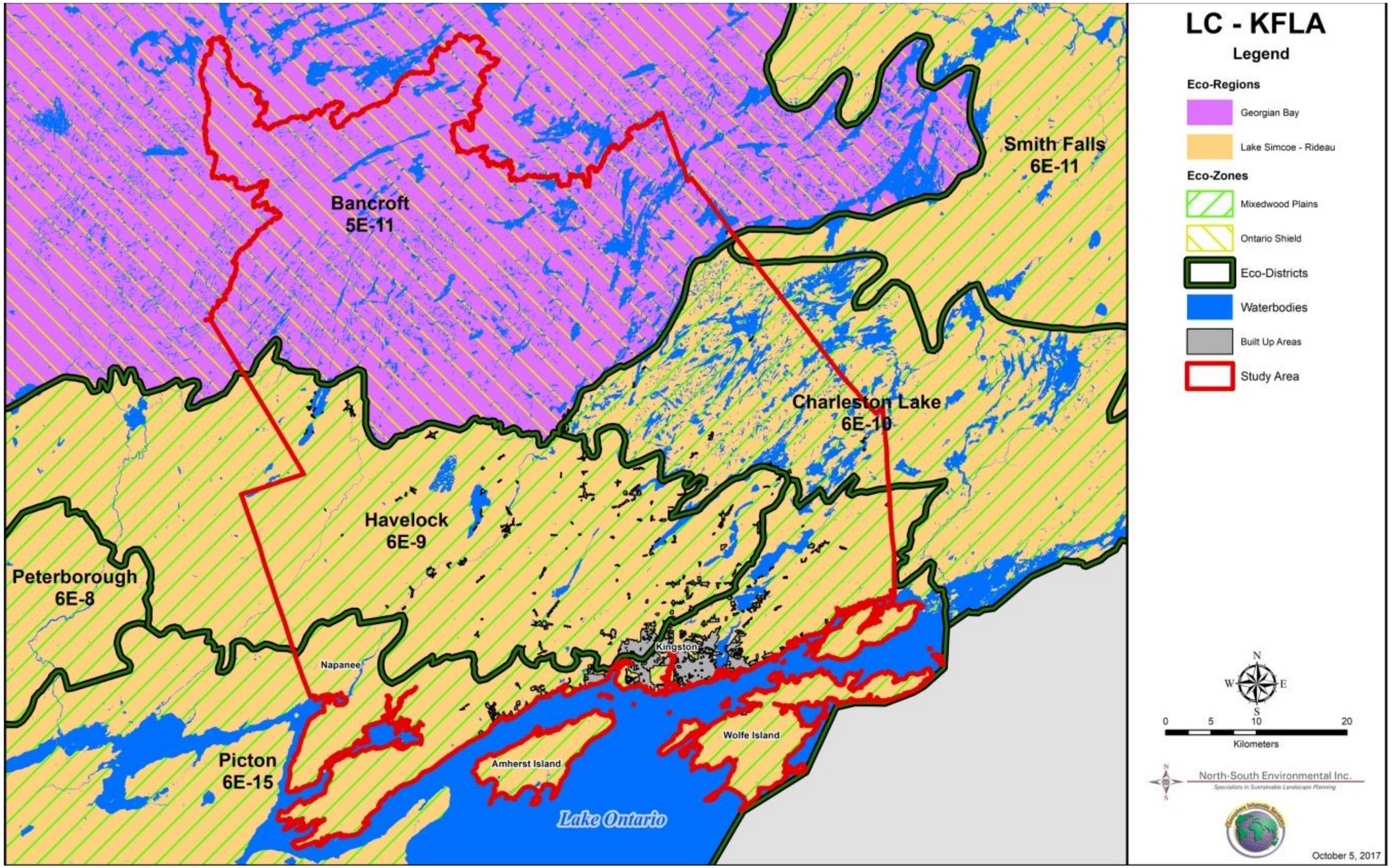

Figure 2. Ecoregions and Ecodistricts mapped by MNRF within the Study Area. Note that Ecodistrict 6E-10 (Charleston Lake) is the Frontenac Axis: an area where granitic bedrock extends to Lake Ontario.

This page intentionally left blank

4.0 Natural Heritage Plan Criteria

Criteria for mapping in the second draft of the Plan, and a summary of the changes from the preliminary criteria as a result of consultation (described in Section 7), are shown in Table 2.

Table 2. List of Criteria used in the Plan: Bold type indicates change due to consultation

Criterion	Buffer
Canadian Shield	
Significant Wetland	50m **increase to 120m**
Wetland >30ha	50m
Wooded Area 60 ha	None
Interior forest - top 20% in size	None
ANSI **+ Candidate ANSIs**	100m **increase to 120m**
Headwater Lake Areas - top 20% in elevation	50m **increase to 1km**
Lake Trout Lakes	50m
Protected Lands	100m
Watercourse	50m
Waterbody	50m
Limestone Plain	
Significant Wetland	50m **increase to 120m**
Wetland > 30 ha	50m
Wooded Area – top 20% in Size	None
ANSI **+ Candidate ANSIs**	100m **increase to 120m**
Headwater Lake Areas – top 20% in elevation	50m **increase to 1 km**
Lake Trout Lakes	50m
Protected Lands	100m
Watercourse	50m
Waterbody	50m

The most important database available for completion of the Plan was Land Information Ontario (LIO), a spatial database that incorporates the information on topographic mapping. Information on woodlands, wetlands and watercourses was initially based on interpretation of aerial imagery, as in development of topographic maps, by cartographers but many layers have been refined. It is based primarily on aerial photographs and different layers are updated at different times, with some more frequently updated than

others. It includes (dates in brackets are dates when information was updated in mapping within the Plan area, if available):

- roads, railways and trails (2001-2013)
- urban areas (2007)
- lakes, rivers, streams and wetlands (1998-2016)
- wooded areas (2003-2014)
- active and inactive quarries (2006-2014; with active quarries being updated more recently than inactive quarries)
- elevations
- official names and boundaries
- management and classification information

Some information is refined through further investigation, which may include ground-truthing, such as boundaries of evaluated wetlands, including Provincially Significant Wetlands (PSWs), and some wetlands that have been evaluated and found to be non-provincially significant. Provincially Significant Wetlands are updated relatively frequently. However, LIO mapping can have inaccuracies at the higher resolution, small spatial scale.

Mapping criteria focused on inclusion of core features (woodlands and wetlands of appropriate size and shape, previously identified significant wetlands and other significant areas) and linkages (generally associated with watercourses). As discussed in Appendix 1, the mapping criteria were different for the Canadian Shield and Limestone Plain, to respond to the differences in landscape context associated with the differences in landscape cover.

4.1 Core Areas

4.1.1 Wetlands

> *Wetlands are habitats forming the interface between aquatic and terrestrial systems. The ecological, social and economic benefits that can be ascribed to wetlands are substantial. They are among the most productive and biologically diverse habitats on the planet* (Natural Heritage Reference Manual 2010).

A high priority has been set on identifying and mapping significant wetlands and other water-based features for this Plan. Throughout the Plan area, wetlands are some of the most important features in the landscape, as among other ecosystem services they tend to support a disproportionately high biodiversity (for their size) of flora and fauna, are important for connectivity, and have a large number of ecological functions. As can be seen in the illustration below, wetlands are often composed of a large number of diverse communities in a small area, because different plant species thrive in different water depths, microclimatic conditions, sediments, and flows.

Figure 3. Google Earth image example of a wetland in Frontenac County, showing multiple vegetation communities that foster diversity, and forested neighbouring upland habitat that provides adjunct habitat for wetland-dependent wildlife

Land Information Ontario provides a publicly available source of wetland mapping. Finer mapping of wetlands, and an assessment of wetlands' significance, is provided by the province in the study area using the Ontario Wetland Evaluation System (OWES) for Southern Region. The evaluation is based on their biology (which includes size and diversity), hydrology, social value, and special features. For wetlands that have been evaluated, these attributes have been determined through detailed aerial photo interpretation and field surveys. However, many wetlands have not been evaluated by the Ontario Ministry of Natural Resources and Forestry, especially those in regions where there is little development; generally regions where wetland and forest cover are very high.

Some of these attributes (such as hydrology, size, and diversity) can be determined through GIS analysis, which in OWES methods is accompanied by aerial photo interpretation. In addition, some ecological functions can be inferred through GIS. The mapping approach used by LC-KFLA incorporates all GIS information on wetlands: it includes provincial mapping of PSWs and evaluated wetlands, as well as mapping in LIO. In general, large wetlands, which can be determined through GIS analysis, are likely to have more ecological functions than small wetlands: they will support more diversity of vegetation communities and therefore more species.

The wetlands mapped for this project are shown in Figures 4 and 5.

The main limitations of mapping wetlands in this study area were:

- Wetland boundaries are not always evident in aerial photography, particularly in forested wetlands that can resemble forests very closely. Where wetlands have been evaluated with ground-truthing, the boundaries are more accurate.
- There are four types of wetlands: open wetlands include marsh, bog and fen and closed wetlands are classified as swamp, whether dominated by shrubs or trees. Habitats are different within each wetland type. The wetland type can be important for determining which species are found in the wetland; especially Species at Risk

which are highly specific in their habitat needs. For example, Least Bittern, considered Threatened in Ontario, occurs only in certain marshes dominated by cattail and other robust emergent plants. Wetland type can be difficult to determine from aerial photography; for example marsh can be difficult to separate from bog, and fen. Interspersion (the amount of vegetation in relation to water) is extremely important to its function to support breeding waterfowl, but the finer points of interspersion may not be reflected in mapping. Many open wetlands have several communities visible in aerial photography. These details may not be reflected in Land Information Ontario mapping though they should be picked up in wetland evaluations.

- Provincially Significant Wetlands are occasionally evaluated through aerial photo interpretation, with less intensive (or no) ground-truthing. Nonetheless, the wetlands evaluated through OWES likely have had a higher level of scrutiny than many unevaluated wetlands. In addition, conservation authorities may undertake wetland evaluations and aerial interpretation to map wetlands more accurately.

Approach to Mapping and Modifications Through Consultation

Provincially Significant Wetlands are mapped as core areas. Core areas also include other wetlands 30 ha and larger, as significance of many wetlands has not yet been evaluated and, as noted above, larger wetlands are an important measure of high function. This was based on the recommendation of Environment Canada's How Much Habitat is Enough? (2013) that wetlands over 30 ha be protected. The approach to mapping wetlands was not modified through consultation.

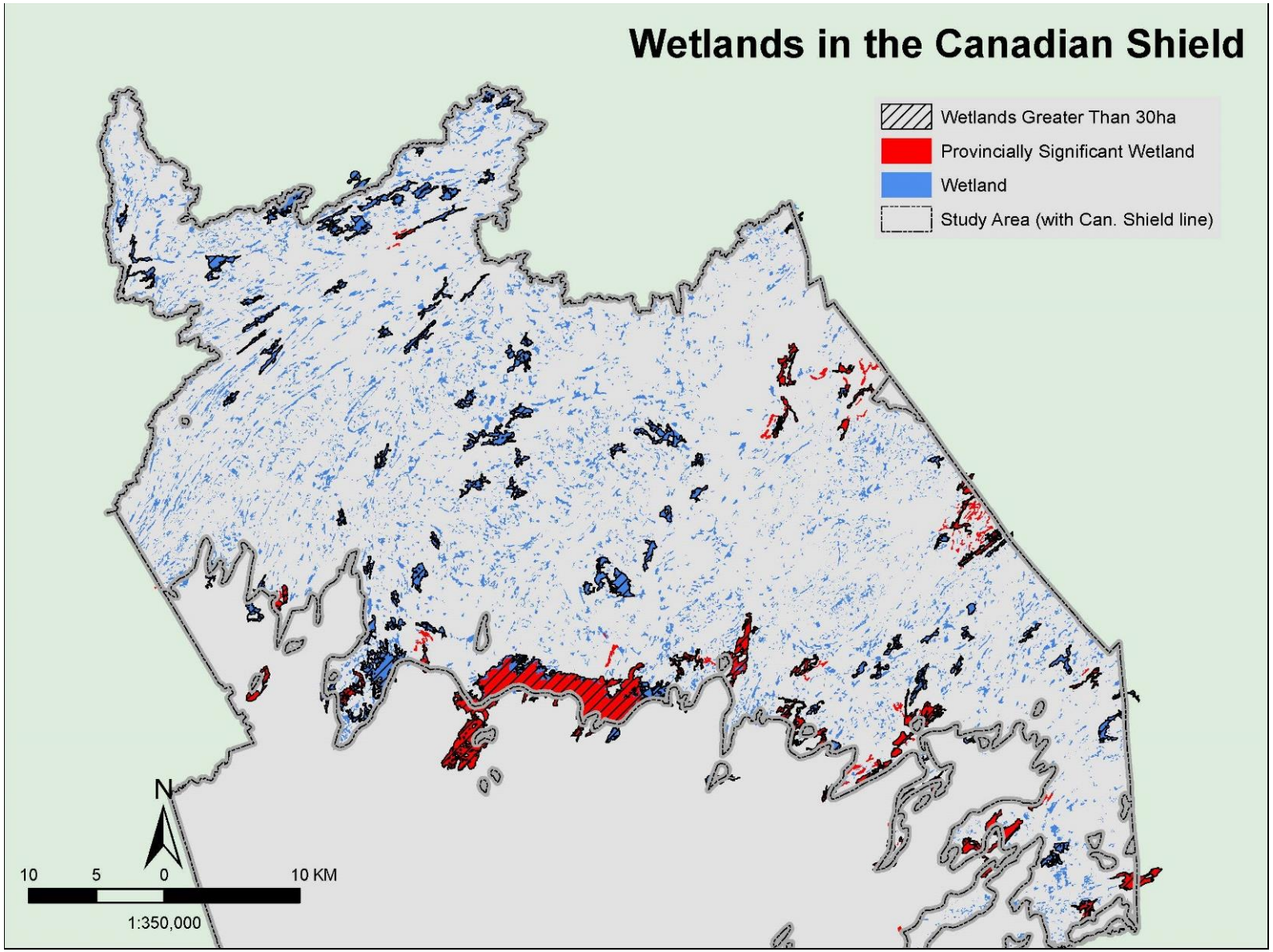

Figure 4. PSWs and Wetlands 30 ha or greater on the Canadian Shield

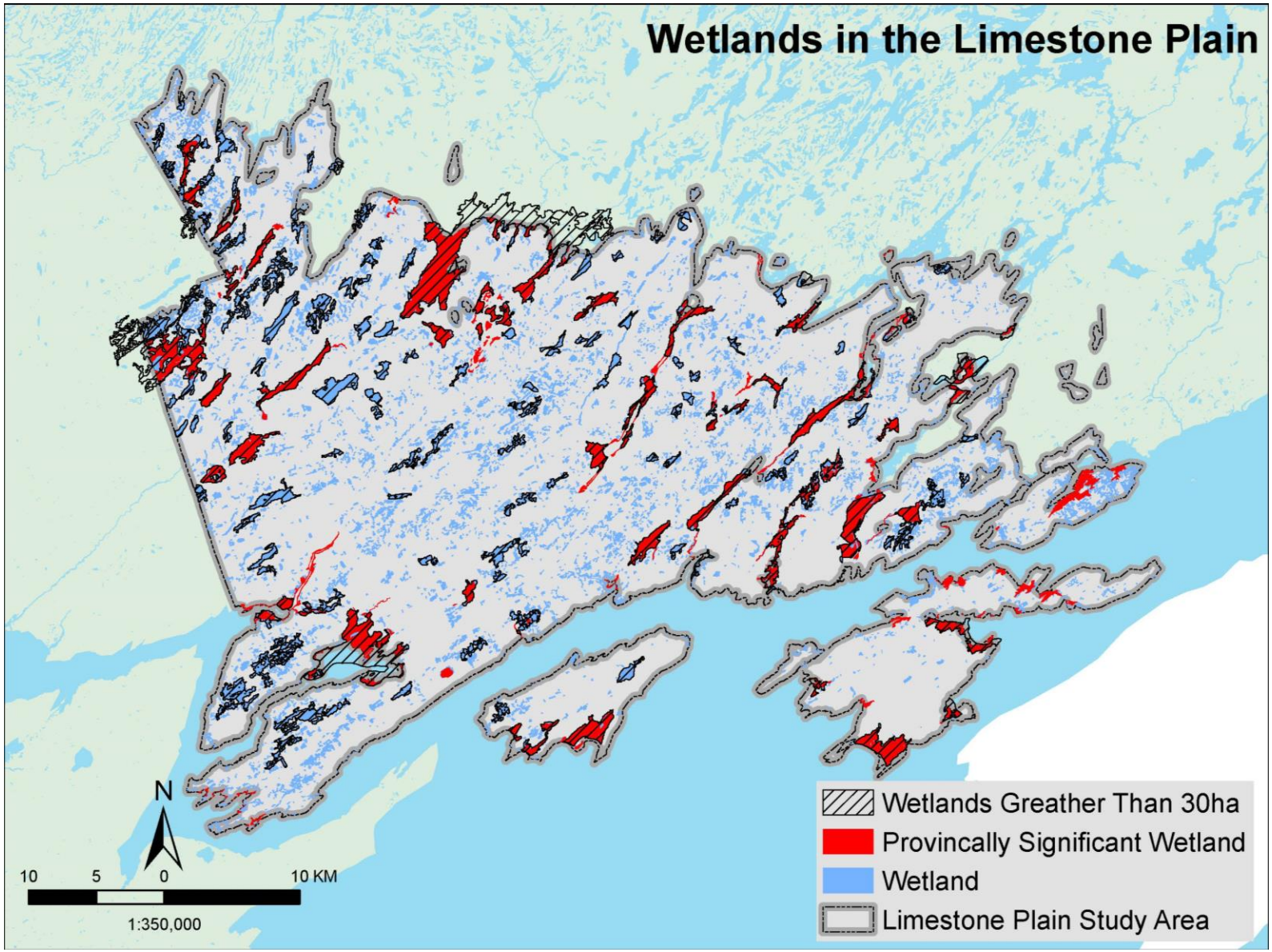

Figure 5. Wetlands over 30 ha and PSWs on the Limestone Plain

4.1.2 Adjacent Lands to Wetlands

The Plan maps the 120 m of upland habitat adjacent to wetlands because it has particular significance to the wetlands that form core features within the Plan. Adjacent lands have been defined in the Provincial Policy Statement as the lands within 120 m of a Provincially Significant Wetland boundary. This is because many wetland-dependent species use neighbouring uplands as adjunct habitat where they find, for example, nest sites, foraging areas, song perches and overwintering habitat. The functional area adjacent to a wetland is called the Critical Function Zone.

> *Adjacent lands are defined in the PPS as "those lands contiguous to a specific natural heritage feature or area where it is likely that development or site alteration would have a negative impact on the feature or area."* PPS, 2014

Though many species use habitat more than 120 m from the edge of a wetland (for example turtles in search of nesting areas), 120 m captures the upland habitat most often used by wetland-dependent species. It also captures the area within which a wetland tends to fluctuate depending on yearly fluctuations in moisture. In addition, 120 m is the area adjacent to a wetland where there is the highest probability of impacts from surrounding development: such as impacts from contaminants, surface runoff, noise, light and excess heat and drying winds created by pavements and other hard surfaces.

Figure 6. Google Earth example of an open wetland in Lennox and Addington County where forested adjacent uplands provide habitat for foraging and overwintering frogs that breed in the wetland

The PPS policies only partially protect adjacent lands. Development can (and frequently does) occur within lands 120 m from wetlands if the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or on their ecological functions. But many of the functions of adjacent lands are hard to measure, and studies may overlook their importance. Environment Canada (2013) notes that the most important upland area adjacent to a wetland in terms of the critical function zone is within 50 m. In practice, as land uses change from rural to urban, buffers put in place to protect Provincially Significant wetlands from development extend approximately 30 m (or less) from the wetland boundary, often largely based on the zone within which water quality impacts are attenuated, and on protection of wetland tree rooting zones. Buffers from non-provincially significant wetlands are frequently less than 30 m.

Approach to Mapping and Modifications Through Consultation

The Plan includes the entire adjacent land boundary (120 m) in its core areas. The Plan thus prioritizes acquisition of properties with a high level of function adjacent to wetlands. Acquisition of land within 120 m allows protection of a large portion of land within the Critical Function Zone, and focuses on the area where the wetland is most likely to be affected by development should the land use change. This approach was modified as a result of communications received during consultation from the previous figure of 50 m.

4.1.3 Woodlands

Woodland habitats are particularly important environments as they provide habitat for a high diversity of animal and plant life, as well as being some of the most important areas for carbon storage and other ecosystem services. Environment Canada (2013) and the Ontario Ministry of Natural Resources and Forestry (2010) evaluate the importance of woodlands based on size, condition, shape (blocky or round shapes are more functional than narrow linear shapes), diversity of communities and species, and special features. Special features can include locally, regionally, and provincially rare species, as well as so-called conservative species that are dependent on a few, specialized habitats. Woodland size and shape, which are discernable through GIS analysis, correlate with many attributes of significance: diversity of microclimates created by topographic and soil variations, which foster a high diversity of vegetation communities and species, including conservative species. Thus the Plan uses criteria for including woodlands related to attributes that could be measured by GIS: particularly their size and configuration.

Figure 7. Google Earth example of a large, contiguous woodland and wooded wetland complex in Lennox and Addington County that would include large areas of forest interior habitat, contrasting with smaller fragmented woodlands to the east and southeast

On the Canadian Shield, the woodland cover is so high (65 % of the Plan area on the Canadian Shield) that woodlands over 60 ha are included but given a moderate weighting (see Section 6 for a discussion of weighting). On the Limestone Plain, the Plan gives woodlands that are the top 20% in size of the remaining woodlands the highest weighting On the Limestone Plain, the size of these woodlands range from ~5 to 690 ha, with just 16% of these over 60 ha in size. The mean size of woodland in the top 20% is ~ 40 ha, but the median size is only ~15 ha.

GIS analysis assessed the optimal shape of woodlands by measuring so-called "forest interior": the sheltered area within the depths of a forest that is protected by the forest edge. Forest-interior is often moist and sheltered, and

supports higher numbers of invertebrates that provide prey for a variety of wildlife. The Ontario Ministry of Natural Resources and Forestry (MNRF 2015a) notes that forests with areas 200 m from the forest edge are candidate significant wildlife habitat, and this provided the focus for the mapping (Figure 7).

One of the most recent findings in research related to landscape ecology is that the number and type of species that inhabit woodlands is influenced as much by their surroundings as by their size and shape. In largely wooded areas like the Canadian Shield, woodland size and shape are less important. Woodland size and shape are highly significant in the Limestone Plain where forest cover is less than approximately 60%. In areas where forest cover is greater than 60%, the size and shape of individual woodland patches is less important. Percentage of forest on the Canadian Shield within the Plan area is slightly more than 60% (65%) so only woodlands larger than 60 ha, which were adjacent to a waterbody or watercourse, were included to give additional weight as a criterion in order to identify core areas to include in the NHP.

Approach to Mapping and Modifications Through Consultation

Figures 8 and 9 provide an illustration of woodlands included in the mapping. These include:

- Woodlands on the Canadian Shield that are greater than 60 ha in size, and within 60 m of a waterbody or watercourse
- Woodlands with the top 20% of forest interior (200 m from the forest edge) in the Canadian Shield
- The top 20% in size of woodlands in the Limestone Plain

Forest interior areas were included as a result of comments received during consultation.

This page intentionally left blank

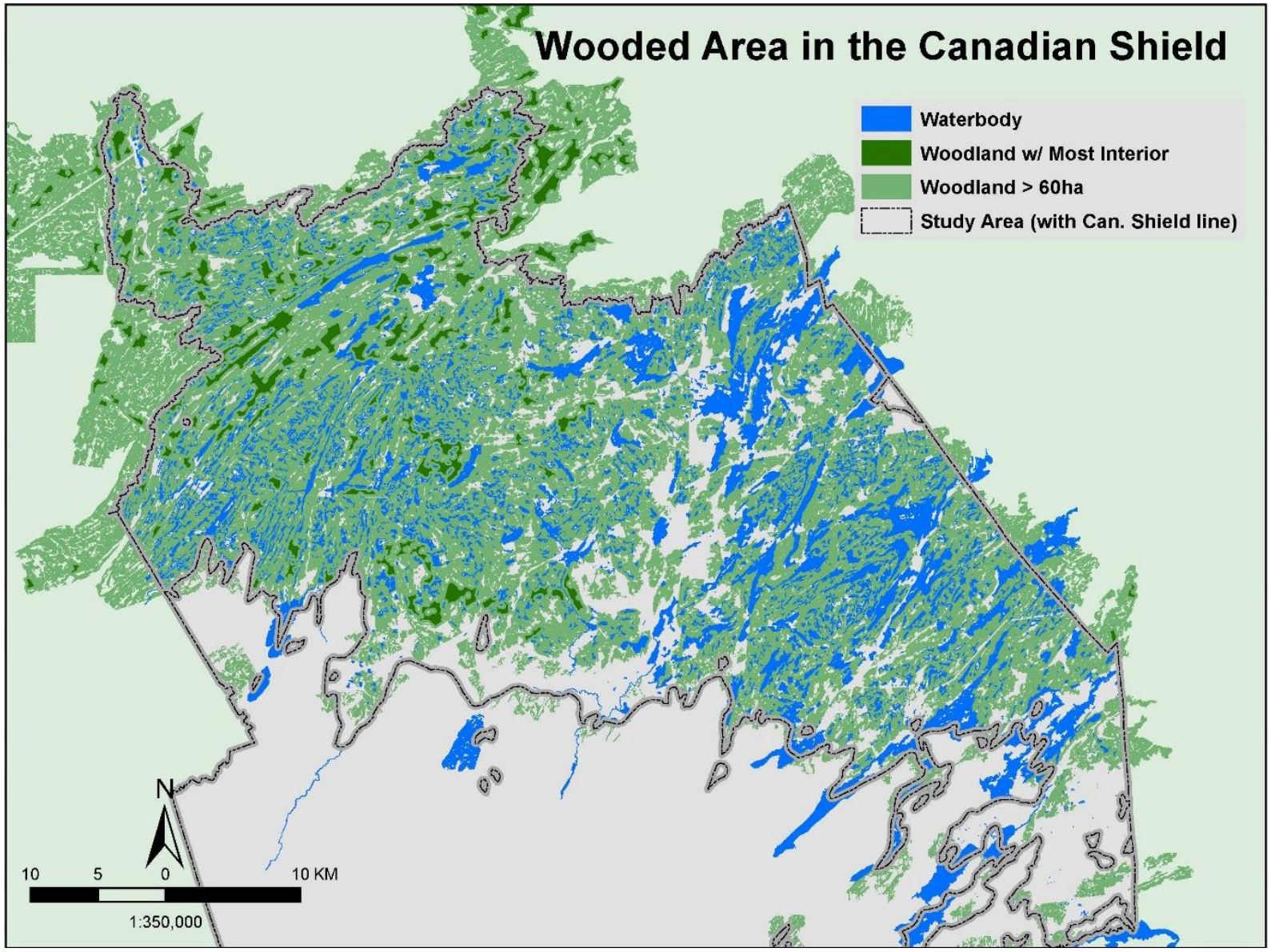

Figure 8. Forests over 60 ha, forest interior areas, and water bodies on the Canadian Shield

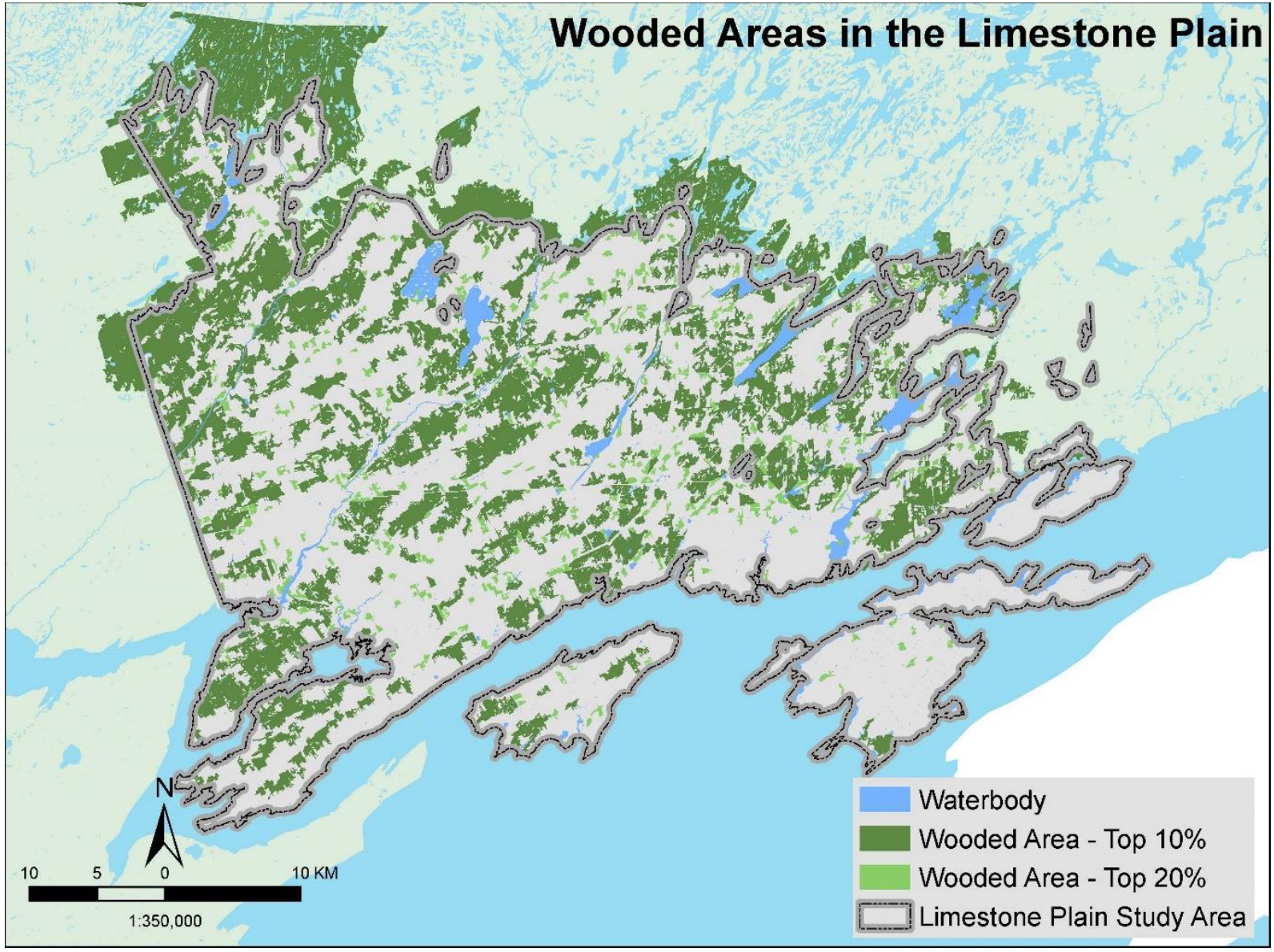

Figure 9. Forests in the top 10% and 20% in size, showing adjacent waterbodies, on the Limestone Plain

4.1.4 Life Science and Earth Science Areas of Natural and Scientific Interest (ANSIs)

> *Areas of natural and scientific interest (ANSI): means areas of land and water containing natural landscapes or features that have been identified as having life science or earth science values related to protection, scientific study or education.* (PPS, 2015)

The Ontario Ministry of Natural Resources and Forestry selects Life Science ANSIs to represent "the best" of each representative landform / vegetation units within each Ecodistrict in Ontario (Ecodistricts in Ontario are illustrated in Figure 2: the study area contains portions of Ecodistricts 6E-8, 9, 11, 15, and 18, and 5E-11). They select these areas through a gap analysis for each Ecodistrict that indicates, through satellite imagery, the landform/vegetation units within the Ecodistrict, and whether there are landform/vegetation units that do not occur in protected areas and are therefore considered under-represented. The best areas of representation are then selected through more detailed investigations on the basis of size, condition, diversity, ecological functions and special features. These ANSIs are shown in Figure 10.

The Natural Heritage Plan identifies ANSIs as core features. ANSIs are protected to a large extent by the Provincial Policy Statement, which does not permit development in a significant ANSI unless it has been demonstrated that there will be no negative impacts on the feature or its ecological functions, but some portions of ANSIs can be developed under this criterion. The importance of land adjacent to ANSIs is also considered in the Natural Heritage Plan. For example development is not permitted on adjacent lands (defined by the Natural Heritage Reference Manual (2010) as lands within 120 m of an ANSI boundary) unless the ecological function has been evaluated and it is demonstrated that there will be no negative impacts on the feature or its ecological functions.

<u>Approach to Mapping and Modifications Through Consultation</u>

- The Plan includes all provincially significant Life Science and Earth Science ANSIs as core areas.
- The Plan also includes Candidate provincially significant Life Science and Earth Science features as the ANSI program has received a lower priority in recent years.
- The Plan includes a 50 m buffer adjacent to Earth Science and Life Science ANSIs. The Natural Heritage Reference Manual (2010) stipulates that a 120 m Adjacent Lands boundary should be investigated adjacent to Life Science ANSIs if development is proposed as this is the area within which development is most likely to affect the feature; a 50 m buffer will be most likely to include any features that are present within the ANSI. The NHRM advises that a 50 m Adjacent Lands boundary should be investigated adjacent to Earth Science ANSIs should development be proposed within this area.

This page intentionally left blank

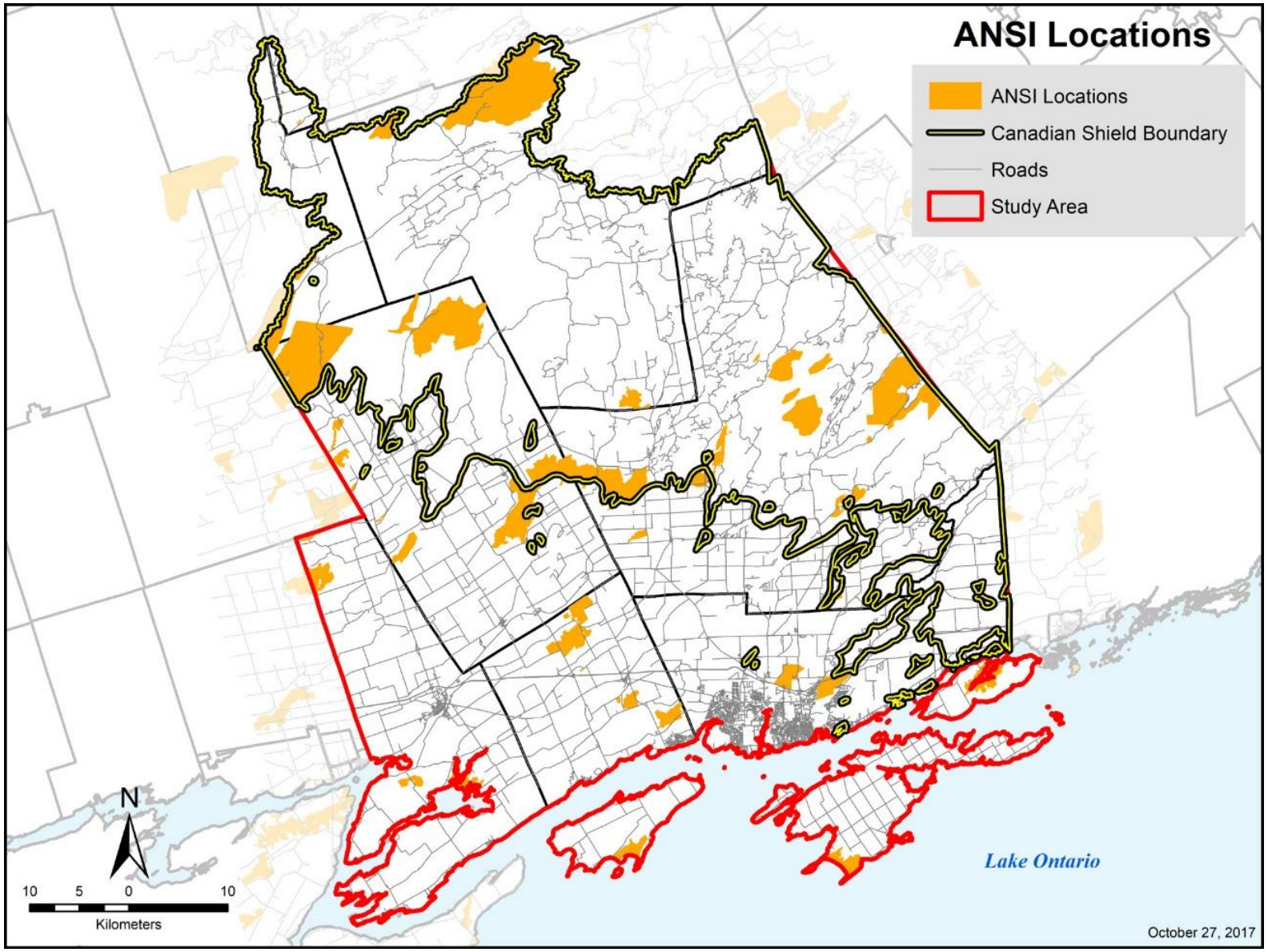

Figure 10 Provincially significant and Candidate ANSIs in the LC-KFLA study area.

This page intentionally left blank

On the basis of the comments received during consultation, Candidate Life Science and Earth Science ANSIs were also added to the core area of the Plan. Candidate ANSIs are those for which preliminary gap analysis has been undertaken and the evaluation (which includes ground-truthing) has been conducted, but where the evaluation has not been reviewed by MNRF. The review might ultimately conclude that the candidate ANSI is not "the best", but the "second best", and would thus be more appropriately classified as a Regionally significant ANSI than a provincially significant ANSI, but the inclusion of regionally significant ANSIs within the Plan is valuable in protecting important features specific to the Plan area. Figure 10 shows the provincially significant and candidate Life Science and Earth Science ANSIs mapped within the study area.

4.1.5 Headwater Lake Areas

The Ontario Headwaters Institute (2017) defines headwater areas as surface drainage features, including ephemeral and intermittent streams; groundwater recharge areas and aquifers; areas of groundwater discharge and upwelling; vernal pools, spring-fed ponds, and off-line wetlands; and first and second-order streams (i.e. streams with no tributaries or streams that result from convergence of two first order streams, respectively).

Headwater areas serve important functions (Ontario Headwaters Institute 2017). For example, headwaters and their catchment areas, the area drained by small streams:

- Comprise the majority of both the total surface area and stream length in most watercourses;
- Contribute the majority of flow to most watercourses;
- Help regulate that flow – through natural cover, soil type, and surface geology – to both surface and groundwater, thereby reducing both flooding and erosion;
- Furnish key habitat types for the breeding, feeding, and sheltering of upstream species, thereby harbouring a large portion and in many ways the base of a watershed's biodiversity; and,
- Nurture downstream ecosystems by providing significant portions of a stream's nutrients, organic material, and sediment.

In addition:

- Headwater streams and catchments are as important to terrestrial insects, a key element of the food chain, as they are to aquatic species;
- Forest cover in headwater areas and along small streams protects local water, and their biodiversity, from thermal heating;
- Headwaters may be sensitive to small volumes of pollutants; and,
- Headwater areas may become both less resilient and increasingly important to watershed integrity in a changing climate.

Headwater areas are of particular interest to LC-KFLA because they are important to many of the functions in downstream lakes, streams and wetlands. Headwater areas have not previously been mapped in the Plan area, and there are no reliable computer techniques for deriving boundaries for headwater areas. For this reason, contour mapping was used to identify the highest elevations to give a general location for headwaters. The top 20% in

elevation of waterbodies within each watershed was used as an approximation of high density of headwater streams, wetlands and ponds. Figure 11 and 12 show the headwater areas that were included as core areas in the Canadian Shield and Limestone Plain respectively.

Approach to Mapping and Modifications Through Consultation

Headwater lakes were included conceptually in the first draft of the Plan, but were not mapped. Through consultation, techniques for determining headwater areas were further investigated, and mapped with a 1 km buffer.

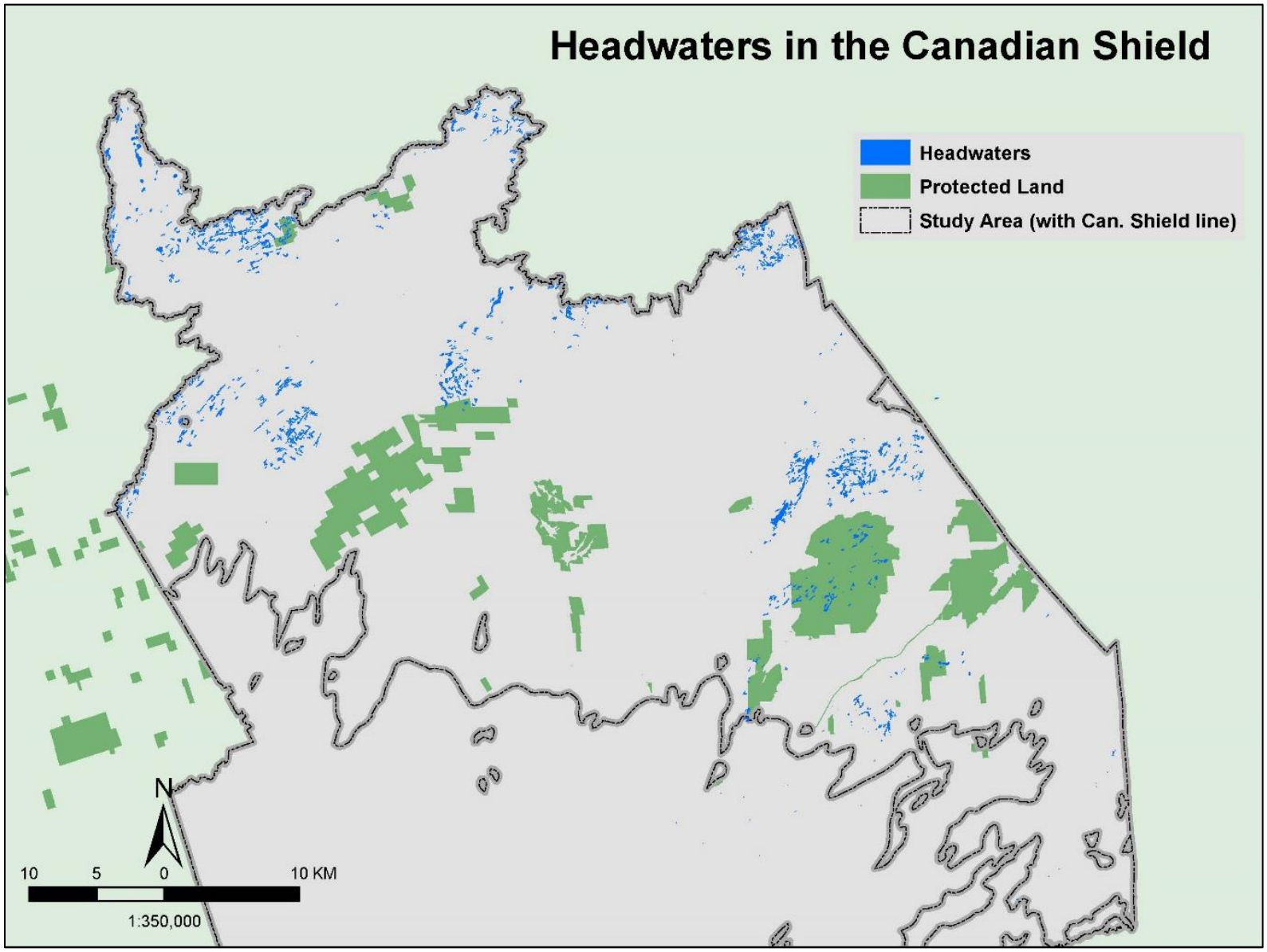

Figure 11. Headwater Lake areas on the Canadian Shield

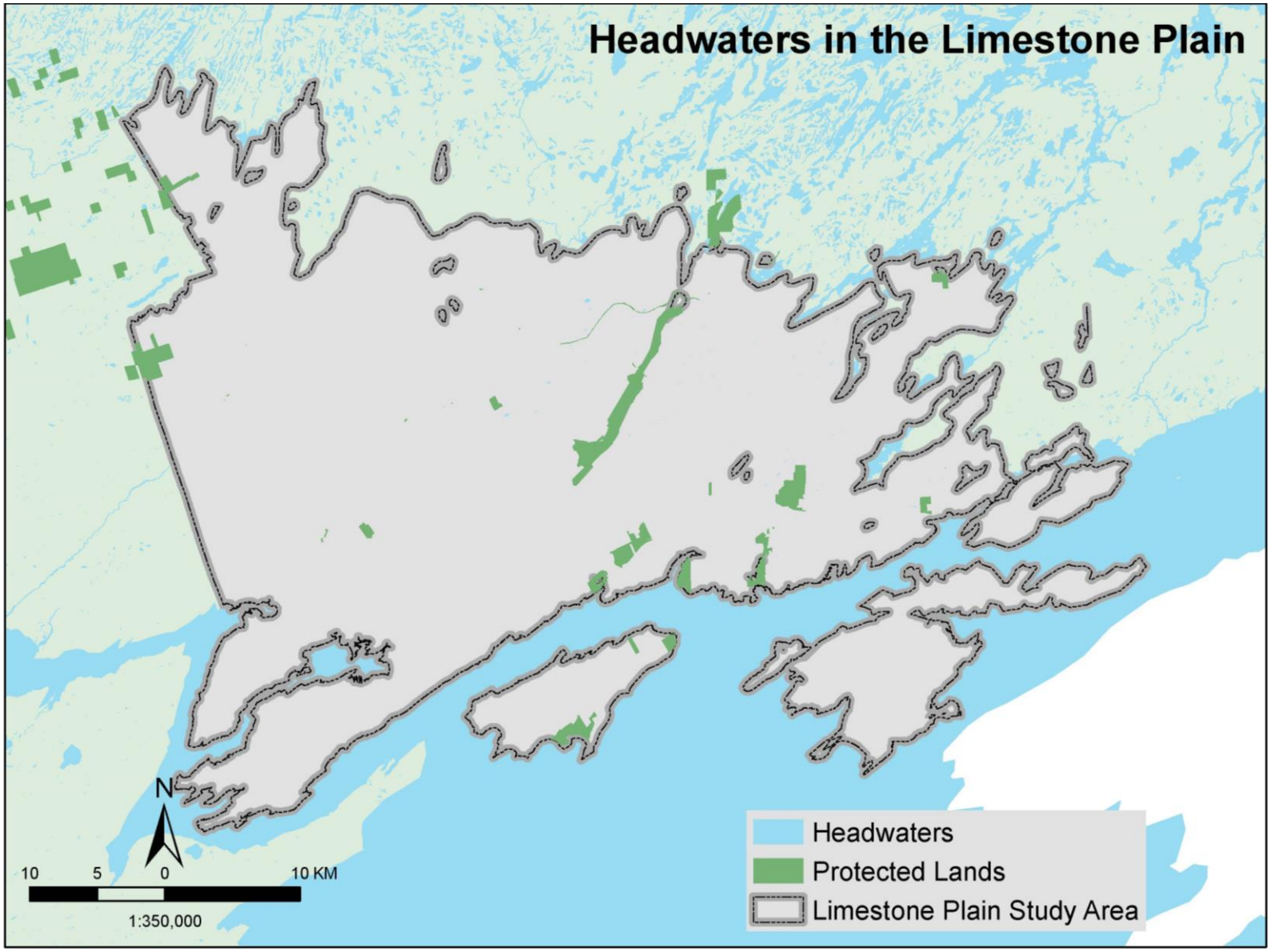

Figure 12. Headwater Lake areas on the Limestone Plain

4.1.6 Lake Trout Lakes

The Lake Trout is the only major, indigenous sport fish species in Ontario that is adapted to oligotrophic lakes (i.e. lakes with low levels of nutrients, high dissolved oxygen levels, and typically deep areas with very cold water) (MNRF 2015b). Lake Trout lakes are rare (MNRF 2015b). Only about one percent of Ontario's lakes contain Lake Trout, but this represents 20-25% of all Lake Trout lakes in the world. In the LC Plan area, all but two of the lakes are considered "natural" Lake Trout lakes (i.e. they naturally support Lake Trout or have the capacity to be restored to support lake trout). Two lakes are considered "put-grow-take" lakes that are stocked to provide a recreational fishery, but may not have originally supported Lake Trout. The Frontenac County Official Plan lists 33 Lake Trout lakes with only 8 not-yet-at-capacity. There are 8 Lake Trout lakes in Lennox and Addington County. Lake Trout lakes (which are confined almost entirely to the Canadian Shield) are shown in Figure 13.

Lakes that support Lake Trout are indicative of an unusual microclimate, as they are cold and deep. Lake Trout lakes were included in the NHS for their rare quality as coldwater fish habitat and for their potential to contribute to unusual, cold microclimatic conditions.

Approach to Mapping and Modifications Through Consultation

The Plan included Lake Trout lakes in the original NHP, but increased their weighting on the basis of comments received through consultation. Lake Trout lakes were mapped as core areas in the Plan.

This page intentionally left blank

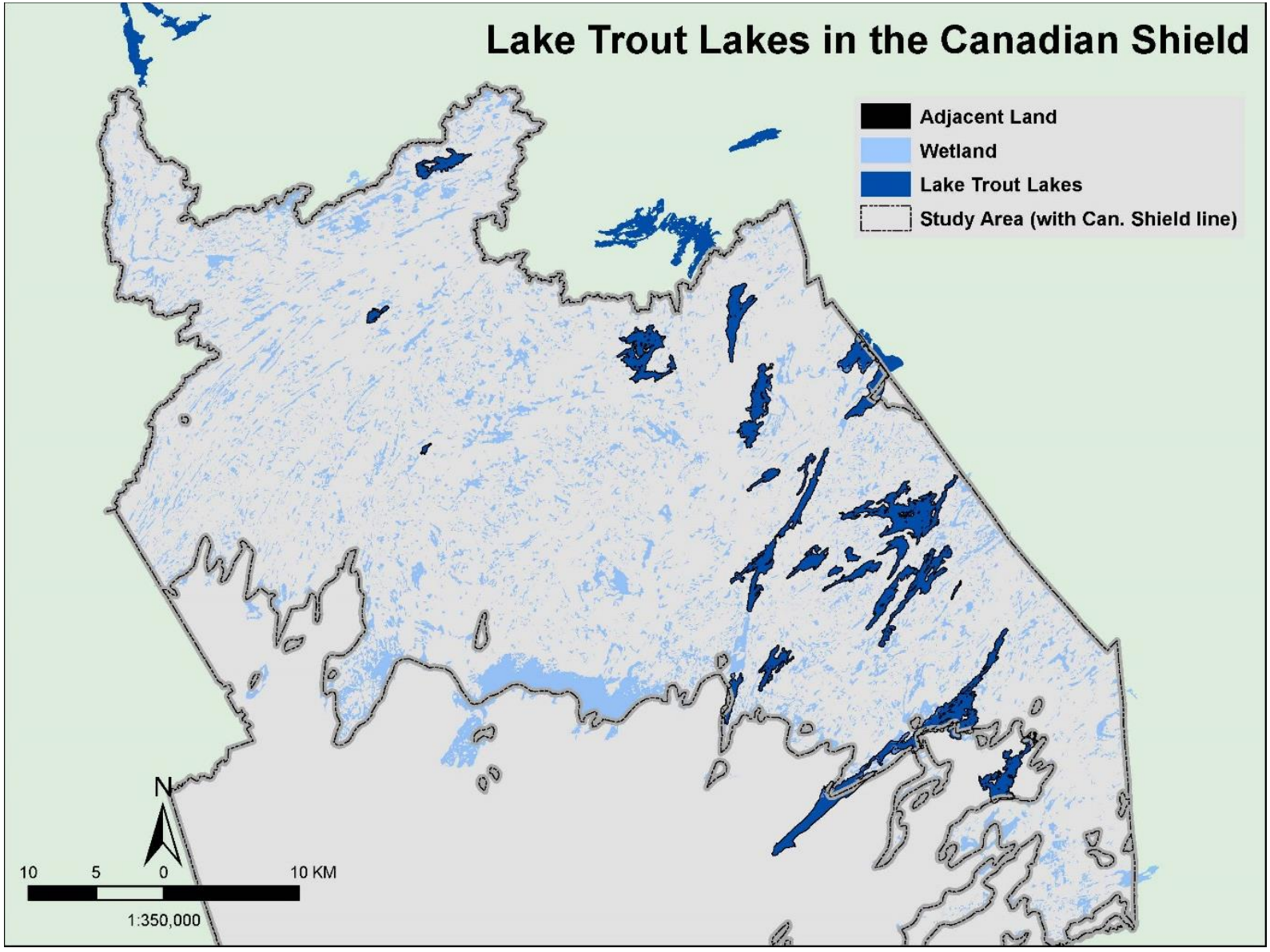

Figure 13. Lake Trout Lakes on the Canadian Shield

This page intentionally left blank

4.1.7 Protected Areas

Protected areas were included as core areas in the mapping (Figure 14). As they are part of the 'base' natural areas that LC-KFLA will continue to build on and connect in the landscape. The LIO database includes areas under conservation easements or ownership of the province (provincial parks and nature reserves), conservation authorities (conservation areas) and other land trusts. Since these lands were likely (though not always) purchased for their value as conservation lands, and since the intention is to preserve them as natural heritage features in the long term, they were considered important building blocks for the Plan.

Approach to Mapping and Modifications Through Consultation

Protected lands are shown in Figure 13. They include the provincial parks and lands owned by land trusts, conservation authorities, Queen's University, and the lands owned by the Nature Conservancy of Canada. They were not weighted, as they are already protected. However, the 100 m buffer to the protected area boundary is weighted as this area is considered important to the functions of protected areas and is the area within which surrounding development is most likely to affect the feature.

This page intentionally left blank

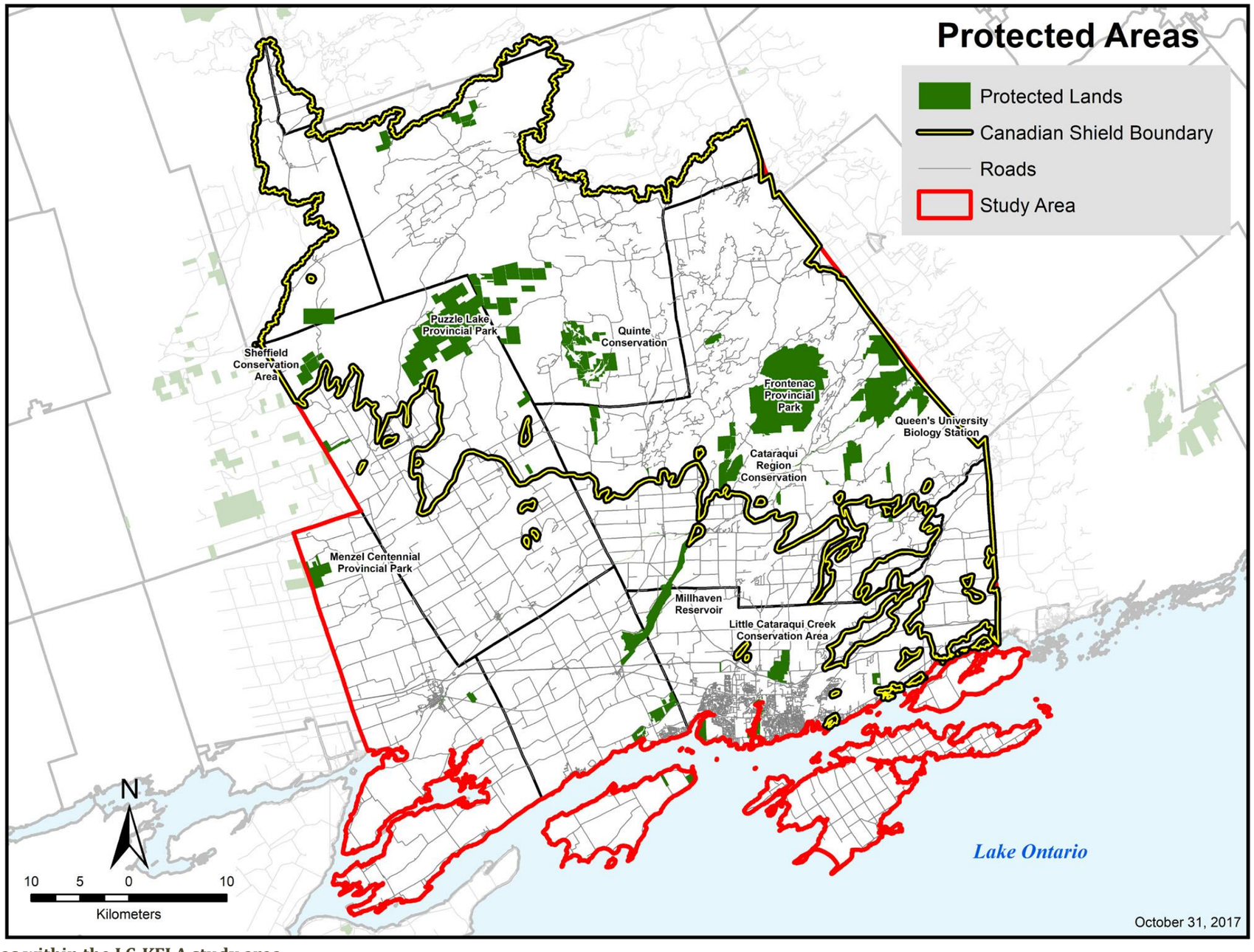

Figure 14. Protected areas within the LC-KFLA study area

This page intentionally left blank

4.2 Linkages

There is an extensive discussion of the science behind the need for connectivity in the Natural Heritage Reference Manual (2010). Ideally, connections between patches of habitat should be designed specifically to meet the dispersal requirements of the species within core areas, and wide enough to provide linkage through inhospitable urban landscapes. However, when dealing with the limitations of available data, the most effective strategy is to map prospective linkages along watercourses. On the Canadian Shield, the extensive wetlands, watercourses and forests within the landscape afford connectivity at a broad scale. Local connections may be important but they cannot be discerned using the sources available.

4.2.1 Watercourses

Watercourses (Figure 15, 16 and 17) provide the most continuous connections available, particularly within the southern part of the study area. Watercourses with wider riparian corridors are of more value than narrow riparian corridors. Environment Canada recommends a minimum of 30 metres of naturally vegetated habitat on both sides of streams based on their literature review.

Figure 15. Google Earth image from Lennox & Addington County as an example of the importance of watercourses for connecting patches of habitat in fragmented landscapes

This page intentionally left blank

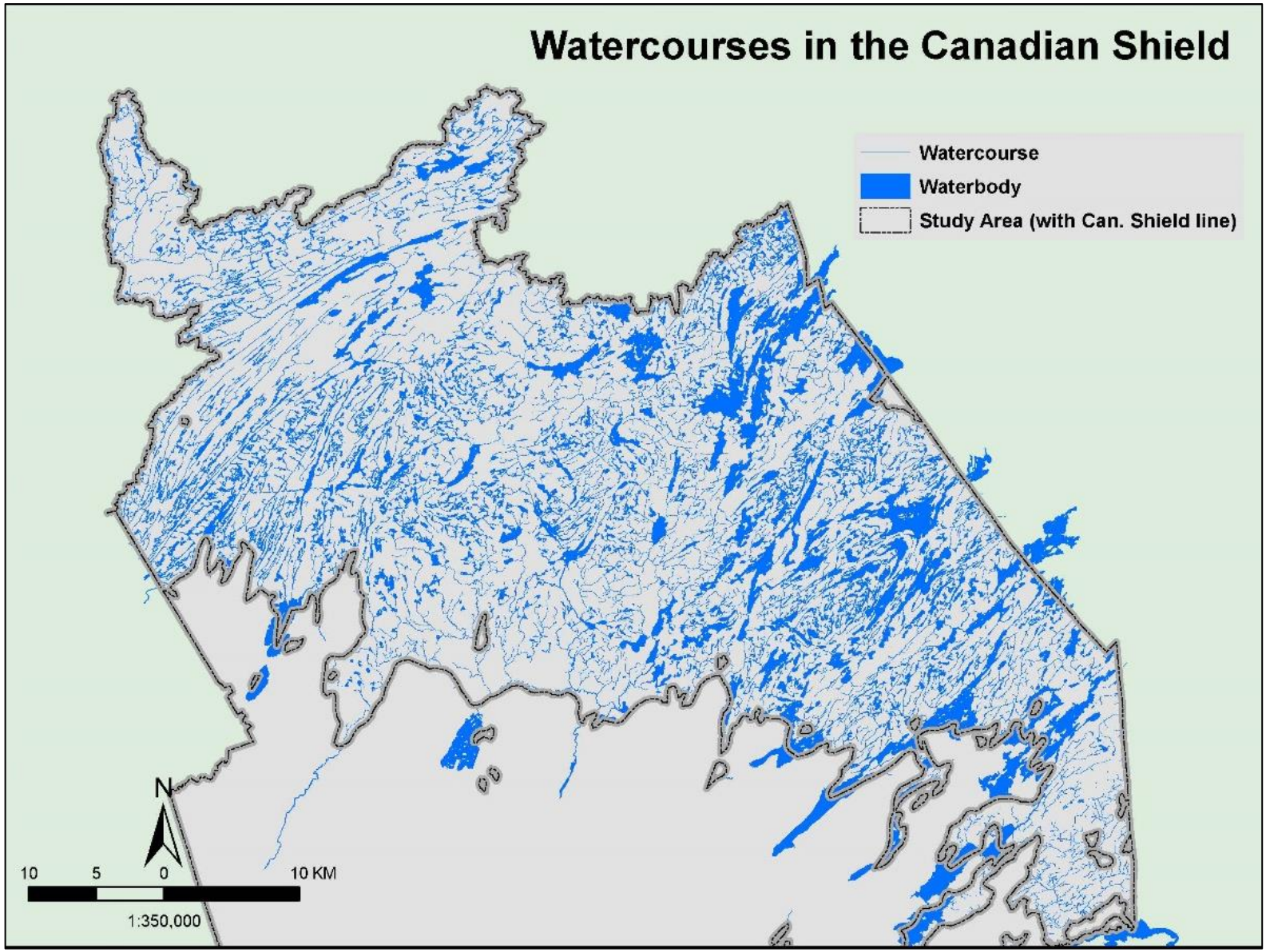

Figure 16. Watercourses and Waterbodies on the Canadian Shield

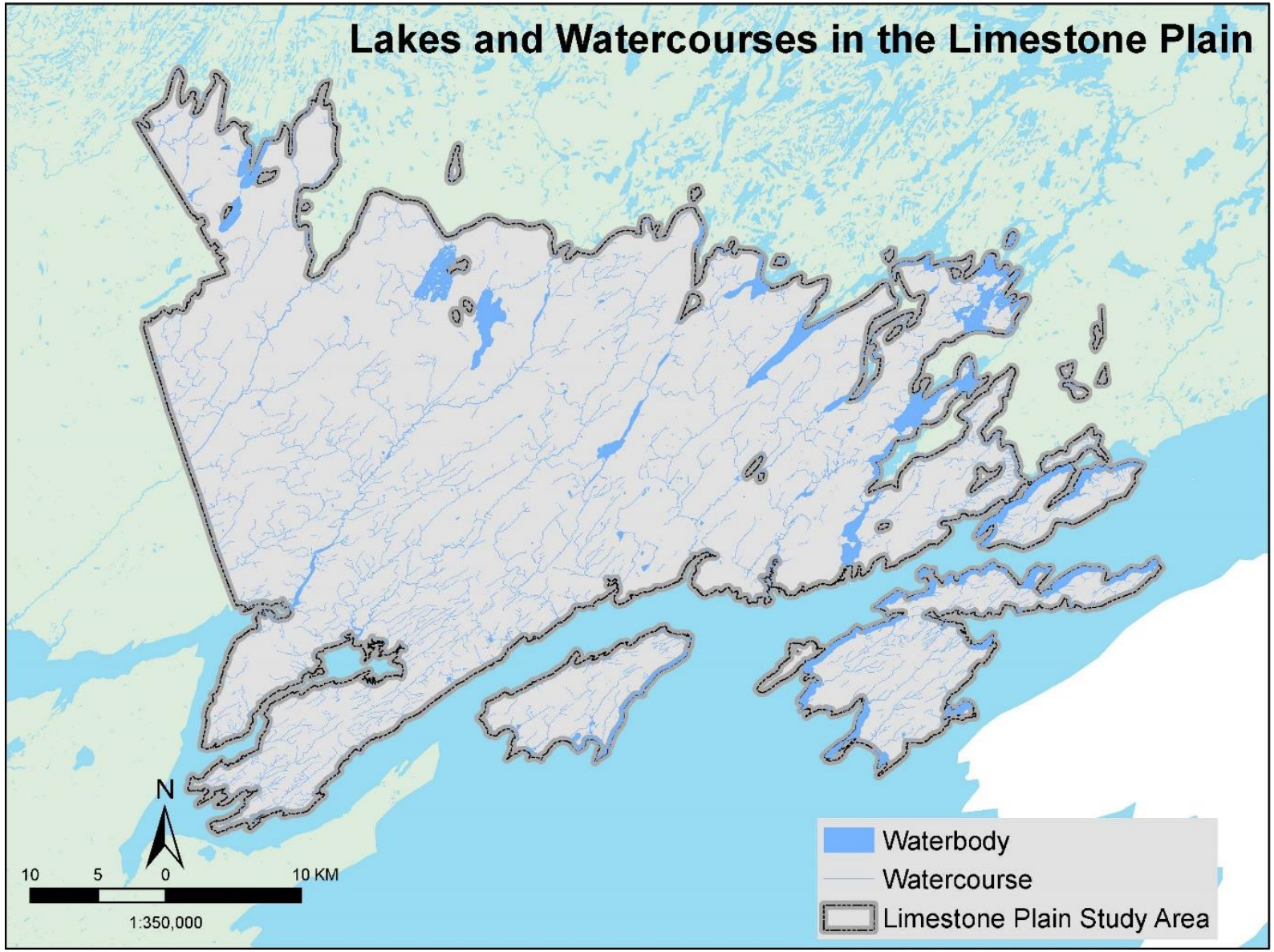

Figure 17. Watercourses and Waterbodies on the Limestone Plain

Approach to Mapping and Modifications Through Consultation
Watercourses were included as features that provide connection within the NHP. Riparian vegetation was included on either side of the watercourse. A 50 m area of riparian vegetation was included as a buffer.

Comments received during consultation supported this approach to watercourse mapping. Environment Canada (2013; How Much Habitat is Enough?) notes that the provision of highly functional wildlife habitat may require total vegetated riparian widths greater than 30 metres.

4.2.2 Linkages indicated in Other Natural Heritage Systems

Natural Heritage System studies were conducted by the City of Kingston, County of Frontenac and Cataraqui Conservation Authority. The linkages shown by these municipalities were studied as an overlay to inform the linkages for the NHP.
The following linkages are available:

- Nature Conservancy of Canada (priority areas),
- Adirondack to Algonquin (priority areas and connectivity data, mainly in the south),
- The Land Between (Priority areas),
- Conservation Authorities' Natural Heritage corridors.

Approach to Mapping and Modifications Through Consultation
Some areas in the NHP study area are not covered by these priority areas and identified linkages, so there are gaps. For this reason, these layers will be used as overlays and not additively. These layers are considered qualitatively on top of other criteria mapping and weighting.

4.3 Overlays that Add Landscape Context to the Plan

The following were assessed to determine if they could be used as 'landscape context' in terms of additional features that can be taken into account when setting overall priorities. Overlays will be used qualitatively in the future to determine where priority areas overlap with priority areas identified by other groups, such as the Nature Conservancy of Canada and The Land Between. Overlays from other groups may be used when evaluating individual properties at a smaller scale. Other instances would be when a higher resultion analysis is required of particular areas, for example high-density regions of headwater lakes areas or between other protected areas such as Puzzle Lake and Depot Lake and Frontenac Provincial Park. Future analyses may include analyses of this type of smaller spatial scale.

4.3.1 Alvars

Alvars are areas of thin soil over limestone bedrock where drought and extreme soil conditions have fostered a specialized plant community that is considered globally, nationally and provincially rare. Alvars frequently support provincially rare flora and

fauna species. The Plan area within the Limestone Plain is a particularly important site in Ontario for alvar communities (Figure 18).

Alvars were initially not included in the NHP because they may not be ideal targets for an organization such as LC-KFLA, as there are groups, particularly NCC, that are focusing effort on alvars in the Limestone Plain. However, they are reservoirs of biodiversity, often for both flora and fauna. It was apparent during the consultation that there are several organizations that could provide the expertise needed to partner with LC-KFLA.

Approach to Mapping and Modifications Through Consultation

The inclusion of alvars was strongly recommended during consultation. Alvars were therefore included in the Plan as an overlay to help inform priorities. While acquisition priorities need not necessarily include these areas it may be possible to partner with other organizations to contribute to stewardship or management of adjacent lands.

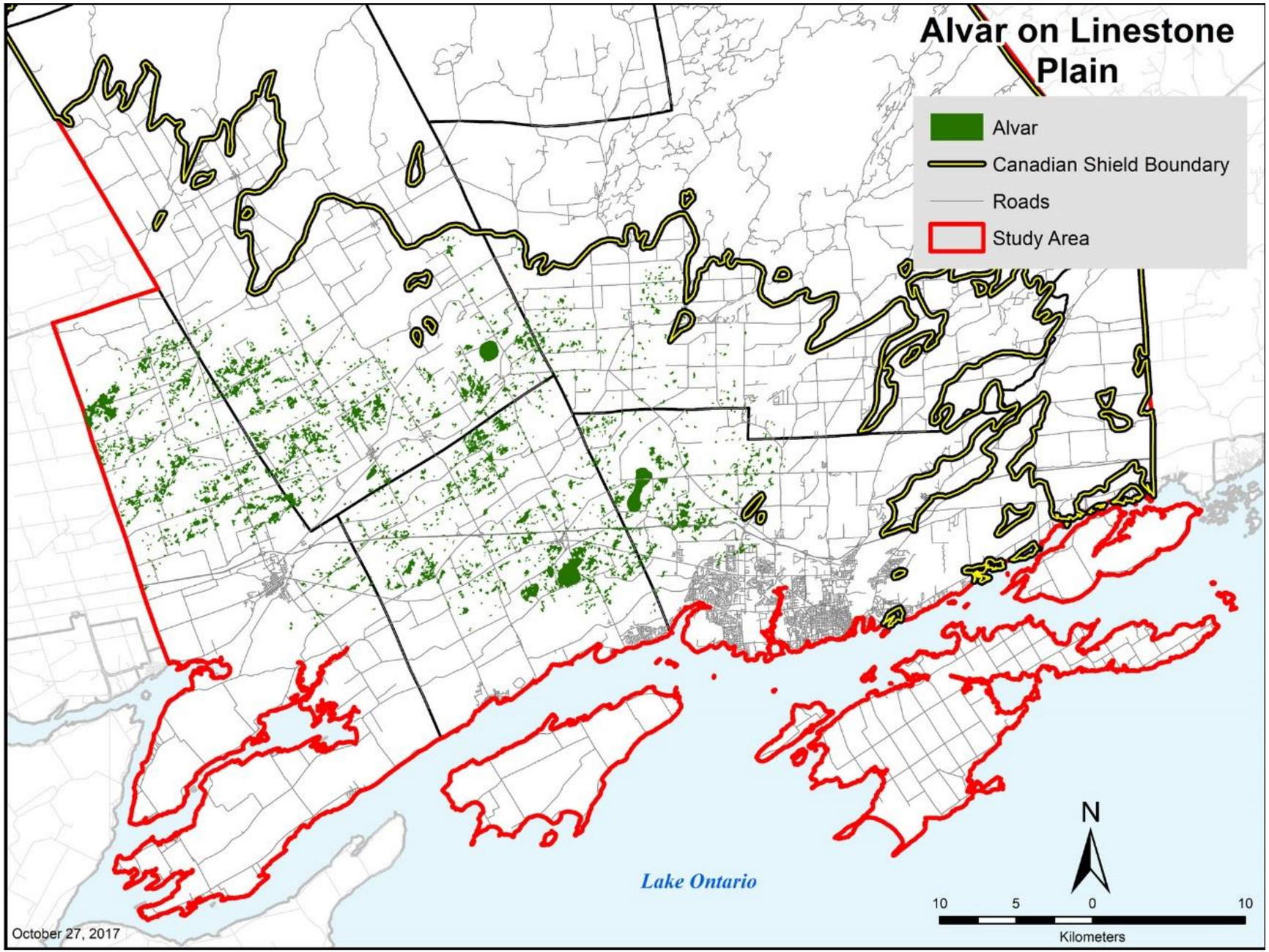

Figure 18: Alvars within the LC-KFLA Study Area

This page intentionally left blank

4.3.2 Nature Conservancy of Canada and The Land Between Priority Habitat

The Nature Conservancy of Canada (NCC) has identified areas of priority habitat that can be used to add weight to the scoring for patches within the NHP (Figure 19). NCC assesses "conservation blueprints" within Canada's southern ecoregions; those areas where the biodiversity is greatest, but so is the threat. Each conservation blueprint seeks to prioritize a set of areas that, if conserved, could collectively sustain the biodiversity of the ecoregion.

NCC works with local experts and academics to identify the rare or endangered species and habitats that are representative of an ecoregion, along with the threats to them. Priority areas in Eastern Ontario include NCCs Frontenac Axis and Coastal Strategic Plans.

The Land Between is a charitable organization devoted to stewardship of the land encompassing the transition between the Canadian Shield and Limestone Plain in Ontario. It promotes research that identifies areas of biodiversity for conservation and stewardship. They have identified priority areas for stewardship that include alvars, wetlands, and rock barrens (Figure 20).

Approach to Mapping and Modifications Through Consultation

Priority areas of other organizations will be studied to determine where they overlap with LC-KFLA priority maps and whether partnership relationship might be warranted. Furthermore, in areas where priorities overlap, other organizations' priority mapping can strengthen justifications to funding sources or fundraising campaigns.

This page intentionally left blank

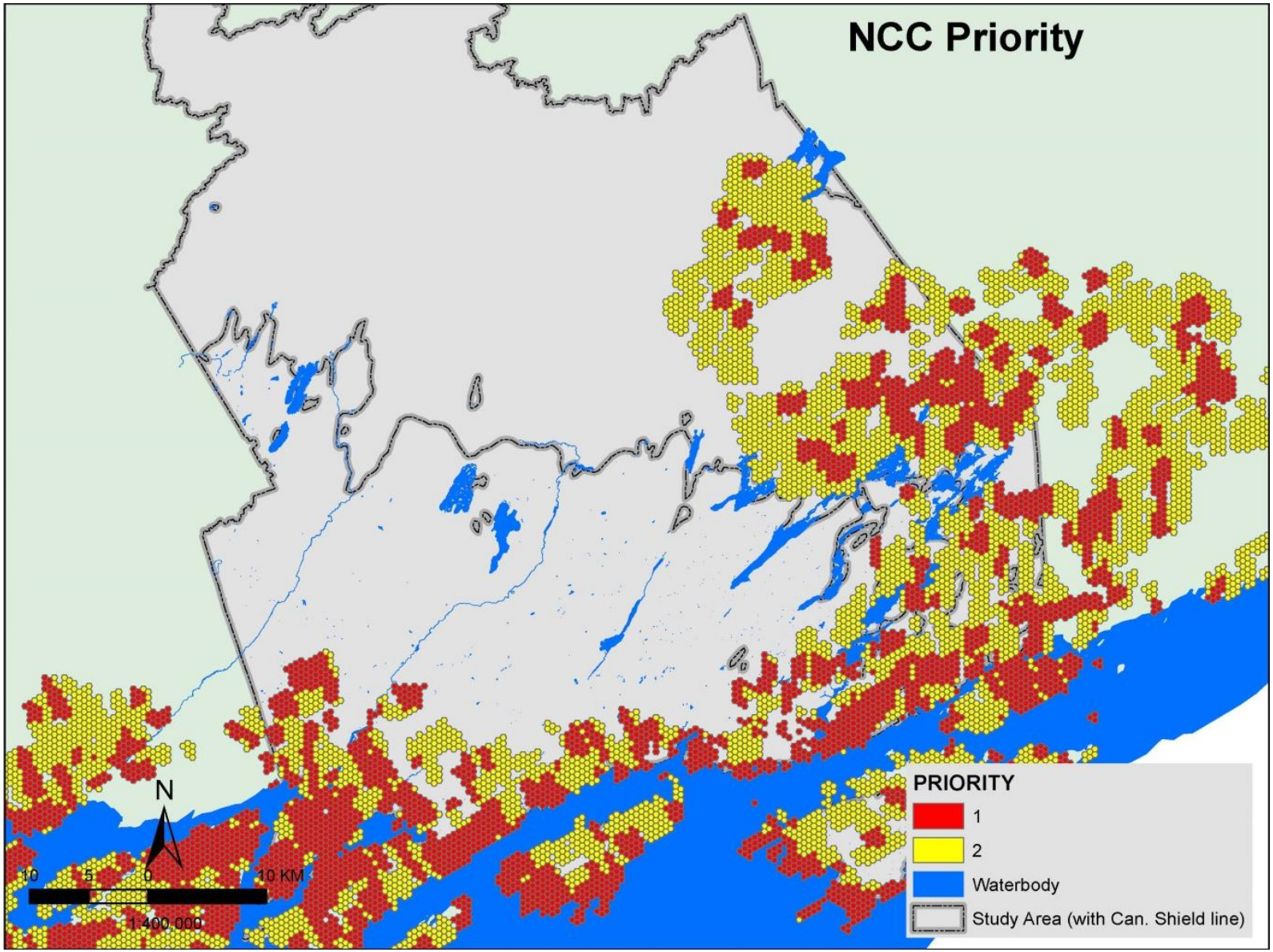

Figure 19. Areas of NCC habitat priority

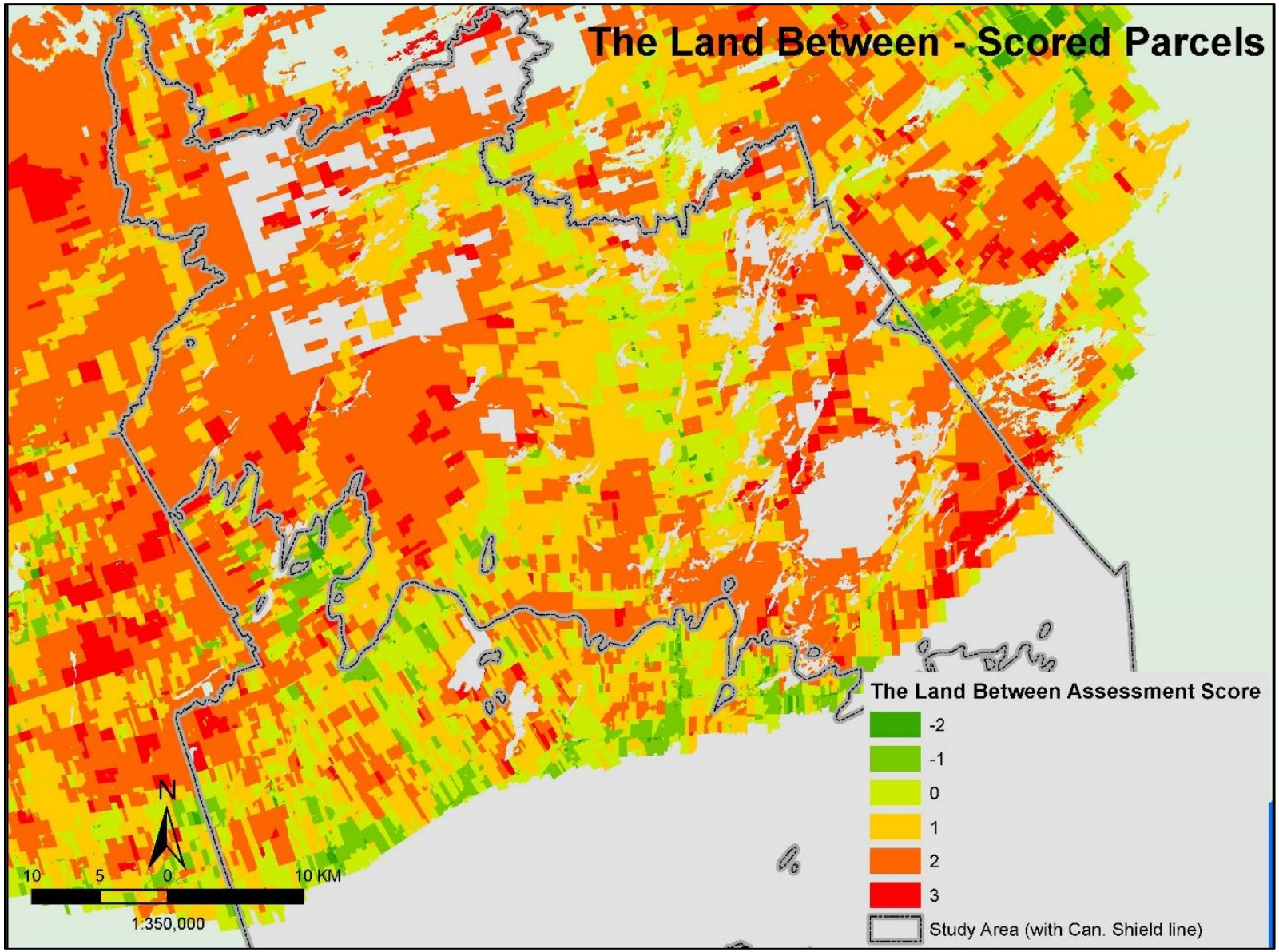

Figure 20. Priority Mapping for the Land Between

5.0 Consideration of Additional Data for Inclusion

The following section explores data that has been considered for inclusion to inform the NHP, or has been recommended during consultation. These data have not been used in the present Plan, but may be considered as the Plan evolves in the future.

5.1 Species at Risk Habitat Information

Species at Risk habitat mapping requires very detailed information on habitat availability and on locations and movements of the species themselves. It is also very sensitive information, as many Species at Risk are of high value to poachers. This information has been collected by a variety of sources such as the Ontario Ministry of Natural Resources, Breeding Bird Atlas of Ontario and Ontario Herpetofaunal Atlas but the accurate locations of species are rarely divulged because of their sensitivity, though general locations may be provided. Even general information is never divulged for highly sensitive species such as Spotted Turtle and American Ginseng. There are many areas that have not received the level of study that would allow Species at Risk to be detected.

Approach to Mapping and Modifications Through Consultation
Species at Risk information was not used to inform mapping. However, the feature-based approach to mapping, which included features with high diversity, size, and ecological function, will mean that many of the habitats identified have a high probability of supporting Species at Risk.

5.2 Habitat within the Vicinity of Lake Ontario

The Lake Ontario shoreline has particular significance for many plant and animal species. Forest areas over 10 ha, within 5 km of the Lake Ontario shoreline, are considered candidate Significant Wildlife Habitat for migrating landbirds (MNRF 2015a). Figure 22 illustrates these forests (wetlands in coastal areas can be seen in Figure 5). Similarly, coastal wetland habitat is considered highly significant in Ontario. Most coastal wetlands have been evaluated as provincially significant. The significance of coastal areas has been captured in part by including Provincially Significant Wetlands and priority areas from the Nature Conservancy of Canada's coastal strategic plan that can help to highlight the importance of the remaining undeveloped areas in this region.

Approach to Mapping and Modifications Through Consultation
Consultation noted that coastal communities were highly significant. The committee is discussing what data to include, and the distance from Lake Ontario within which communities will be considered; this information may be included in future iterations of the Plan.

This page intentionally left blank

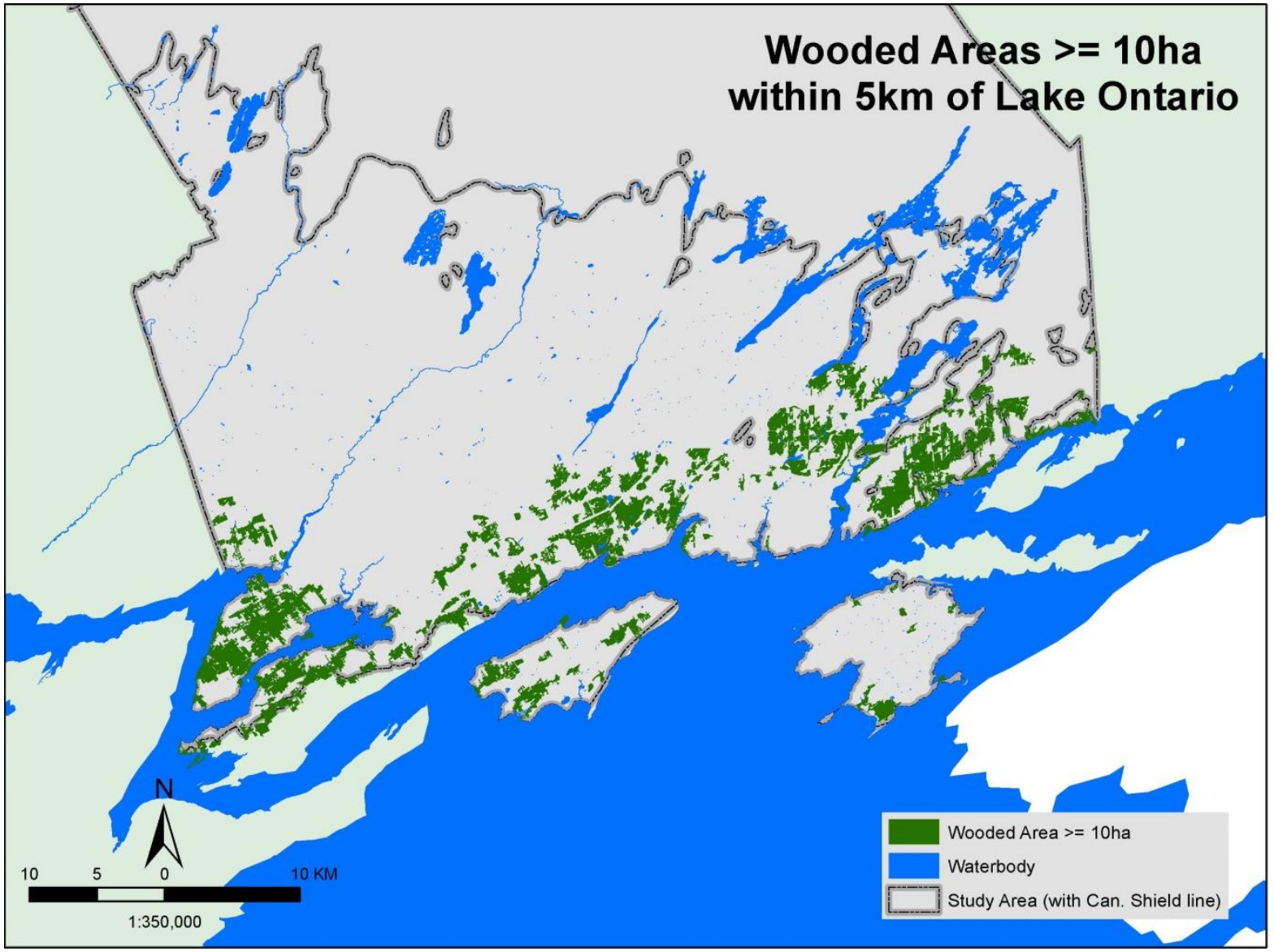

Figure 22. Woodlands 10 ha or greater, within 5 km of the Lake Ontario shoreline (candidate migratory landbird stopover habitat)

This page intentionally left blank

5.3 Parcel Data

Parcel data would be a practical layer for guiding land acquisition. However, parcel data must be purchased from municipalities, and is generally of high cost, or investigated as part of a labour intensive search of tax rolls at the municipal office. This is beyond the scope of a small organization such as LC-KFLA. Lot and concession boundaries are available within LIO, but that there may be subdivided parcels within lots and concessions for which the boundaries would have to be requested from the municipality. The actual landowner information has to be requested from the municipality as well.

Several municipalities were interested in sharing parcel data (not including property owner information). Information on parcels for mapping purposes could be explored as part of a partnership with LC-KFLA. Parcel data would provide a practical basis on which land acquisitions could be prioritized.

Approach to Mapping and Modifications Through Consultation
Lot and concession boundary information is available at a coarse level. In addition, several organizations indicated that they may be able to provide some parcel data. Larger properties may provide greater opportunities for protection than smaller properties, so inclusion of this information will be considered in future iterations of the Plan.

5.4 Additional Aerial Photo Interpretation

Aerial photo interpretation could provide information on vegetation communities that are a high priority for protection, such as habitats for Species at Risk and communities that are not identified in LIO such as thickets and grasslands. It could provide more information on wetlands within forested areas.

Aerial photo interpretation can be conducted by an expert in identifying vegetation polygons through scrutiny of aerial photography, or by using a computer analysis to determine vegetation communities. Both techniques require detailed aerial imagery, which is costly (computer analysis is generally conducted with satellite imagery). Manual aerial photo interpretation is highly labour-intensive. In addition, there is a high margin of error in both types of aerial photo interpretation, and ground-truthing by an expert is required.

Approach to Mapping and Modifications Through Consultation
Aerial photo interpretation is likely not feasible at this stage, as it is beyond the scope of LC-KFLA to conduct aerial photo interpretation for the entire Plan area.

5.5 Canadian Wildlife Service Biodiversity Atlas Data

The Canadian Wildlife Service (CWS) has developed mapping that shows areas of high biodiversity, based on 14 biodiversity elements mapped and scored for each ecoregion:

- Species at Risk richness, count, and irreplaceability,
- globally rare species richness,
- coastal wetlands,
- colonial waterbird colonies,
- Relative density by Bird Conservation Region bird guilds
- Relative density forest and open country birds
- area of suitable landbird stopover habitat,
- area of suitable shorebird stopover habitat, and;
- area of suitable waterfowl stopover habitat.

The resulting mapping is at a very coarse level (Figure 23).

Approach to Mapping and Modifications Through Consultation

Analysis determined that these layers were too coarse to add weight to priority areas within the Plan. The "High Biodiversity" layer comprises a very large area, such that it would not discriminate between properties that would be of most value for protection. Modifications were not suggested through consultation.

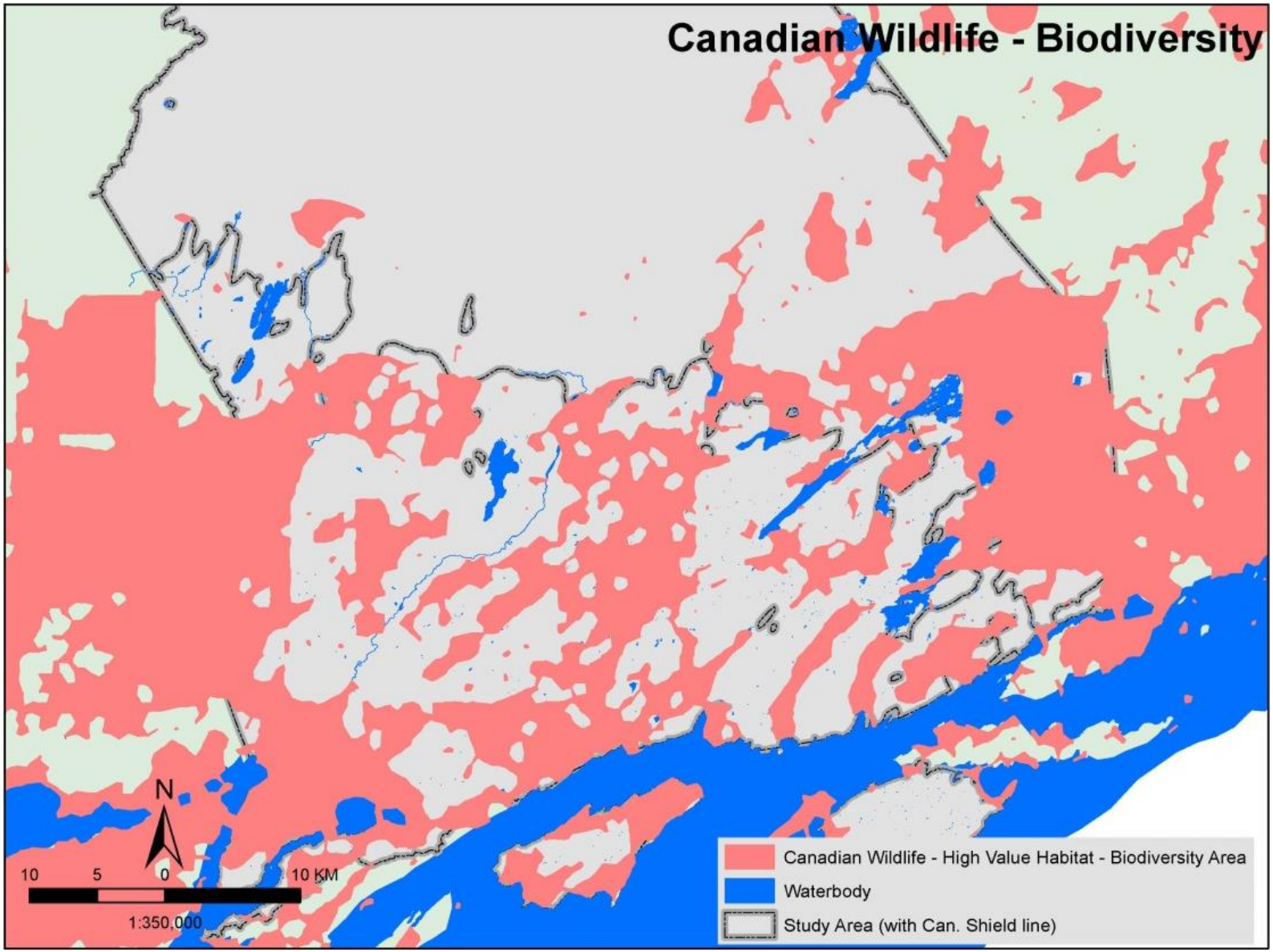

Figure 23. Areas of high value wildlife habitat from the Canadian Biodiversity Atlas

This page intentionally left blank

5.6 Areas of Low Road Density

An analysis of road densities (Figure 24) indicated that there are areas on the Canadian Shield that have relatively few roads within the study area. These areas may provide attributes that are not available elsewhere – they may be less disturbed, with fewer sources of light, contaminants and noise associated with roads. These areas could be used as an overlay to contribute weight to core areas. However, road development is regulated by the Environmental Assessment Act, which involves consideration of alternatives. Though it would be desirable to protect properties in relatively roadless areas there is no guarantee that they would remain roadless. Maybe add sentence on the high density of roads running north-south in the east is associated with Highway 38. The other area in the northwest is associated with Highway 7.

Approach to Mapping and Modifications Through Consultation

Weighting of areas with fewest roads was discussed. However, the long-term potential for persistence of areas of low road density would need to be evaluated in order to use this criterion to inform priorities for the Plan.

This page intentionally left blank

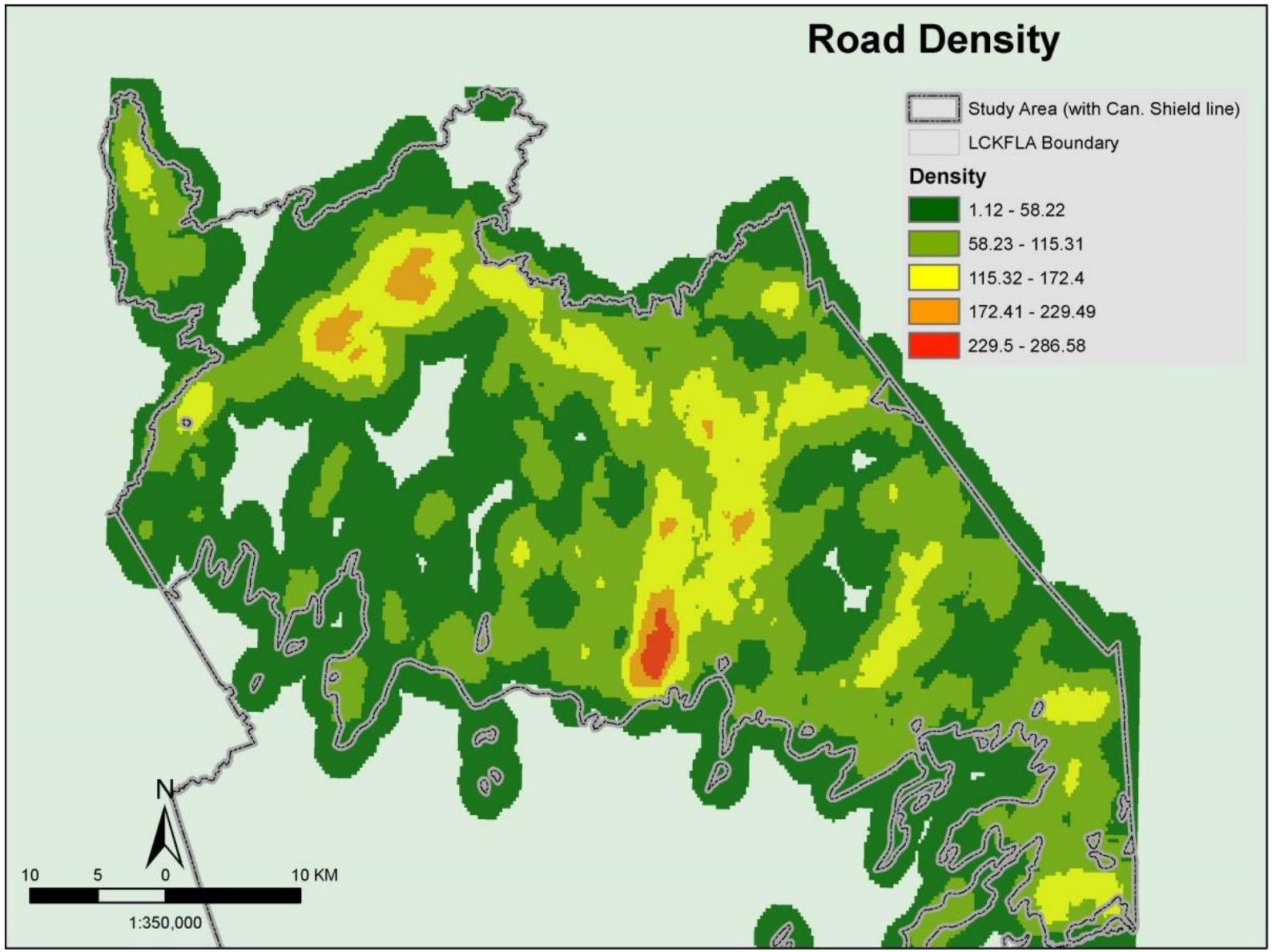

Figure 24. Road density analysis on the Canadian Shield

This page intentionally left blank

5.7 Consideration of Modifying the NHP to Assess Priorities on a Watershed Scale

Comments from consultation indicated that priorities could be explored at the scale of the watershed, as, for example, woodlands and wetlands that might be of low priority on the scale of the study area might be a higher priority on a watershed scale if they were the largest or most diverse in the watershed.

This approach could be scoped to investigations of, for example, the largest patches of woodland and wetland in each watershed, to determine if they have been "picked up" by the analysis already or should receive higher weight. Figure 25 shows watershed boundaries in relation to features within the LC-KFLA study area.

5.8 Including Grasslands and Other Successional Areas

Large grasslands (i.e. those over 30 ha) are reservoirs for Species at Risk, for example Eastern Meadowlark and Bobolink, two Species considered Threatened in Ontario and Canada. They also support a high diversity of species that have narrow habitat requirements and are declining in Ontario. Other successional areas such as thickets also support high biodiversity of birds that are declining in Ontario. Therefore, inclusion of grasslands within the NHP could be a strategy for protecting high biodiversity of bird species.

However, grasslands and other successional areas are difficult to identify in aerial photography. They are not accurately identified by landcover identification computer technology, and they are difficult to recognize during scrutiny of aerial photos unless ground-truthing is undertaken. In addition, they are likely not a good priority for conservation for an organization such as LC-KFLA, as the presence of successional birds depends on the persistence of successional vegetation cover. This cover must be managed by human intervention as the factors that originally controlled woody vegetation in pre-settlement times, such as fire, are usually controlled. In addition, the persistence of the surrounding open landscape is an important factor in successional species' persistence in an individual habitat patch.

<u>Approach to Mapping and Modifications Through Consultation</u>
Inclusion of grasslands in the NHP was not considered at this point, unless they are alvars. Grasslands and other successional areas are likely not appropriate candidate areas to include in the NHP because the information would require a high level of expertise (using aerial photography interpretation and ground-truthing) and be highly labour-intensive to acquire. Protection of successional areas would require management of the individual patch of habitat as well as a large surrounding area, and is likely not feasible.

This page intentionally left blank

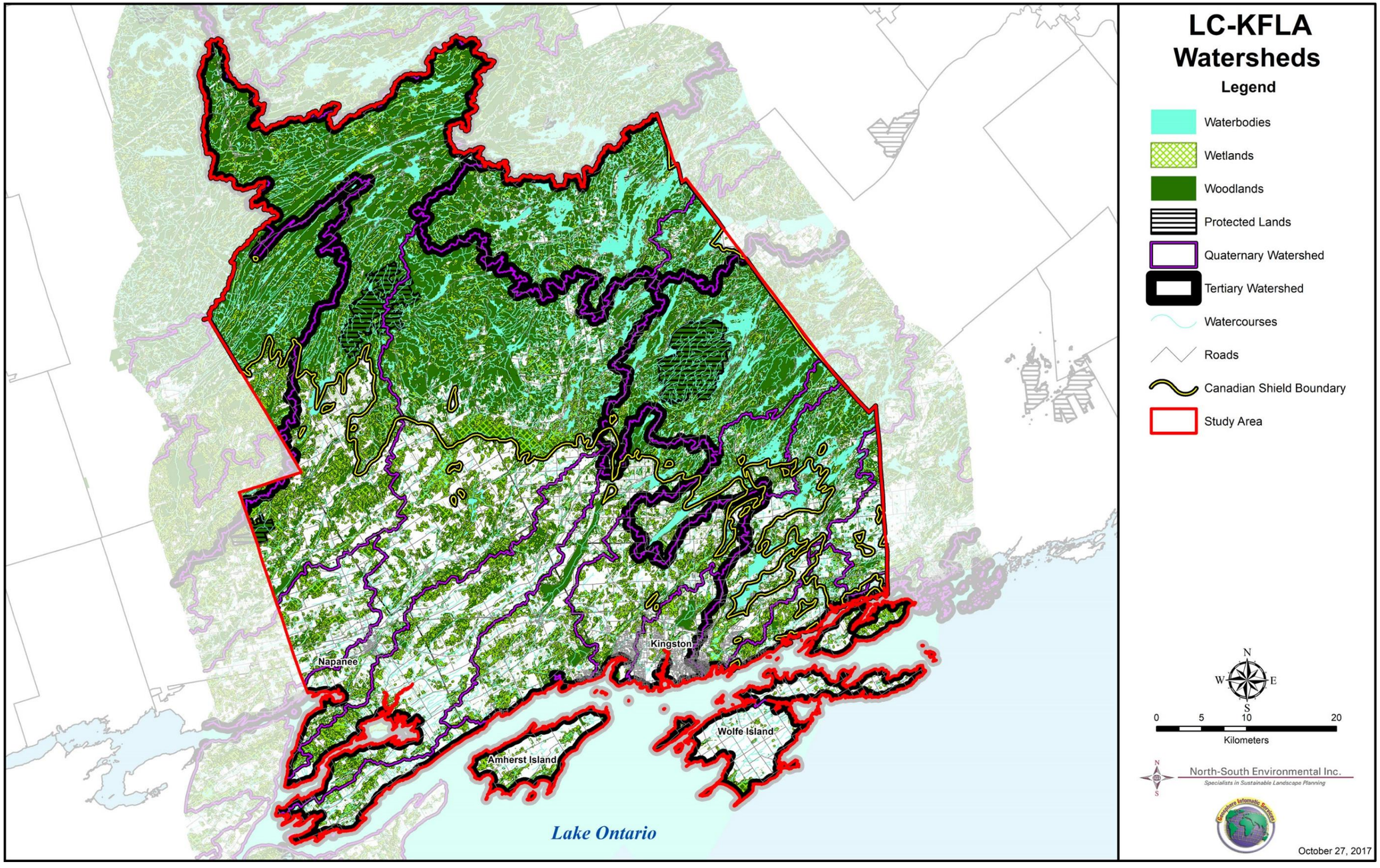

Figure 25. Watershed Boundaries and Core Features in the LC-KFLA study area

This page intentionally left blank

6.0 Final Weighting Criteria

Weighting received very careful consideration, with weighting of each variable considered and discussed by the Mapping Committee. A weighting scale of 1 to 5 was considered, as shown in the Table 3 below, with 1 indicating a low score (i.e. the importance of this variable was considered low on the scale of priorities), and 5 indicating the variable was high on the scale of priorities. Weighting was not applied to protected lands and ANSIs themselves because they are already protected: however, the area within 100 m of protected lands was considered a high priority as this is an area within which the likelihood of impacts from adjacent development is highest.

Table 3. Weighting applied to criteria

Criterion	Buffer	Weighting
Canadian Shield		
Significant Wetland	50m **increase to 120m**	5
Wetland > 30ha	50m	4
Wooded Area 60 ha	None	3
Interior forest - top 20% in size	None	5
ANSI **+ Candidate ANSIs**	100m **increase to 120m**	3 (applied to buffer only)
Headwater Lake Areas - top 20% in elevation	50m **increase to 1km**	4
Lake Trout Lakes	50m	2 **change to 3**
Protected Lands	100m	5 (applied to buffer only)
Watercourse	50m	4
Waterbody	50m	3
Limestone Plain		
Significant Wetland	50m **increase to 120m**	5
Wetland > 30 ha	50m	4
Wooded Area – top 20% in Size	None	3
ANSI **+ Candidate ANSIs**	100m **increase to 120m**	3 (applied to buffer only)
Headwater Lake Areas – top 20% in elevation	50m **increase to 1 km**	3 **change to 4**
Lake Trout Lakes	50m	2 **change to 3**
Protected Lands	100m	5 (applied to buffer only)
Watercourse	50m	4
Waterbody	50m	3

Consideration was given to showing the NHP with different weighting criteria applied to individual features. Without weighting, the Plan did not discriminate sufficiently to inform priorities for acquisition. Removal of headwater areas was investigated, as discussed in

Section 9. Investigation of other changes in weighting may be considered in future stage of the Plan.

7.0 Consultation process

The Land Conservancy's Mapping Committee collected natural heritage plans and GIS maps for the area, see Appendix 1 for a list of these documents. With this material, it developed a series of maps looking for overlapping areas of conservation interest. It also ranked a list of criteria to guide its priority setting, as shown in Table 4. With this as a basis, members of the committee met with organization representatives to receive feedback on the Plan approach and hear about areas of local concern.

Table 4. Preliminary criteria and ranking used prior to consultation process

File	Buffer	Weighting
Canadian Shield		
Protected Lands	100m	5
Significant Wetland*	50m	5
Lake Trout Lakes	50m	2
ANSI	100m	3
Watercourse	50m	4
Waterbody	50m	3
Wetland >30ha	50m	4
Wooded Area	None	3
Headwaters	50m	4
Limestone Plain		
Protected Lands	100m	5
Significant Wetland	50m	5
Lake Trout Lakes	50m	2
ANSI	100m	3
Watercourse	50m	4
Waterbody	50m	3
Wetland >30ha	50m	4
Wooded Area – top 20% in Size	None	3
Headwaters	50m	3

*note: headwaters were not factored into the preliminary mapping because there was no existing mapping source

The consultation set out to build both awareness and potential partnerships. The consultation resulted in some large-scale changes: for example, it led to the increase in weighting of Lake Trout Lakes, mapping of headwater areas and mapping of interior forest criteria and changes to their weighting, as will be described in Section 6.

7.1 Participation

Twenty organizations were consulted, involving 40 people in the consultation process (Appendix 2):

Municipalities

- City of Kingston
- County of Frontenac
- Lennox and Addington County
- Town of Greater Napanee
- Loyalist Township
- Township of South Frontenac
- Township of Stone Mills

Conservation Authorities

- Cataraqui Region Conservation Authority
- Madawaska Valley Conservation Authority
- Quinte Conservation
- Rideau Valley Conservation Foundation

Ontario Ministry of Natural Resources and Forestry

- Partnership Specialist, Ministry of Natural Resources and Forestry

Conservation Organizations

- Ducks Unlimited
- Friends of the Napanee River
- Friends of the Salmon River,
- Frontenac Stewardship Foundation
- Lennox and Addington Stewardship Council
- Mississippi Madawaska Land Trust
- Nature Conservancy of Canada
- Ontario Woodlot Association

Individuals

- Tim Yearington, Algonquin Anishinaabe

7.2 Summary of Comments

The following summarizes recommendations and other comments and suggestions that stemmed from consultation. This input was used to support and inform the development of this draft of the Plan. More detail on the organizations and individuals involved in consultation can be found in Appendix 2.

7.2.1 Providing Opportunities for Sharing with Other Groups

- Several participating organizations noted they were interested in LC-KFLA's approach to land acquisition: noting that two approaches were workable: responding to willing donors or looking for willing sellers. Many organizations noted their willingness to assist with identifying lands that could be high priority for purchasing but might not be identified by the current criteria. Additional priority areas could be identified, for example, through public meetings.

- Several organizations offered to read the report once complete.

- Several organizations noted they had a similar approach to identifying properties for land acquisition and that they would be willing to share information with LC-KFLA that could help to facilitate shared ownership or stewardship. Organizations also noted their willingness to share data that could help to prioritize property.

- The Land Conservancy's work could also benefit municipalities through a working relationship: increasing municipal awareness of habitat preservation issues, assisting with protection of easements, contributing to support for their Natural Heritage System approach; and enhancing their ability to defend natural heritage.

- Organizations expressed interest in the extent to which the Plan would serve the municipal approach to Natural Heritage Systems; while acknowledging that they might be looking through the different lens of satisfying provincial policies. However the Plan could help to inform areas of development; for example broad-scale development scenarios such as solar farms. They noted that the Plan has a high value because it aggregates and documents data from a wide variety of groups. This will be valuable for townships and anyone wanting to purchase land or plan for conservation.

7.2.2 Focusing on Water-based Features

There was a general agreement with the focus on water-based features, but the following suggestions were made on this approach:

- Use headwater data. It was acknowledged that there was no existing mapping. There were suggestions for methods by which headwater lakes could be added to the mapping; for example use contour lines to pick up the highest lakes in each watershed, to derive headwater lake areas.

- Focus on other water bodies instead of Provincially Significant Wetlands (PSWs) as PSWs have protection and other water-based features do not.

- Consider adding areas of peat mosses as they are the biggest acquirers of carbon dioxide;

- Focus on imperfectly drained areas that are highly productive.

- Include additional areas mapped by Conservation Authorities, who noted they would be willing to share data wherever possible.

- Give Lake Trout lakes higher ranking. Even though the MNRF and some municipal plans impose restrictions on Lake Trout lakes there is evidence of considerable pressure from the increase in number of cottages in the past 60 years. Frontenac County Official Plan, for instance, lists 23 Lake Trout Lakes that require a 300 m buffer as they are "at capacity" (i.e. the development of the shoreline has reached the maximum allowed limit) and only 8 that are not yet at capacity; i.e. they have reached the maximum shoreline development allowed.

7.2.3 Refining Watershed Boundaries

- Organizations agreed on the current focus on watershed boundaries but suggested considering a more local scale: for example, refining the approach to reflect what habitat is left in each watershed (ie: a smaller woodland might not seem important on a large scale, but if it is the only one left in a particular watershed, it would be very important.).

7.2.4 Adding Additional Buffers

- Consider buffers for wooded areas as well as wetlands, water bodies, ANSIs etc.

7.2.5 Adding Other Potential Mapping Criteria

- Add alvars, as these are globally, nationally and provincially rare communities that have been mapped.
- Consider including interior forest as a criterion (i.e. forest with a configuration that provides a substantial edge and a sheltered interior).
- Include habitat for Species at Risk as a criterion.
- Use the information from the Canadian Wildlife Service's biodiversity atlas.
- Add other areas that are covered by provincial policies such as adjacent lands, Significant Wildlife Habitat, Significant Valleylands.
- Add Algonquin Land Claim lands (where this applies, and where they are slated for protection).
- Use aerial photo interpretation to identify additional areas worthy of protection and add these, such as grasslands and thickets.
- Consider other approaches to developing priority mapping, for example map riparian areas 30 m from the shoreline.
- Consider the shoreline of Lake Ontario as a special feature.
- Look at areas of high waterfowl potential mapped by Ducks Unlimited, include areas mapped by the Bay of Quinte Remedial Action Plan.
- Consider adding parcel data as a layer; with larger parcels being higher priority.
- Consider using Quinte Conservation's Watershed Report Card data.
- Consider factoring in the condition of the area; for example, areas with high recreational use could be less of a priority.

7.2.6 Considering Additional Criteria for Linkages

- Linkages may be too heavily based on a ”path of least resistance” rather than ecological criteria; other analyses could be used to identify linkages.
- Consider using the NCC “least cost path” approach.
- Linkages should be selected based on juxtaposition of features rather than arbitrary connections.
- Connect the existing protected lands. For example, consider linking the area that extends between Frontenac Provincial Park and Puzzle Lake Provincial Park, and consider connecting the Bayfield Bog area with the Parrott’s Bay Property of the Cataraqui Region Conservation Authority.

7.2.7 Adding Individual Areas of Concern

- Consider adding individual areas of concern where justification is provided based on ecological principles, particularly if it is based on knowledge that is not available through current mapping. For example consider including additional wetlands, particularly smaller wetlands that are not provincially significant.
- Include Crown lands.
- Fifteen additional areas were suggested by participants that were of particular significance to them.

7.2.8 Considering Additional Analyses

- Consider cluster or density analysis as a substitute for parcel data; this would mean choosing a polygon as a priority area when it reaches a certain density of medium to high priority pieces of the landscape.
- Develop “what if” scenarios prior to settling on final priority criteria. That is, choose a variety of criteria and change their weighting to see what the priority areas look like under each set of conditions. For example, what impact would weighting forest cover much higher than water-related features have on the mapping?
- Consider the Ontario Ministry of Natural Resources climate change maps that indicate the impact on habitat of climate change under varying scenarios.
- Focus on expanding patches to enable natural processes to continue and get away from a “beads on a string” approach – i.e. bigger conserved spaces with less worry about connectivity

7.2.9 Refining Weighting

- Consider giving more weighting to features that are rare in each watershed.
- Include Candidate (as well as confirmed) Provincially Significant Wetlands and Areas of Natural and Scientific Interest in the weighting, as the program for identifying these features has not been active recently.
- Reduce the weight on Provincially Significant Wetlands, as these already receive a high level of protection from provincial policies.

7.2.10 Other Comments that Informed this Plan

- Consider prioritizing depending on the threat level; could the places under the most imminent threat of development be a priority?
- Consider ecosystems that are most likely to withstand climate change as most important.
- Recognize value of forests and peatlands in carbon management and potential for cap and trade programs.
- Consider taking a new role in providing signage and other education materials, improving trails.
- This should be a "living plan", being updated regularly and changeable based on new data and input from stakeholders.
- Consider incorporating a cultural element into the mapping. The environmentalist view of protecting species and habitat for nature and not including the human element seems limited. Humans are a main user of the land now and people can benefit by enjoyment of the land. This should be reflected in the designations of some of the features mapped in the Plan: for example, an ANSI could be called an ANSCI where C means cultural.

8.0 Information from Additional Studies

Queen's University students (Danielle Beaulne and Rebecca Hudson) conducted two studies that have the potential to inform the Plan in the future. The following provides a brief summary of their findings.

8.1 Exploration of Analyses that Would Contribute to Increased Understanding of the Landscape Within the Plan Area (Beaulne 2017)

A landscape model was created for a portion of the Kingston, Frontenac, Lennox and Addington counties, which comprise the focus area of the LC-KFLA for this Plan. Classification was performed using computer algorithms to analyse LANDSAT-8 multispectral imagery, which has a resolution of 30m x 30m. The analysis was performed on two sets of satellite imagery data from different dates: April and June, 2016. Analysis combining spring and summer imagery has been shown to increase the accuracy of interpreting wetlands. For instance, wetlands may appear as open water in the spring due to snow melt, precipitation, and a lack of vegetative covering. In the summer, wetlands may appear as vegetation due to the recession of ephemeral wetlands and the growth of vegetation.

Raster Mapping: In its simplest form, a raster consists of a matrix of cells (or pixels) organized into rows and columns (or a grid) where each cell contains a value representing information (for example, the cumulative weighting score). Rasters are well suited for representing data that changes continuously across a landscape.

Seven spectral bands (bands in or near the visible spectrum of light), and two band ratios which help to identify vegetation and water, were used in the analysis, and combined with the two imagery dates, resulting in a raster analysis using 18 bands. Areas obscured by cloud cover were corrected in the analysis.

Four models of land cover were obtained. Land cover classification was carried out using pixel-based image analysis (PBIA), which analyses each tiny square of image data used to compile the image, and object-based image analysis (OBIA), which analyses groups of squares based on their similarity. For example, all of the pixels in a lake appear to be similar in the image, so all of those pixels would be analyzed together as a unit. The same goes for agricultural fields, or patches of barren rock, or a grove of coniferous trees. This grouping of pixels tries to mirror the way that humans can look at the image and immediately recognize a whole area as being 'farmland'. In addition, the data were analysed using "decision tree" and "random forest" classification algorithms: different machine learning algorithms which depend on multiple computer decisions, and "training" of the computer with combinations of multiple decisions, respectively. These algorithms essentially teach the computer how to recognize different land cover classes based on the data that is provided to the algorithm.

Overall, the accuracy of all four models was comparable. However, some landscape configuration metrics differed depending on the model used. The main difference was that pixel-based analysis resulted in a landscape characterized by smaller, more isolated patches of landscape features (such as deciduous forests and wetlands). This in turn generated higher estimates of landscape diversity across the landscape, which is defined as the number of land cover types as well as the even distribution of different land cover types.

8.2 Land Cover Change in the Kingston, Frontenac, Lennox and Addington region (Hudson, 2017)

Examination of past aerial photography data concluded that there have been significant changes to both the climate and to the land cover over the past 30 years. Since 1968, there has been an increase in average monthly temperature of 1.5˚C and an increase in average monthly precipitation of 5.7 mm. Between 1984 and 2016, there has been an overall loss of agricultural land of 5.1%, an overall loss of coniferous trees of 6.2% and an overall gain of wetlands of 9.7%. The loss of agricultural land is most likely due to the flooding of farmland since this land cover type is usually changed to wetland or open water. However, conservation efforts may also play a large part in this change.

When comparing the past data to the future predications for the KFLA region, it is expected that the past trends in both temperature and precipitation will continue, most likely at accelerated rates. However, trends in past land cover changes are less well established than that of the climatic data and are based on fewer data points.

It is predicted by Parker et al. (2000) that the forests within the KFLA region will continue to be successful. By examining the past land cover data, we can see that deciduous forests remain fairly constant in area over time despite increased temperatures and precipitation. However, the changes in temperature and precipitation have correlated with a decline in coniferous forests in the land cover maps. If there is a relationship between these climate factors and the presence of coniferous trees, then it is possible that with increased temperature and precipitation that there may be a continuing of this decline. However, this change is quite small and so further study may be need in order to provide confidence in this trend.

Wetlands are also expected to be impacted by climate change. It has been predicted by Kling et al. (2013) that wetlands will be negatively affected by warmer temperatures and precipitation patterns that are more variable. Comparison between land cover maps show that there have been increases in the area that wetlands have covered despite increased temperatures. It has been predicted that water levels will go down with a warmer climate since with higher temperatures there will be higher rates of evaporation. However, past data shows that there has been a slight gain in area (0.5%) for open water bodies. The relationship between ground water, precipitation, and other factors, like plant species within the wetland class itself, are complex. Therefore, it is possible that there are external factors besides changes in temperature and precipitation (for example, increased Beaver activity) that have resulted in increased wetlands and open water. This could explain the difference between past changes and future predictions.

Habitat diversity, an important environmental parameter, has shown overall decreases over time. However, within the KFLA region, the change in habitat diversity has been quite localized with areas of increased habitat diversity right next to areas of decreased diversity.

9.0 Natural Heritage Plan

The Plan (illustrated for the Canadian Shield and Limestone Plain in Figures 26 and 27, respectively) shows the map of core areas and the linkages between core areas, as described above. The map was created using raster data. Weightings for each variable were applied to the data to create a score for each part of the map. The resulting cumulative scores were divided into three categories based on the standard deviation around the raster score: Low (with scores of 0 to 4), Medium (with scores of >4 to 9) and High (with scores of >9 to 25).

Raster maps are shown in figure 26 (Canadian Shield) and 27 (Limestone Plain). The raster maps are on different scales to emphasize the higher priority areas within each of the

regions (if they were on the same scale, then the Limestone Plain would have much smaller areas of yellow and red).

With weighting applied, some patterns emerged. The highest scores on the Canadian Shield (Figure 26) were driven by the Headwater lake areas layer, thus those areas that have high elevation points within the quaternary level watershed had higher scores in the northern shield area. Particularly concentrated yellow/red areas were in the northwest (upper reaches of the Salmon River watershed), areas to the north and west of Puzzle Lake and then areas north, adjacent and south of Frontenac Park.

In the Limestone Plain (Figure 27) the higher scores were determined largely by Provincially Significant Wetlands. The mapping identified an area of high priority in a band approximately 2-3 km south of the Canadian Shield boundary.

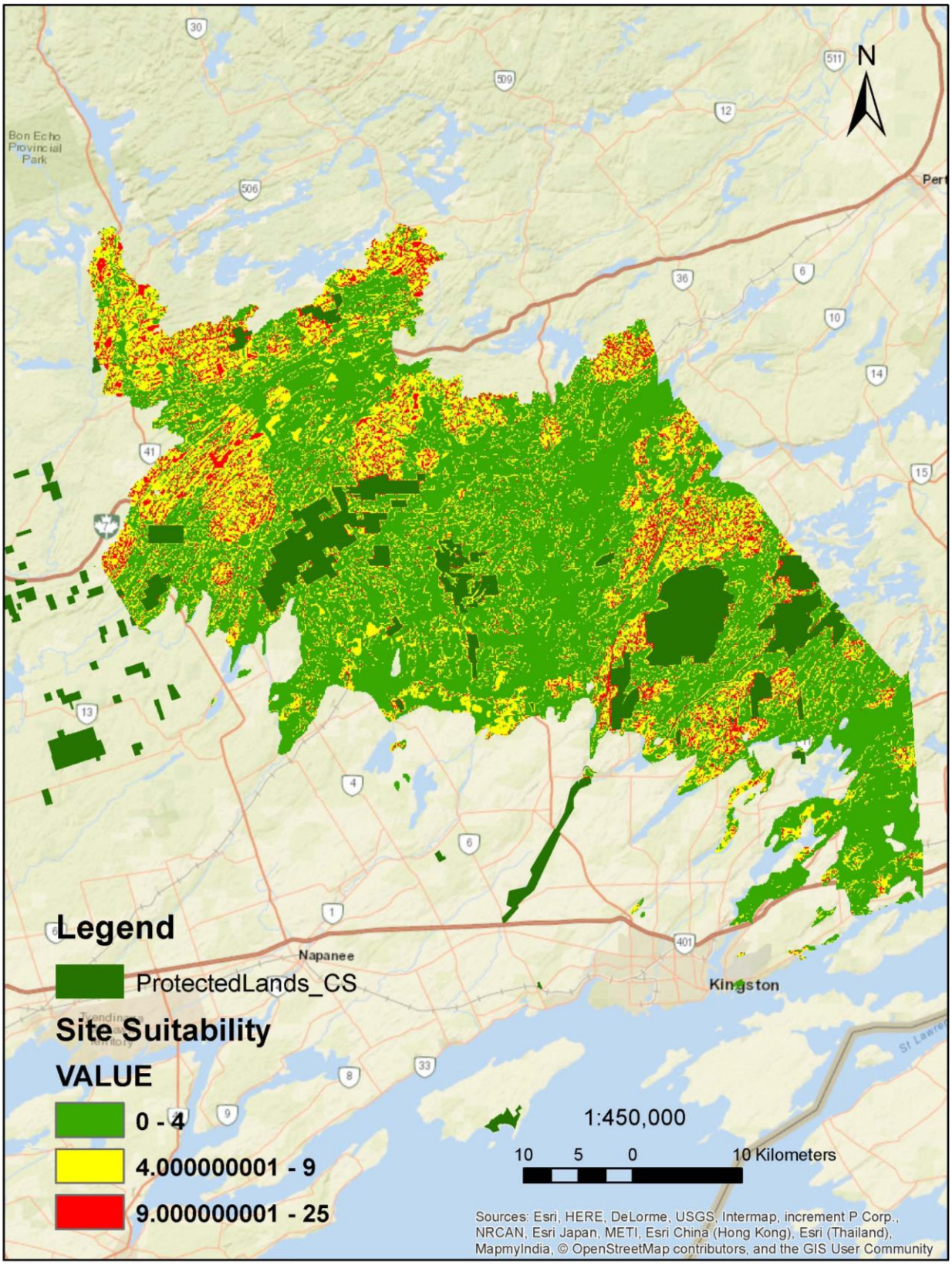

Figure 26: map of the Natural Heritage Plan within the Canadian Shield, including headwater lake areas.

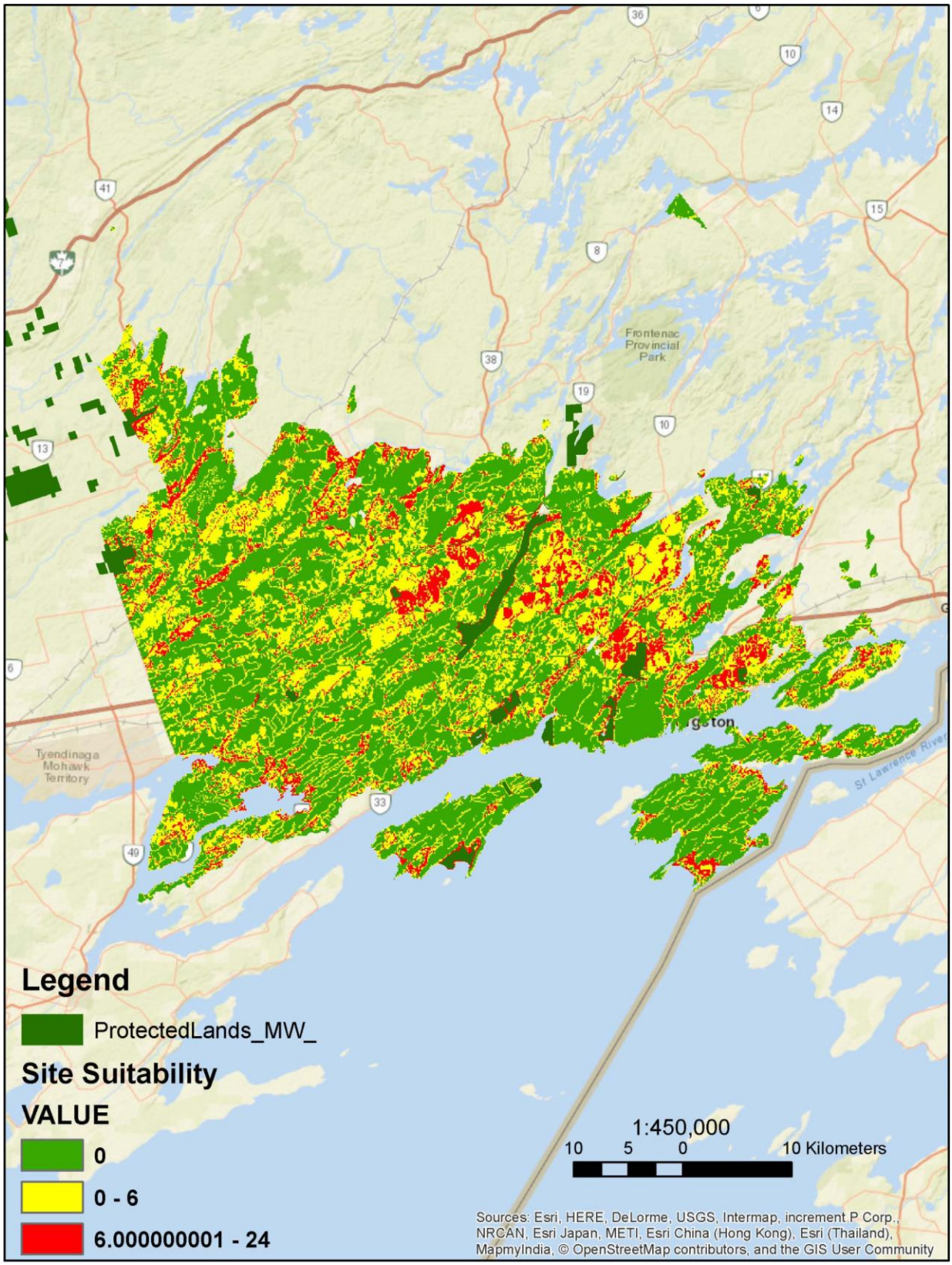

Figure 27. Map of the Natural Heritage Plan within the Limestone Plain, including headwater lake areas.

These emphases were re-evaluated in a raster analyses that omitted the headwater lake areas (Figure 28 and 29). Without the addition of headwater lake areas, the indication was that the main concentrations of high and medium priority were in the east around Frontenac Park region (omission of headwater areas in the south made very little difference, as headwater areas were much smaller in the south). These layers may be highly important for ecological significance and for the LC focus.

Ultimately, for practical purposes, prioritization for acquisition will be on three levels. First is the ecological: areas with the highest contribution to the natural heritage of the Plan area will be the first priority. Second is the political or organizational: prioritizing areas which meet the objectives of the LC-KFLA and its partners, and may be in greatest need of protection because they have incomplete protection at the policy and legislative level. Third is vulnerability or high-risk habitats: areas that need a high level of either management or restoration may not be feasible, given the small resources of LC-KFLA. However, even these areas may be within the scope of LC-KFLA's capabilities if a partnership fosters stewardship opportunities for volunteer efforts and fundraising that LC-KFLA could help organize and implement.

9.1.1 Areas of Exclusion from the NHP

Areas of aggregate extraction (with a 500 m buffer), major roads, and built-up areas (with the addition of a 500 m buffer) are areas that may weigh against inclusion in the NHP (Figure 30). While their affect would not be to subtract from the score, they could be used to inform the final layout of the NHP.

Approach to Mapping and Modifications Through Consultation

This layer will be used to inform priorities for acquisition.

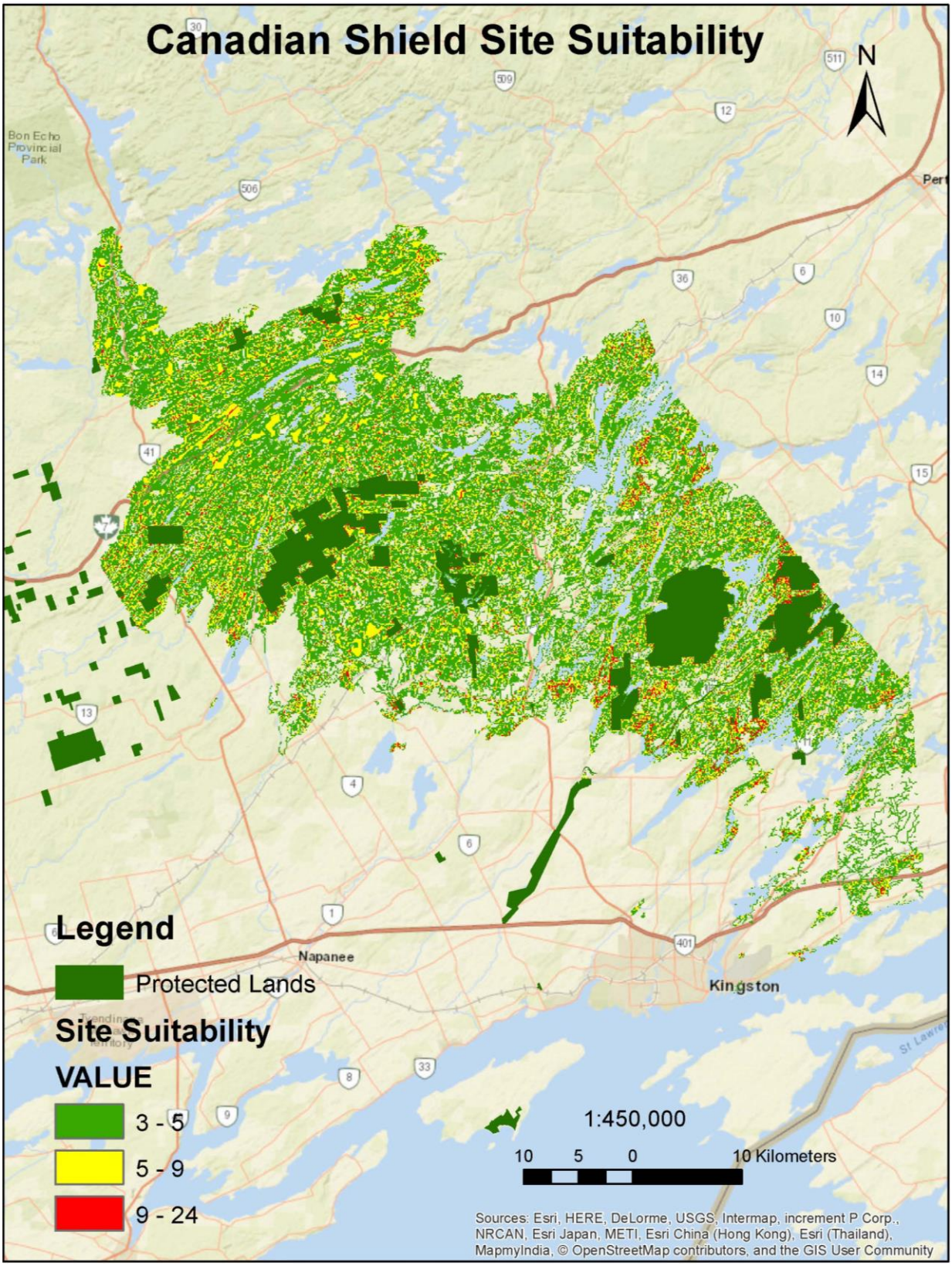

Figure 28. Map of the Natural Heritage Plan on the Canadian Shield, excluding headwater lake areas.

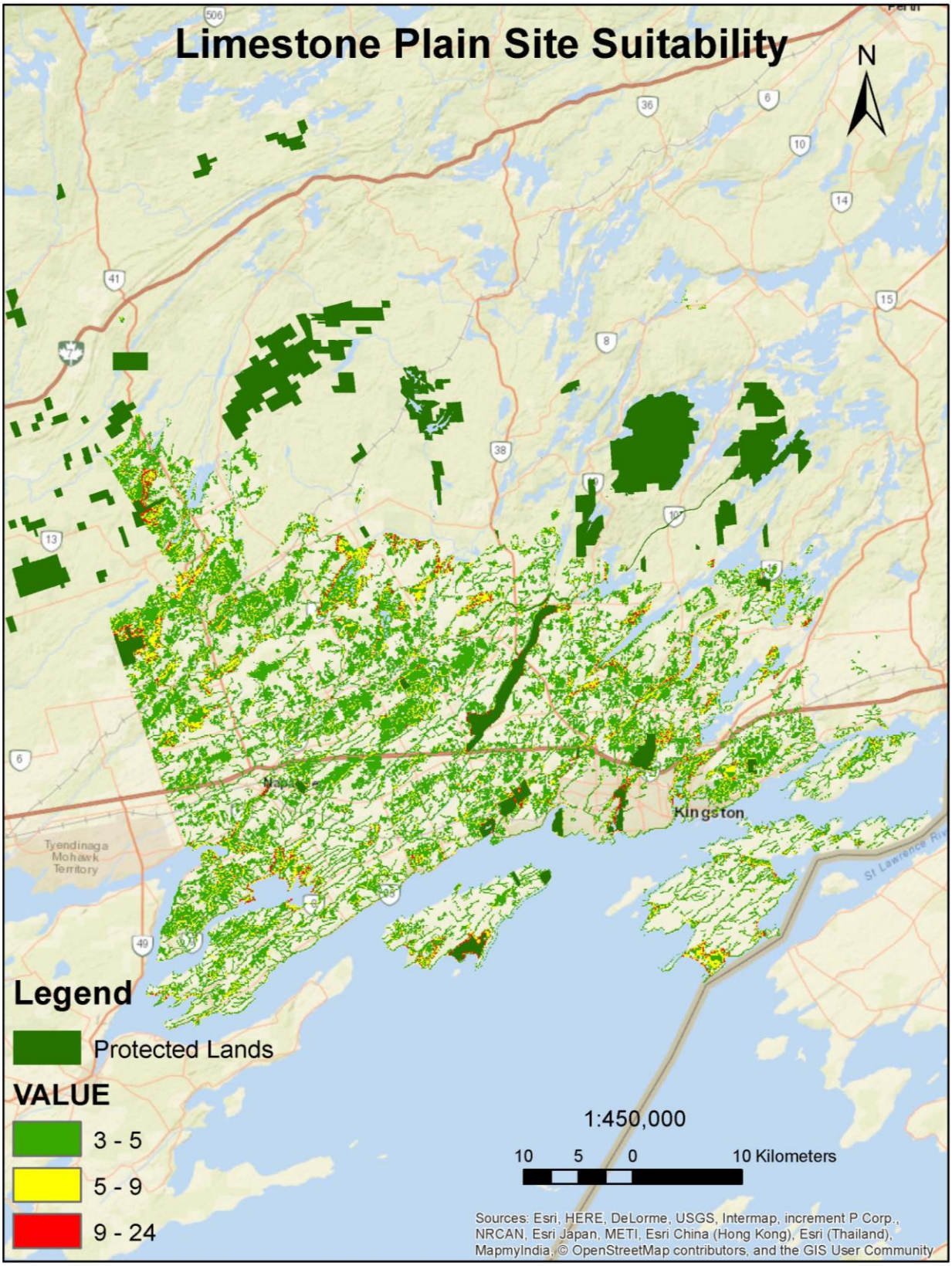

Figure 29. Map of the Natural Heritage Plan on the Limestone Plain, excluding headwater lake areas.

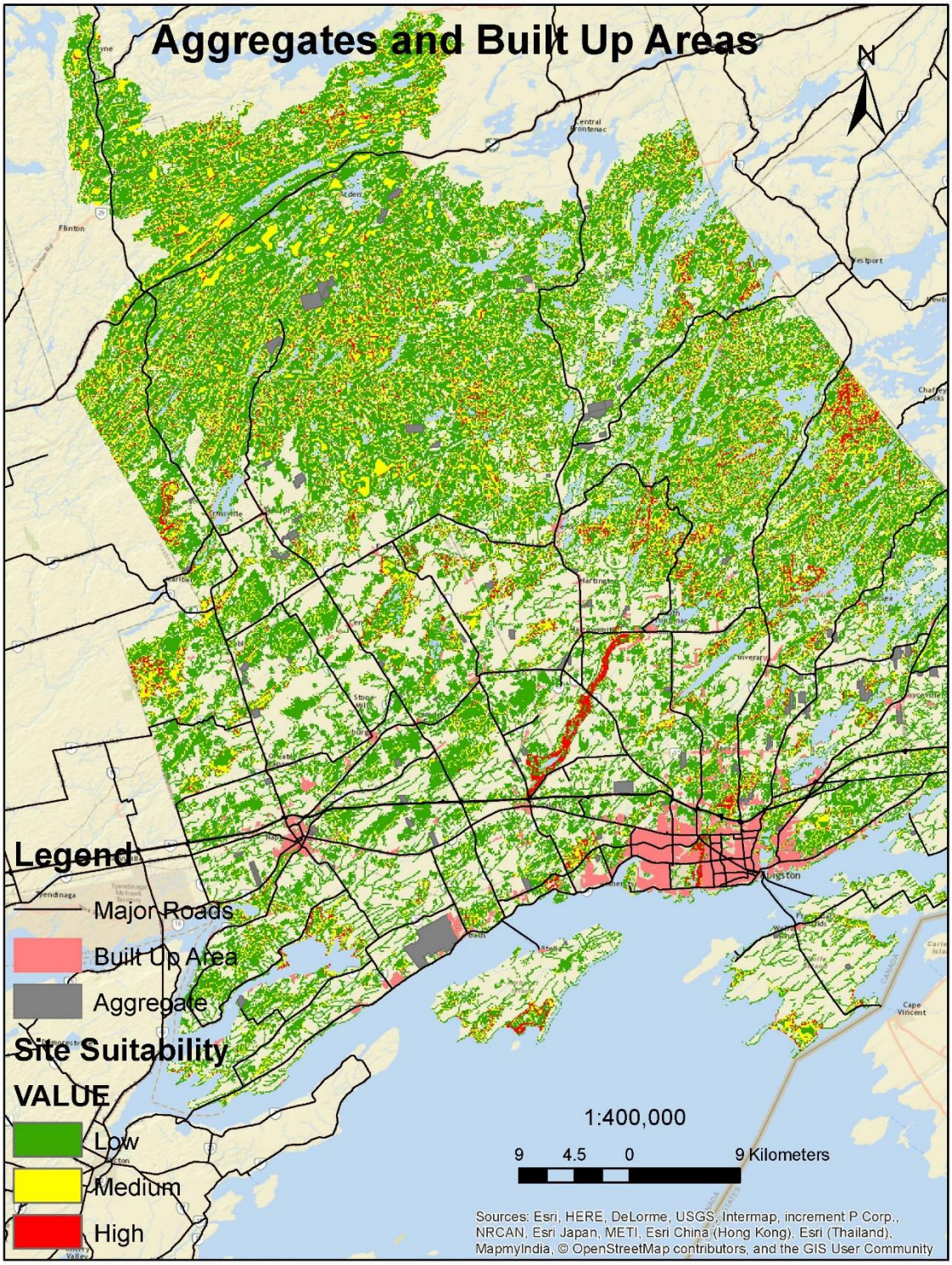

Figure 30. Map of the Natural Heritage Plan showing built-up areas and aggregate areas, which may be areas considered for exclusion.

10.0 Conclusions and Recommendations

The Plan builds on the areas that are protected through ownership (provincial parks, NCC, and Queen's University Biological Station lands) and through legislation (PSWs, ANSIs), taking a landscape approach to look for the consolidation of protected areas and building larger patches with an aim of increasing habitat health. The Plan takes a feature-based approach to protecting ecosystems, rather than attempting, for example, a species at risk approach and focusing on areas that are used by specific listed species, which may be difficult to map, and for which habitat or provincial distributions may change. Species need different habitats during their life cycles so safeguarding mosaics of diverse patches is important. Increasing connectivity between the protected lands also contributes to ecosystem health.

The NHP presented here provides guidance for identification of core areas and primary corridors throughout the LC-KFLA study area. It uses high-level mapping to identify features, supplemented with more refined mapping where possible. It takes into consideration connectivity provided by watercourses, without specifying the width required for corridors, as this would require more detailed information on prospective land use and species. However, primary linkages defined by other agencies such as conservation authorities and the Algonquin to Adirondacks Collaborative will be considered when developing priorities for acquisition.

Consultation has indicated that many organizations in the study area have similar interests in defining natural heritage systems and that they are willing to forge partnerships with LC-KFLA. Municipalities are interested in the techniques used to identify the NHP because of its potential to provide support for protection of lands that have a high value for the broader natural heritage system. While the mapping used is relatively high level, the identification of elements of the NHP using criteria cited by the Natural Heritage Reference Manual could provide support for municipal protection, with the caveat that the boundaries of the NHP would need to be refined by additional aerial photo interpretation and ground-truthing.

The weighting of areas, building on existing protected lands and significant features and increasing the connectivity between these lands, has indicated a priority for acquisition within a broad corridor in the Canadian Shield around Frontenac Provincial Park and in the northwest portion adjacent to Hastings County. In the southern Limestone Plain, highlighted areas include a band approximately 2-3 km south of the Canadian Shield boundary driven largely by Provincially Significant Wetlands. The area between Puzzle Lake and Frontenac Provincial Park may also be investigated in future raster mapping as it also has many features of high priority.

11.0 References

Beaulne, D. 2017. Exploration of Analyses that Would Contribute to Increased Understanding of the Landscape Within the LC-KFLA Plan Area. Report prepared for LC-KFLA.

Crins, W.J., P. A. Gray, P. W.C. Uhlig, and M. C. Wester. The Ecosystems of Ontario, Part 1: Ecozones and Ecoregions. Report for Science & Information Branch, Inventory, Monitoring and Assessment Section

Environment Canada. 2013. *How Much Habitat is Enough? Third Edition*. Environment Canada, Toronto, Ontario.

Hudson, R. 2017. Land Cover Change in the Kingston, Frontenac, Lennox and Addington region. Report prepared for LC-KFLA.

Ontario Headwaters Institute. 2017. What are Headwaters?. http://ontarioheadwaters.ca/what-are-headwaters/ Last Accessed on November 6, 2017.

Ontario Ministry of Municipal Affairs and Housing. 2014. 2014 Provincial Policy Statement, Under the Planning Act. Toronto, Ontario: Ministry of Municipal Affairs and Housing, Provincial Planning Policy Branch.

Ontario Ministry of Natural Resources [MNR]. 2010. Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, 2005. Second Edition. Toronto: Queen's Printer for Ontario. 248 pp.

Ontario Ministry of Natural Resources and Forestry. 2015a. Significant Wildlife Habitat Criteria Schedules For Ecoregion 7E.

Ontario Ministry of Natural Resources and Forestry. 2015b. Inland Ontario Lakes Designated for Lake Trout Management. Report for Species Conservation Policy Branch, Ontario Ministry of Natural Resources and Forestry, Peterborough, Ontatio. 54 pp.

Appendix 1: Criteria Used to Develop Preliminary Natural Heritage Plan and Preliminary Natural Heritage Plan

This page intentionally left blank

Preliminary Habitat criteria, ranking, and mapping considered by the Land Conservancy of Kingston, Frontenac, Lennox and Addingtonfor the Natural Heritage Plan, prior to consultation

1. Forest Patch size.

a) Northern shield vs. southern limestone plain. Our initial exploratory mapping was based on 100 acres (40 ha) and then also on 150 acres (60 ha) forest patch sizes for entire area, north and south. This showed dramatically that the northern Shield has high forest cover compared to much less and in smaller patches on the limestone plain.

Choosing of patch size in Northern Shield: Natural Heritage Reference Manual (MNR) - outlines forest patch size based on % forest cover: e.g if 15-30% forested use 20 ha patch size; if 30-60% forested -use 50 ha; if > 60% forested - no minimum size. The Northern Canadian Shield in our focus area is > 60% forested. The committee chose to use 60 ha forest patch size.

Excerpt from Natural Heritage Reference Manual (MNR):
Woodlands should be considered significant if they: are located within a sensitive or threatened watershed or a specified distance (e.g., 50 m or top of valley bank if greater) of a sensitive groundwater discharge, sensitive recharge, sensitive headwater area, watercourse or fish habitat and meet minimum area thresholds (e.g., 0.5–10 ha, depending on circumstance)

The mapping committee, in consultation with the land acquisitioncommittee and the Board, identified woodlands within the Canadian Shield that are at least 60 ha in size, AND within 60 m of a waterbody as a means of differentiating higher priority woodlands within a highly forested landscape. This criterion identifies and focuses on the ecological significance of waterbodies for conservation of habitat and biodiversity of aquatic ecosystems and their associated upland habitats.

Choosing of patch size in Southern Limestone Plain:

Excerpt below from Principles of Developing a NH System from Mainguy (2015):

In areas where forest patches tend to be smaller, the largest patches (in the top 10%) should be identified (identify all patches over 20 ha).

The Southern Limestone Plain of our focus area falls into this category with much higher development than the north and few remaining large size forest patches. As such the strategy in the south was to identify the top 20% of remaining forest patch size as priority lands.

While these criteria for both the north and south focus on larger intact tracks of land, it does not negate exploring or focusing on smaller tracks of land, particularly if they are

adjacent to protected lands, Provincially Significant Wetlands (PSWs), ANSIs or have a high diversity of habitats or provide a linkage between other high priority lands.

2. Wetland size and buffer

Choosing of size of wetlands and buffer region:
Excerpt below from Principles of Developing a NH System (Mainguy, 2015):
Clusters of wetlands: e.g. networks of isolated wetlands; wetlands in close proximity (within approximately 750 m) including a range of hydrological types (Environment Canada 2013) and wetland types (swamp, marsh, fen and bog);

Forested lands adjacent to wetlands: highest priority is land within 50 m of the wetland boundary; land within 375 m may also be particularly critical for wetland function; for example if certain species of turtles are present - but functions can continue up to 1000 m. (Environment Canada 2013).
Wetlands of a large size (greater than 30 ha, or the top 10% in terms of size within the planning unit) can form part of core area (MNR 2010)

We chose to identify wetlands that were at least 30 ha in size, which often is based on a cluster of smaller wetlands. We wanted to identify large wetland complexes that have not been identified as PSWs. We chose to use a 50 m buffer as this is highest priority and incorporates the riparian vegetation. A minimum of 30 m buffer is recommended for fish habitat in streams. The NH manual does often identify the recommended buffer size of 120 m. In these cases, these are the recommended buffer for minimizing impact on the habitat of interest. In our case, we are identifying the highest priority areas for conservation. In most cases, a property which encompasses an intact 50 m buffer, would likely have a much larger buffer that could be maintained under conservation.

In all of our waterbody habitats we chose to include a 50 m buffer and for the ANSIs we chose to add a 100 m buffer, to highlight those properties adjacent to these habitats as high priority for conservation.

3. Habitat rankings:
The mapping committee, with periodic feedback from the board and land acquisition committee, established the habitat criteria that the Land Conservancy felt were the highest priority layers for our natural heritage strategy. Protected lands and Provincially Significant Wetlands (PSWs) were established as the highest priority layers, as these are the foundation of building the natural heritage strategy. The mapping committee asked board members and lands committee members to rank each of the remaining layers outlined in the excel file (habitat rankings). The Land Conservancy focus area encompasses two extremely different regions: the Southern Limestone Plain and the Northern Canadian Shield, as such the natural heritage plan will have slightly different strategies for these two

regions. To use the data effectively, each of the layers were ranked for both the North – Canadian Shield – and South – Limestone Plain. A number between 1 and 9, *with 9 being the highest rank*, was used to rank each layer for the North and again for the South to help the Mapping Committee prioritize the layers. The mapping committee was seeking guidance on what each person felt was the most important habitat to consider when identifying areas for conservation. In each grouping, a number could only be used once (in other words, cannot give seven 9s, only one per grouping). The excel file, Habitat Rankings - has the individual rankings, and then summary statistics that were used in the end to provide weights for each of the habitat criteria. The weights for each of the habitat criteria are outlined below.

4. Habitat weights based on the overall habitat rankings:

The summary statistics of the habitat rankings (see excel habitat rankings file) were used to establish the weights below that are used in the mapping for identifying priority areas (raster mapping).

Negative layers: There are several negative layers (roads, aggregates and built up areas) that have been identified. The committee chose to not have these negative layers as additive to the positive habitat criteria layers, but rather to maintain as a separate layer that may be mapped with other layers. This will enable a better distinction of where the negatives are in reference to the identified priority areas.

5. Addition of other NHP mapping layers.

The final priority mapping will be based on our habitat criteria layers with other overlapping NHP mapping from other organizations, e.g. Nature Conservancy of Canada, Adirondack to Algonquin, The Land Between, Conservation Authorities. These layers were initially considered as an additive factor on top of our criteria mapping and weighting. So, where there are areas of priority that overlap between the different NHP mapping, consideration was given to additive weights. Thus areas that may have been of mid-priority may become high priority if other NHPs have also identified the same regions as priority for conservation.

This page intentionally left blank

Appendix 2: Consultation Participants

This page intentionally left blank

Meeting Participation Summary. Individuals shown in red represented more than one organization.

Organization	Individual and Role (if Noted)	Date
Lennox and Addington Stewardship Council	Kurt Hennige Susan Moore Marilyn Murray Lawrence O'Keeffe	3 May 2017
Frontenac Stewardship Foundation	Gray Merriam	3 May 2017
Friends of the Salmon River	Susan Moore	3 May 2017
Friends of the Napanee River	Lawrence O'Keeffe Barbara Roch	3 May 2017
Ontario Woodlot Association	David Sexsmith Thom Snowman	3 May 2017
Ontario Ministry of Natural Resources	Justin White (Partnership Specialist)	3 May 2017
Nature Conservancy of Canada	Mark Stabb (Program Manager, Central-East Ontario) Gary Bell (Program Director, Eastern Ontario)	19 April 2017
Township of Stone Mills	Roger Hogan (Deputy Clerk/Planning)	26 April 2017
Town of Greater Napanee	Jean Rixen (Planning Clerk)	26 April 2017
Lennox and Addington County	Mark Douw (Planner) Nick MacDonald (Planner) Stephen Paul (Director, Community & Development Services)	26 April 2017
Cataraqui Region Conservation Authority	Rob McCrae (Manager, Watershed Planning & Engineering) Tom Beaubiah (Manager, Conservation Lands) Travis York (Supervisor, Information Technology)	29 March 2017
County of Frontenac	Joe Gallivan (Director of Planning & Economic Development) Megan Rueckwald (Communit Planner)	25 April 2017
Township of South Frontenac	Forbes Symon (Manager, Development Services)	25 April 2017
Quinte Conservation	Maya Navrot (Stewardship and Education Coordinator) Curtis Vance (GIS specialist)	3 May 2017
City of Kingston	Greg Newman (Manager, Policy Planning) Sukriti Agarwal (Senior Planner, Policy) Stewart Waldron (Manager, GIS)	31 May 2017
Ducks Unlimited	Erling Armson (Head of Land securement/Invasive species/Northern Projects) Chris Delage (Conservation Programs Specialist)	5 May 2017
Tim Yearington	Respondent from Algonquin Anishinaabe	1 June 2017
Loyalist Township	Murray Beckel (Director, Planning and Building) Andrea Furniss (Supervisor, Planning)	23 June 2017
Mississippi Madawaska Land Trust	Cathy Keddy (Board Member) Janet Mason (Board Member) Bob Betcher (Board Member)	12 June 2017

Organization	Individual and Role (if Noted)	Date
	Susan Sentsey (Program Manager)	
Madawaska Valley Conservation Authority	Alyson Symon (Watershed Planner) Alex Broadbent (Information Technology Supervisor)	12 June 2017

21 organizations; 38 People in total

Land Conservancy Board of Directors at the time weighting criteria were discussed

- Tina Bailey
- Christine Cannon
- Dale Dilamarter'
- Roger Healey
- Kathleen Laird
- Larry McCurdy
- Paul Mackenzie
- Anne Robertson
- Caroline Rowlands
- Vicki Schmolka
- Mary Alice Snetsinger

LC-KFLA Land Acquisition Committee members at the time weighting criteria were discussed

- Chris Cannon
- Dale Dilamarter
- Janet Elliott
- Paul Mackenzie
- Anne Robertson
- Barry Robertson
- Caroline Rowlands
- Mary Alice Snetsinger
- Thom Snowman