Elgin Natural Heritage Systems Study

(includes City of St. Thomas)

2019 (June 5th DRAFT)

Prepared by

Upper Thames River Conservation Authority

in cooperation with Elgin County Conservation Authorities

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The County of Elgin
450 Sunset Drive
St. Thomas, ON
N5R 5V1
Phone: (519) 631-1460
Web: www.perthcounty.ca

Available at:
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Project Management by:
Upper Thames River Conservation Authority
1424 Clarke Road
London, Ontario N5V 5B9
Phone: (519) 451-2800
Web: www.thamesriver.on.ca
Email: info@thamesriver.on.ca

Cover Photo
A bird's eye view of the Elgin County shoreline and nearby woodlands. *Drone photo by Joseph McNeil.*

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Upper Thames River Conservation Authority Study Team

Cathy Quinlan	Report author and technical expertise
Terry Chapman	GIS modeling and technical expertise
Tracey Haycock	GIS vegetation mapping
Tracy Annett	Project management, policy and implementation
Tara Tchir	Technical expertise
Chris Harrington	Project management

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Project Study Team Participants

Steve Evans	County of Elgin, Manager of Planning
Marion-Francis Cabral	MMAH, Municipal Advisor
Karina Cerniavskaja	Ministry of Natural Resources and Forestry (MNRF), Aylmer District
Kathleen Buck	MNRF, Biologist
Jason Webb	MNRF, Management Biologist
Val Towsley	Lower Thames Valley CA, Resource Technician
Joe Gordon	Kettle Creek CA, Director of Operations
Leigh-Anne Mauthe	Long Point Region CA, Planning Technician, Regulations Officer
Chris Boothe	Long Point Region CA, Planning Technician, Regulations Officer
Tony Difazio	Catfish Creek CA, Resource Planning Coordinator
Peter Dragunas	Catfish Creek CA, Water Quality Technician
Tracey Pillon-Abbs	Dutton/Dunwich, Planner
Heather James	West Elgin, Southwold, Planner
Jim McCoomb	Central Elgin Planning Office and City of St. Thomas, Manager of Planning Services
Gene DiMeo	Malahide, Director of Development & Community Services
Margaret Underhill	Bayham, Deputy Clerk/Planning Coordinator
Kale Brown	Town of Aylmer, Director of Corporate Services

Steering Committee

Ed Ketchabaw	Mayor of Bayham
Sally Martyn	Mayor of Central Elgin
Dominique Giguere	Deputy Mayor of Malahide
Heather Derks	Citizen appointee

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Executive Summary

The 2019 Elgin Natural Heritage Systems Study (ENHSS) evaluates the existing ecologically important terrestrial (land) resources of the county based on 2015 aerial photography (ortho-imagery) using scientific methods and Geographic Information Systems (GIS) modeling.

Chapter 1 introduces the importance of the natural heritage systems planning, including policy rationale and a summary of natural heritage systems studies in other nearby counties. The study scope is discussed, including the study area, project governance, and general limitations of the study. The distinction between "significant" features, as defined in the PPS, and "ecologically important", as defined in this study, is explained. A summary of past natural heritage studies in Elgin County is provided.

Chapter 2 describes how the various components of the county's natural heritage system were defined and mapped. A variety of base mapping layers were developed by the Upper Thames River, Lower Thames Valley, Kettle Creek, Catfish Creek and Long Point Region Conservation Authorities. Using these mapping layers, the first step was to identify and delineate the smallest unit of vegetation, the *Vegetation Community*. Seventeen types of *Vegetation Communities* were delineated. The *Vegetation Communities* were then lumped into six broader categories called *Vegetation Groups*: woodlands, thickets, meadows, water features, and connected vegetation features. Three *Vegetation Ecosystems* were defined: terrestrial, wetland and aquatic. The final step consisted of delineating *Vegetation Patches*, which are a mosaic of one or more abutting *Vegetation Groups*.

Chapter 2 concludes with a summary of mapping results for the Elgin Study Area (geographic Elgin plus a 500 m buffer around all sides except the lake side). In the Elgin Study Area there is 20.77% woodland cover, 0.77% thicket cover, 1.80% meadow cover, 0.48% water feature cover, and 0.07% connected vegetation feature cover. Wetland cover (comprised of woodland, thicket and meadow groups) is 2.64%. The wetland cover is based on MNRF evaluated wetlands plus unevaluated wetlands mapped by the UTRCA using only air photo interpretation. Environment Canada (2013) sets guidelines for sustainability of at least 30% vegetation cover and at least 10% wetland cover at the watershed (or county) scale.

Chapter 3 describes the 13 criteria used to identify ecologically important *Vegetation Groups* and *Vegetation Patches*. Each criterion is described, providing rationale, application/mapping rules and modeling results in terms of how many *vegetation groups* or *patches* meet each criterion. Maps showing the results for each criterion are included in Appendix H.

Chapter 4 summarizes the overall results of the criteria modeling at the *vegetation group* and *patch* levels. Patches meeting one or more criteria are deemed ecologically important in this study. The woodland group criteria for ecological importance also establish significance for woodlands consistent with the PPS. Maps showing the patches that meet one or more criteria for ecological importance are provided for Elgin County and for each local municipality and the City of St. Thomas in Appendix K and L. Approximately 81% of vegetation patches meet at least one criteria, representing 98.8% of the patch area. Some 21.74% of Elgin County is in ecologically important vegetation cover (24.12% for Elgin County Study Area with the 500 m buffer). At the local municipal level, the results range from 10.72% in Aylmer to 32.47% in Bayham.

Chapter 5 provides recommendations for the implementation of this science-based study. A number of land use planning related recommendations are provided along with additional stewardship and education recommendations.

The appendices provide additional information on methodology, rationale, and metadata. The digital data is provided to each municipality and conservation authority.

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American Goldfinch. *Photo by Ron Ridout*

1.0 Background

1.1 Purpose of the Elgin County Natural Heritage Systems Study

The Elgin Natural Heritage Systems Study (ENHSS) addresses the need for information on the state of the county's natural areas and systems. The study provides a landscape level assessment of natural heritage features and functions.

The identification of natural features and areas in southwestern Ontario is an important undertaking. Environment Canada (2013) identified that human activities, such as agriculture, urban development and associated infrastructure, have resulted in the loss or degradation of over 70% of the naturally vegetated areas in Southern Ontario. In some areas this reduction is greater. The remaining naturally vegetated areas tend to be in unconnected patches across the landscape. Intensive land use activities have also been found to contribute to degraded water quality conditions in many streams and lakes.

The Province of Ontario provides policy guidance to municipalities on matters of provincial interest in the Provincial Policy Statement (PPS). The PPS (2014) includes the following general directives for municipalities related to planning for natural heritage:

Excerpt from the 2014 PPS (page 22)

2.0 Wise Use and Management of Resources

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

Accordingly:

2.1 Natural Heritage

2.1.1 Natural features and areas shall be protected for the long term.

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

2.1.3 *Natural heritage systems* shall be identified in Ecoregions 6E & 7E1*,* recognizing that *natural heritage systems* will vary in size and form in *settlement areas*, *rural areas*, and *prime agricultural areas*.

Note: Elgin County falls within Ecoregions 6E and 7E1, more specifically 7E2 and 7E6.

The ENHSS is a science based study that uses high quality ortho-imagery and Geographic Information System (GIS) modeling to identify natural vegetation patches that are considered to be ecologically important at the County level. Many of the ecologically important features also are significant in the context of the PPS (see text box below).

Excerpt from the 2014 PPS (pages 48, 49)

Significant means

a) in regard to wetlands, coastal wetlands and areas of natural and scientific interest, an area identified as provincially significant by the Ontario Ministry of Natural Resources using evaluation procedures established by the Province, as amended from time to time;
b) in regard to woodlands, an area which is ecologically important in terms of features such as species composition, age of trees and stand history; functionally important due to its contribution to the broader landscape because of its location, size or due to the amount of forest cover in the planning area; or economically important due to site quality, species composition, or past management history. These are to be identified using criteria established by the Ontario Ministry of Natural Resources;
c) in regard to other features and areas in policy 2.1, ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or natural heritage system;

Criteria for determining significance for the resources identified in sections (c)-(e) are recommended by the Province, but municipal approaches that achieve or exceed the same objective may also be used.

While some significant resources may already be identified and inventoried by official sources, the significance of others can only be determined after evaluation.

The ENHSS methodology is intended to establish the local approach for identifying the terrestrial Natural Heritage System (Fish Habitat and other aquatic habitat features are not identified in the study), as required by the natural heritage policies of the PPS. The ENHSS incorporates the most current information available from the Ministry of Natural Resources and Forestry (MNRF) to identify the Natural Heritage Features and Areas that they are responsible for identifying as per a) of the PPS definition of significant in the above text box and related policies (e.g., provincially significant wetlands and Areas of Natural and Scientific Interest).

The study also includes the identification of significant woodlands and valleylands, in accordance with the Natural Heritage Reference Manual (MNR, 2010), and sets outs a recommended approach for identifying significant wildlife habitat, to address the PPS requirement for planning authorities to identify such Natural Heritage Features and Areas as per b) and c) of the PPS definition in the text box above. The complete list of Natural Heritage Features and Areas as set out in the PPS is shown in the text box below.

NOTE: In the case of valleylands, the identification and evaluation of Significant Valleylands is based on the recommended criteria outlined in section 8.3.1 of the Natural Heritage Reference Manual (MNR, 2010). It is the responsibility of planning authorities to identify these features.

Excerpt from the 2014 PPS (page 22)

2.1.4 *Development* and *site alteration* shall not be permitted in:

a) *significant wetlands* in Ecoregions 5E, 6E and 7E1; and

b) *significant coastal wetlands*.

2.1.5 *Development* and *site alteration* shall not be permitted in:

a) *significant wetlands* in the Canadian Shield north of Ecoregions 5E, 6E and 7E[1];

b) *significant woodlands* in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Marys River)[1];

c) *significant valleylands* in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Marys River)[1];

d) *significant wildlife habitat*;

e) *significant areas of natural and scientific interest*; and

f) *coastal wetlands* in Ecoregions 5E, 6E and 7E1 that are not subject to policy 2.1.4(b)

unless it has been demonstrated that there will be no *negative impacts* on the natural features or their *ecological functions*.

2.1.6 *Development* and *site alteration* shall not be permitted in *fish habitat* except in accordance with *provincial and federal requirements*.

2.1.7 *Development* and *site alteration* shall not be permitted in *habitat of endangered species and threatened species*, except in accordance with *provincial and federal requirements*.

2.1.8 *Development* and *site alteration* shall not be permitted on *adjacent lands* to the *natural heritage features and areas* identified in policies 2.1.4, 2.1.5, and 2.1.6 unless 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*.

2.1.9 Nothing in policy 2.1 is intended to limit the ability of *agricultural uses* to continue.

This study also identifies various other natural features and areas that comprise the natural heritage system that are not considered "significant" as defined in the PPS. These other features and areas are described in more detail in Section 1.5.

The ENHSS provides mapping of the Natural Heritage Systems for the Corporate County of Elgin, including local municipalities: Municipalities of West Elgin, Dutton/Dunwich, Central Elgin, and Bayham and the Townships of Southwold and Malahide and the Town of Aylmer. The City of St. Thomas is geographically located in Elgin County and so is included in this study, but it is a separated city.

The PPS (2014) defines the natural heritage system as follows:

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

The Natural Heritage System includes: woodlands, wetlands, thickets, young plantations, meadows, waterbodies and watercourses and connected vegetation features.

Agriculture is the dominant land use in the County of Elgin. The working agricultural fields can provide linkages between natural features and areas and these linkages may be utilized in different ways depending on the cropping patterns or the time of year. The ENHSS does not attempt to map all of these potential system linkages but rather acknowledges that the agricultural landscape (i.e., crop fields, pastures, etc.) can provide some linkage functions. Given the size of the study area, the predominantly agricultural land use and that land use change is anticipated to be limited, the ENHSS maps the Natural Heritage Systems at the county level of scale.

In cases where land use change is anticipated, the potential impact of the land use change on system linkages must be considered. For example, if agricultural land is proposed to be converted to urban development or other non-agricultural uses, the system linkages that would have been provided in the working agricultural landscape may be disrupted or eliminated by the post development urban landscape. In such cases it is necessary that Natural Heritage System linkages be studied at an appropriate level of detail and that system linkages be provided as part of the planning approval process.

The 2015 Elgin County Official Plan, Section D1.2.4 states that "It is a policy of this Plan that the establishment of a natural heritage system be considered at the time of the next Official Plan Review."

Excerpt from the 2015 Elgin County Official Plan

Section D1.2.4 Establishing a Natural Heritage System

The County of Elgin is committed to maintaining and promoting a healthy natural environment and protecting its unique and special natural heritage features for the present generation and all successive generations. Therefore, an ecosystem based planning and management approach is required to guide the land use decision-making process. This approach must emphasize that *development* should not only protect and manage impacts to ecosystems but also include the objective of enhancing and restoring ecosystems appropriately. The diversity and connectivity of natural features in an area, and the long term *ecological function* and biodiversity of *natural heritage systems*, should be maintained, restored or where possible, improved, recognizing linkages between and among *natural heritage features and areas*, *surface water features* and *groundwater features*. It is a policy of this Plan that the establishment of a *natural heritage system* be considered at the time of the next Official Plan Review.

After a Natural Heritage Study is completed the County Official Plan will be amended to implement the recommendations of the study. Local municipalities will also need to update their Official Plans to conform with the County Official Plan. The County will engage adjacent jurisdictions when developing its *natural heritage system*, recognizing that *natural heritage features and areas* cross municipal boundaries.

1.2 Natural Heritage Systems Studies

The UTRCA has led Natural Heritage Systems Studies in Oxford (County of Oxford, 2016), Middlesex (County of Middlesex, 2014) and Huron (County of Huron, 2014 draft). These studies evolved from earlier Natural Heritage Studies (County of Oxford 2006 and County of Middlesex 2003).

1.2.1 Natural Heritage Studies (2003 to 2006)

The first study, the 2003 Middlesex Natural Heritage Study (County of Middlesex and UTRCA 2003), was a pilot project for the Carolinian Canada Big Picture Project and the Ministry of Natural Resources Ecological Land Classification System. The Middlesex Natural Heritage Study (MNHS) involved analysis of existing information along with new botanical information for private property that was collected as part of the study. This information, combined with a detailed review of the ecological literature, led to the development of a set of landscape criteria that were then modelled using Geographic Information System (GIS) technology. The study focused on the identification of significant woodland patches only.

Building upon the Middlesex study, the 2006 Oxford Natural Heritage Study (ONHS) (County of Oxford 2006) was led by the UTRCA in collaboration with other county Conservation Authorities and completed for the County of Oxford. Various partners participated in the project. The 2006 ONHS had the following goals:

1. To increase understanding of the County's natural heritage features and systems (e.g. woodlands, wetlands, aquatic systems such as streams and rivers, etc.).
2. To develop land use planning information and establish the scientific and provincial policy basis, to identify, protect and enhance the natural heritage features and systems, at both the County and local municipal levels.
3. To encourage and facilitate private stewardship and public education.
4. To strengthen links between natural areas and protect the relationships between plant and animal communities.

The ONHS broadened the approach beyond wooded areas to include flood plain meadows and other elements of the natural heritage system, including an aquatic resources analysis. The ONHS was subjected to a third party peer review. The basic approach was validated through the peer review and minor adjustments were made to some criteria.

1.2.2 Natural Heritage Systems Studies (2014 to present)

Since the 2014 PPS Section 2.1.3 requires that natural heritage systems be identified in ecoregions 6E and 7E, new iterations of natural heritage studies are using a systems approach. The system expands from the previous studies that primarily focused on identifying significant woodlands. Current system studies now include other habitat types such as meadows, thickets, hedgerows, riparian buffers, etc.

Recent studies using this approach were completed by the UTRCA for Middlesex (County of Middlesex, 2014), Huron (County of Huron, 2014 draft), Oxford (County of Oxford, 2016 draft), and Perth (County of Perth, 2018 draft). These studies provide the basis for this Elgin study.

1.3 Study Area

A map of Elgin County is shown in Figure 1. The County of Elgin has seven local municipalities, including the municipalities of Bayham, Central Elgin, Dutton/Dunwich, Town of Aylmer, Township of Malahide, Municipality of Southwold, and Municipality of West Elgin. The City of St. Thomas is geographically located in Elgin County and so is included in this study, but is a separated city. However, this study treats the entire county as a whole for the purposes of natural heritage mapping. The county is under the jurisdiction of four Conservation Authorities: Lower Thames Valley, Kettle Creek, Catfish Creek and Long Point Region.

A 500m buffer was placed around the county boundary when modelling the criteria to avoid cutting off woodlands and other natural heritage features that spanned both sides of the boundary or were less than 120 m from the boundary. The buffer is not included on the lake side of the county. This larger area is termed the Study Area. The Natural Heritage Reference Manual (page 156) recommends that the natural heritage system adequately and appropriately connect features to other natural heritage systems beyond the study area. The Elgin County geographic area is approximately 188,482 ha and the study area with the 500 m buffer is 197,159 ha.

1.4 Project Governance

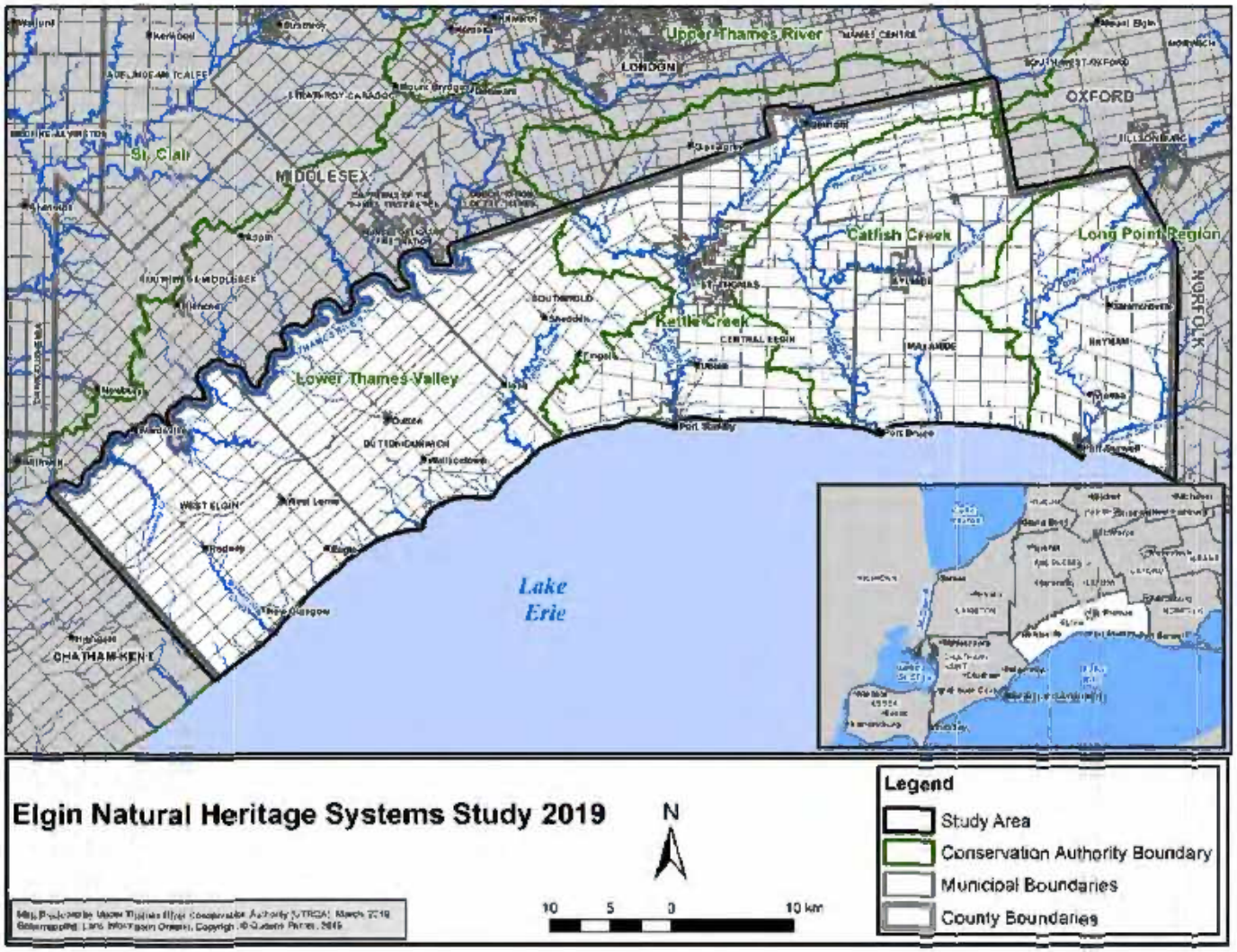
To involve all of the partners, a Project Team was assembled and invited to meetings to review the methodology and discuss various specifics around criteria, etc. The project was guided by a partnership of the following agencies:

- County of Elgin, Planning & GIS staff
- Upper Thames River Conservation Authority
- Lower Thames Valley Conservation Authority
- Kettle Creek Conservation Authority
- Catfish Creek Conservation Authority
- Long Point Region Conservation Authority
- Ministry of Natural Resources and Forestry (Aylmer Office)
- Ministry of Municipal Affairs and Housing
- Municipality of West Elgin
- Municipality of Dutton/Dunwich
- Township of Southwold
- Municipality of Central Elgin
- City of St. Thomas (separated city)
- Township of Malahide
- Municipality of Bayham
- Town of Aylmer

A total of three meetings were held between Sept 2018 and April 2019. The kick-off meeting provided an introduction to natural heritage systems studies and some of the technical issues to be discussed. The second meeting was a technical workshop where the woodland size cutoff options were reviewed in detail with draft mapping results, and the modeling criteria were reviewed in greater depth. The third meeting focused on reviewing the study findings, maps, and recommendations.

The County of Elgin approved the final project proposal and oversaw the fulfillment of project time lines and deliverables. The Upper Thames River Conservation Authority (UTRCA) oversaw project coordination.

Figure 1. County of Elgin showing Local Municipalities, City of St. Thomas and Conservation Authority Watersheds



Peer Review

A third party peer review of the ENHSS was not part of the contract as similar earlier studies have been peer reviewed and the ENHSS project team and steering committee provided feedback at several stages throughout the study.

The 2006 Oxford Natural Heritage Study (ONHS) and the 2014 Middlesex Natural Heritage Systems Study (MNHSS) were both peer-reviewed by third party consultants. The early 2006 ONHS was received by the County of Oxford and subjected to a third party per review. The basic approach was validated through the peer review and minor adjustments were made to some criteria.

The 2014 MNHSS was subjected to a technical peer review by a qualified third party expert at two stages in the process, the criteria development phase and the mapping results phase. This study was the first 'systems' study to evolve out of the earlier natural heritage studies, so a review was appropriate. Again, the approach was validated.

The only significant changes from the 2014 MNHSS to this ENHSS study are:

- the meadow size criterion cut-off was reduced from ≥ 10 ha in the MNHSS to ≥ 5 ha (the rational is included in section 3.4.2.),
- there was the addition of the Shoreline Zone criterion (see section 3.3.2), and
- the unmapped criterion (Significant Wildlife Habitat, Groundwater Dependent Ecosystems, and Watercourse Bluffs & Depositional Areas) were removed as criterion and grouped into the list of additional natural heritage features and areas that must be considered in an EIS (see Appendix N and Section 5.1).

The methodology used to identify the valleyland systems in the 2014 MNHSS and 2016 Oxford Natural Heritage Systems Study was reviewed by the MNRF who agreed that the methodology met evaluation criteria and standards as per the NHRM requirements to identify Significant Valleylands.

1.5 Significant versus Ecologically Important

As outlined in Section 1.1., this study maps and evaluates the natural heritage systems of Elgin County and its component features and areas, to provide the scientific basis for their identification by the County, as required to be consistent with the applicable natural heritage policies of the PPS.

The term/phrase "ecologically important" is used to identify the features of the natural heritage system that meet the ecologically based criteria established in this study. These features include:

- vegetation groups and patches that are "significant" as per the definitions of significant in the PPS and MNRF criteria, including significant woodlands, significant valleylands, fish habitat, provincially significant wetlands, and provincially significant ANSIs, and

- various other vegetation groups that are ecologically important from a natural heritage system analysis perspective, including additional features and areas such as meadows, thickets, regionally significant ANSIs, evaluated and unevaluated wetlands, and connected vegetation features. These latter features are not significant as per the PPS definition and the MNRF criteria (unless they are determined to be Significant Wildlife Habitat).

Table 1 summarizes the natural heritage features that meet the definition of significant and ecologically important.

The valleyland layer developed in this study meets the requirements of Significant Valleylands as noted in the previous section.

Natural Heritage Systems Studies identify "ecologically important" features using a series of ecologically based criteria and GIS modeling. Each criterion measures a unique aspect of the ecological services that a natural feature provides. Thus, any patch that meets at least one criterion is considered "ecologically important" in Elgin, with some of these ecologically important features also being significant as per the PPS.

This one-criterion approach has been utilized in many other studies including the 2016 Oxford Natural Heritage Systems Study, 2014 Middlesex Natural Heritage Systems Study and the 2014 Huron Natural Heritage Study. In these other studies, the criteria were called "significance criteria", but in this study the word "significant" has been replaced with "ecologically important". This change was made to distinguish the use of the word significant in the Provincial Policy Statement for features such as Provincially Significant Wetlands and Provincially Significant ANSIs.

Table 1. Significant versus Ecologically Important Natural Heritage Features and Areas

Natural Heritage Features	Significant as per the PPS	Ecologically Important in the ENHSS 2019
Significant Woodlands that meet PPS Criteria (as per Table 7-2 NHRM)	Yes	Yes (see Section 3.2.2 of this study)
Significant Valleylands	Yes	Yes (only the NHFs within or touching them)
Fish Habitat	Yes	No (not a criteria in this terrestrial study)
Provincial Earth Science ANSIs	Yes	No (some NHF&A on them may be if they meet other ENHSS criteria)
Provincial Life Science ANSIs	Yes	Yes
Regional Life Science ANSIs	No	Yes (the ENHSS is the appropriate regional scale to recognize them)
Provincially Significant Wetlands	Yes	Yes
Evaluated Wetlands (non-significant)	No	Yes
Unevaluated Wetlands	No	Yes
Meadows	No	Yes (if meet ENHSS group or patch criteria)
Thickets	No	Yes (if meet ENHSS group or patch criteria)
Connected Vegetation Features	No	Yes (if meet ENHSS group or patch criteria)
Non-significant Woodlands that do not meet PPS criteria	No	Yes (if they meet ENHSS patch criteria)
Water bodies and Major Watercourses	Yes (If they contain Fish Habitat)	Yes (if part of a group or patch that meets ENHSS criteria)
Other Natural Features and Areas that require field-level identification (e.g., they are not landscape level criteria so cannot be modeled as part of the ENHSS)		
Habitat of Endangered, Threatened species	Yes (where identified, under the SAR Act)	
Significant Wildlife Habitat	Yes (where identified, see SWH Criteria Schedule)	
Watercourse Bluffs and Depositional Areas	Yes (if they contain Fish Habitat)	
Groundwater Dependent Wetlands/Ecosystems	Yes (if they meet MNRF Provincially Significant Wetland criteria)	

1.6 Statement of Limitations (Scope)

The methodology for this study involves using the best available vegetation information from digital mapping layers and current landscape ecology literature to develop landscape criteria for local importance (e.g., size, proximity). Several limitations are noted in this section.

1.6.1 Mapping Limitations

The base mapping layer is based on spring colour 2015 aerial photography (ortho-imagery). The boundaries of the natural features are accurate for that point in time only. Base mapping layers are manually interpreted through an on-screen process. The *Vegetation Community* information is derived from the colours and patterns seen on the photography. Misinterpretation of certain features may occur. As well, the mapping layer is only accurate to the date and season when the air photo was taken. The 2015 photography was flown prior to leaf-out and is an excellent product for discerning natural heritage features.

Although the boundary of some natural heritage features will have changed from 2015 to present, it is important to use a base layer from a single point in time that is consistent across the county so that it can be used for future comparisons. If needed, an Environmental Impact Study will verify any changes to the boundaries of the natural features.

Another limitation with mapping features that are developed and maintained by dynamic processes (e.g., old field succession) is that they are more likely to change over a shorter period of time than features that are more stable (e.g., mature woodlands).

For many of the ecosystem functions and derived services, it is not possible or appropriate to delineate clear spatial boundaries between natural heritage features. Often these boundaries are dynamic in both space and time, depending on seasonal patterns of rainfall and/or land use. Dynamic processes include geomorphology (e.g., bluff development), natural disturbances such as fire, wind erosion, flooding, plant succession (e.g., meadow to thicket to woodland), and anthropogenic disturbances (e.g., cattle grazing, drainage changes, deforestation, etc.).

1.6.2 Watercourse Layer

Although digital data for watercourses exists for southern Ontario, this data is not current and was not updated as part of this study. Recognizing time and resource constraints, a method was developed that eliminated the need to update the entire watercourse layer when running the criteria. Using spring 2015 aerial photography (SWOOP – Southwestern Ontario Orthoimagery Project), an on-screen interpretation of the edge (i.e., the bank-full width) of open watercourses was completed in tandem with the interpretation of Vegetation Community boundaries. Section 3.3.3 provides more details.

Notwithstanding the state of the water course layer, it should be understood that all open watercourses are still considered to be potential fish habitat and should be screened for at the site level as part of any development application. All open watercourses are considered part of the aquatic system, however, this study focuses on the terrestrial system. Best available watercourse mapping is shown in Appendix I-3.

1.6.3 Connectivity and System Linkages

Ecological connectivity is a fundamental conservation biology principle that is scientifically defensible, yet difficult to identify given the dynamic nature of the landscape and the species within it (Rodewald 2003). In urban areas, roads, hard surfaces and dense human populations are an obvious barrier to many native plant and animal species. As a result, remaining wildlife linkages in existing developed urban areas are often limited to waterways, valleys and protected parkland/natural areas.

However, in agricultural landscapes, it is difficult to define linkages outside of the defined natural heritage system (woodlands, hedgerows, wetlands, major watercourses, etc.) where it could be argued that many farm fields can be part of the system. Ontario Nature (2014) recognizes the natural heritage / agricultural matrix interactions in southwestern Ontario. Crop fields and pastures do not present as much of a barrier to animal/seed movement as dense urban landuses, though they do not replace Natural Heritage Features and Areas (NHFA) and formal linkages. Thus the ENHSS does not attempt to identify current or future linkages between patches or across agricultural fields or along unvegetated stretches of watercourses (drains) in rural areas, as the concern over loss of connectivity is not asd great as it is for urban areas.

Identifying and planning for a natural heritage systems study ideally should include both the identification of patch and linkage/corridor attributes. This is supported in the policies/definition for natural heritage studies under the PPS 2014, and the technical guidance under the 2010 Natural Heritage Reference Manual.

This study identifies Significant Valleylands *as per* the methods established in the 2016 Oxford Natural Heritage Systems Study, which MNRF recommended form the backbone of the linkages/corridors of the Natural Heritage System. This study also identifies the Lake Erie shoreline zone as an important linkage feature that connects the vegetation groups along the shore as well as the lower ends of the valleys/ravines that discharge into the lake.

Chapter 5 outlines recommendations for identifying and evaluating natural linkages as part of the review of proposals to develop land for uses that could affect the ability for species to move between natural features. The recommendations consider the site as a part of the overall system and the need to demonstrate that there is no impact on the loss of connectivity and linkages between the features defined in this study. The analysis of proposed development of agricultural and future development lands for other uses must characterize and prioritize these linkages according to factors such as the presence of threatened and endangered species, proximity to other features, application of the Carolinian Canada Big Picture corridor rules, etc. As well, several criteria deal with proximity between Vegetation Communities and Patches.

This study evaluates what is significant, but does not attempt to analyze whether the natural heritage features are in the best location, nor does it build an ecologically sustainable ecosystem. Through the submissions of an Environmental Impact Study, opportunities to improve linkages should be provided.

1.7 Earlier Elgin Studies on Natural Areas and Features

Over the last few decades, several studies have been undertaken to identify the most important natural areas in the county and to further restore and conserve the natural heritage of Elgin County. These studies, and others like it, can be seen as the precursors to this landscape-level natural heritage systems study. This section highlights three key studies.

Significant Natural Areas of Elgin County, Ontario 1985-1986 (Carolinian Canada 1993)

In 1985-1986, an in-field study was undertaken in Elgin and Kent Counties, under the Carolinian Canada Committee, to identify key natural areas throughout the region which required protection through government and municipal planning processes in order to protect the natural diversity of the county. Identification of areas was accomplished by accumulating data on the vegetation, flora, fauna and physical features of candidate sites (Bowles, Oldham and Klinkenberg, 1993). A standard set of environmental criteria were developed by which to judge the sites. In total, 41 Significant Natural Areas were identified, those which met at least three, but usually more of the criteria.

Elgin Landscape Strategy (Elgin Stewardship Council 2005)

The Elgin Landscape Strategy is an information tool to identify and prioritize potential stewardship actions throughout Elgin County. It maps out key natural heritage areas where focused conservation and restoration efforts would be most effective in retaining a healthy and functioning landscape. The Elgin Stewardship Council, in partnership with many stakeholders, undertook this GIS mapping exercise, producing maps of restoration potential that identify the potential contribution of non-vegetated lands to meeting the county-wide stewardship goals. The strategy was meant to provide coordination and direction for informing stakeholders about options for land stewardship actions, a tool to identify and prioritize areas for rehabilitation in cooperation with landowners and the farming community.

Elgin Greenway Conservation Action Plan (Carolinian Canada Coalition 2012)

In 2012, the Carolinian Canada Coalition completed the Elgin Greenway Conservation Action Plan (CAP) in partnership with many local stewardship, agricultural and naturalist groups and agencies. The CAP identified 10 key conservation targets ranging from valley and ravine forests to inland wetlands and Species At Risk reptiles. It also identified key stressors and key conservation objectives and strategic actions to overcome or improve the health of the system including establishing functional ecological linkages between and within existing core natural areas, developing outreach strategies to communication the themes to residents, control the spread of invasive plant species, and develop a strategy to promote sustainable agricultural practices. As a spinoff project, the Thames Talbot Land Trust (TTLT) spearheaded the *Lake Eire Coastal Ravines Initiative* aimed at securing and protecting natural habitat specifically along Elgin County's coastline.

2.0 Mapping Guidelines

2.1 Assemble Digital Vegetation Layers (Base Mapping Layers)

Before evaluation criteria can be applied to the natural heritage features of the county, it is necessary to develop a method to define and delineate these natural heritage features and systems. Photo interpretation techniques using 2015 South Western Ontario Orthoimagery Project (SWOOP) as a backdrop were used to prepare a detailed and comprehensive mapping product of the natural heritage features in Elgin County. Air photo interpretation enables coarse level identification of vegetation communities without a site visit.

The natural heritage features were defined using a minimum scale of 1:2,000. The work was completed primarily by the UTRCA with base layers supplied by LTVCA, KCCA, CCCA, and LPRCA. Table 2 summarizes the work that each conservation authority undertook.

Table 2. Digital mapping layer development for the 2019 ENHSS

Agency	Data Provided
Lower Thames Valley CA	- Natural Heritage Cover, reviewed by UTRCA - Draft of Valley Lands and Lakeshore Zone
Kettle Creek CA	- Draft Woodlands - Hydrology - Component of Valley Lands and Shoreline Zone
Catfish Creek CA	- Draft Woodlands - Hydrology - Component of Valley Lands and Shoreline Zone
Long Point Region CA	- Hydrology - Component of Valley Lands and Shoreline Zone
Land Information Ontario	- Evaluated Wetlands layer, evaluated using the Ontario Wetland Evaluation System (MNRF) - Draft Woodland layer for Long Point Region CA watershed within Elgin County
Upper Thames River CA (as the ENHSS consultant)	- Review and update of natural heritage features using SWOOP 2015 imagery - Unevaluated Wetlands identified through a cursory view of the SWOOP imagery. No other wetland parameters (e.g., soils, elevation data, historical woodlands, etc.) were used to confirm wetland identification.

2.2 Delineation of Digital Vegetation Layers

Natural heritage in Elgin County is comprised of a hierarchy of four vegetation layers or components described in detail in this chapter and shown in the schematic below. The smallest unit of delineation is the *Vegetation Community*. *Vegetation Communities* are lumped by type into *Vegetation Groups* and contiguous *Vegetation Groups* are then lumped into *Vegetation Patches*. *Vegetation Communities* are also lumped by type into *Vegetation Ecosystems*.

The graphic below summarize and illustrate how the layers are put together and Table 3 summarizes the relationship between the various layers. Land ownership boundaries do not impact the creation of *Vegetation Communities*, *Groups*, *Ecosystems* and *Patches*. For example, any given *Vegetation Patch* could be under the ownership/jurisdiction of many landowners.

The metadata for *Vegetation Patch* and *Group* is included in Appendix F and the metadata for *Vegetation Community* is included in Appendix G.

Vegetation Layers in the ENHSS

Vegetation Community
smallest unit
17 types
↓
Vegetation Group
grouping of Vegetation Communities
6 types
↓
Vegetation Patch
grouping of contiguous Vegetation Groups

Vegetation Communities and Ecosystems

Vegetation Community
17 types
↓
Vegetation Ecosystem
grouping of Vegetation Communities
3 types

Table 3. Relationship between *Vegetation Communities, Groups* and *Ecosystems*

Vegetation Community (18 types)	*Vegetation Group* (7 types)	*Vegetation Ecosystem* (3 types)
Deciduous Woodland	Woodland	Terrestrial
Mixed Woodland	Woodland	Terrestrial
Coniferous Woodland	Woodland	Terrestrial
Mature Plantation	Woodland	Terrestrial
Deciduous Swamp	Woodland, Wetland	Wetland
Mixed Swamp	Woodland, Wetland	Wetland
Coniferous Swamp	Woodland, Wetland	Wetland
Plantation Swamp	Woodland, Wetland	Wetland
Upland Thicket	Thicket	Terrestrial
Young Plantation	Thicket	Terrestrial
Young Plantation Swamp	Thicket, Wetland	Wetland
Wetland Thicket	Thicket, Wetland	Wetland
Meadow Marsh	Meadow, Wetland	Wetland
Upland Meadow	Meadow	Terrestrial
Connected Vegetation Feature	Connected Vegetation Feature	Terrestrial
Water bodies	Water Feature	Aquatic
Major Watercourses	Water Feature	Aquatic

Note: The shoreline bluff can be considered an open vegetation community but because of its vertical nature it cannot be seen well on aerial photography (i.e., not wide enough) and so cannot be mapped. The Lakeshore Zone as a whole is an important natural heritage/landform feature, and is mapped as an overlay feature (see Section 3.3.2).

2.3 *Vegetation Communities*

The smallest unit mapped in this study is the *Vegetation Community.* The *Vegetation Community* is a unit of vegetation that is normally visible and consistently interpreted on remotely sensed images. *Vegetation Communities* are internally homogenous and distinguishable at a 1:2,000 scale by the dominant types of plant forms that characterize the *Vegetation Community*. The *Vegetation Communities* must be at least 0.5 ha in area and 30 m wide to be included (length is the longer direction and width is the shorter). This minimum width was chosen to ensure the protection of the roots of some of the tree species. Tree roots often extend out from the core of the tree to a distance of at least the height of the tree, and the average height of a mature tree in this region is 30 m. The Natural Heritage Reference Manual (section 7.3.2) suggests 0.5 ha in size and 40 m width, but the width was reduced to 30 m in the Middlesex, Oxford and Perth NHSSs for the reasons mentioned above.

Vegetated areas 20 to 30 m wide and connected to two or more *Vegetation Communities* are considered connecting features (e.g., hedgerows), not woodlands. Unconnected vegetated areas of the same width are not mapped or included in this study. Linear treed areas <20 m wide are considered windbreaks and are not mapped or included in this study, though it is understood that windbreaks do provide many benefits to the environment including protection from soil erosion. For consistency, the 30 m width was chosen as the minimum width for thickets and meadows as well as woodlands.

A Minimum Mapping Unit (MMU) of 0.5 ha was used as the minimum size of an isolated *Vegetation Community*. The Ecological Land Classification (ELC) (Lee *et al.* 1998) uses 0.5 ha and that is one of the standards referenced as being acceptable for woodland delineation in the PPS definition. Land cover classifications commonly use a MMU of 0.5 to 1.0 ha for large scale county level maps, and 10 to 100 ha for very small scale regional maps.

Exceptions to the 0.5 ha MMU rule in this study include:

- **Connected Vegetation Features.** These features do not have a minimal area associated with them, but they do have to be > 20 m in length and 20 to 30 m in width and connected to two or more *Vegetation Communities.*

- **Provincially Significant Wetlands.** Some evaluated wetland communities are smaller than 0.5 ha and are retained as part of the natural heritage system.

- **Artifacts of Mapping**. *Vegetation Communities* smaller than 0.5 ha in size are identified if they are either: 1) surrounded by *Vegetation Communities* or 2) connect two or more *Vegetation Communities* that are greater than 0.5 ha. A *Vegetation Community* < 0.5 ha does not, by itself, become a *Vegetation Group*, but it is included in the *Vegetation Patch* to maintain shape and size of the *Vegetation Patch* (see Figure 3).

Vegetation Communities in Elgin County were mapped using on-screen air photo interpretation. The work was guided by the Southern Ontario Land Resources Information System (SOLRIS) Image Interpretation Manual (MNR 2004).

A note about features that do and do not break up a vegetation community:

- **Small Intrusions** – Existing buildings, structures, gardens, manicured areas and waterbodies that are < 20 m in width are considered part of the surrounding natural feature (i.e., they do not cause a break in the *Vegetation Community*), as per the SOLRIS manual.

- **Roads, Railroads, Watercourses** − All municipal roads, railroads and watercourses do separate *Vegetation Communities* regardless of their width. However, later, when *Vegetation Communities* are put into *Vegetation Groups*, clustering rules apply when these features are < 20 m wide (see Section 2.4 and 2.4.7).

Seventeen types of *Vegetation Communities* were delineated in Elgin County for this study. Table 4 provides a description of each *Vegetation Community* including how they are identified and the ELC (Ecological Land Classification) equivalent. The ELC code name descriptions are provided in Appendix A1 and A2.

Royal Ferns grow in a deciduous swamp within the Lusty Family Tract of West Lorne Woods, a Thames Talbot Land Trust property. Photo by Cathy Quinlan.

Table 4. Definitions and attributes of the 17 *Vegetation Communities*

Vegetation Community	Description and Methods uses for Identification on Imagery	**ELC Equivalent** (Appendix A)
1. Deciduous Woodland (Forest)	- Contains ≥60% tree cover. Comprised of tree species that lose their leaves at the end of the growing season and are capable of reaching heights of several metres (typically 20-30 m). - Individual deciduous trees have a billowy texture on air photography. If the image is taken when trees are not in leaf, individual trees have a translucent appearance such that tree trunks can be seen through the branching canopy.	FOD
2. Mixed Woodland	- Contains ≥60% tree cover. Comprised of a combination of coniferous and deciduous tree types scattered throughout. - Each tree type comprises >25% but <75% of the canopy.	FOM
3. Coniferous Woodland	- Contains ≥60% tree cover. Comprised of >60% coniferous (cone-bearing) tree species capable of reaching heights of several metres. - Individual trees are dark in colour as most are evergreen, and have a conical shape with a pointed top.	FOC
4. Mature Plantation	- Contains ≥60% tree cover. Comprised of deciduous and/or coniferous tree species. - In the past, most plantations start as planted rows of conifers, but in time deciduous trees filled in. - Boundary distinguishable by at least one edge with a straight line. - At maturity, individual trees or rows of trees are not clearly discernible at 1:2,000.	CUP
5. Deciduous Swamp	- Contains ≥60% tree cover. Deciduous woodland with a more open canopy (indicating lower tree vigor) located in a wetland as identified by MNRF or CAs. - Common in Elgin. - The standing water, common in spring, appears dark in colour.	SWD
6. Mixed Swamp	- Contains ≥60% tree cover. Mixed woodland (coniferous and deciduous) with a more open canopy (indicating lower tree vigor) located in an MNRF or CA identified wetland area.	SWM
7. Coniferous Swamp	- Contains ≥60% tree cover. Coniferous woodland with a more open canopy (indicating lower tree vigor) located in a MNRF or CA identified wetland area. - Treed bogs, a type of coniferous wetland, are uncommon and often have a pond or low open thicket at the centre.	SWC
8. Plantation Swamp	- Contains ≥60% tree cover. A mature plantation with a more open canopy (indicating lower tree vigor) located in a MNRF or CA identified wetland area. - Not common in Elgin. - Trees are usually conifers (planted).	CUP
9. Upland Thicket	- Comprised of 25 to 60% tree or shrub cover. Shrubs are woody plants that are not capable of reaching heights of several metres. - < 20% standing water.	TPW, CUT, CUW
10. Wetland Thicket	- A thicket located either along a watercourse or in a MNRF or CA identified wetland area and/or has ≥20% standing water. - Has 10-25% tree cover or, <10% tree cover and >25% shrub cover. - Dark water tones interspersed demarking standing water.	SWT, FET, FES, BOT, BOS

11. Young Plantation	- Comprised of coniferous (usually) or deciduous trees planted in rows that are discernable at 1:2,000 scale. Trees short, not mature. - Boundary distinguishable by at least one edge with a straight line - Does NOT include fruit/nut orchards or Christmas tree farms and these may need to be verified at the site level if in question.	CUT, CUW
12. Young Plantation Wetland	- A young plantation *Vegetation Community* located in a MNRF or CA identified wetland area where individual trees or rows of trees are discernible at 1:2,000. Trees are usually young conifers.	CUT
13. Upland Meadow	- Comprised of grasses or forbs primarily, with <25% tree or shrub cover.	TPO, CUM
14. Meadow Marsh	- A meadow marsh *Vegetation Community* located in a wetland identified by the MNRF or CA, comprised of cattails, wetland grasses and other wetland forbs (non-treed). - Fens and open bogs may not be distinguished in the wetland mapping layer, but these habitats are uncommon in Elgin County. They should be distinguished when conducting EIS surveys.	FEO, BOO, MAM, MAS, SAS, SAM, SAF
15. Water Bodies	- Comprised of a body of standing water ≥ 20 m wide <u>adjacent</u> to another *Vegetation Community*. Can include a: • man-made pond associated with construction or extraction (e.g., aggregate pit), • reservoir created by a dam or barrier, • natural pond within a wetland or a natural water feature such as a kettle lake, or • sewage lagoon found in/on the outskirts of an urban area. - Appears as a flat plain surface on air photos; may show patterns of wind disturbance, floating aquatic vegetation, or cloud reflections.	OAO
16. Major Watercourse	- A linear feature >1 km long and mostly >20 m wide and containing flowing water at least for part of the year. - Delineated as a polygon using bank-full width as seen on aerial photography flown in the spring. - See Section 2.4.5 for more details.	OAO
17. Connected Vegetation Feature	- A linear feature comprised of woody plants (trees, shrubs) that connects two or more *Vegetation Communities*, often called a buffer, hedgerow or shelterbelt. - Length is >20 m and width is >20 m but <30 m. See Section 2.4.6 - Considered one feature as long as there are no gaps >20 m. - Often located between farm fields.	--

2.4 *Vegetation Groups*

Each *Vegetation Community* is assigned to broader *Vegetation Groups*. Six types of *Vegetation Groups* were delineated in Elgin County for this study:

1) Wetland (contains woodland, thicket and meadow)
2) Woodland
3) Thicket
4) Meadow
5) Water Feature, and
6) Connected Vegetation Feature.

Vegetation Groups are comprised of a mosaic of one or more *Vegetation Communities* within 20 m of each other, as illustrated in Figure 2. Figure 3 also illustrates *Vegetation Group* formation as well as *Vegetation Patch* formation.

Figure 2. Illustration of two Woodland *Vegetation Communities* (Deciduous Woodland and Deciduous Swamp) forming a *Woodland Group*

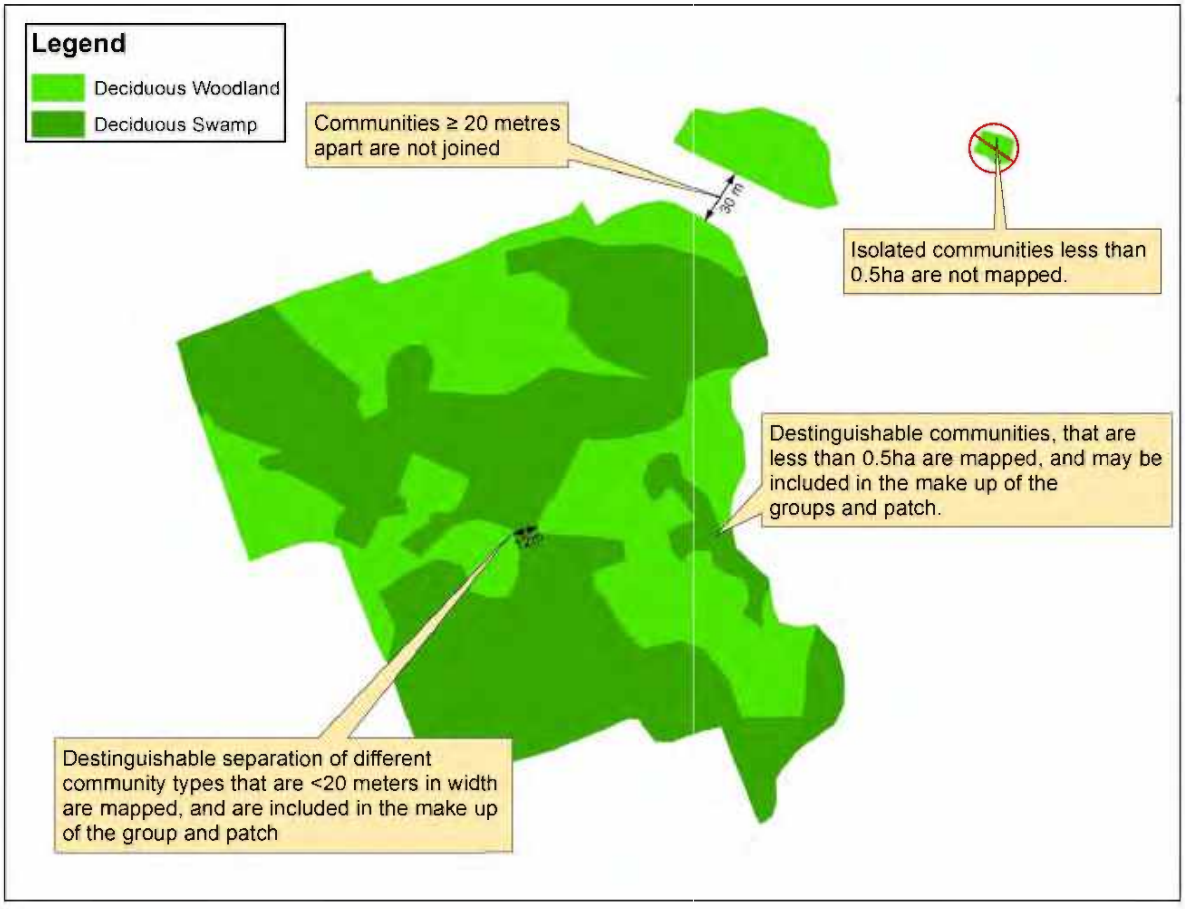
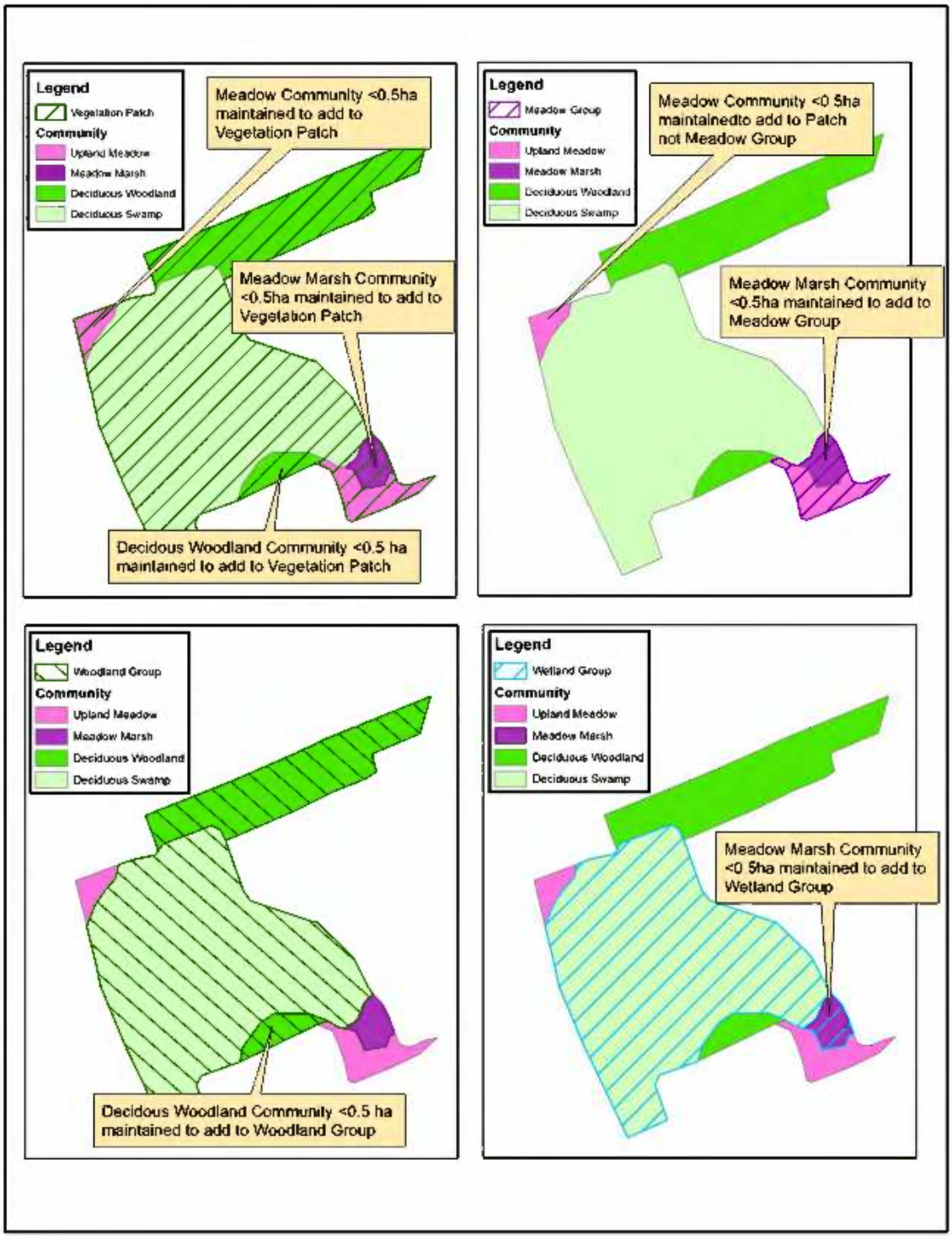


Figure 3. Illustration of how small and large *Vegetation Communities* are combined into *Vegetation Groups* and *Patches*



Note: Small *Vegetation Communities* <0.5 ha become part of *Vegetation Groups* if they are adjacent to (or <20 m from) a *Vegetation Community* of the same group (e.g., Deciduous Woodland and Deciduous Swamp are both in the Woodland Group). Small *Vegetation Communities* <0.5 ha become part of a *Vegetation Patch* if they are adjacent to any *Vegetation Community* within the patch.

Table 4, shown earlier, presents a comparison between the *Vegetation Groups* identified in this study to the ELC *Vegetation Community* Series level (Lee *et al.* 1998). Appendix A-2 contains additional details on the similarities and differences between the ELC (Ecological Land Classification) Vegetation Community Series and the *Vegetation Groups* defined in this study. There are four main differences outlined below.

- The ELC distinguishes whether the vegetation is the result of an anthropogenic (cultural) process or a natural process. However, it should not be assumed that a cultural feature is not significant. Cultural, disturbed or successional natural features can have significant ecological functions and could be identified as Significant Wildlife Habitat (SWH). Therefore, it is important to consider any ELC communities classified as cultural for their potential to provide important ecological functions by comparing the community description with criteria in the Significant Wildlife Habitat Technical Guide. Thus, there is no distinction in this study as to whether the vegetation was influenced by natural or anthropogenic (cultural) processes.

- The ELC defines Open Water bodies as > 2 m depth and Shallow Water bodies as <2 m depth. Since depth of water bodies cannot be determined from aerial photos or remotely sensed data, these two features are combined into a single open water feature.

- The key factor in distinguishing wetlands from water bodies and other aquatic components in the ELC is the presence of > 25% emergent or woody vegetation cover. For this study, water bodies did not contain any water tolerant herbaceous or woody plants.

- The ELC distinguishes thickets, woodlands and forests. The ELC lists two types of woodlands (Tallgrass Woodland TPW and Cultural Woodland CUW), with a tree cover of 35% to ≤60%. Both these woodland types are rare in Elgin. For the ENHSS, these ELC woodlands were lumped in the thicket *Vegetation Community* because of the low tree cover. As well, the ELC defines forests as habitats with > 60% tree cover. The ENHSS calls them woodlands to be consistent with the PPS wording. See Appendix A for more details.

2.4.1 Wetland *Vegetation Group*

The wetland *Vegetation Group* is comprised of seven wetland *Vegetation Communities* of which four are treed and three are untreed:

1) coniferous swamp (treed)
2) deciduous swamp (treed)
3) mixed swamp (treed)
4) plantation swamp (treed)
5) wetland thicket (untreed)
6) meadow marsh (untreed)
7) young plantation wetland (untreed)

The wetland information for this study was derived from the MNRF Evaluated Wetlands layer (2017). Additional unevaluated wetlands were mapped through air photo interpretation by the UTRCA during the vegetation mapping for this study. The full procedure for mapping unevaluated wetlands was not used so additional work to refine the layer and to map additional unevaluated wetlands may still be required.

2.4.2 Woodland *Vegetation Group*

The Woodland *Vegetation Group* is comprised of eight *Vegetation Communities*, of which four are terrestrial/upland and four are wetland:

1) coniferous woodland (terrestrial/upland),
2) deciduous woodland (terrestrial/upland),
3) mixed woodland (terrestrial/upland),
4) mature plantation (terrestrial/upland),
5) coniferous swamp (wetland),
6) deciduous swamp (wetland),
7) mixed swamp (wetland) and
8) plantation swamp (wetland).

Because this is a GIS exercise, the SOLRIS (Southern Ontario Land Resources Information System) definition for woodland is used: Woodland describes areas with more than 60% tree cover. The ELC uses the word *forest* for this same definition, but to be consistent with the PPS, the word woodland is used in this study. In the NHRF (OMNR 2010), woodland means "a treed area, woodlot or forested area, other than a cultivated fruit or nut orchard or a plantation established for the purpose of producing Christmas trees, that is located south and east of the Canadian Shield".

Mature plantations and plantation swamps are included as part of the woodland *Vegetation Group* as they are important components in the ecosystem. Mature plantations are old enough that the original tree rows (usually conifers) are not very visible on the ortho-imagery because a variety of other tree species (usually deciduous) have moved in. Plantation swamps are communities where trees have been planted in an area recognized as a wetland (evaluated or unevaluated) and the trees are full size or taller than shrub height.

Similar to natural forests and woodlands, plantations contribute to the net removal of carbon dioxide from the atmosphere, produce oxygen, modify wind and temperature, remediate soil pollution and structure and provide wildlife habitat. Often, landowners plant trees into a plantation or block planting to retire a parcel of land from agriculture and begin the process of natural succession towards mature forest/woodland. Narrow plantings of trees < 30 m wide and < 0.5 ha in size are not included in this group as they fall into the category of windbreaks, screen trees or visual barriers.

2.4.3 Thicket *Vegetation Group*

The Thicket *Vegetation Group* is comprised of four *Vegetation Communities*, two terrestrial and two wetland:

1) upland thicket (terrestrial/upland),
2) young plantation (terrestrial/upland),
3) wetland thicket (wetland), and
4) young plantation swamp (wetland).

Thickets are usually early successional communities dominated by shrubs, young trees or stunted mature trees. Upland thickets that develop on abandoned farm fields succeed to woodland much more quickly than wetland thickets which tend to be found in areas too wet for trees. Wetland thickets may also succeed to swamp if the wetland slowly fills in. Thickets along watercourses may be maintained even longer as flooding and ice scour knock back trees. Young tree plantations are called thickets when the trees are still short (e.g., shrub height).

Table 4 provides definitions for each thicket *Vegetation Community*. To be included, thicket *Vegetation Communities* must be ≥ 30 m wide and ≥ 0.5 ha.

2.4.4 Meadow *Vegetation Group*

The Meadow *Vegetation Group* is comprised of two *Vegetation Communities*, one terrestrial/upland and one wetland:

1) upland meadow (terrestrial/upland), and
2) meadow marsh (wetland).

Table 4 provides a description of the defining meadow habitat features. Meadows are short, open *Vegetation Communities* dominated by grasses and broad-leaved herbaceous plants and a scattering of shrubs and trees. Many meadows in Elgin County are old fields of cultural origin (e.g., abandoned or retired farmland, future development land) and may, in time, succeed to thicket and then forest/woodland if left in a natural state. Meadows are often transitional communities, as in the examples given. However, meadows along watercourses may be more permanent habitats as the frequent flooding and ice scour keeps trees and shrubs from becoming established.

Meadows must be ≥ 30 m wide and ≥ 0.5 ha to be included. Pastures are not included in meadows as they are often heavily grazed and are part of the farm cycle.

2.4.5 Water Feature *Vegetation Group*

The Water Feature *Vegetation Group* is comprised of two *Vegetation Communities*:

1) permanent water bodies and
2) major watercourses.

Permanent water bodies include natural and man-made ponds ≥ 20 m wide and ≥ 0.5 ha in size without any vegetation cover or emergent vegetation.

Major watercourses are defined as watercourses ≥ 20 wide and ≥ 1 km long. Short stretches of major watercourses that are < 20 m wide are included as part of the major watercourse to maintain continuity. However, when a watercourse is < 20 m wide for 1 km or longer, it no longer becomes a major watercourse and becomes part of the surrounding *Vegetation Group*. However, all open watercourses are used to inform the proximity criteria as described in Section 3.3.3.

2.4.6 Connected Vegetation Feature *Vegetation Group*

The Connected Vegetation Feature *Vegetation Group* is comprised only of the Connected Vegetation Features *Vegetation Community*. Connected Vegetation Features are narrow *Vegetation Communities* consisting of trees and/or shrubs that connect two or more *Vegetation Communities.* They must be >20 m long and 20-30 m wide. They are sometimes called buffers, hedgerows, shelterbelts or natural fencerows. For example, a connected vegetation feature can connect two deciduous woodlands, or it can connect a deciduous woodland and a major watercourse, or a water body and a meadow marsh and a mixed woodland.

They are an important component of the natural heritage system because they provide corridors for wildlife movement as well as wildlife habitat, and may include remnants of vegetation present prior to disturbance (e.g., forest remnants). More common in the past, many of these features have been or are being removed in the agricultural landscape to increase field size. This is despite the fact that these features have many advantages to agriculture including protecting crops from wind damage, protecting soil from wind erosion, increasing crop yields, conserving water and controlling snow accumulation (Agriculture Canada and Ministry of Agriculture and Food 1992). Hedgerows provide a barrier that can slow water flow and trap soil particles especially along waterways (Hobbs and McGrath, 1998).

Section 7.3.2 of the Natural Heritage Reference Manual (NHRM) (MNR 2010) recommends establishing a minimum width to Woodland *Vegetation Groups* to exclude these relatively narrow linear treed areas (e.g., windbreaks). Recognizing that breaks < 20 m are too small to separate Woodland *Vegetation Groups*, the width of a connected vegetation feature was defined as being >20 m but < 30 m in width.

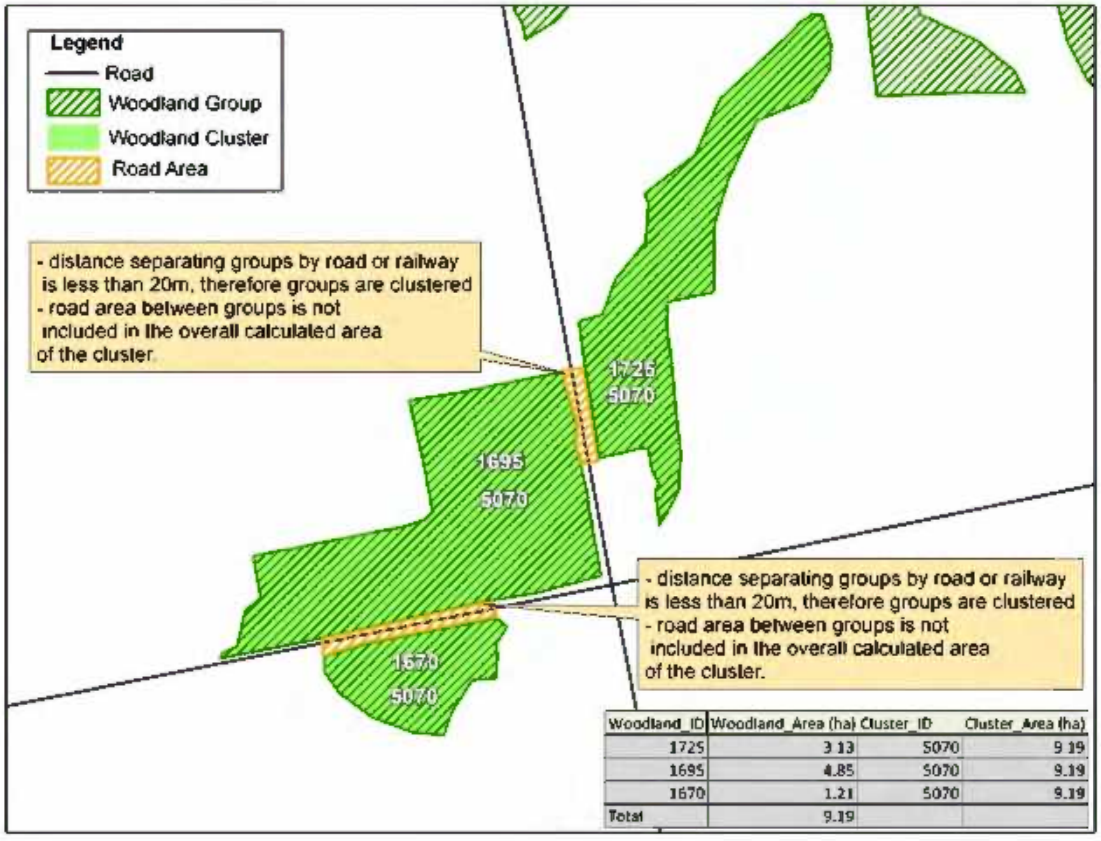
2.4.7 Clustering around Narrow Breaks (Roads, Railroads, Rivers)

As stated in Section 2.3, roads, railroads and watercourses ≥ 20 m separate *Vegetation Communities* and *Vegetation Groups*. Where roads, railroads and watercourses are < 20 m wide, the vegetation is not broken, but an extra step in the mapping is needed so that the area of the road/railroad/ watercourse is not included when vegetation area measurements are calculated, as per section 7.3.2 of the Natural Heritage Reference Manual (MNR 2010). This step is called clustering and is applied to woodlands, thickets and meadow groups.

Clustering methodology is as follows (see Figure 4 example):

- A unique identification number is assigned to each *Vegetation Group* (in Figure 4: 1725, 1695, 1670).
- A unique cluster identification number is assigned to each clustered *Vegetation Group* (5070).
- Clustering was applied to the *Vegetation Groups* before modeling the criteria (Chapter 3).
- Criteria that measure area were applied to the entire clustered *Vegetation Group* (5070), and then the area of the road was subtracted.
- The remaining criteria were applied to the clustered *Vegetation Groups* (5070).

Figure 4. Illustration of clustering *Vegetation Groups* (1725, 1695, 1670) around narrow roads into one Woodland Cluster (5070)



Woodland_ID	Woodland_Area (ha)	Cluster_ID	Cluster_Area (ha)
1725	3.13	5070	9.19
1695	4.85	5070	9.19
1670	1.21	5070	9.19
Total	9.19		

2.5 *Vegetation Patches*

A *Vegetation Patch* is a mosaic of one or many different abutting (or < 20 m apart) *Vegetation Groups* (see Figure 5).

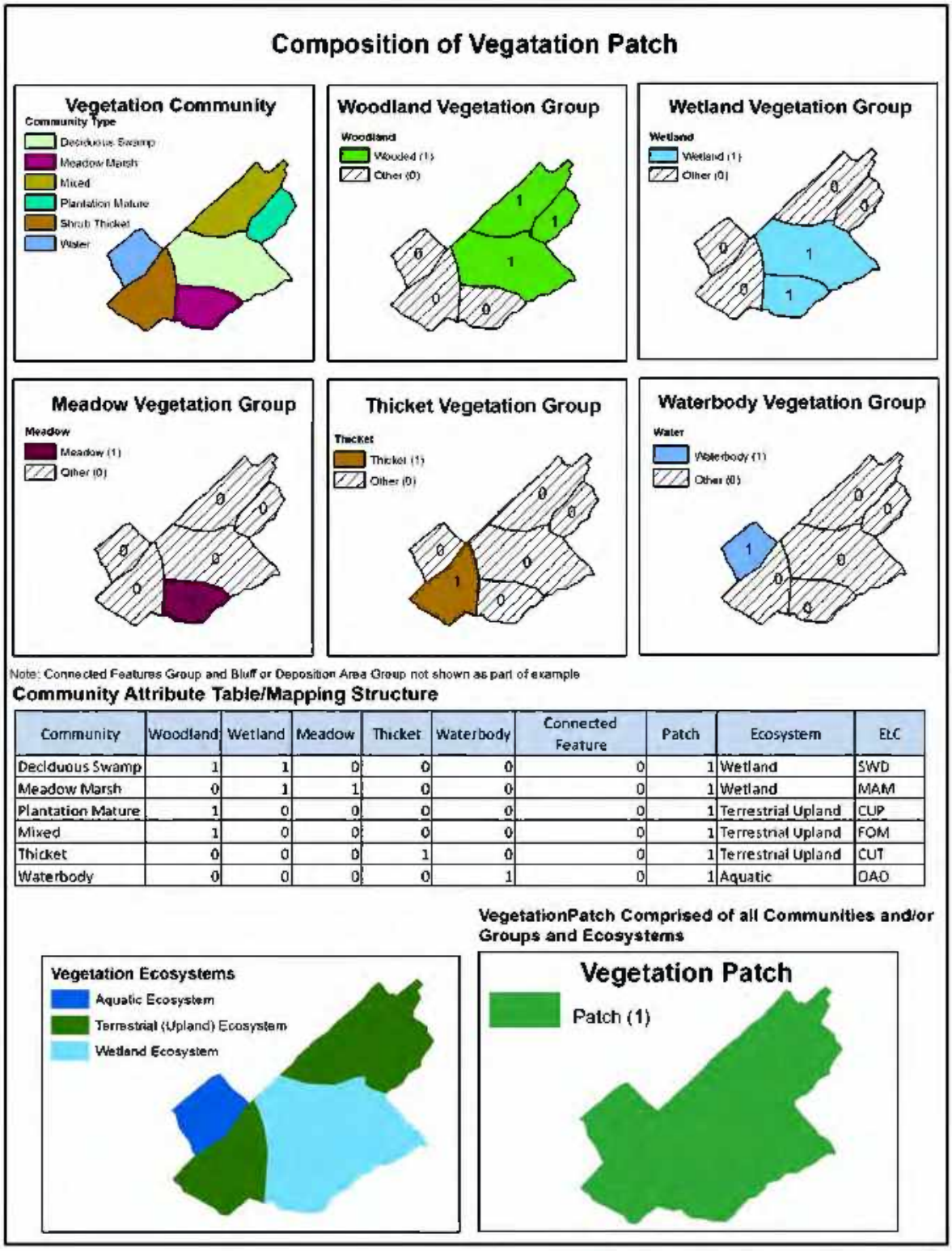
Roads ≥ 20 m wide separate *Vegetation Patches* as they do for *Vegetation Groups*. However, where smaller roads < 20 m wide separate *Vegetation Patches*, the patches are rejoined as a cluster as described for *Vegetation Groups* in Section 2.4.8. Clustering is applied to the *Vegetation Patches* before modeling the patch criteria (see Table 9). Since the NHRM does not calculate the area of a road when determining size and interior (MNR 2010), area criteria will be applied to the entire clustered *Vegetation Patch* less the area of the road. The remaining criteria will be applied to the clustered *Vegetation Patches* and include the road and railroads as part of the *Vegetation Patch* (see Figure 4).

A *Vegetation Patch* digital layer was created with unique number attributes assigned to each *Vegetation Patch*:

- the unique identification number to each *Vegetation Patch*, and
- a unique cluster identification number for clustered *Vegetation Patch*(s).

The young tree planting site in the foreground is classified as a meadow until the trees reach close to mature height. This meadow is also part of a patch that contains the adjacent woodland.
Photo by Cathy Quinlan

Figure 5. Illustration of the composition of a *Vegetation Patch* comprised of different *Vegetation Communities, Groups* and *Ecosystems*



Note: Connected Features Group and Bluff or Deposition Area Group not shown as part of example

Community Attribute Table/Mapping Structure

Community	Woodland	Wetland	Meadow	Thicket	Waterbody	Connected Feature	Patch	Ecosystem	ELC
Deciduous Swamp	1	1	0	0	0	0	1	Wetland	SWD
Meadow Marsh	0	1	1	0	0	0	1	Wetland	MAM
Plantation Mature	1	0	0	0	0	0	1	Terrestrial Upland	CUP
Mixed	1	0	0	0	0	0	1	Terrestrial Upland	FOM
Thicket	0	0	0	1	0	0	1	Terrestrial Upland	CUT
Waterbody	0	0	0	0	1	0	1	Aquatic	OAO

VegetationPatch Comprised of all Communities and/or Groups and Ecosystems

2.6 *Vegetation Ecosystems*

The 18 *Vegetation Communities* belong to one of three *Vegetation Ecosystems*:

1) terrestrial,
2) wetland and
3) aquatic.

Vegetation Groups can belong to one or more *Vegetation Ecosystem* (see Table 5). For example, woodland, thicket and meadow *Vegetation Groups* include both wetland and terrestrial *Vegetation Communities*. The only time *Vegetation Ecosystems* are used is for Criterion 13 on habitat diversity.

Terrestrial Vegetation Ecosystem

Table 5 lists the nine *Vegetation Communities* and five *Vegetation Groups* that are part of the *Terrestrial Vegetation Ecosystem* within this study.

Terrestrial *Vegetation Ecosystems* occur where soil moisture is scarce for at least some point in the growing season. Terrestrial *Vegetation Ecosystems* are distinguished from wetland or aquatic Vegetation Ecosystems by:

- a lower availability of water and the consequent importance of water as a limiting factor,
- greater temperature fluctuations on both a diurnal and seasonal basis,
- greater availability of light and gases (including carbon dioxide for photosynthesis, oxygen for aerobic respiration, and nitrogen for nitrogen fixation), and
- a subterranean portion (soil) from which most water and ions are obtained, and an atmospheric portion from which gases are obtained and where the physical energy of light is transformed into the organic energy of carbon-carbon bonds through the process of photosynthesis.

Wetland Vegetation Ecosystem

Table 5 lists the seven *Vegetation Communities* and four *Vegetation Groups* that are part of the *Wetland Vegetation Ecosystem*. Wetland *Vegetation Ecosystems* are considered semi aquatic. Section 2.4.1 describes how these features were identified and delineated.

Aquatic Vegetation Ecosystem

Table 5 lists the two *Vegetation Communities* (Water Bodies and Major Watercourses) and one *Vegetation Group* (Water Body Feature) that are part of the Aquatic *Vegetation Ecosystem*. Freshwater aquatic *Vegetation Ecosystems* are characterized as lotic (having flowing water) or lentic (still water).

Table 5. ***Vegetation Ecosystems*** **in relation to** ***Vegetation Communities*** **and** ***Groups***

	Vegetation Ecosystem		
	Terrestrial	**Wetland**	**Aquatic**
Vegetation Community			
Deciduous Woodland	Yes		
Coniferous Woodland	Yes		
Mixed Woodland	Yes		
Mature Plantation	Yes		
Deciduous Swamp		Yes	
Mixed Swamp		Yes	
Coniferous Swamp		Yes	
Plantation Swamp		Yes	
Upland Thicket	Yes		
Wetland Thicket		Yes	
Young Plantation	Yes		
Young Plantation Wetland		Yes	
Upland Meadow	Yes		
Meadow Marsh		Yes	
Water Bodies			Yes
Major Watercourse			Yes
Connected Vegetation Feature	Yes		
Vegetation Group			
Woodland	Yes	Yes	
Thicket	Yes	Yes	
Meadow	Yes	Yes	
Wetland		Yes	
Water Body Feature			Yes
Connected Vegetation Feature	Yes		

2.7 Results of Mapping the Vegetation Layers

Table 6 summarizes the number and area of the three vegetation layers: communities, groups and patches. The 7,413 *Vegetation Communities* are merged into 4,072 *Vegetation Groups*, and then are compiled into 1,909 *Vegetation Patches*.

Table 6. Number of *Vegetation Communities, Groups* and *Patches* in the Study Area

Vegetation Layers	Approximate Number in the Study Area*
Communities	7,413
Groups	4,072 (642 Wetlands**)
Patches	1,909

*The Study Area is the area of geographic Elgin County plus a 500 m buffer around the perimeter, excluding the lake side which ends at the top of the bluff, established to capture natural heritage features that are located on both sides of the boundary and need to be modeled based on their full size. The area is 197,159 ha.

***Wetland Groups* are all part of other *Vegetation Groups* (e.g., Deciduous Swamp is part of the *Wetland Group* and *Woodland Group*) so it is double counting to add them to the 4,072 other groups.

Table 7 shows the number and area of each *Vegetation Community* in the study area (buffered Elgin). Table 8 shows the same information, sorted from largest to smallest area.

The three *Vegetation Communities* making up the largest area (83% of total vegetation cover) are: deciduous woodland, mixed woodland and deciduous swamp. Deciduous woodland is by far the largest community at 26,228 ha or 56% of the total vegetation cover. In second place is mixed woodland (coniferous/deciduous woodland) at 8,070 ha or 17.3% of the total vegetation cover. A distant third, deciduous swamp at 4,156 ha or 8.9% of the vegetation cover. In fourth place is upland meadow at 3,226 ha or 6.9% of the vegetation cover.

Table 7. Number and area of the 17 *Vegetation Community* types in the Study Area

Vegetation Community **(sorted by like types)**	**Number of *Vegetation Communities***	**Area of *Vegetation Communities*** (ha)	**% Area of all *Vegetation Communities*** (46,548 ha)	**% of Elgin Study Area** (197,159 ha)
Deciduous Woodland	2,428	26,228	56.3%	13.30%
Mixed Woodland	465	8,070	17.3%	4.09%
Coniferous Woodland	450	993	2.1%	0.50%
Mature Plantation	131	331	0.7%	0.17%
Deciduous Swamp	589	4,156	8.9%	2.11%
Mixed Swamp	90	579	1.2%	0.29%
Coniferous Swamp	20	9	<1%	0.00%
Plantation Swamp	1	<1	0%	0.00%
Upland Thicket	679	1,206	2.6%	0.61%
Wetland Thicket	53	86	0.2%	0.04%
Young Plantation	133	237	0.5%	0.12%
Young Plantation Swamp	0	0	0%	0.00%
Upland Meadow	1,724	3,225	6.9%	1.64%
Marsh Meadow (Meadow Marsh)	219	317	0.7%	0.16%
Water Body	230	408	0.9%	0.21%
Major Watercourse	15	541	1.2%	0.27%
Connected Vegetation Feature	184	160	0.3%	0.08%
TOTAL	**7,411**	**46,548**	**100%**	**23.61%**
Shoreline Zone*		8,842		

Notes:

- Study Area = Geographic Elgin County plus a 500 m buffer around all sides except the lake side. The boundary is the top of the bank, not the waterline or out into the lake.
- *The Shoreline Zone is an important natural feature in Elgin, and is treated as an overlay feature for the purposes of this study, similar to the Significant Valleylands. Its area is shown here for information only. It is not treated as a vegetation community or vegetation group because it is extremely large (8,842 ha) and would skew the percent vegetation cover results.

Table 8. *Vegetation Community* types sorted by Area in the Study Area

Order Number	*Vegetation Community*	Area (ha)	% of Total Vegetation Community Area (46,548 ha)
1	**Deciduous Woodland**	26,228	56.3%
2	**Mixed Woodland**	8,070	17.3%
3	**Deciduous Swamp**	4,156	8.9%
4	**Upland Meadow**	3,225	6.9%
5	**Upland Thicket**	1,206	2.6%
6	**Coniferous Woodland**	993	2.1%
7	**Major Watercourse**	541	1.2%
8	**Water Body**	408	0.9%
9	**Mixed Swamp**	579	1.2%
10	**Mature Plantation**	331	0.7%
11	**Marsh Meadow/Meadow Marsh**	317	0.7%
12	**Young Plantation**	237	0.5%
13	**Connected Veg Feature**	160	0.3%
14	**Wetland Thicket**	86	0.2%
15	**Coniferous Swamp**	9	<0.0%
16	**Plantation Swamp**	<1	<0.0%
17	**Young Plantation Swamp**	0	0.0%
	Total	**46,548**	**100%**
	Shoreline Zone*	8,842	

Notes:

- Study Area = Geographic Elgin County plus a 500 m buffer around all sides but the lake side. The boundary is the top of the bank, not the waterline or out into the lake.
- *The Shoreline Bluff is an important natural feature in Elgin, and is treated as an overlay feature for the purposes of this study, similar to the Significant Valleylands. Its area is shown here for information. It is not treated as a vegetation community or vegetation group because it is extremely large (8,842 ha) and would skew the percent vegetation cover results.

Table 9 summarizes the information by *Vegetation Group* for the Study Area. Vegetation Groups make up 23.89% of the Elgin Study Area. As expected, the woodland group is the largest. Overall, woodland covers 20.77% of the Elgin Study Area, meadow 1.80%, thicket 0.77%, water features 0.48% and connected vegetation features 0.07%. Watercourse bluffs and depositional areas are not mapped but will be very small.

There is 2.64% wetland cover in the county, comprised of swamps, wetland thickets and meadow marshes. It makes up 11.1% of the vegetation cover. The 2.64% wetland cover is part of the total vegetation cover, not in addition to it.

Table 9. Area of *Vegetation Groups* as a percentage of the Elgin Study Area

Vegetation Group	**# of groups**	**Area (ha)**	**% Area of Total Vegetation Cover** (47,107 ha)	**% of Elgin Study Area** (197,159 ha)
Woodland	1,730	40,949	6.9%	20.77%
Thicket	784	1,527	3.2%	0.77%
Meadow	1,217	3,544	7.5%	1.80%
Water Feature	237	949	2.0%	0.48%
Connected Veg. Feature	104	138	0.3%	0.07%
Total	**4,072**	**47,107**	**100%**	**23.89%**
Wetland Group (part of the total above)	690	5,210	11.1%	2.64%

3.0 Criteria for Ecological Importance

3.1 Background

In settled landscapes, both habitat loss and fragmentation of the original natural cover increases the significance of, and need to protect, any remaining natural heritage features and functions (Levenson 1981, Lovett *et al*. 2005, Manning *et al*. 2004). However, haphazard protection of individual natural heritage features is unlikely to ensure the survival of species or ecosystems, as it does not take into account how well the remaining natural features function or how effective they are in providing environmental benefits (Humke *et al*. 1975).

Carter (2000), Bowles (1997) and Bowles *et al*. (2000) argue that no single characteristic can sufficiently measure the value of a natural feature. On the one hand, there is a danger of cumulative loss when habitat patches are assessed solely on site specific characteristics because their importance within the broader landscape is unknown. On the other hand, the external characteristics or location of a feature using landscape metrics such as size, connectedness, regional representation, and hydrological function may not always reflect its internal quality. Instead, it is important to use multiple criteria to assess the characteristics of a natural feature.

Site level analysis (i.e., biological inventory) is not feasible for a county scale study. However, local municipalities, because of their smaller geographic area, are encouraged to conduct more in-depth studies and evaluate their natural heritage features at the site level. For example, the City of London has used landscape, community and species parameters to assess importance/significance (City of London 2006). In general, regional (i.e., county) natural heritage studies evaluate natural areas based on landscape metrics while local (i.e., lower tier) natural heritage studies tend to use both landscape metrics and site specific content metrics (i.e., what the natural feature contains).

The location, size and shape of a *Vegetation Patch* have been identified as critical factors in the maintenance of species diversity and abundance in fragmented landscapes (Burgess and Sharpe 1981, Forman 1995a, b and c, Forman and Godron 1986, Harris 1984, Turner and Gardner 1991, Schiefele and Mulamoottil 1987, Robbins *et al*. 1989, Hounsell 1989, Weyrauch and Grubb 2004). These metrics act as surrogate measurements of more detailed studies and can be easily measured using remote sensing/GIS.

However, these indicators provide only a partial picture of the complexity of ecosystem functioning. Land managers must realize that conservation of biological diversity might not be achieved by manipulating the size and configuration of remnant *Vegetation Patches*, but instead depend on how the extensive areas surrounding the *Vegetation Patches* are managed. Recognizing that this area of human modified land, the habitat matrix, overwhelmingly dominates all of the world's terrestrial ecosystems (Foley *et al*. 2005, Lindenmayer and Franklin 2002), conservation biologists and resource managers need to also focus attention on improving the quality of the habitat matrix and the environmental impacts associated with a change of land use in the habitat matrix if programs to conserve biological diversity are to succeed.

3.2 Ecologically Important Criteria

According to the Natural Heritage Reference Manual (MNR 2010), the responsibility for the identification and evaluation of significant wetlands and Areas of Natural and Scientific Interest (ANSIs), in accordance with the PPS, lies with the Ontario Ministry of Natural Resources and Forestry (MNRF). The MNRF also approves what is to be considered as significant habitat of endangered species and threatened species. In all other cases, with the exception of fish habitat, the responsibility for the identification, evaluation and designation of significant natural features and areas in accordance with the PPS lies with the planning authority.

The purpose of this 2019 Elgin Natural Heritage Systems Study is to identify the Natural Heritage Systems, which is comprised of "ecologically important" natural features and areas identifiable on 2015 colour air photos of Elgin County using a set of ecological criteria that include and go beyond the criteria for Significance according to the PPS.

The term "Significant" as it relates to Natural Heritage Features and Areas in the (PPS) is discussed on page 2 of this report. Natural Heritage Features and Areas include the following:

- Significant Wetlands,
- Significant Woodlands,
- Significant Valleylands,
- Significant Areas of Natural and Scientific Interest (ANSIs), Life and Earth Science*,
- Fish Habitat*,
- Habitat of Endangered and Threatened Species*, and
- Significant Wildlife Habitat*.

Of the above features, those with asterisks (*) are not identified in this study. Earth Science ANSIs are not necessarily correlated to the importance of the vegetation community on it. The presence of an Earth Science ANSI does not mean that there are unique vegetation community features that result from the characteristics of the Earth Science ANSI (e.g., a moraine or glacial spillway). Fish habitat is identified by DFO (Department of Fisheries and Oceans). This study does not identify or address habitat of endangered and threatened species because Species at Risk have their own legislation and are not uniformly mapped across the landscape (i.e., they need to be identified at the site level). Significant Wildlife Habitat also needs to be identified at the site level (see Chapter 5, Recommendations). These features should still be identified at the site level during an EIS (see Chapter 5).

3.2.1 Thirteen Ecologically Important Criteria

Thirteen criteria were developed in this study to identify ecologically important *Vegetation Patches*, using the discrete *Vegetation Communities*, *Vegetation Groups* and *Vegetation Patches* defined in Chapter 2. Table 10 provides a summary of the criteria. Appendix D provides a more detailed summary table that includes rationale and a list of other studies that have used the criteria.

Criteria 1 to 10 are used to identify ecologically important *Vegetation Groups*. Criteria 1 to 4 are applied to all *Vegetation Groups*. Criterion 5 is applied to wetlands only. Criteria 6 to 10 are applied to either woodlands, thickets or meadows and are based on specific size cutoffs and proximity. Criteria 11 to 13 are applied to all *Vegetation Patc*hes.

Two additional criteria (patches ≥ 100 ha and woodland with interior ≥0.5 ha) were modeled but did not capture any patches that were not already captured by other criteria, so they were not used. However, the results are provided as additional information (Section 3.6). As well, many other criteria were examined but were not used for a variety of reasons as described in Appendix E.

Table 10. Summary of the 13 Ecologically Important Criteria

Criterion #	Key Words	Description
Applied to *Vegetation Groups*		
1	**Significant Valleylands**	Any *Vegetation Group* within or touching a Significant Valleyland
2	**Shoreline Zone**	Any *Vegetation Group* within 100 m of the Shoreline Zone
3	**ANSI**	Any *Vegetation Group* located within or touching a provincial or regional Life Science ANSI (Area of Natural and Scientific Interest)
4	**Open Watercourse**	Any *Vegetation Group* located within 30 m of an Open Watercourse
5	**Wetlands**	All evaluated and unevaluated Wetland *Vegetation Groups* ≥ 0.5 ha (*Note*: additional unmapped wetlands are to be included when identified)
6	**Woodland Size**	Any Woodland *Vegetation Group* ≥ 4 ha
7	**Woodland Proximity**	Any Woodland *Vegetation Group* within 100 m of a ≥ 4 ha Woodland *Vegetation Group*
8	**Thicket Size**	Any Thicket *Vegetation Group* ≥ 2 ha
9	**Meadow Size**	Any Meadow *Vegetation Group* ≥ 5 ha
10	**Meadow Proximity**	Any Meadow *Vegetation Group* within 100 m of a ≥ 4 ha Woodland or ≥ 2 ha Thicket *Vegetation Group*
Applied to *Vegetation Patches*		
11	**Patches with a *Vegetation Group* that meet a Group Criteria**	Any *Vegetation Patch* that contains a *Vegetation Group* that meets a group criteria (i.e., meets Criteria 1 – 10 above)
12	**Diversity**	Any *Vegetation Patch* that contains a diversity of *Vegetation Communities*, *Groups* or *Ecosystems*
13	**Proximity**	Any *Vegetation Patch* within 100 m of a *Vegetation Patch* that meets Criteria 11 or 12 above.

3.2.2 Significant Woodlands

Of the 13 criteria mentioned above and shown in Table 10, six establish Significant Woodlands consistent with the PPS (section 2.1) and NHRM (Table 7-2 Recommended Significant Woodland Evaluations Criteria and Standards). Table 11 provides a summary of ENHSS criteria that are applied to woodland vegetation groups that meet the criteria for significance in the PPS.

The GIS layers and associated data for this study have been provided to the County to allow Significant Woodlands (e.g., woodlands meeting one or more of the above noted criteria) to be differentiated from other ecologically important woodlands for the purposes of informing Official Plan policy development.

> **PPS, Section 6, Definitions.**
> "**Significant**: means…
>
> b) in regard to *woodlands*, an area which is ecologically important in terms of features such as species composition, age of trees and stand history; functionally important due to its contribution to the broader landscape because of its location, size or due to the amount of forest cover in the planning area; or economically important due to site quality, species composition, or past management history. These are to be identified using criteria established by the OMNR;

Table 11. ENHSS Criteria for Ecologically Important Woodlands that meet PPS Criteria for Significant Woodlands

ENHSS Ecologically Important Criteria applied to Woodland Vegetation Groups	Description of how it meets/fits PPS Criteria for Woodland Significance	PPS Section	NHRM Table 7-2 Section
Criteria 1 – Any Vegetation Group within or touching a Significant Valleyland	Due to their connectivity and linkage function	2.1.5	2c
Criteria 2 – Any Vegetation Group within 100 m of the Shoreline Bluff	Due to linkage function, stepping stones for movement		2c
Criteria 3 – Any Vegetation Group located within or touching a provincial or regional Life Science ANSI	Meets standards for proximity and linkage functions		2b, 2c
Criteria 4 – Any Vegetation Group located within 30 m of an Open Watercourse	Meets water protection standard		2d
Criteria 6 – Any Woodland Vegetation Group ≥ 4 ha	Meets size criteria and may contain woodland interior		1, 2a
Criteria 7 – Any Woodland Vegetation Group within 100 m of a ≥ 4 ha Woodland Vegetation Group	Meets the standard for proximity and linkage function		2b

NHRM = Natural Heritage Reference Manual (MNR 2005)

3.3 Criteria Applied to all *Vegetation Groups* and *Ecosystems*

Note: Small *Vegetation Communities* <0.5 ha become part of Ve*getation Groups* if they are adjacent to another *Vegetation Community* belonging to the same Group (e.g., a small deciduous swamp next to a larger mixed swamp). Small (<0.5 ha) *Vegetation Communities* also become part of the patch if they are adjacent to any other larger *Vegetation Community* or *Group*. Figure 3 in Chapter 2 illustrates this mapping rule.

3.3.1 Criterion 1 – *Vegetation Group* within or touching a Significant Valleyland

Rationale

River valleys perform numerous ecological functions. The Natural Heritage Reference Manual (NHRM) (MNR 2010) recognizes that valleys can be important linkages and corridors for wildlife movement, providing habitat for a variety of wildlife and connecting natural areas over large distances. Some river valleys have unusual features associated with them, such as calcareous seeps, cliffs, bedrock pavements, etc. These features are characterized by micro-environments that may provide conditions for unusual and diverse *Vegetation Communities* and / or species.

Permanent vegetation on valley lands improves water holding capacity and reduces river erosion. Actively eroding valleys have unstable slopes with little or no vegetation cover. As they erode, valleys deepen, widen and land area is lost. Valley land erosion is exacerbated by human activity. Excess weight near the top of the slope from buildings, roads or farm machinery can increase internal stresses. Structural attempts to stabilize valleys (e.g., retaining walls or hardening the toe of the slope) can be expensive and are usually unsuccessful in the long term.

Valleys are linear depressions that stretch across the landscape from their origins in headwater areas to their outlets into aquatic systems such as lakes. They contain water that flows for at least some periods of the year. The Natural Heritage Reference Manual (NHRM) recognizes that an understanding of hydrological and geomorphic structure is important to identifying valley lands. Valley lands are formed by a combination of the down cutting action of swiftly flowing water, the slumping action of river banks, and the removal of slumped material from the river bed (Etmanski and Schroth 1980, Bowles 1993).

Application / Mapping Rules

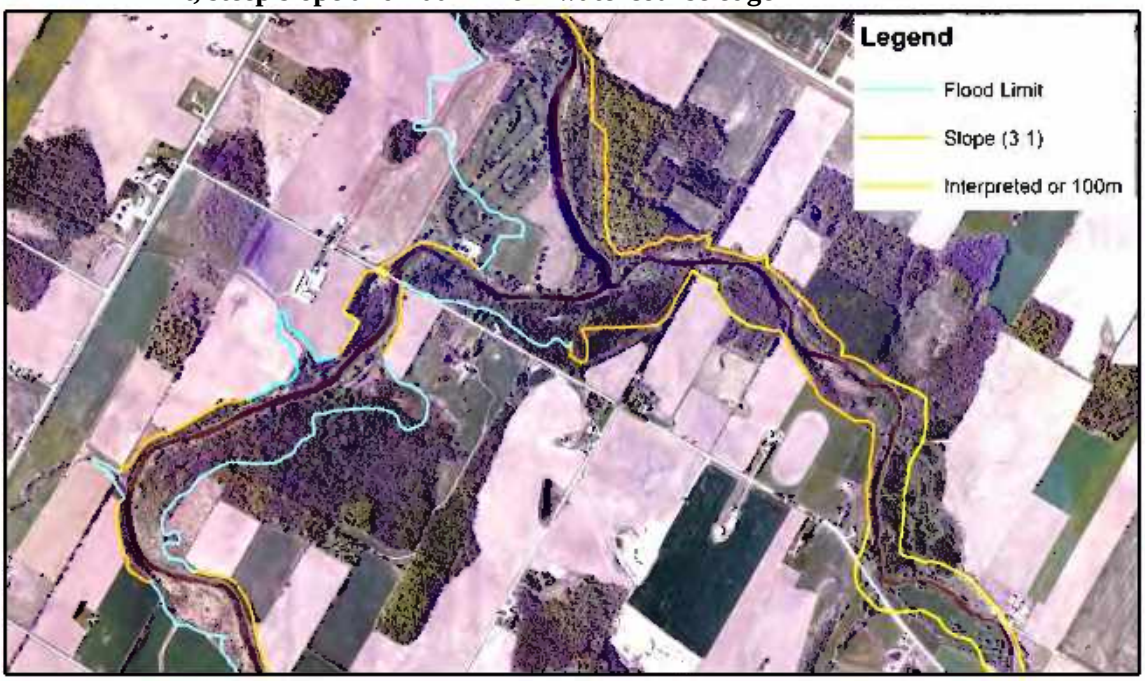
Table 8-1 (Recommended Significant Valleylands Evaluation Criteria and Standards) of the NHRM was used to identify and map Significant Valleylands in Elgin County. It is the responsibility of planning authorities to identify Significant Valleylands using these recommended NHRM criteria and standards. The key components are outlined below.

- ***Groundwater function*** – areas contributing to groundwater infiltration and groundwater release. Overlayed Significant Groundwater Recharge Areas (SGRAs) defined by local Source Water Protection Plans (see Appendix J-1). SGRCAs are prominent along the valley borders, suggesting groundwater seepage may be occurring along the banks, creating groundwater dependent wetlands and seepage zones.
- ***Landform prominence*** – Large, well-defined valleylands are often significant landscape features essential to the character of an area. Valley land makes up approximately 13% of the Elgin Study Area.
- ***Distinct geomorphic landforms*** – Soils, quarternary geology and physiography mapping provide information that allows distinct landforms to be identified. Fluvial features from the Ministry of Northern Development and Mines Surficial Layer, Bottom Land and Water from the OMAFRA Soils layer, and Beaches and Shorecliff, Spillways, and Water from the Physiography of Ontario were used to assist in the identification of Significant Valleys (see Appendix J-2).

- ***Degree of naturalness*** – 71% of the valley land in Elgin County is in natural patch cover and 39% of total patch cover in the county lies within the valley boundaries (see Appendix J-3).
- ***Unique communities*** – though not unique, the valleyland contains a majority of the 18 *Vegetation Communities* in the Study Area, making it one of the most naturally diverse areas within the county
- ***Linkage function*** – some of the largest and most diverse patches within the county are within the valley corridor because of the continuous watercourse layer linking many vegetation communities and groups together. The linkage to the watercourse also provides habitat value as described in the Habitat Value Section of the NHRM.

Figure 6 illustrates the delineation of the Significant Valley System boundary using flood limit, steep slope and 100 m from watercourse edge.

Figure 6. Criterion 1, illustration of Significant Valleyland boundary delineation using flood limit, steep slope and 100 m from watercourse edge



For well-defined valleys, the following components of the Conservation Authority riverine erosion and flooding hazards boundaries were used to identify the stable top of bank (top of slope):

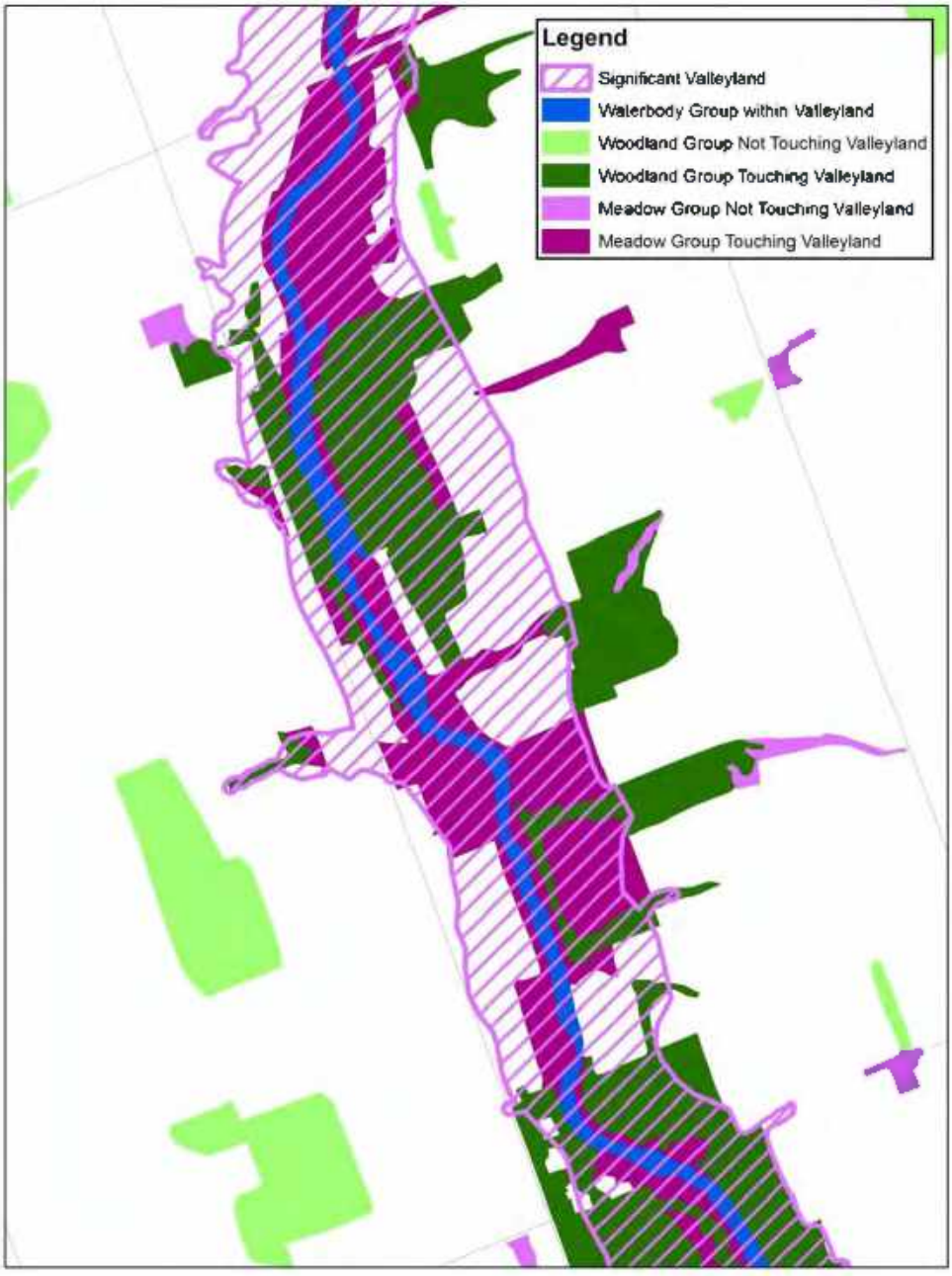
i) The valley must be ≥100 m wide and ≥2 km long.
ii) The valley banks must be ≥3 m in height (extrapolated from 5 m contours at 1:10,000 or better).
iii) To create a continuous valley feature in situations where the valley slope is 3:1 on one side and no slope on the opposite side, the opposite valley limit was delineated using either the limit of the floodplain (based on conservation authority flood lines) or, if unavailable, 100m from the centre line of the water course.
iv) Where 3:1 valley slopes occur on both sides of the river, but they are not continuous, the flood plain limit (or contour information and professional judgment) was used to delineate a continuous valley feature.

For less defined valleys, riparian vegetation, flooding hazard limit (based on regional events), meander belt, or highest seasonal (annual) inundation were used to determine the valley boundary.

All *Vegetation Groups* found within or touching the valley land meet this criterion (see Figure 7).

Other land uses within the valleyland (e.g., cropland, pasture, golf courses) are not identified as part of the Natural Heritage System in this study. However, the valleyland, by its nature, includes natural hazard features (i.e., flood plains, erosion hazards) which are constraints to development. The areas of Significant Valleylands not identified as part of the Natural Heritage System may provide Natural Heritage System linkage functions which should be assessed if a substantial land use change is proposed within or adjacent to such areas. See Chapter 5 for further discussion.

Figure 7. Criterion 1, illustration showing *Vegetation Groups* on or touching a Significant Valleyland



Results

Table 12 below shows the results of the application of Criterion 1 in the Study Area. Over 40% (43%) of the *Vegetation Groups* meet Criterion 1, accounting for 61.9% of the total vegetation cover (total of all *Vegetation Groups*). This result is not surprising given the large number of watercourses and ravines in Elgin County. Of the *Vegetation Groups* that meet this criterion, only a small number (163 of 2,147) meet only Criterion 1 and no other. See map in Appendix H-1.

Table 12. Criterion 1 Results – *Vegetation Groups* located on or touching Significant Valleylands in the Study Area

	Number				Area			
Vegetation Group	**# that meet Criterion 1**	**Total # Groups**	**% that meet Criterion 1**	**# that meet only Criterion 1**	**Area that meets Criterion 1 (ha)**	**Total area (ha)**	**% Area that meet Criterion 1**	**% of Study Area that meet Criterion 1**
Woodland	552	2,146	25.7%	13	25,626	40,949	62.6%	13.00%
Thicket	426	784	53.3%	103	837	1,527	54.8%	0.42%
Meadow	977	1,712	57.1%	4	1,946	3,544	54.9%	0.99%
Water Feature	107	237	45.1%	34	678	949	71.4%	0.34%
Connected Veg. Feature	85	119	71.4%	9	92	138	66.7%	0.05%
TOTAL	**2,147**	**4,998**	**43.0%**	**163**	**29,179**	**47,107**	**61.9%**	**14.8%**
Wetland	119	642	18.5%	0	963	5,210	18.5%	0.49%

The Study Area is 197,159 ha and includes a 500 m buffer around the county perimeter, excluding the lake side.

3.3.2 Criterion 2 – *Vegetation Group* within 100 m of the Shoreline Zone

Rationale

Lake shorelines perform numerous ecological functions. Wildlife such as foxes, deer and snakes move along shoreline beaches and bluff and access the lake water for drinking or foraging (MNRF Aylmer Biologist, Personal communication). Some species such as the threatened Bank Swallow, nest exclusively in bluffs and banks. Bald Eagles nest near the shoreline and frequent it in search of fish prey. Rare forest birds such as the Acadian Flycatcher breeds in the coastline's forested ravines and adjoining patches of upland forest.

The Lake Erie shoreline is a major migratory pathway for birds. Archibald *et al.* (2017) showed that when birds migrate south in the fall, they can pileup on the north side of the lake if the weather is poor or they judge they can't make the crossing successfully in one night. Thus shoreline habitats are highly valuable for conservation of migratory bird populations in the Great Lakes Region by providing resting and feeding areas so the birds can continue their migration in good physical condition (lakeeriewaterkeeper.org). With the exception of the Gulf coast, no other region of eastern North American can demonstrate concentrations of avian migrants like Lake Erie's coastland (lakeeriewaterkeeper.org.). The strip of Elgin coastline from J.E. Pearce Provincial Park (in Dutton/Dunwich) westwards to the Chatham-Kent border (IB948 Southwest Elgin Forest Complex) is designated an internationally Important Bird Area (www.ibacanada.ca/).

The north shore of Lake Erie is renowned as one of the best places in North America to view flights of hawks. The birds become concentrated through a combination of wind and geography. Hawks and other birds of prey try to avoid crossing large bodies of open water and so follow the shoreline and move down the spits (Theberge 1989).

Migrating Monarch butterflies rely on meadows near the shore to fuel up before the long flight southward in the autumn.

Lake Erie water levels have been high for the last several years, so very little beach is evident. However, during lower lake level conditions, beaches are present, providing increased linkage function for wildlife movement as well as feeding grounds for shorebirds, etc. Soil from these bluffs is washed into the lake, then moved by shoreline currents, and finally deposited on the sand spits of Point Pelee, Rondeau and Long Point (Theberge 1989).

The Natural Heritage Reference Manual (MNR 2010) recognizes that linkage is an important factor in woodland significance. Just as watercourse valleys play an important role in connecting habitats, the Lake Erie shoreline bluff would do the same. Linkages are natural corridors for wildlife movement, and connecting natural areas over large distances.

Vegetation on or near the bluff also provides some protection from erosion. Permanent vegetation on the lakeshore bluff improves water holding capacity and reduces erosion somewhat. While this erosion is a natural process, erosion can be exacerbated by human activity. Excess weight near the top of the slope from buildings, roads or farm machinery can increase internal stresses. Structural attempts to stabilize valleys (e.g., retaining walls or hardening the toe of the slope) can be expensive and are usually unsuccessful in the long term.

Application / Mapping Rules

To map the shoreline zone, a polygon was created from the top of the bluff to 1 km out into the lake, as seen on the 2015 aerial photography (see map in Appendix H-2). The shoreline zone is extended 1km out as this is the active zone where sediment that is eroded from the bluff mixes with the lake water and travels up and down the shore to the major sand spits (see illustration in Appendix O). The shoreline in Elgin County is over 80 km long and1 km wide, totalling 8,842 ha.

The ENHSS Project Team Participants agreed that the bluff and shoreline zone should be recognized as a key natural heritage feature in the county since it is an important linkage between the land and lake, especially for migratory birds.

Given the benefits associated with proximity of vegetation communities to the shore and using 100m as the cutoff distance (a conservative estimate based on the scientific literature discussed in Section 3.4.3), all *Vegetation Groups* found within 100 m of the Shoreline Zone meet Criterion 2.

Note 1: The shoreline zone polygon is provided as an overlay feature in this study, similar to Significant Valleylands.

Note 2: It is recognized that the policies of the PPS do not provide protection for upland thickets and meadows as natural heritage features and areas, unless they have been determined to be significant wildlife habitat.

Results

The results for Criterion 2 are shown in Table 13 and in Appendix H-2. Only 4.6% of the *Vegetation Groups* meet Criterion 2, accounting for 10.1% of the total vegetation cover (total of all *Vegetation Groups*). This result is not surprising given that only vegetation groups within 100 m of the Shoreline Zone are eligible, but the shoreline is very long, over 80 km. Of the 233 *Vegetation Groups* that meet this criterion, only 23 meet only Criterion 2 and no other criteria. See map in Appendix H-2.

Table 13. Criterion 2 results – Vege*tation Groups* within 100 m of the Shoreline Zone

Vegetation Group	Number				Area			
	# that meet Criterion 2	Total # Groups	% that meet Criterion 2	# that meet Criterion 2 and no other	Area that meet Crit. 2 (ha)	Total area of Groups (ha)	% Area of All Veg Groups	% of Elgin Study Area that meet Criterion 2
Woodland	108	2,146	5.0%	9	4,362	40,949	10.7%	2.21%
Thicket	40	784	5.1%	13	86	1,527	5.6%	0.04%
Meadow	78	1,712	4.6%	0	196	3,544	5.5%	0.10%
Water Feature	7	237	3.0%	1	110	949	11.6%	0.06%
Connected Veg Feature	0	119	0.0%	0	0	138	0%	0%
Total	**233**	**4,998**	**4.6%**	**23**	**4,754**	**47,107**	**10.1%**	**2.41%**
Wetland	12	642	1.9%	0	75	5,210	1.4%	0.04%

Notes: The Study Area is the geographic Elgin County plus a 500 m buffer around all sides but the lake side. The boundary is the top of the bank, not the waterline or out into the lake.

The Lake Erie shoreline with Hawk Cliff Woods in the foreground. Drone photo by Joseph O'Neil.

3.3.3 Criterion 3 − *Vegetation Group* within or touching any Life Science ANSI

Rationale

The Natural Heritage Reference Manual (MNR 2010) recognizes that significant natural heritage features and areas are typically used as a starting point in natural heritage system studies as they provide a logical foundation upon which to design a planning area's natural heritage system. Life Science Areas of Natural and Scientific Interest (ANSIs) are areas of land and/or water located on both public and private lands that are significant representative segments of Ontario's biodiversity and natural landscapes (MNR 2000a). These areas contain relatively undisturbed vegetation and landforms including specific types of forests, valleys, prairies, and wetlands as well as their associated plant and animal species and communities. ANSIs are a critical complement to provincial parks and conservation reserves as they represent important natural features that are not found in publicly protected areas. Earth Science ANSIs were not included in this criterion for the reasons noted in Appendix E, point 16.

The Ministry of Natural Resources and Forestry (MNRF) evaluates and subdivides candidate ANSIs into categories of significance: provincial (considered Significant under the PPS), and regional or local (not Significant under the PPS). These categories are based on the consideration of five evaluation selection criteria (MNR 2000a):

i. Representation – landform/vegetation features of an ecodistrict,
ii. Condition – degree of human-induced disturbances,
iii. Diversity – the number of high quality, representative features that exist within a site,
iv. Other ecological considerations – ecological and hydrological functions, connectivity, size, shape, proximity to other important areas, etc., and
v. Special features – such as populations of species at risk, special habitats, unusual life science features and educational or scientific value.

Application / Mapping Rules

The Life Science ANSI boundary layer is based on MNRF data. This study considers both provincially and regionally designated Life Science ANSIs as ecologically important as they contain the best examples of landform/vegetation features and contribute to the representation of the natural features and landscapes of the county. All *Vegetation Groups* included within a Life Science ANSI boundary or those touching the ANSI meet Criterion 3 (see Figure 8). There are 21 Life Science ANSIs in the Elgin Study Area (see map in Appendix H-3):

Regional ANSIs		**Provincial ANSIs**
Big Mundy Creek	Little Otter Creek	Big Otter Creek
Big Otter Creek S of Bayham	Mount Salem Forest	Kent & Elgin Shoreline
Eagle Woodlots	North Rodney Woodlots	Skunk's Misery*
Hawk Cliff	Plum Point	Springwater Forest
Iroquois Beach Prov. Pk.	Tate's Bridge Floodplain*	Talbot Creek
Lakeview South	West Elgin Tract	Thames River Floodplain
Little Jerry Creek	West Lorne Tract	

*Note: * located on the north side of the Thames River in Middlesex County*

Results

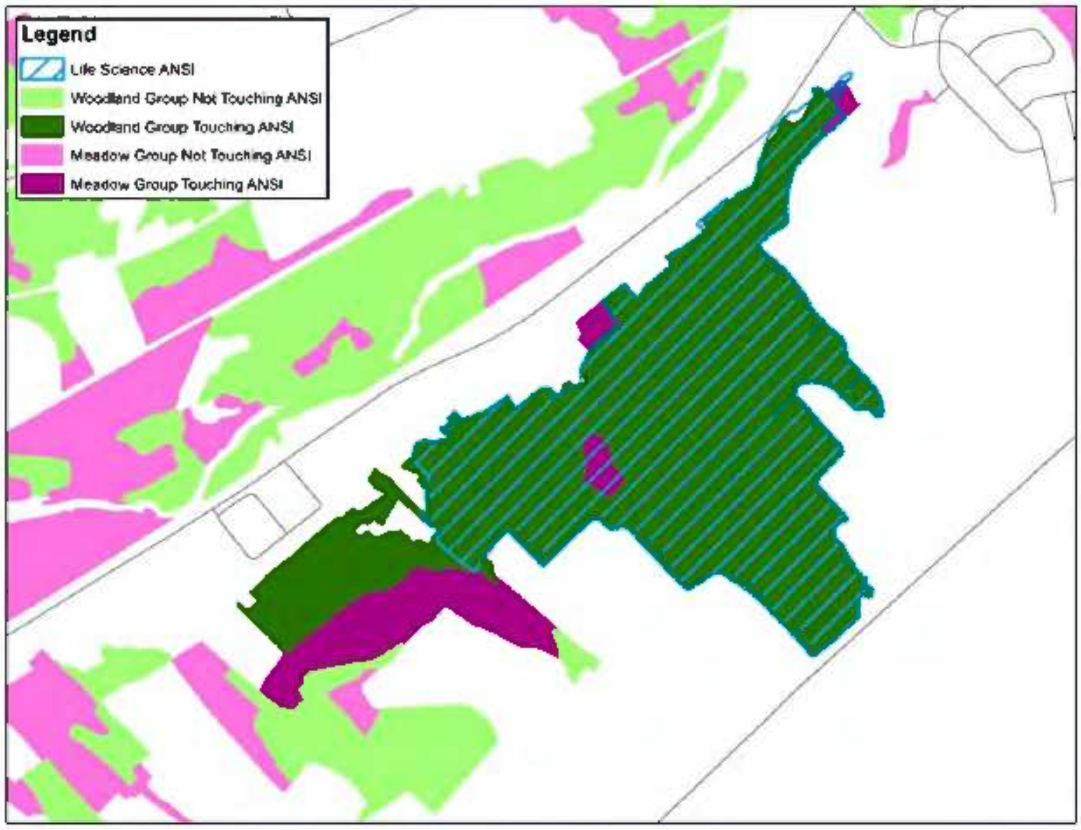
Table 14 below summarizes the mapping results for Criterion 3. Not surprisingly, only a moderately small number of *Vegetation Groups* (180) meet Criterion 3 since there are only 21ANSIs in the study area. However, the groups that meet this criterion account for a large area (7,487 ha or 15.9% of the vegetation cover), indicating that the ANSIs include some of the largest natural areas on the landscape. Only 9 *Vegetation Groups* meet this criterion and no other, also not surprising since ANSIs are designated on numerous criteria. See map in Appendix H-3.

Table 14. Criterion 3 results – *Vegetation Groups* within or touching a Life Science ANSI in the Study Area

Vegetation Group	Number				Area			
	# that meet Criterion 3	**Total # Groups**	**% that meet Crit. 3**	**# that meet only Criterion 3**	**Area that meet Criterion 3** (ha)	**Total area** (ha)	**% Area of All Veg Groups**	**% of Study Area that meet Criterion 3**
Woodland	44	2,146	2.0%	0	6,785	40,949	16.6%	3.44%
Thicket	30	784	3.8%	4	67	1,527	4.4%	0.33%
Meadow	91	1,712	5.3%	0	216	3,544	6.1%	0.11%
Water Feature	10	237	4.2%	5	415	949	43.7%	0.21%
Connected Vegetation Feature	5	119	4.2%	0	4	138	2.3%	0.00%
Total	**180**	**4,998**	**3.6%**	**9**	**7,487**	**47,107**	**15.9%**	**3.80%**
Wetland	75	642	11.7%	0	1,265	5,210	24.3%	0.64%

Study Area is 197,159 ha and includes a 500 m buffer around the county perimeter, excluding the lake side.

Figure 8. Criterion 3, illustration showing *Vegetation Groups* within or touching a Life Science ANSI



3.3.4 Criterion 4 – *Vegetation Group* within 30 m of an Open Watercourse

Rationale

Natural areas adjacent to watercourses (i.e., areas of riparian vegetation) affect and are affected by the water. Open watercourses contain flowing water for at least part of the year and can be natural or channelized, but not buried or tiled (these are considered closed watercourses). Some watercourses in Elgin County are classified as agricultural drains. Whether or not they are open drains or natural watercourses they are all part of a connected creek or river system and can support Species at Risk, sport fish, top predators, cool water species, and have permanent flow. Best available watercourse mapping is shown in Appendix I-3.

The Natural Heritage Reference Manual (MNR 2010) recognizes that the relationship between water features and vegetation is interactive. The physical processes operating in and adjacent to the stream channel create and maintain fish habitat by providing shade for water temperature regulation, food through organic inputs such as leaves, habitat from input of large woody debris, and cover in the form of accumulated vegetation. As a result, fish community composition and productivity in streams is partly related to the condition and health of vegetation beside the stream. Permanent vegetation near waterways protects water quality by reducing peaks in water flow, filtering out sediments and excess nutrients, trapping toxins, and reducing soil erosion by retaining water run-off (Bosch and Hewlett 1982, Mooney 1993, Filyk 1993).

Riparian habitats are important terrestrial habitats in their own right and are supported by healthy watercourses. Vegetated riparian areas along streams are regional hot spots for a disproportionately high number of wildlife species, providing a wide array of ecological functions and values (Naiman *et al*. 1993, Fischer and Fischenich 2000). Watercourses and associated riparian areas can provide important linkage functions and act as continuous corridors for the movement of wildlife because the land-water interface usually supports a high level of biodiversity that meets multiple species needs (Wegner and Merriam 1979). Many plants and animals benefit from riparian habitat where the water and the high level of nutrients derived from overland flow create primary centres of bird activity and critical locations for amphibians and reptiles (Harris and Gallagher 1989).

Definition

Natural features and areas in proximity to water features maintain linkages across the landscape. The PPS *recognizes linkages between and among natural heritage features and areas, surface water features and ground water features* (MMAH 2014)

Based on a review of literature, Fischer and Fischenich (2000) found that 30 m is the minimum width for ecological functions such as wildlife movement and that a vegetated strip of 30 m will protect most water quality parameters on moderate slopes. Environment Canada (2013) sets a guideline target of at least 30 m wide naturally vegetated riparian areas on both sides of streams, as a minimum to protect aquatic habitat, and wider riparian buffers to provide highly functional wildlife habitat. Environment Canada (2013) also sets a guideline of 75% of stream length be naturally vegetated. In the Upper Thames River Watershed Report Cards (UTRCA 2012), one of three indicators for forest condition grades is “percent riparian zone forested”. Here, a 30 m swath on both sides of a watercourse defines the riparian zone. Conservation Ontario (2011) recommends the same approach for conservation authorities developing watershed report cards.

Since 30 m is a commonly held minimum riparian buffer width, this Criterion 3 captures *Vegetation Groups* that contain a watercourse or lie wholly or in part within this 30 m riparian zone.

Application / Mapping Rules

Open watercourses are linear features that contain flowing water for at least part of the year and can be natural or channelized. They include open intermittent or headwater drainage features, streams, rivers, creeks and open drains. Tiled or buried drains with no surface connection are considered "closed" watercourses and were excluded from the analysis.

Although digital data for watercourses exists for southern Ontario, this data is not current. Recognizing time constraints, a method was developed that eliminates the need to update the entire watercourse layer. Using spring 2015 aerial photography (SWOOP), an on-screen interpretation of the edge of open watercourses (i.e., the bank-full width) was completed in tandem with the interpretation of *Vegetation Community* boundaries. Onscreen measurements were made from the watercourse edge to the *Vegetation Community* edge, and if ≤ 30 m, the community was identified as meeting this criterion.

Terrestrial *Vegetation Communities* within 30 m of the bank-full width of an open watercourse are identified as a riparian area (Figure 9). As these riparian *Vegetation Communities* were attributed to their broader *Vegetation Groups*, the *Vegetation Groups* containing these riparian *Vegetation Communities* meet this criterion (Criterion 4).

Results

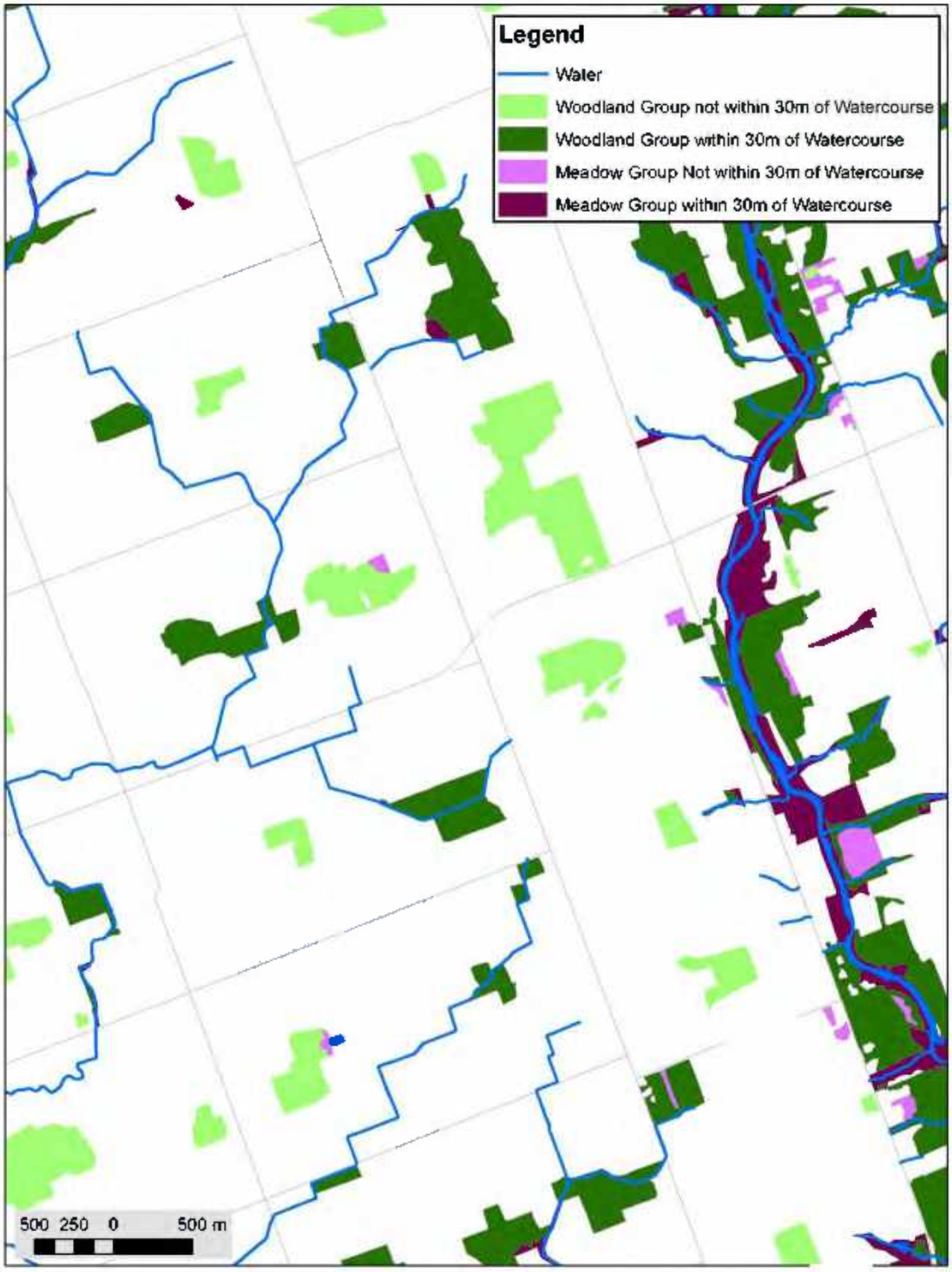
Table 15 below summarizes the results for Criterion 4 and the map in Appendix H-4 shows the results. About half (55.7%) of the *Vegetation Groups* meet this criterion but 85.2% of the vegetation cover. These figures indicate that many of the remaining natural areas on the landscape are near a watercourse because the land is harder to farm or develop and/or because there is a high density of watercourses in the county. Of the 2,786 *Vegetation Groups* that met this criterion, 405 (14%) met only this criterion and no other criterion.

Table 15. Criterion 4 Results – *Vegetation Groups* containing or within 30 m of an Open Watercourse in the Study Area

Vegetation Group	Number				Area			
	# that meet Criterion 4	Total # Groups	% that meet Criterion 4	# that meet Criterion 4 and no other	Area that meet Crit. 4 (ha)	Total area of Groups (ha)	% Area of All Veg Groups	% of Study Area that meet Criterion 4
Woodland	1,124	2,146	52.4%	155	35,819	40,949	87.5%	18.17%
Thicket	443	784	56.5%	107	1,009	1,527	66.1%	0.51%
Meadow	1,025	1,712	59.9%	96	2,491	3,544	70.3%	1.26%
Water Feature	99	237	41.8%	28	693	949	73.0%	0.35%
Connected Veg Feature	95	119	79.8	19	107	138	77.5%	0.05%
Total	**2,786**	**4,998**	**55.7**	**405**	**40,119**	**47,107**	**85.2%**	**20.35%**
Wetland	322	642	50.2%	0	3,293	5,210	63.2%	1.67%

Study Area is 197,159 ha and includes a 500 m buffer around the county perimeter, excluding the lake side.

Figure 9. Criterion 4, illustration showing *Vegetation Groups* within 30 m of Open Watercourses



3.4 Size Criteria Applied to Specific *Vegetation Groups*

A note about clustering Vegetation Groups around roads, railroads and watercourses

Vegetation Groups separated by a road, railroad or watercourse < 20 m in width were clustered into the adjacent *Vegetation Group* (Section 2.4.8). All criteria for *Vegetation Groups*, except area, were applied to the clustered *Vegetation Group*. When calculating the area of a *Vegetation Group* cluster, the area of the road/railway/watercourse was not included in the calculation. Instead, area was calculated as the area of the entire *Vegetation Group* cluster less the area of the road/railroad/watercourse. Area of the woodland *Vegetation Group* and interior area were calculated on the non-clustered woodland *Vegetation Groups* (i.e., calculated before clustering so it does not include roads or watercourses in the calculation).

3.4.1 Criterion 5 – All Wetland *Vegetation Groups* ≥ 0.5 ha

Rationale

Since European settlement, approximately 85% of wetlands greater than 10 ha have been lost in southern Ontario (Ducks Unlimited Canada 2010). The Natural Heritage Reference Manual (MNR 2010) recommends protection of wetland areas for their important contribution to stream flow through groundwater release.

Wetlands provide important breeding and overwintering habitat for reptiles and amphibians, many of which are at-risk due to habitat loss, as well as herons and Wood Ducks. Wetlands are among Ontario's most productive and diverse habitats, in large part because of the irregular mosaic of 'edge' created where land and water meet.

Wetlands occur where the water table is close to or at the surface and are characterized as seasonally or permanently covered by shallow water less than 2 m deep. The presence of this abundant water causes the formation of hydric soils. The fluctuation of water levels and the presence of water tolerant plants distinguish wetlands from aquatic Vegetation Ecosystems (Lee *et al*. 1998).

It has been well documented that wetlands improve water quality and base flow by storing and infiltrating precipitation and runoff on the landscape and filtering out contaminants. In Wisconsin, Hey and Wickencamp (1996) found that increasing the amount of wetland in a watershed to 10% resulted in reduced flooding, higher base flows, and reduced occurrence of high flows. Environment Canada (2013) set the following guideline: "At a minimum, the greater of (a) 10% of each major watershed and 6% of each subwatershed, or (b) 40% of the historic watershed wetland coverage, should be protected and restored". Wetlands are not uniformly distributed across the landscape and there is limited data on historical wetland cover within the watersheds of Elgin County. Environment Canada (2013) recognizes that a watershed and a municipality are similar-sized units, useful for planning purposes.

It is important to protect as many wetlands on the landscape as possible. Johnson *et al*. (1990) found that watersheds containing less than 10% wetland cover were more susceptible to incremental losses of wetlands than those with more wetlands. The amount of natural habitat that is located adjacent to wetlands can be important to the maintenance of wetland functions and attributes. The value of a wetland is enhanced where the wetland is located close to other wetlands and natural areas so that wildlife can move between them to take advantage of favourable habitat and food (Findlay and Houlahan 1997, Houlahan and Findlay 2003). For example, wetlands situated within 100 m of other wetlands are more likely to have movement of fish among them (Golet 1976).

Application / Mapping Rules

The wetland layer was derived from:

- the MNRF evaluated wetland mapping layer (2017), providing Significant Wetlands and evaluated wetlands, and
- the unevaluated wetlands mapped as *Vegetation Communities* by the UTRCA during the vegetation mapping of the ENHSS (see Section 2.4.1). See Note 3 below.

All evaluated wetlands approved by the MNRF, regardless of size, as well as unevaluated wetlands ≥0.5 ha identified by the UTRCA, meet Criterion 5.

Since it is recognized that there are additional unmapped and unevaluated wetlands on the landscape that have not been captured in this model, any wetlands mapped or evaluated in the future also meet this criterion.

Note 1: The term significant wetland is reserved for wetlands that have been evaluated and deemed significant using the Ontario Wetland Evaluation System of MNRF. The identification and delineation of significant wetlands must be approved by MNRF.

Note 2: If a Woodland *Group* contains a Wetland *Vegetation Community*, the entire woodland group does NOT become ecologically important until it becomes a *Vegetation Patch*.

Note 3: The evaluated wetland layer obtained from MNRF can contain wetlands that are shown as many small components dispersed throughout a larger feature. For example, some woodland swamps are characterized by gently undulating topography, and only the wettest pockets are mapped as wetland by the MNRF, creating a tight, intricate pattern. However, the entire feature is generally considered to function as a wetland (e.g., swamp), not just the wettest pockets. During the mapping process for the ENHSS, these small communities may be captured and represented as a single feature (i.e., one large swamp). Thus, the wetland layer in this study will not represent the Evaluated Wetlands boundaries defined by MNRF and the original layer should be obtained from MNRF when reviewing planning applications.

Results

Table 16a shows the results of the wetland *Vegetation Group* (see map in Appendix H-5). There are 658 wetland *Vegetation Groups*, totaling 5,001 ha in the Study Area. There is 2.54% wetland cover in the Elgin Study Area.

Table 16b shows the breakdown of wetlands by type/source: evaluated and unevaluated. The unevaluated wetlands mapped by the UTRCA as part of this study add another 50% to the evaluated cover.

Table 16c shows the results for each member municipalities (the areas do not include the buffer zone). West Elgin has the highest wetland cover (3.87%) and the other municipalities have less than 3% wetland cover. Environment Canada (2013) recommends a minimum of 6% wetland cover at the subwatershed scale (equivalent to a small sized municipality).

Table 16a. Criterion 5 Results – *Vegetation Groups* that contain Wetland *Vegetation Communities* (in the Study Area)

Vegetation Group	Number	% that meet Criterion 5	Area (ha)	% of Elgin Study Area (197,159 ha)
Wetland *Vegetation Group*	642	100%	5,210	2.64%

Table 16b. Wetland Cover: Evaluated and Unevaluated in the Study Area

Wetland (Source)	Area (ha)	% of Total Wetland Area
Evaluated (Significant and other)	3,293	63%
Unevaluated	1,917	37%
Total	**5,210**	**100%**

Table 16c. Wetland Cover by Municipality

Name	Municipal Area (ha)	Wetland Area (ha)	% Wetland Cover in Municipality
West Elgin	32,324	1,250	3.87%
Dutton/Dunwich	29,526	436	1.48%
Southwold	30,182	889	2.95%
Central Elgin	28,142	688	2.45%
Malahide	39,552	855	2.16%
Bayham	24,558	668	2.72%
St. Thomas	3,588	29	0.80%
Aylmer	611	2	0.35%
County (no buffer)	**188,482**	**4,816**	**2.56%**

Areas of the municipalities and wetlands do NOT include the 500 m buffer, so the area figures are smaller than shown in Tables 16a and 16b.

3.4.2 Criterion 6 – Woodland *Vegetation Groups* ≥ 4 ha

Rationale

Habitat size is one of the most important measures for sustaining stable, diverse and viable populations of wildlife species. Larger woodlands tend to have a greater diversity of habitat niches and are more effectively buffered from external negative influences such as environmental disturbances, nest predation, and parasitism (Askins and Philbrick 1987, Villard *et al*. 1999, Schwartz 1999, Soulé and Terborgh 1999, Burke and Nol 2000, Burke *et al*. 2011, Forman 1995c, Kohm and Franklin 1997, Bennett 2003, Marini *et al.* 1995). In a highly fragmented landscape, the size definition of a "large" woodland can be relatively small. Studies indicate that smaller woodlands (<10 ha) can be considered important and worth protecting as they provide certain ecosystem benefits.

Small mammals, such as mice and voles, use woodlands as small as 0.1 ha. In agricultural landscapes, these small woodlands become especially important during harvest, when these rodents are displaced from the field (Fitzgibbon 1997). Although small woodland *Vegetation Groups* are often regarded as poor habitat for breeding birds, Friesen *et al*. (1999) have demonstrated that small woodlands in agricultural landscapes can experience high pairing success for birds. Small forest fragments of 1 to 4 ha are also important stopover sites for migratory birds (Packett and Dunning 2009, Swanson *et al*. 2005). Insects, especially bees and butterflies, also rely on small woodlands in a fragmented landscape. Small woodlands may be just as important as larger ones for pollinator diversity and abundance (Banaszak 1996, Cane 2001, Donaldson *et al.* 2002).

Application / Mapping Rules

Riley and Mohr (1994) and the Natural Heritage Reference Manual (MNR 2010) recommend that the minimum standard for determining the size of wooded *Vegetation Groups* considered to be significant within the planning area is a function of the percentage of forest cover within that area. The Natural Heritage Reference Manual (MNR 2010) recommends that woodlots of 4 ha or more should be considered significant in landscapes with about 5-15% woodland cover, and woodlots of 20 ha for areas with about 15-30% woodland cover. However, the Provincial Policy Statement states that authorities can go above the minimum standards.

Based on this guidance, the 2016 Oxford Natural Heritage Systems Study, 2013 Huron Natural Heritage Systems Study (draft) and 2014 Middlesex Natural Heritage Systems Study all used a woodland size cutoff of ≥ 4 ha. These counties had approximately 13.2%, 16.6% and 15.8% woodland cover respectively. Elgin County has approximately 20% woodland cover (see Table 9), slightly more than these other counties, but well within the range.

The Elgin NHSS Project Team reviewed the woodland size options. Elgin County's current Official Plan policy for significant woodlands states:

Section D1.2.2.1

- **Elgin County considers woodland ≥10 ha as significant woodland.**
- **Woodlands between 2 ha and 10 ha are also significant if they are located within 30 m of a significant natural heritage feature (e.g., significant wetland, significant valleyland, fish habitat and/or watercourse).**

To make the determination, the consultants mapped the woodland criteria for both the 4 ha and 2 ha woodland size cutoffs. The maps and statistics were reviewed and discussed at the subsequent meeting. The 4 ha and 2 ha cutoffs capture close to 98% and 99% of woodland area, respectively. The Project Team felt the 4 ha cutoff was appropriate as this cutoff is used in many other southwestern Ontario jurisdictions. Also, woodlands ≥1 ha will still be subject to the Woodlands Conservation Bylaw.

Therefore, all woodland *Vegetation Groups* ≥ 4 ha in size meet Criterion 6 (see Appendix H-6).

Results

Table 17 shows the results for Criterion 6 and a map of the results is provided in Appendix H-6. Slightly fewer than half (47.8%) the woodland *Vegetation Groups* (1,026 of 2,146) met this size criterion but they account for over 95% of the woodland area (39,114 of 40,949 ha). Thus, the remaining woodland *Vegetation Groups* that don't meet the criterion are very numerous but small and don't add up to a lot of area. Of the 1,026 *Vegetation Groups* that meet this size criterion, 240 (approximately 23%) meet only Criterion 6 and no other criterion.

Table 17. Criterion 6 Results – Woodland *Vegetation Group* ≥ 4 ha in the Study Area

Vegetation Group	**# that meet criterion 6**	**% of all Woodland Groups** (2,146)	**# that meet only criterion 6**	**Area that meet Criterion 6** (ha)	**% of Total Woodland Group Area** (40,949 ha) **that meet Criterion 6**	**% of Study Area** (197,159 ha) **that meet Criterion 6**
Woodland *Vegetation Group* ≥ 4 ha	1,026	47.8%	240	39,114	95.5%	19.84%

3.4.3 Criterion 7 – Woodland *Vegetation Groups* within 100 m of a Woodland *Vegetation Group* ≥ 4 ha

Rationale

The Natural Heritage Reference Manual (MNR 2010) recognizes that the distance between individual woodlands is an important factor in maintaining woodland integrity. Woodlands that are located near each other or to other natural features have more opportunities for restoring connectivity since linkages are important for both animal and plant dispersal. Small woodlands located close to large woodlands are more important in feature and function than those that are isolated. One reason is that smaller woodlands that are closely spaced can serve as stepping stones for species movement. For example, Bowles (1997) found that species richness was higher for small *Vegetation Patches* closely linked to larger *Vegetation Patches* than similarly sized *Vegetation Patches* not linked to larger *Vegetation Patches.*

The identification of landscape connectivity is an evolving science. Sutherland *et al*. (2000) compared dispersal data for 77 bird and 68 mammal species. In the case of birds, maximum dispersal distances ranged from 130 m for the European Magpie to 1,305 km for the Great Horned Owl. For mammals, maximum dispersal distances ranged from 140 m for the Prairie Vole to 930 km for the Lynx. As for plants, the limited distances that most seeds travel are well documented for all growth forms (Cain *et al*. 2000, Harper 1977, Howe and Smallwood 1982, Willson 1993, Cain *et al*. 1998).

Recognizing that plants (seeds, pollen) have limited mobility compared to animals, the average wind dispersal distance of 100 m (Nathan *et al*. 2002) was used as the distance that would functionally connect two woodlands.

Application and Mapping Rules

Woodland *Vegetation Groups* that are within 100 m of a woodland *Vegetation Group* ≥ 4 ha, regardless of what is surrounding them, meet Criterion 7 (see Figure 10).

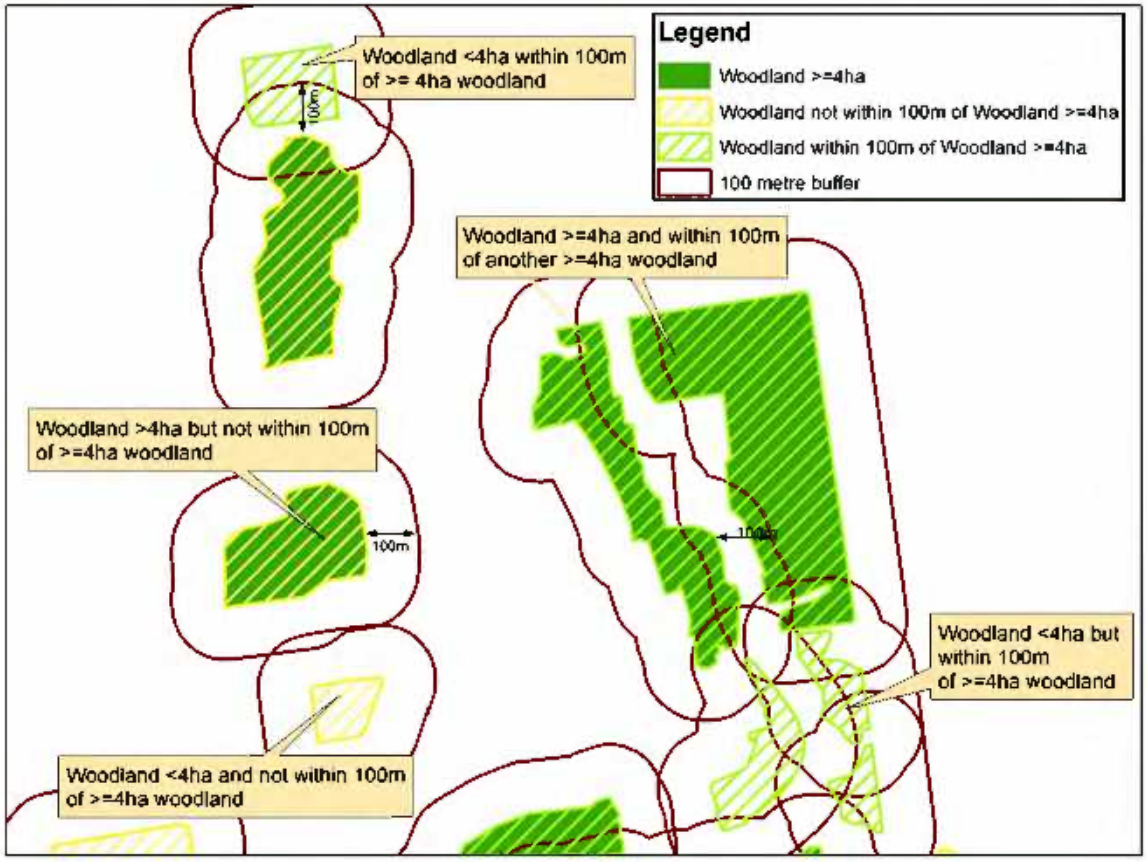
Results

The findings are shown in Table 18 and in Appendix H-7. Over 40% (42.2%) of all the woodland *Vegetation Groups* are within 100 m of a woodland *Vegetation Group* ≥ 4 ha, amounting to 75.1% of all woodland area. These figures indicate that about three-quarters of woodland area is in close enough proximity to larger woodlands to help maintain ecological integrity.

Table 18. Criterion 7 Results – Woodland *Vegetation Groups* within 100 m of a Woodland *Vegetation Group* ≥ 4 ha in the Study Area

	# meet Criterion 7	**% of all Woodland Groups** (2,146)	**# that meet only Criterion 7**	**Area meeting Criterion 7** (ha)	**% of Total Woodland Group Area** (40,949 ha)	**% of Study Area** (197,159 ha)
Woodland *Vegetation Group* within 100 m of a Woodland *Vegetation Group* ≥ 4 ha	905	42.2%	188	30,743	75.1%	15.59%

Figure 10. Criterion 7, illustration of 100 m proximity between woodland Vegetation Groups ≥ 4 ha



3.4.4 Criterion 8 – Thicket *Vegetation Group* ≥ 2 ha

Rationale

Thickets are vegetation communities dominated by shrubs or young trees. Like woodlands, they are most likely to support and sustain a diversity of species if they are large (Rodewald and Vitz 2005, MNR 2012). Often thicket habitats are temporary and eventually succeed or transition into woodlands/forests. For example, when a farm field is left fallow for just a few years, grasses and sun-loving herbaceous plants will colonize the field first as part of the natural succession process. A few years later the area is colonized by shrubs (e.g., hawthorn, sumac, Grey Dogwood) and young trees such as poplars and willows; this is the thicket stage. As the trees mature, they shade out most shrubs, grasses and sun-loving wildflowers and within 25 to 30 years, the area becomes a young woodland. Some thickets do not succeed to woodlands as they are maintained by wet, poor or shallow soils or disturbances such river flooding and ice scour. Wetland thickets and upland thickets can be identified by remote sensing.

The literature on bird species that use thickets suggests that thicket habitat is on the decline and large thickets are becoming increasingly uncommon. Thicket habitats may be declining due to changes in rural land uses (e.g., more cropland and less rough land pasture and hedgerow). As a result, many of the bird species that typically use thickets and early succession stages of woodland development are also declining rapidly (Sauer *et al*. 2001). Some thicket birds are area sensitive and select large areas of contiguous habitat for breeding. Birds such as the Chestnut-sided Warbler will use smaller areas less than 0.5 ha, but the more uncommon species such as Golden-winged Warblers, Yellow-breasted Chats or Woodcock require areas of 10 ha or more (Chandler *et al.* 2009, Rodewald and Vitz 2005, Oehler *et al*. 2006, Schlossberg and King 2008, King *et al*. 2001, King and Byers 2002, King *et al*. 2009). In general, large blocks of any habitat (grassland/meadow, thicket, mature forest, wetland, etc.) are more valuable to wildlife than small blocks because they tend to support both the common and uncommon species.

Note: It is recognized that the policies of the PPS do not provide protection for upland thickets and meadows as natural heritage features and areas, unless they have been determined to be significant wildlife habitat. Wetland thickets are protected under wetland policies.

Application / Mapping Rules

If managing thickets to enhance the long-term survival of a variety of wildlife, larger is better. Thickets of at least 10 ha in size are required for area sensitive thicket birds, yet this class size is very rare in Elgin County. To determine the cut-off size for thicket *Vegetation Groups* in the study area, the top 25th percentile of data was calculated (a method of descriptive statistical analysis to determine rarity). The 25th percentile was 2.1 ha and it was then rounded to the nearest whole number, 2 ha.

Thus, all thicket *Vegetation Groups* ≥2 ha meet Criterion 8.

Results

The results of the mapping are shown in Table 19 and in Appendix H-8. Over a quarter (28.1%) of all thicket *Vegetation Groups* (220 of 784) meet the criterion, accounting for almost two-thirds (62.3%) of all thicket area. Appendix H-8 shows the results in map form. Only 38 of 220 thicket *Vegetation Groups* (17%) met only this criterion and no other criterion.

Table 19. Criterion 8 Results – Thicket *Vegetation Group* ≥2 ha in the Study Area

	# meet Criterion 8	**% of all thicket groups** (784)	**# that meet only Criterion 8**	**Area meeting Criterion 8** (ha)	**% area of all thicket groups** (1,527 ha)	**% of Study Area** (197,159 ha)
Thicket *Vegetation Group* ≥2 ha	220	28.1%	38	952	62.3%	0.48%

3.4.5 Criterion 9 – Meadow *Vegetation Group* ≥ 5 ha

Rationale

Meadows and grasslands of all sizes are used by many different native wildlife species from butterflies and bees to birds and mammals. The amount of native grassland and meadow habitat has declined drastically throughout North America. Minimum habitat size is not usually a limiting factor for most generalist species and no reasonable estimate of minimum habitat size exists for butterflies as a group (USDA and the Wildlife Habitat Council 2000).

Grassland birds, however, are of special concern since they are habitat size dependant and have suffered more serious population declines than any other group of birds (Igl and Johnson 1997, Peterjohn and Sauer 1999, Sauer *et al.* 2001). Johnson (2001) demonstrated a number of grassland bird species, including the Savannah, Grasshopper, and Henslow's Sparrow prefer large grasslands far in excess of their territory size (typically <1 ha). Corace *et al.* (2009), Davis (2004), Winter *et al*. (2006) and Ribic and Sample (2001) found that the density of open land bird species is regulated by the interaction of field size, shape and edge type, and that larger open areas tend to support a more diverse bird community.

The Significant Wildlife Habitat Technical Guide (MNR 2000b) identifies 10 ha blocks of undisturbed grassland as excellent raptor hunting areas, and meadows >30 ha as significant open country bird breeding habitat. Grassland species such as Bobolink, Savannah Sparrow, Eastern Meadowlark and Grasshopper Sparrow are more abundant as breeding birds in continuous grassland habitats of 4-6 ha (McCracken *et al*. 2013, Ochterski 2006a, 2006b, Mitchell *et al*. 2000).

Bobolinks and Eastern Meadowlarks can nest in relatively small patches of grassland, but abundance and productivity are higher in large patches (>10 ha) and in patches surrounded by other open habitats (e.g., Ribic and Sample 2001, Herkert *et al*. 2003, Bollinger and Gavin 2004, Keyel *et al*. 2011). The General Habitat Description for the Eastern Meadowlark (MNR undated) notes that "*minimum patch area requirements to support breeding habitat for the species have been reported at 5 ha (Herkert 1994), however abundance and productivity are higher in larger patches and in patches surrounded by other open habitats"*. Regardless of the patch size, breeding habitat for Eastern Meadowlark is protected under the Endangered Species Act.

Application

Based on the Bobolink and Eastern Meadowlark Recovery Strategy (McCracken *et al*. 2013) and the General Habitat Description for the Eastern Meadowlark, patch areas of 5 ha support these grassland bird species protected under the Endangered Species Act. In Elgin County the natural cover is fragmented by other land uses and grassland/meadow patches closer to 5 ha may be more widely utilized by listed grassland birds because there is a lack of larger patches to support breeding pairs. In fact, in the Elgin study area, the top 25th percentile of meadow sizes is 2.4 ha, indicating most (75%) meadows are less than 2.4 ha in size.

Thus, all meadow habitats ≥ 5 ha meet Criterion 9.

Note: It is recognized that the policies of the PPS do not provide protection for upland thickets and meadows as natural heritage features and areas, unless they have been determined to be significant wildlife habitat.

Results

The results for Criterion 9 are shown in Table 20 below. Only 7.9% of the meadow *Vegetation Groups* meet this criterion, but account for over a third (38.5%) of the meadow area. Of the 136 meadow *Vegetation Groups* that meet the criterion, only 3 meet this criterion alone and no other criteria. Thus the vast majority of meadows meet other criteria as well. The map in Appendix H-9 shows the meadows that meet criterion 9.

Table 20. Criterion 9 Results – Meadow *Vegetation Groups* ≥ 5 ha in the Study Area

	# that meet Criterion 9	**% of Total Number** (1,712)	**# that meet only Criterion 9**	**Meadow Area** (ha)	**% of total Meadow Area** (3,544 ha)	**% of Study Area** (197,159 ha)
Meadow *Vegetation Groups* ≥ 5 ha	136	7.9%	3	1,364	38.5%	0.69%

3.4.6 Criterion 10 – Meadow *Vegetation Group* within 100 m of a ≥ 4ha Woodland or ≥ 2 ha Thicket *Vegetation Group*

Rationale

While larger meadows are required for grassland and open country birds, smaller meadows and meadows closely associated with woodlands and thickets are used by other animals. Mammals such as White-tailed Deer, Red Fox, and Coyote are generalists and live in many diverse habitats from forests to grasslands. Meadows provide both food and cover for animals at times when the woodlands do not.

Butterflies, in particular, rely on this habitat mosaic of meadow-thicket-woodland. According to the U.S. Department of Agriculture (USDA) and the Wildlife Habitat Council (2000), land use and development practices have resulted in significant losses of native butterfly habitat. Among the invertebrates, butterflies are an iconic species for recognition and conservation for many reasons; butterflies are important pollinators, are not usually considered pest species, are of interest to the public, have a relatively short lifespan as an adult, are relatively low in biodiversity, and are a food source for other species.

Minimum habitat size is not usually a limiting factor for most generalist species and no reasonable estimate of minimum habitat size exists for butterflies as a group (USDA and the Wildlife Habitat Council 2000). Instead, it is important to consider meadow butterfly habitat in context with the surrounding range of habitats. To be effective, butterfly habitat must support as many of the life stages of the butterfly species as possible. The adults have very different food and cover needs from their larval (caterpillar) stage. Adult butterflies have a strong preference for open, sun-lit habitats with nectar sources (flowers), while the larvae require host trees, shrubs and herbaceous plants found in shaded thicket and woodland habitats (USDA and the Wildlife Habitat Council 2000). Larger woodlands and thickets are more likely to contain a wider variety of species to meet the needs of a range of butterfly species.

Application / Mapping Rules

Given the benefits associated with proximity of meadows to larger woodland and thicket habitats and using 100 m as the cutoff distance (a conservative estimate based on the scientific literature discussed in Section 3.4.3), all meadow *Vegetation Groups* found within 100 m of a ≥4 ha woodland *Vegetation Group* (see Criterion 7) or ≥ 2 ha thicket *Vegetation Group* (see Criterion 8) meet Criterion 10.

Note: It is recognized that the policies of the PPS do not provide protection for upland thickets and meadows as natural heritage features and areas, unless they have been determined to be significant wildlife habitat.

Results

The results for Criterion 10 are shown in Table 21 and in Appendix H-10. Over 80% (81.8%) of all meadow *Vegetation Groups* meet this criterion. Of the 1,401 groups that meet this criteria, a moderate number, 221(12.9%), meet only this criterion and no others. These results suggest the three habitat types (meadow, thicket and woodland) are closely tied and intermixed in the landscape.

Table 21. Criterion 10 results – Meadow *Vegetation Groups* within 100 m of a ≥4 ha woodland or ≥2 ha thicket *Vegetation Group* in the Study Area

	# that meet Criterion 10	**% of all Meadow Groups** (1,712)	**# that meet only Criterion 10**	**Area that meet Criterion 10** (ha)	**% of all Meadow Area** (3,544 ha)	**% of Study Area** (197,159 ha)
Meadow *Vegetation Group* within 100 m of a ≥ 4 ha woodland or ≥2 ha thicket *Vegetation Group*	1,401	81.8%	221	2,994	84.5%	1.80%

3.5 Criteria Applied to All *Vegetation Patches*

3.5.1 Criterion 11 – *Vegetation Patches* containing a *Vegetation Group* that meets a Group Criterion

Note: Criterion 11 is used to identify the natural heritage system since it recognizes that *Vegetation Groups* identified using Criteria 1-10 and 14-17 do not exist in isolation. Criterion 11 is a mapping rule that translates *Vegetation Group* criteria 1-10 into a single *Vegetation Patch* criterion.

Rationale

Vegetation Patches are comprised of one- to- many *Vegetation Groups*. The spatial arrangement between the *Vegetation Communities* within the *Vegetation Patch* determines the resistance to flow or movement of species, energy, materials, and water (Forman 1995b). Recognizing this interdependency between landscape structure and function, it is important to consider the entire *Vegetation Patch* as a single entity when determining importance. To maintain biological diversity, natural functions, and viable populations of native species and ecosystems, significant natural features and functions cannot exist in isolation.

Application

Mapping rules of adjacency and proximity were used to define a *Vegetation Patch*. If a *Vegetation Patch* contained a *Vegetation Group* that met a group criterion (i.e., Criterion 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10), the entire *Vegetation Patch* meets this criterion.

Results

The results for Criterion 11 are shown in Table 22 and in Appendix H-11. Some 76.5% of the patches met this criterion, accounting for 98.5% of the patch area. Since Criterion 11 is really a summary of Criteria 1 through 10, it should account for a great number of patches on the landscape.

Table 22. Criterion 11 Results – *Vegetation Patches* that contain a *Vegetation Group* that meets a group criteria in the Study Area

	# that meet Criterion 11	**% of all *Vegetation Patches*** (1,909)	**# that met only Criterion 11**	**Patch Area** (ha)	**% Area of all *Vegetation Patches*** (48,116 ha)	**% of Study Area** (197,159 ha)
***Vegetation Patches* that contain a *Vegetation Group* that meets a Group Criterion**	1,460	76.5%	1,141 (9,025 ha)	47,397	98.5%	24.04%

3.5.2 Criterion 12 – *Vegetation Patch* Containing a Diversity of *Vegetation Ecosystems, Groups* or *Communities*

Rationale

Representation approaches have become key concepts in developing methods to select the most significant remaining natural areas (Canadian Council on Ecological Areas 1991, Peterson and Peterson 1991, Horn and Koford 2004). The Natural Heritage Reference Manual (MNR 2010) recognizes that a fundamental step in natural heritage system planning is to consider the protection of the full range of natural features that occur in an area (representation), including both rare and common features, in order to preserve biodiversity at the species and community levels.

Natural areas or clusters of natural areas that span a range of topographic, soil and moisture conditions tend to contain a wider variety of plant and animal species, and may support a greater diversity of ecological processes. The diversity of species is dependent upon the diversity of habitats on the landscape since dissimilar habitats provide food, shelter, and reproductive requirements for different species. Since many species use more than one habitat type to meet their life cycle requirements, it is valuable for *Vegetation Patches* to be comprised of different habitat/vegetation types or communities. This criterion encompasses structural diversity (i.e., the full range of canopy heights and types), as well as diversity in the context of slope, aspect, wetness, physiography, etc.

Definition

The number of different *Vegetation Ecosystems*, *Vegetation Groups* and *Vegetation Communities* in a *Vegetation Patch* can be used as proxy measures of diversity.

The three types of *Vegetation Ecosystems*, terrestrial, wetland and aquatic (see Table 3 in Section 2.2), are linked by a multitude of processes. For example, aquatic *Vegetation Ecosystems* in forests are coupled to adjacent terrestrial *Vegetation Ecosystems* by transitional riparian zones and wetland areas. Processes within wetlands and riparian zones can regulate the retention and release of nutrients and carbon into the aquatic *Vegetation Ecosystem* (Tufford *et al*. 1998, Junk *et al*. 1989). At a broader scale, the inflow of water, nutrients, and sediments from surrounding watersheds are heavily influenced by conditions within the floodplain. Conversely, floodplain plant and animal habitat value and sediment supply and fertility are often determined by river hydrology. The surrounding landscape can also influence the capacity of wetlands to perform functions such as sequestering pollutants, modifying nutrient loads, and providing habitat (Wetzel 2001). The interdependencies between the three natural *Vegetation Ecosystems* provide strong support for criteria based on linkages and spatial patterns.

Application

Three different measures (combinations of vegetation ecosystems, groups and communities) were used to determine if a *Vegetation Patch* was diverse. If any one of the following three measures was met, the *Vegetation Patch* met this criterion (see Figure 11):

i) *Vegetation Patch* contains > 1 *Vegetation Ecosystem* or,
ii) *Vegetation Patch* contains > 2 *Vegetation Groups* or,
ii) *Vegetation Patch* contains > 3 *Vegetation Communities*.

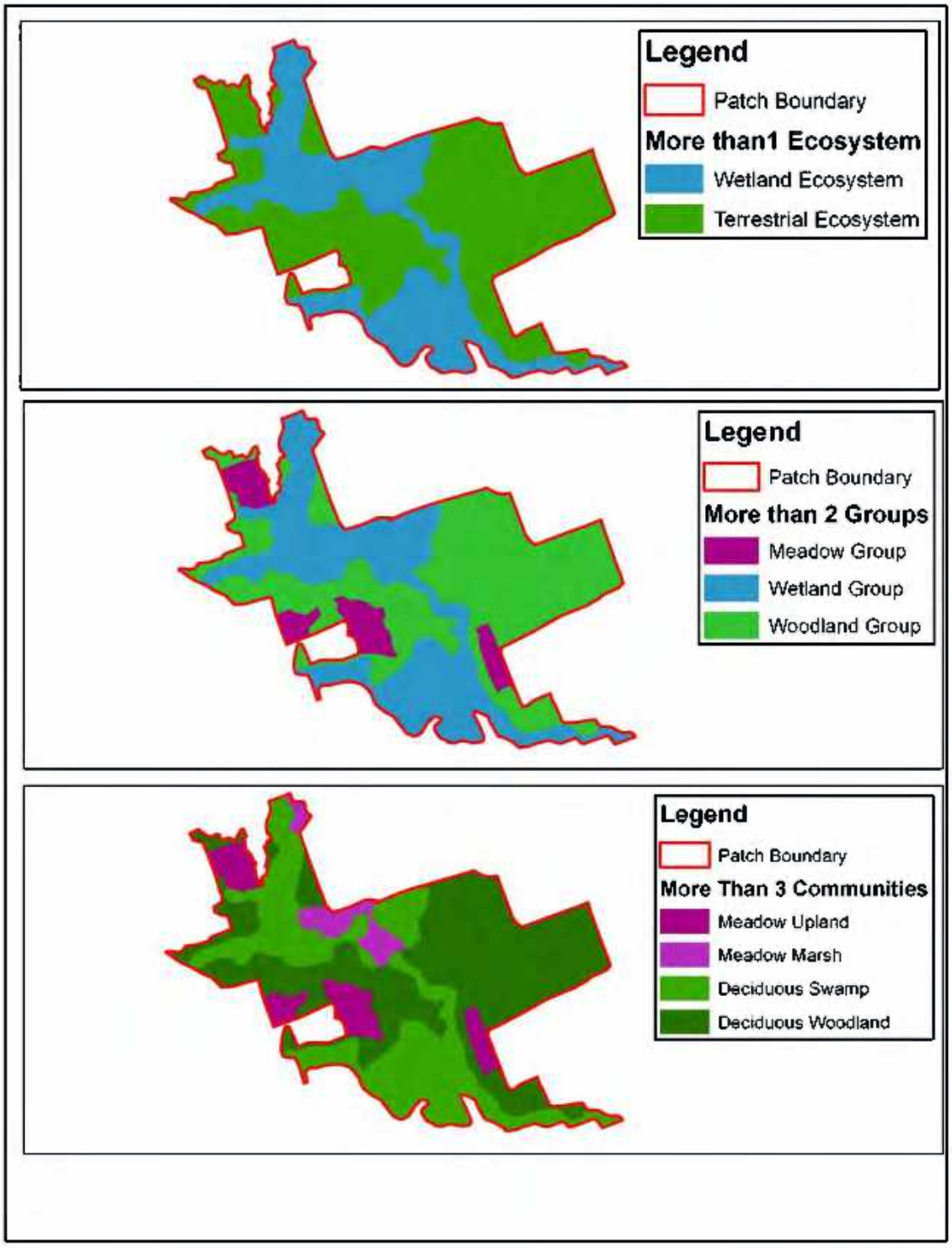
Results

Table 23 shows the results for Criterion 12 and the results map is included in Appendix H-12. Only 19% of all patches met this criterion, but the area totals 81.2% of patch area, indicating it is picking up mostly large patches. It is not surprising, since large patches are more likely to contain more habitat types than small patches. Only a small number of patches (12) met only this criterion and no others.

Table 23. Criterion 12 Results –*Vegetation Patches* that contain a diversity of *Vegetation Ecosystems, Groups* and/or *Communities* in the Study Area

	# that meet Criterion 12	**% of *Vegetation Patches*** (1,909)	**# that meet only Criterion 12**	**Area** (ha)	**% Total Patch Area** (48,116 ha)	**% of Study Area** (197,159 ha)
***Vegetation Patches* that contain:** **> 1 Vegetation Ecosystem or** **> 2 Vegetation Groups or** **> 3 Vegetation Communities**	362	19.0%	12 (36 ha)	39,077	81.2%	19.82%

Figure 11. Criterion 12, illustration of patches containing many different *Vegetation Ecosystems, Groups* and *Communities*



3.5.3 Criterion 13 − *Vegetation Patches* that don't meet any criteria but are within 100 m of a *Vegetation Patch* that meets other Patch Criteria

Rationale

The presence of large natural habitat patches in a landscape is not sufficient to counteract the effects of fragmentation, especially if there are relatively few such patches, they are widely dispersed, or there are few natural corridors linking them (Riley and Mohr 1994, Prugh *et al*. 2008). Natural areas close to protected areas are increasingly seen as important to the ecological integrity of the protected sites. Research shows local landscapes that include large natural areas, linked to the regional landscape mosaic by a network of smaller interacting natural areas and corridors, offer the highest probability of maintaining overall ecological integrity (Larson *et al*. 1999, Villard *et al*. 1999).

Smaller *Vegetation Patches* of natural cover that are closely spaced can serve as stepping stones for species movement. Baguette and Van Dyck (2007) showed that the ability and willingness of wildlife species to move between and successfully settle in different *Vegetation Patches* was affected by the distance between the *Vegetation Patches*. Environment Canada (2013) found that two or more *Vegetation Patches* are more likely to support more species collectively than they would if they were isolated from each other. In areas where large core areas do not exist, clusters of smaller natural areas that span a range of habitats and are arranged close together support a greater diversity of ecological processes and are able to reduce the effects of fragmentation.

Application / Mapping Rules

Recognizing that plants have limited mobility compared to animals, the average wind dispersal distance of 100 m (for seeds and pollen) was used as the distance that would functionally connect two *Vegetation Patches* (Cain *et al*. 2000, Harper 1977, Howe and Smallwood 1982, Nathan *et al*. 2002, Willson 1993, Cain *et al*. 1998).

In Elgin County, all *Vegetation Patches* that do not meet a criterion but are within 100 m of a *Vegetation Patch* that does meet a criterion, meet Criterion 13. Figure 12 illustrates this criterion.

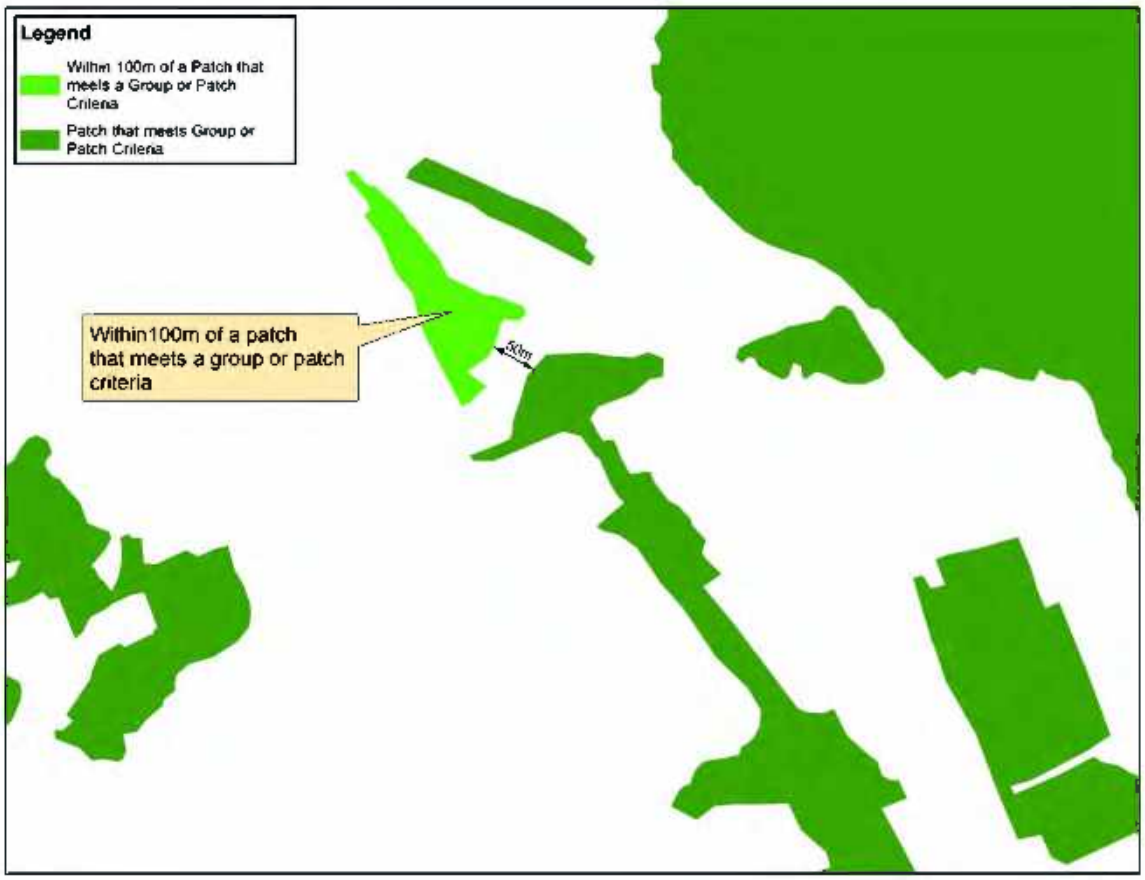
Results

Table 24 below shows the mapping results for Criterion 13. The map showing the results is included in Appendix H-13 (note, the patches are very tiny and difficult to see). This criterion is met by only 77 patches and accounts for only 113 ha (0.2% of patch area). Because this is the last criterion and it is targeted at those patches that have not met any other criterion, it stands to reason that all 77 of these patches only meet this one criterion. Thus, this criterion picks up a small number of small patches that would not have been picked up with any other criteria.

Table 24. Criterion 13 Results −*Vegetation Patches* that do not meet any criteria but are within 100 m of a *Vegetation Patch* that meets other patch criteria in the Study Area

	# that meet Criterion 13	**% of all *Vegetation Patches*** (1,909)	**# that only meet criterion 13**	**Patch Area** (ha)	**% Total Patch Area** (48,116 ha)	**% of Study Area** (197,159 ha)
***Vegetation Patches* that do not meet any criteria, but are within 100 m of a *Vegetation Patch* that meets other patch criteria**	77	4.0%	77	113	0.2%	0.06%

Figure 12. Criterion 13, illustration of a small patch that does not meet any criteria but is within 100 m of a patch that does meet criteria



3.6 Additional Information – Criteria that did not pick up any patches not already picked up by other criteria

Two criteria, *Vegetation Patches* ≥ 100 ha and Woodland Interior, were part of the 2006 Oxford Natural Heritage Study and other early natural heritage studies. However, the current study has more and slightly different criteria. For example, the woodland size cutoff is 4 ha versus 10 ha in the earlier study (see section 3.4.3). When the model was run for the current study, these two criteria did not pick up any patches that were not already picked up by other criteria. These two criteria and their results are provided here as added information items.

3.6.1 *Vegetation Patches* ≥ 100 ha

Rationale

Size is a key landscape-level factor affecting the presence, abundance, and diversity of species (Environment Canada 2013, Mazerolle and Villard 1999, Lovett-Doust and Kuntz 2001, Lovett-Doust *et al*. 2003, Bender *et al*. 1998). The Natural Heritage Reference Manual (MNR 2010) recognizes that large patches of natural area are more valuable than smaller patches, provided that size is not the only consideration.

The size of a *Vegetation Patch* considered to be large depends on the landscape of the planning area. In a planning area with a low percentage of natural feature cover that is highly fragmented, the size of areas considered to be large would be smaller than in a region where natural feature cover is extensive. As well, natural areas should be large enough to be resilient to typical natural disturbances. Current science suggests that 100 ha woodland *Vegetation Groups* will support approximately 60% of area sensitive species while 200 ha woodland *Vegetation Groups* will support approximately 80% (Environment Canada 2013). Burke and Nol (2000) determined that reproductive success of forest birds in southern Ontario was consistently higher for woodland *Vegetation Groups* greater than 94 ha.

However, the size of a patch does not take into account its shape; long linear patches would not function the same as square shaped patches of the same size.

Application / Mapping Rules

All *Vegetation Patches* ≥ 100 ha in size or greater meet this parameter.

Results

Table 25 shows there are only 62 patches (3.2% of all patches) that are ≥ 100 ha. However, these patches account for almost two-thirds (63.6%) of all the vegetation patch area. Appendix I-1 shows the results in map form. Many of the large patches include the long, continuous vegetated ravine corridors.

Table 25. *Vegetation Patches* ≥ 100 ha

	# meeting this criterion	**% of all *Vegetation Patches*** (1,909)	**# meeting this criterion and no other**	**Patch Area** (ha)	**% Total Patch Area** (48,116 ha)	**% of Study Area** (197,159 ha)
***Vegetation Patches* ≥ 100 ha**	62	3.2%	0	30,611	63.6%	15.53%

3.6.2 Woodland Interior Habitat

Interior habitat is useful as a measure of ecosystem health (Weathers *et al.* 2001, LRC and MNR 2000, Sandilands and Hounsell 1994, Sisk *et al*. 1997), but not as useful in selecting significant woodlands. Environment Canada (2013) recommends that a minimum of 10% of watersheds should be in woodland interior habitat. Many area-sensitive forest birds require the protective core of a woodland to nest successfully, away from the edge habitat that is more prone to high predation, wind damage and alien species invasion. The Natural Heritage Reference Manual (MNR 2010) defines edge habitat as habitat that exists within 100 m from the outermost trees. Meffe and Carroll (1997), Matlack (1993), Chen *et al*. (1995), and Hamill (2001) consider edge habitat as a zone of influence that varies depending on where and what is being measured.

Application / Mapping Rules

To define interior habitat, a swath of 100 m around the inside perimeter of the woodland *Vegetation Group*, before clustering around roads, was delineated as "edge" habitat. Any habitat within the woodland *Vegetation Community*, but not within the 100 m wide edge, was identified as woodland interior. Figure 13 provides an illustration of the mapping of interior.

The 2006 Oxford Natural Heritage System study used an interior habitat criterion because the woodland size cutoff was 10 ha and the study wanted to capture those woodlands 4 to10 ha with interior. Woodlands 4 to 10 ha in size may contain interior habitat depending on their shape, but woodlands < 4 ha do not (i.e., a perfectly square 4 ha woodlot is 200 m x 200 m, leaving no room for interior). Since the current study uses a 4 ha woodland size minimum, there should be no woodlands smaller than 4 ha that contain interior.

Results

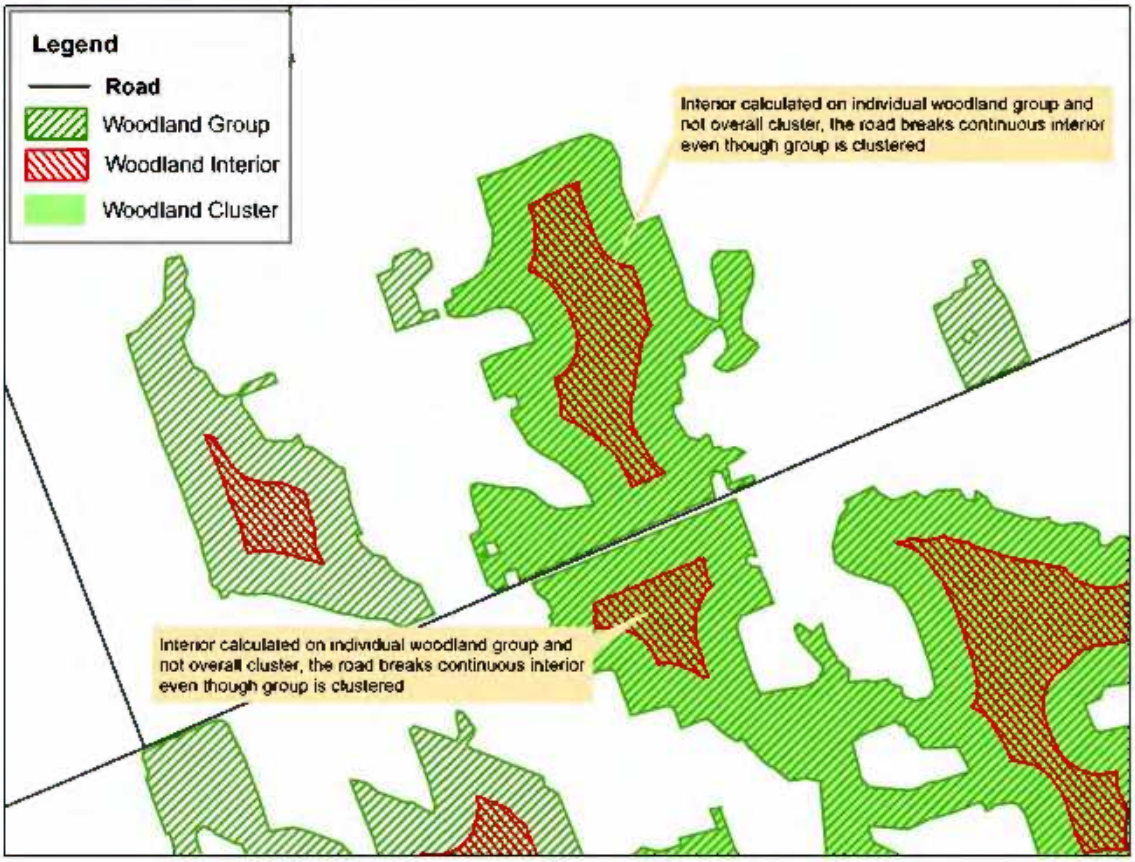
Table 26 and Appendix I-2 provide a summary of interior woodland habitat in the Elgin Study Area. Only 21% of all woodland groups contain interior habitat, which means 79% of woodlands are too small and/or narrow to contain interior. There are 6,045 ha of interior forest in the study area, representing almost 15% of the woodland area and 3% of the study area. Environment Canada (2013) recommends at least 10% woodland interior cover by watershed.

Table 26. Woodland Groups with Woodland Interior Habitat

	# Woodland Groups that have interior	**% of all Woodland Groups** (2,146)	**# that only meet this criterion**	**Area of woodland groups that contain interior** (ha)	**Total Area of woodland interior ≥0.5 ha** (ha)
Woodland *Vegetation Groups* that contain ≥0.5 ha of interior woodland habitat	455 (755 polygons)	21%	0	32,982	6,045 (14.8% of Woodland area; (3.07% of Study Area)

Study Area = 197,159 ha; Total Woodland Area = 40,949 ha

Figure 13. Illustration showing how interior woodland area is calculated



3.7 Criteria Reviewed but Not Included

Several additional potential criteria were suggested and reviewed as part of the 2014 Middlesex Natural Heritage Systems Study and 2016 Oxford NHSS and were not used for a variety of reasons. Many did not add value (e.g., were redundant), did not fit the study or had other limitations. A full description of these criteria and the rationale for not including them is shown in Appendix E. Below is a list of the 19 criteria that were not used:

- Best representative *Vegetation Patch* on landform physiography and soil type
- Located on a distinctive, unusual or high quality landform. All areas (both vegetated and non-vegetated) on: gullies, valley lands, within 30 m of limestone outcroppings
- *Vegetation Patch* on an Earth Science ANSI that contributes to the presence of an uncommon *Vegetation Community*
- All *Vegetation Patches* found alongside a coldwater watercourse or watercourse containing Brook Trout
- Shape of *Vegetation Patch* (i.e., closest to a round shape)
- Adjacent to an MNR evaluated wetland or life science ANSI
- Contains an area identified in the local official plans such as the Locally Significant Natural Areas identified by Hilts and Cook 1982
- Unique intrinsic characteristics (i.e., site level characteristics)
- Distance from development (e.g., permanent infrastructure and buildings) or matrix
- Persistence or threatened
- Porous or erodible soils
- *Vegetation Patch* contains a large sized wetland defined as:
    - wooded wetlands > 4 ha based on Environment Canada (2013),
    - wetland meadows and marshes >10 ha based on Environment Canada (2013),
    - small wetland meadows and marshes adjacent to other *Vegetation Communities* may be vital to butterflies,
    - wetland thicket size determined by top 75th percentile distribution cutoff of all county wetland thicket sizes.
- *Vegetation Patch* contains a wetland that is within 1000 m of another wetland
- *Vegetation Patch* contains a recently observed (post 1980) regionally rare plant
- *Vegetation Patch* contains thicket with interior
- Carolinian Canada Big Picture Corridors
- Interior woodland habitat that is ≥0.5 ha in size of continuous habitat
- Presence of Species at Risk

The 2014 MNHSS and 2016 ONHSS included three "unmapped criteria" (see list below). However, upon review for the ENHSS, it was decided that since these features can only be identified at the site-level, they should not be included as landscape-level criteria in this modelling study. Instead, they are specifically named in the list of features to be identified at the EIS stage (See Chapter 5).

- *Vegetation group* contains a Significant Wildlife Habitat
- *Vegetation group* contains a Groundwater Dependent Ecosystems or Wetlands
- *Vegetation group* contains a Watercourse Bluff or Depositional Area

4.0 Results of Running the Ecologically Important Criteria

Each criterion in this study measures a unique aspect of the ecological services that a natural feature provides. Thus, any patch that meets at least one criterion is considered "ecologically important" in Elgin County. This one-criterion approach has been utilized in many other studies including the 2018 Perth Natural Heritage Systems Study (draft), 2016 Oxford Natural Heritage Systems Study, 2014 Middlesex Natural Heritage Systems Study and the 2014 Huron Natural Heritage Study (draft). In the Middlesex and Huron studies, the criteria were called "significance criteria", but in this study the word "significant" has been replaced with "ecologically important". This change was made to distinguish it from the use of the word significant in the Provincial Policy Statement for certain Natural Heritage Features and Areas such as Provincially Significant Wetlands and Provincially Significant ANSIs (see section 1.1).

As explained in the previous chapter, the running of the criteria was done on the Elgin Study Area that includes a 500 m buffer around the perimeter of Elgin County (excluding the lake side). This was done so that *Vegetation Communities* and *Patches* that spanned the border would be modelled in their entirety and not artificially cut off by the political boundary.

Section 4.1 summarizes the results of running the *Vegetation Group* level criteria (Criteria 1 to 10). Section 4.2 summarizes the results of running the *Vegetation Patch* level criteria (Criteria 11 to 13). Section 4.3 describes the three categories of woodlands that inform Official Plan policies.

Central Elgin landscape with Hawk Cliff in the foreground. Drone photo by Joseph McNeil.

4.1 *Vegetation Groups* that meet Criteria

Table 27 summarizes the results of running the model for *Vegetation Groups* for the Elgin Study Area.

As expected, the woodland group, which is the largest group at 40,949 ha, has the largest percentage that is ecologically important (98.4% or 40,276 ha).

The meadow group has the second largest area (3,544 ha) and 95.4% of the area is ecologically important. The thicket group and water feature groups have similar areas (952 ha and 949 ha respectively), and 91.3% and 80.3% of those groups respectively are ecologically important.

The wetland group, made up of woodland, thicket, and meadow vegetation communities, is also quite large at 5,210 ha or 2.64% of the Elgin Study Area. All wetland groups are ecologically important. As noted earlier, only the evaluated wetlands are included at this time, and unevaluated wetlands are currently unmapped.

The map in Appendix K-1 shows the woodland groups that meet a criterion (and are ecologically important) and those that do not. Since the woodland group criteria (Criteria 1, 2, 3, 4, 6 and 7) establish significance for woodlands consistent with the PPS (see Table 11), the ecologically important woodland groups also represent Significant Woodlands as per the PPS.

The map in Appendix K-2 shows the meadow groups that meet a criterion (and are ecologically important) and those that do not. The map in Appendix K-3 shows the thicket groups that meet a criterion (and are ecologically important) and those that do not (note: the features are quite small).

> *Note:* It is recognized that the policies of the PPS do not provide protection for upland thickets and meadows as natural heritage features and areas, unless they have been determined to be significant wildlife habitat.

Table 27. *Vegetation Group* Results for the Elgin Study Area

Vegetation Group ↓	**Total Group Area** (ha)	**% Total Group Area of Study Area** (197,159 ha)	**Ecologically Important Area** (ha)	**% Ecologically Important Group Area of Study Area** (197,159 ha)	**% Group Area that is Ecologically Important**
Woodland	40,949	20.77%	40,276	20.43%	98.4%
Thicket	1,527	0.77%	1,390	0.71%	91.3%
Meadow	3,544	1.80%	3,379	1.71%	95.4%
Water Feature	949	0.48%	762	0.39%	80.3%
Connected Veg. Feature	138	0.07%	115	0.06%	83.7%
Total	**47,107**	**23.90%**	**45,922**	**23.29%**	**98.7%**
Wetland	5,210	2.64%	5,210	2.64%	100.0%

- Wetlands include woodland, thicket and meadow groups and are already part of the total. Wetland area includes evaluated and some unevaluated wetlands (see Section 3.4.1)
- Ecologically Important *Woodland Groups* also meet criteria for Significant Woodlands as per the PPS

4.2 *Vegetation Patches* that meet Criteria

Table 28 summarizes the number of vegetation patches that met a certain number of criteria in the Study Area. The number of criteria met refers to the total number of criteria, not any specific criterion. The maximum number of criteria any patch can meet is 11 out of the 13, since Criterion 11 is simply a mapping rule to bring Criteria 1-10 from a *Vegetation Group* to a *Vegetation Patch*, and Criterion 13 can only apply to patches that have not yet met any criteria.

Over 80% of patches (1,549 of 1,909) meet at least one criterion, and are thus ecologically important. Some 360 patches (18.9%), do not meet any criterion, however, the total area of these patches is very small. The figures in Table 29 show that 98.8% of *Vegetation Patch* area meets one or more criteria, representing 24.12% of the Elgin Study Area.

Tables 30 and 31 summarize the modeling results by municipality. These results were calculated for the municipalities without the 500 m buffer, so the figures are smaller than shown in Table 29 for the entire Study Area. The corresponding maps showing the patches that do and do not meet a criterion for each municipality are included in Appendix L-1 to L-10.

Table 28. The number of *Vegetation Patches* versus the number of criteria met in the Elgin Study Area

# of Criteria Met	# *Vegetation Patches*	% of Patches (1,909)
0	360	18.9%
1	617	32.3%
2	350	18.3%
3	206	10.8%
4	130	6.8%
5	80	4.2%
6	68	3.6%
7	35	1.8%
8	35	1.8%
9	17	0.9%
10	8	0.4%
11	3	0.2%
TOTAL	**1,909**	**100.0%**

Note: The number of criteria met refers to the total number of criteria, not any specific criterion.

Table 29. The Area of *Vegetation Patches* that meet criteria in the Elgin Study Area

Total Area of *Vegetation Patches*	Area of *Vegetation Patches* that met at least one criterion	% of Vegetation Patch Area that meet criteria	% Ecologically Important Vegetation Patches in Elgin Study Area (197,159 ha)
48,116	47,546	98.8%	24.12%

Table 30. Number of Vegetation Patches that are Ecologically Important by Municipality

Municipality	# Patches	# Patches that are ecologically important	% of Patches that are ecologically important
West Elgin	331	275	83.1%
Dutton/Dunwich	283	236	83.4%
Southwold	309	252	81.6%
Central Elgin	309	255	82.5%
Malahide	350	279	79.7%
Bayham	222	167	75.2%
Aylmer	17	13	76.5%
St. Thomas	47	41	87.2%
Elgin County (no buffer)	**1,868**	**1,549**	**81.3%**

- The number of patches is slightly lower than in the Study Area results shown in Table 28 because the buffer zone around the municipalities has been removed.

Table 31. Area of Vegetation Patches that are Ecologically Important by Municipality

Municipality	Municipal Area (ha)	Area of all patches (ha)	% of municipality in patch cover*	Area of patches that are ecologically important (ha)	% of patch area that is ecologically important	% of municipality that is ecologically important*
West Elgin	32,324	7,442	23.02%	7,344	98.7	22.72%
Dutton/ Dunwich	29,526	6,504	22.03%	6,421	98.7	21.75%
Southwold	30,182	5,568	18.45%	5,479	98.4	18.15%
Central Elgin	28,142	6,388	22.70%	6,308	98.8	22.42%
Malahide	39,552	6,704	16.95%	6,598	98.4	16.68%
Bayham	24,558	8,049	32.77%	7,973	99.1	32.47%
Aylmer	611	69	11.30%	66	94.9	10.72%
St. Thomas	3,588	794	22.14%	784	98.7	21.85%
Elgin County (no buffer)	**188,482**	**41,517**	**22.03%**	**40,973**	**98.7**	**21.74%**

- Area of each municipality was calculated based on municipal boundaries obtained from Land Information Ontario, 2017 (based in 2015 photography). The vegetation patches were clipped at the municipal boundaries, and no buffer was added.

The key findings are listed below.

Results for the Elgin Study Area (includes 500 m buffer around all sides except lake side):

- 24.40% is in natural vegetation/patch cover (48,116 ha of 197,159 ha)
- 20.77% is in woodland/forest cover and an additional 3.12% is in other vegetation cover (meadow, thicket, water feature and connected vegetation feature cover)
- 24.12% is in ecologically important patch cover (47,546 ha)
- 20.43% is in ecologically important woodland cover
- 81% of vegetation patches meet at least one criteria for ecological importance, representing 98.8% of the patch area.

Municipal and Elgin County Results (no buffer)

- 98.7% of the natural vegetation/patch cover by area (40,974 of 41,519 ha) in Elgin County meets one or more criterion and is ecologically important and only 1.3% of the vegetation patch cover (545 ha) meet no criteria
- 21.74% of Elgin County is in ecologically important vegetation cover and at the municipal level, the results range from 10.72% in Aylmer to 32.47% in Bayham
- 2.64% of Elgin County is in wetland cover, including both evaluated and unevaluated wetlands, totaling 5,210 ha

4.3 Woodlands: Significant, Ecologically Important, and Other

To inform Official Plan policies, woodlands have been sorted into three categories:

1) Significant Ecologically Important Woodlands
   - *Definition*: woodland groups that meet group level criteria within the ENHSS
   - As explained in section 3.2.2, ENHSS criteria 1, 2, 3, 4, 6 and 7 establish significance for woodlands consistent with the PPS (see Table 7-2 of the NHRM).
   - These woodlands are considered to be both significant as per the PPS and ecologically important as per the ENHSS.

2) Non-Significant Ecologically Important Woodlands
   - *Definition:* woodland communities or groups within a patch that meet patch level criteria but not group level criteria within the ENHSS
   - Some woodlands that do not meet *Vegetation Group* level criteria, may be part of a larger *Vegetation Patch* made up of other vegetation groups such as thicket, meadow, or water feature, that does meet a patch level criteria (i.e., Criteria 11, 12 or 13).
   - Thus, the woodland is ecologically important and part of the Elgin Natural Heritage System, though not Significant as per the PPS.

3) Other Woodlands / Non-ecologically Important Woodlands
   - *Definition:* woodland groups and patches containing woodlands that do not meet any group or patch level criteria within the ENHSS
   - Although non-ecologically important based on mapped ENHSS criteria, these woodlands could still be considered "candidate sites" until an EIS determines that no unmapped criteria are present (see Chapter 5 recommendations).

Appendix M provides a map that shows these three categories of woodlands in Elgin County. Other PPS features (e.g., Significant Wetlands) are not shown on this map as they are part of the provincial data layer available from MNRF. The Significant Valleylands are shown separately in Appendix H-1-1. Table 32 shows that 98.4% of the woodland group area falls under the significant ecologically important category and occupies 20.43% of the Elgin County study area.

The GIS data for the ENHSS allows the planning agencies to determine which criteria any individual vegetation group or patch met, as well as other details.

Table 32. Woodland Category Results for the Elgin Study Area

Woodland Category	# of Woodland Groups	% of total number of Woodland Groups	Area (ha)	% of total Woodland Group Area	% of Elgin Study Area (197,159 ha)
Significant Ecologically Important	1,730	81%	40,276	98.4%	20.43%
Non-significant Ecologically Important	134	6%	205	0.5%	0.10%
Other (Non-ecologically Important)	282	13%	469	1.1%	0.24%
Total	**2,146**	**100%**	**40,949**	**100.0%**	**20.77%**

5.0 Recommendations

The Elgin Natural Heritage Systems Study (ENHSS) is a science based study that identifies natural heritage system components following a landscape ecology methodology. The information it provides can be implemented through both regulatory and non-regulatory approaches. However, regulation must play a role in implementation due to the need for local planning policies and decisions to be consistent with the PPS natural heritage policies. This section provides various recommendations for implementation of the study.

It is important to note that the ENHSS focused primarily on the natural heritage system of the Elgin landscape and that implementation will also require consideration of cultural, economic, public health and safety factors. The broader considerations are inherent in implementation processes under Planning and Environmental Legislation. These processes involve considerable review and consultation to assist in providing a positive impact on the quality of life in Elgin County and its environs.

The ENHSS project did not include a process to engage stakeholders on implementation options. However, extensive consultations on implementation options were undertaken as part of the 2006 ONHS. The majority of the implementation options developed as part of that study could be applied to the Elgin County area and so are included in Appendix K for reference. The ENHSS focused primarily on identifying and characterizing natural heritage features and areas and the broader natural heritage system, so that this information could inform the various implementation options. It is recognized that further stakeholder consultation will be undertaken as part of the various processes required to implement the study recommendations (e.g., updates to Official Plan policies and Woodland Conservation By-Law).

John E. Pearce Provincial Park preserves an older growth deciduous forest. Photo by Cathy Quinlan

5.1 Land Use Planning

The results of this study should be incorporated into the Official Plan policies, as necessary to ensure consistency with the natural heritage policies of the Provincial Policy Statement (PPS). The PPS notes that the policies represent minimum standards while planning authorities and decision-makers may go beyond these standards to address matters of local importance (see text box below).

> ***Excerpt from 2014 PPS (page 3)***
>
> **Policies Represent Minimum Standards**
>
> The policies of the Provincial Policy Statement represent minimum standards.
>
> Within the framework of the provincial policy-led planning system, planning authorities and decision-makers may go beyond these minimum standards to address matters of importance to a specific community, unless doing so would conflict with any policy of the Provincial Policy Statement.

The most appropriate means to implement the results of this study will be determined at the time that Planning Act applications are considered and will be guided by the PPS, Official Plan policies and input obtained through the process. To ensure an appropriate review framework is put in place to evaluate such applications, this study provides a number of specific land use planning recommendations for consideration by the County and City of St. Thomas, as follows:

1) To be consistent with the Provincial Policy Statement (2014), it is recommended that the County of Elgin and City of St. Thomas utilize the ENHSS (2019) as the scientific basis for identifying natural heritage features and areas and the broader natural heritage systems within the Official Plans.

   The Official Plan should include policies governing the protection of natural heritage features and areas and the protection of natural heritage systems as a result of land use change that could impact such features and areas. Such policies should require assessment that is appropriate to the scale of the proposed land use change. For example, small scale applications should consider the potential impact on the natural heritage system through the preparation of an Environmental Impact Study (EIS) or edge management planning process (i.e., verifying natural feature boundaries on a site specific basis for scoped level assessments). Larger scale developments and urban expansions should be assessed at a subwatershed scale of study and include the integration of natural heritage, natural hazard and servicing planning.

   The natural heritage features and areas can be identified on a map schedule in an appendix to the Official Plan which would not require such features and areas to be designated as a land use. Rather, such mapping would raise the public's awareness that these natural heritage features are important to the County and its local municipalities and that they should be protected for future generations.

   Note: Provincially Significant Wetlands and Provincially Significant ANSIs are designated in the OP.

2) An updated Environmental Impact Study (EIS) guideline document should be developed to provide more specific guidance on the implementation of the ENHSS through the land use planning and development process, including initial consultation, EIS submission requirements, review process and scoping and/or waiver criteria. Currently, Appendix B of the Elgin OP outlines the contents of an EIS. The City of St. Thomas OP contains policies and associated guidelines in Section 8.3.4.

   a) A patch validation guideline should be developed to support the EIS guideline document. The patch validation guideline can assist with confirming patch attributes (e.g., which criteria were met, confirm unevaluated wetlands are wetlands, etc.) and patch boundaries. An example would be re-measuring distance to woodlands, valleylands and the shoreline.

   b) Patches that do not meet any criteria can be viewed as non-ecologically important or candidate ecologically important. If development is proposed, preparation of an EIS should be requested to confirm that the patch does not:

      - meet any of the 13 mapped landscape criteria,
      - contain an unevaluated or unmapped wetland,
      - contain any natural heritage features and areas that need to be identified at the site level including: Significant Wildlife Habitat, Groundwater Dependent Wetlands/Ecosystems, Bluffs and Depositional Areas (see Appendix N), and rare vegetation communities,
      - contain fish habitat or habitat of endangered or threatened species in accordance with provincial and federal requirements (MMAH, 2014).

        Note: It should be recognized that development and site alteration may not be permitted in fish habitat and habitat of endangered species and threatened species except in accordance with provincial and federal requirements (MMAH, 2014). These features need to be confirmed to be consistent with the PPS.

   c) The guideline document should also identify instances where the completion of an EIS can be scoped and/or waived (i.e., maintenance activities associated with stormwater management ponds and sewage lagoons, minor additions to buildings, etc.).

3) If agricultural or other similar lands are proposed to be developed for settlement or other non-agricultural land uses, the system linkages that would have been provided in the working agricultural or other pre-development landscape may be disrupted or eliminated by the post development landscape. In such cases, it is necessary that natural heritage system linkages be studied at an appropriate level of detail and that appropriate system linkages be identified (e.g., through an EIS) and provided as part of the development review process.

4) Significant valleylands have been identified in this study. The vegetation groups within or abutting these valleylands meet the criteria for significance consistent with the PPS, as well as this study. However, farmland and other lands that do not correspond with an ecologically important vegetation group that fall within significant valleylands are not specifically identified as part of the Elgin Natural Heritage System. Thus, proposed developments adjacent to these lands (e.g., farmland) do not require the completion of an EIS to assess negative impacts. Development within valleylands is typically already limited by the Natural Hazard features with which the valleyland is associated. However, in the limited instances where development may be proposed within a significant valleyland, natural heritage system linkages should be studied at an appropriate level of detail and appropriate system linkages identified (e.g., through an EIS) and provided as part of the development review process.

5) Policies should be included in the Official Plan to maintain, restore and improve the existing natural heritage systems.

   Note: The ENHSS does not determine if there are enough natural heritage features, whether they are in the right places or of the right type. Also, this study does not determine whether the existing natural heritage system is sustainable over the long term. The 2005 Elgin Landscape Strategy (Elgin Stewardship Council) does present restoration potential.

5.2 Other Implementation Measures

1) Elgin County's Protection and Enhancement of Tree Canopy and Natural Vegetation Policy includes several initiatives that, cumulatively, protect and enhance the tree canopy and natural vegetation within the County including: the Elgin Natural Heritage Systems Study, the Elgin County Official Plan, Decisions under the Planning Act, and the Woodlands Conservation By-law.

2) The County should develop a mechanism to implement the *No Net Loss Policy* under the Woodland Conservation By-law to ensure trees that are planted by order as part of a *No Net Loss Policy* (i.e., when trees are cleared for development), are maintained and allowed to mature into woodland over time.

3) The ENHSS should be considered in the development and ongoing implementation of stewardship and incentive programs (i.e., Clean Water Program and ALUS), education programs and the management of publicly owned forests and natural areas in the county.

4) The county/municipalities should produce a factsheet on ways to minimize negative impacts on wildlife during routine maintenance of man-made pond structures such as sewage lagoons, stormwater management ponds, irrigation ponds and ponds in licenced aggregate pits. These man-made ponds can be included in the Water Feature *Vegetation Group* if they are connected to meadows, woodlands or other *Vegetation Groups*. Some of these *Vegetation Groups* may be ecologically important by meeting one or more criteria. The results of this study do not presume to change the intended purpose of these man-made structures. These structures can continue to function as designed. However, since they attract plants and wildlife by their very design (i.e., holding water, using biological processes to break down pollutants, etc.), undertaking cleanouts and other maintenance activities should be done prior to wildlife hibernation or after fledging.

   Such a factsheet could assist the managers of these pond structures. Regular maintenance activities would not require the submission of an EIS, however, the updated EIS guidelines recommended above should address this. The county/municipalities should work with the Certificate of Approval process for sewage lagoons and stomwater management ponds to see if there is flexibility in the timing of maintenance works.

5) The county/municipalities should continue to support the Southwestern Ontario Ortho-Imagery Project (SWOOP), or other similar partnerships, to obtain updated digital aerial photography on a regular basis. The County should update the vegetation layers (including unevaluated wetlands) as new ortho-imagery becomes available, approximately every 5 years. The natural heritage systems model of the ENHSS should be re-run with the updated vegetation layers to assess vegetation cover changes every five years.

   The ENHSS modeling criteria (Criteria 1 to 13) should be re-visited at 10 year intervals to confirm and/or update the science.

6) The watercourse layer should be updated to ensure that smaller watercourses are accurately delineated and categorized to distinguish them from other features such as swales and enclosed drains.

   Note: Notwithstanding the current state of the water course mapping layer shown in this study, all open watercourses are considered to be potential fish habitat and should be screened for at the site level as part of any development application. All open watercourses are considered part of the aquatic system, however, this study focuses on the terrestrial system.

Mixed woodland on steep valley land in West Elgin. Photo by Cathy Quinlan.

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List of Acronyms

ANSI	Area of Natural and Scientific Interest
CA	Conservation Authority
CCCA	Catfish Creek Conservation Authority
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COSSARO	Committee on the Status of Species At Risk in Ontario
DEM	Digital Elevation Model
DFO	Department of Fisheries and Oceans
EIS	Environmental Impact Study
ELC	Ecological Land Classification
EO	Element Occurrence
ESA	Environmentally Significant Areas
FEFLOW	Finite Element Subsurface FLOW System (software package for modeling fluid flow)
GDE	Groundwater Dependent Ecosystems
GIS	Geographic Information System
HVA	Highly Vulnerable Aquifer
IRS	Indian Remote Sensing
ISI	Intrinsic Susceptibility Index
IUCN	International Union for Conservation of Nature
KCCA	Kettle Creek Conservation Authority
LPRCA	Long Point Region Conservation Authority
LTVCA	Lower Thames Valley Conservation Authority
MECP	Ministry of the Environment, Conservation and Parks
MMU	Minimal Mapping Unit
MNHS	Middlesex Natural Heritage Study
MNHSS	Middlesex Natural Heritage Systems Study
NHIC	Natural Heritage Information Centre
NHRM	Natural Heritage Reference Manual
NHS	Natural Heritage System
NRVIS	Natural Resource Value Information System
OBM	Ontario Base Mapping
OMAFRA	Ontario Ministry of Agriculture ,Food and Rural Affairs
ONHS	Oxford Natural Heritage Study
ONHSS	Oxford Natural Heritage Systems Study
MMAH	Ministry of Municipal Affairs and Housing
MNR	Ministry of Natural Resources
MNRF	Ministry of Natural Resources and Forestry
ONHSS	Oxford Natural Heritage Systems Study
OWES	Ontario Wetland Evaluation System
PNHSS	Perth Natural Heritage Systems Study
PPS	Provincial Policy Statement
SAR	Species At Risk
SOLRIS	Southern Ontario Land Resource Information System

SWH	Significant Wildlife Habitat
SWHTG	Significant Wildlife Habitat Technical Guide
SWOOP	South West Ontario Ortho Photography
SWP	Source water Protection
USDA	United States Department of Agriculture
UTRCA	Upper Thames River Conservation Authority

Appendices

Appendix A-1. Ecological Land Classification (ELC) Code Descriptions

FOC – Coniferous Forest
FOD – Deciduous Forest
FOM – Mixed Forest
CUP – Cultural Plantation
TPW – Tallgrass Woodland
CUT – Cultural Thicket
CUW – Cultural Woodland
TPO – Open Tallgrass Prairie
CUM – Cultural Meadow
BBO – Open Beach / Bar
BBS – Shrub Beach / Bar
BBT – Treed Beach / Bar
BLO – Open Bluff
BLS – Shrub Bluff
BLT – Treed Bluff
CLO – Open Cliff
CLS – Shrub Cliff
CLT – Treed Cliff
TAO – Open Talus
TAS – Shrub Talus
TAT – Treed Talus
SWC – Coniferous Swamp
SWD – Deciduous Swamp
SWM – Mixed Swamp
SWT – Thicket Swamp
FET – Treed Fen
FES – Shrub Fen
BOT – Treed Bog
BOS – Shrub Bog
FEO – Open Fen
BOO – Open Bog
MAM – Meadow Marsh
MAS – Shallow Marsh
SAS – Submerged Shallow Aquatic
SAM – Mixed Shallow Aquatic
SAF – Floating-leaved Shallow Aquatic
OAO – Open Aquatic

Source: Lee *et al*, 1998. *Ecological Land Classification for Southern Ontario: First Approximation and Its Application.* SCSS Field Guide FG-02.

Appendix A-2. The similarities and differences between the ELC *Vegetation Community* Series and the ENHSS *Vegetation Groups*

ELC *Vegetation Community* Series		ENHSS *Vegetation Group*	
Code	**Definition**	***Veg. Group* (Ecosystem)**	**Definition**
SWC, SWD SWM	>25% tree or shrub cover; >20% standing water;	Woodland (Wetland)	>20% standing water; >25% tree or shrub
CUP	>60% tree cover; >20% standing water; ≥1 linear edge;		
FOC, FOD FOM	>60% Tree cover	Woodland (Terrestrial)	>60% Tree cover <20% standing water
CUP	>60% tree cover < 20% standing water; ≥1 linear edge		
TPW	35-60% tree cover	Thicket (Terrestrial)	25-60% tree/shrub cover; <20% standing water
CUT	<25% Tree cover; >25% shrub cover		
CUW, TPW	35-60% tree cover		
SWT	<25% tree cover; >25% hydrophytic shrub cover	Thicket (Wetland)	10-25% tree cover or <10% tree cover and >25% shrub cover; >20% standing water
FET	20-25% tree cover		
FES	<10% tree cover; >25% shrub cover		
BOT	10-25% tree cover		
BOS	<10% tree cover; >25% shrub cover		
TPO CUM	<25% tree cover; <25% shrub cover	Meadow (Terrestrial)	<10% tree cover and <25% shrub cover
FEO BOO	<10% tree cover; <25% shrub cover	Meadow (Wetland)	<10% tree cover and <25% shrub cover; located in wetland as defined in Section 2.2.2.1 below
MAM MAS	<25% tree cover; <25% shrub cover		
SAS, SAM SAF	No tree cover; >25% macrophytes		
OAO	No vegetation; open water	Water Feature (Aquatic)	No vegetation; open water
BBO, BBS BBT	<60% tree cover; along shorelines	Watercourse Bluff and Depositional Area (Terrestrial)	<60% tree cover; on naturally active sites such as shorelines, steep slopes and base of cliffs
BLO BLS BLT	<10% tree cover; on active or steep near vertical surfaces		
CLO, CLS CLT	<60% tree cover; on steep near vertical surfaces		
TAO, TAS TAT	<60% tree cover; on slopes of rock rubble at base of cliffs		

*Note: Connected *Vegetation Group* can be made up trees and shrubs

Appendix B. Evaluated Wetland Layer

Ministry of Natural Resources and Forestry (MNRF) Evaluated Wetlands

The Ontario Ministry of Natural Resources and Forestry evaluates wetlands based on the Ontario Wetland Evaluation System (OWES) Southern Manual (MNR 2013). Sites are evaluated in the field, mapped, and then scored based on field data, hydrology and use. Since evaluated wetlands have been mapped during site visits, they can be smaller than 0.5 ha and are retained as part of the natural heritage system.

In some cases, Conservation Authority staff found the perimeter of the evaluated wetland did not match the natural heritage feature boundary on the latest orthoimagery and so boundary amendments were made. It should be noted that this may have resulted in extending or decreasing the wetland beyond the boundary approved under OWES at the time of the evaluation.

For policy decisions, the approved wetland boundary should be referenced. Recognizing that wetlands are dynamic, an Environmental Impact Study be completed to determine the accurate wetland boundary using the OWES (MNR 2013). The OWES uses an open file system where files can be amended as new information becomes available. MNRF is the approval authority on Significant Wetlands so any changes to the boundaries must be approved by the MNRF.

Appendix C. Unevaluated Wetlands and their Identification and Mapping (UTRCA Methodology)

The Upper Thames River Conservation Authority (UTRCA) began identifying unevaluated wetlands in 2006 in an attempt to consolidate information and map the numerous wetlands that were not part of the evaluated wetland layer of MNR to better represent natural features in the watersheds. These wetland areas were identified for the generic regulations using the following desk-top procedure:

i. Wetland indicators:
   a. *Historic Forest Cover* -- historic forest cover information collected in the 1950s and 1960s by teams of foresters who examined every woodlot in the watershed and characterized dominant cover types. Identify areas associated with wetland species (e.g., Silver Maple, Black Ash, cedar, White Elm, and Tamarack).

   b. *Soils* -- organic and clay soils (wetland soils) using OMAF soils maps.

   c. *Elevation* -- areas in depressions or lower elevations using a Digital Elevation Model (DEM).

   d. *Groundwater* -- discharge areas as defined in the Six CA Groundwater Model Study, July 2008, and recharge areas as defined as Significant Groundwater Recharge Areas from the Thames-Sydenham and Region Source Protection Region, Upper Thames River Source Protection Area, Assessment Report, Approved, September 16, 2015.

   e. *Proximity* -- areas within 120 m of an MNRF evaluated wetland since 120 m is the distance at which adjacent lands may have an impact on a wetland.

ii. Overlay the indicators to determine possible wetland areas. The more indicators that overlap, the more likely there is a wetland in that area.

iii. Compare the areas delineated by overlaying the wetland indicators to an aerial photo interpretation of wetland areas where wetness is indicated by color (dark), texture (granular), and canopy cover (sparse or spotty). Areas that matched were identified as unevaluated wetlands.

Note: Several other Conservation Authorities use similar methods in mapping unevaluated wetlands within their jurisdictions.

Appendix D. Summary of Ecologically Important Criteria, Rationale and Application

#	***Vegetation Group*** **Criteria**	**Scientific Rationale**	**Application**
1	Any *Vegetation Group* within or touching a significant **valleyland**	Vegetation on valley lands prevents erosion, improve water holding capacity that ensures regeneration of vegetation, and encourages wildlife movement.	*Vegetation Group* on valley land defined using 3:1 slope or 100m from centerline of watercourse.
2	Any *Vegetation Group* within 100 m of the **Shoreline Zone**	Vegetation along the Lake Erie shoreline is crucial for migrating birds as resting and feeding areas. The western section is an Important Bird Area. Vegetation near the bluff also provides some erosion protection.	To map the shoreline zone, a polygon was created from the top of bluff to 1 km out into the lake. The bluff itself is too narrow to map. The shoreline is over 80 km long in Elgin County.
3	Any *Vegetation Group* located within or touching a **Life Science ANSI** (Area of Natural and Scientific Interest) (provincial and regional)	Recognized ANSIs are a logical foundation on which to design a natural heritage system.	Pre-determined by MNR using five evaluation selection criteria: representation, condition, diversity, other ecological considerations, and special features.
4	Any *Vegetation Group* located within 30 m of an **open watercourse**	Relationship between water course and vegetation is interactive whereby vegetation along watercourses improves water quality for aquatic Vegetation Ecosystems through reduction in soil erosion and input of nutrients; while the watercourse attracts animals and acts as a corridor.	All *Vegetation Groups* within 30 m from the edge of an open watercourse (defined as the bank-full width if greater than 20m wide, or a defined channel visible on the aerial photography if less than 20m wide).
5	All evaluated and unevaluated **wetland** *Vegetation Group* ≥0.5 ha	Wetlands have disproportionately been removed from the landscape of southern Ontario. Some of their important functions are to maintain the hydrological regime of the surrounding area by dampening water peaks in the gullies, reduce the potential for erosion and provide critical breeding and overwintering habitat for reptiles and amphibians.	The wetland layer was derived from the MNRF evaluated wetland mapping layer, as well as the unevaluated wetland layers developed by the UTRCA for this study.

6	Any **woodland** ***Vegetation Group*** **≥ 4 ha**	Habitat size is one of the most important measures for sustaining stable, diverse and viable populations of wildlife species. In a highly fragmented landscape, the definition of a "large sized" woodland can be relatively small.	All woodland vegetation groups ≥ 4 ha meet this criterion.
7	Any Woodland *Vegetation Group* **within 100 m of a ≥4 ha Woodland** *Vegetation Group*	The < 100 m distance is based on average seed dispersal distances in the literature.	All woodland less than 1 ha within 100 m of a **≥** 4 ha woodland, regardless of what land use surrounds them, meet this criterion.
8	Any **Thicket** ***Vegetation Group*** **≥ 2 ha in size**	Larger thickets are better if managing to enhance the long-term survival of a variety of wildlife. Large thickets >2 ha are relatively rare in Perth County, yet thickets of at least 10 ha in size are required for uncommon species (Oehler *et al.* 2006).	Thickets ≥ 2 ha meet this criterion. They are relatively rare in Perth County
9	Any **Meadow** ***Vegetation Group*** **≥ 5 ha in size**	The amount of native meadow habitat has declined drastically throughout North America. Grassland birds are of special concern since they have suffered more serious population declines than any other group of birds. Johnson (2001) demonstrated a preference for large grassland *Vegetation Groups* by a number of grassland bird species, irrespective of territory size.	All meadows ≥ 5 ha meet this criterion.
10	Any **Meadow** ***Vegetation Group*** **within 100 m of a ≥4 ha Woodland or ≥2 ha Thicket** *Vegetation Group*	Meadow butterfly habitat must be considered in context with the surrounding range of habitats. Using the average distance of wind dispersed seeds as a conservative estimate, all meadows found within 100 m of a large shrub land or woodland were identified meeting this criterion.	All meadows within 100 m of a ≥4 ha woodland or ≥2 ha thicket meet this criterion.

11	**Any *Vegetation Patch* that contains a *Vegetation Group* identified as significant**	Criterion 10 is really a summary of Criteria 1 through 9.	All *Vegetation Patches* containing a *Vegetation Group* that has been identified as significant.
12	Any *Vegetation Patch* that contains a **diversity of *Vegetation Communities*, Ecosystems or Groups**	The number of *Vegetation Communities* in a *Vegetation Patch* is a measure of habitat and species diversity.	The *Vegetation Patch* was identified as significant if it either contained more than one Vegetation Ecosystem, or more than two *Vegetation Groups*, or more than three *Vegetation Communities*.
13	Any *Vegetation Patch* within 100 m of a *Vegetation Patch* that meet Criteria 11 or 12 above	Local landscapes that include large natural areas linked to the regional landscape mosaic by a network of smaller interacting natural areas and corridors, offers the highest probability of maintaining overall ecological integrity. The < 100 m distance is based on average seed dispersal distances in the literature.	All *Vegetation Patches* within 100m of a significant *Vegetation Patch*, regardless of what land use surrounds them, are identified.

Appendix E. Summary of rationale for criteria NOT used in the ENHSS

Criteria	Rationale for Not Including	Use in Other Natural Heritage Studies*
1. Best representative *Vegetation Patch* on **landform physiography and soil type**	This is redundant as the Life Science ANSI uses this criterion, even though it is done at a different scale (i.e., by site district rather than by county).	ONHS 2006: largest patch on each landform and each soil type LCNHS 2013: largest patch on slope of 10% or greater and largest patch on each landform and each soil type COL 2006: patch contains either: - > 1 ecosite in 1 Community series OR - > 2 vegetation types OR - > 1 topographic feature OR - 1 vegetation type with inclusions/ complexes
2.Located on a **distinctive, unusual or high quality landform**	Definition of a distinctive, unusual or high quality landform is subjective.	COL 2006: patch located on either - Beach Ridge - Sand Plain - Till Plain - Till Moraine
3.All areas (both vegetated and **non-vegetated**) on: - **Valley lands** - **Gullies** - within 30 m of **limestone outcroppings**	The ENHSS identifies *Vegetation Patches* on Significant valleylands as ecologically important and recommend that other land uses on valley lands (e.g., agriculture, golf courses, etc.) be considered as special policy areas with limitations on further development to maintain valley land connectivity. Gullies not used because they require field level surveys to map; it is an important feature in Huron County by the Lake shoreline Limestone outcroppings are not mapped at this time.	ONHS 2006: patches on valley lands HCNHS 2013: patches on or < 100m from landform features - dunes, - shore bluffs, - gullies, - valley lands, - within 30m of limestone outcroppings
4.All *Vegetation Patches* found alongside a **coldwater watercourse or watercourse containing Brook Trout**	Definition of a watercourse, both cold and warm, includes an additional area immediately adjacent to the water (in proportion to the size of the watercourse feature) and therefore it is not necessary to include additional lands for protection (e.g., *Vegetation Patches* 30 m from edge) Non vegetated setbacks from watercourses can be restricted using other official plan and zoning plan policies. Questions remain: Is this sensitive information? How easy is it to determine coldwater streams? Are they already identified?	
5.Shape of *Vegetation Patch*	When shape metrics are used, often very small and round *Vegetation Patches* are selected over larger *Vegetation Patches*.	COL 2006: has perimeter to area ratio <3.0 m/m^2

Appendix E continued

Criteria	Rationale for Not Including	Use in Other Natural Heritage Studies*
6.Adjacent to a MNRF evaluated wetland or life science ANSI	This is redundant as other adjacency rules have these features incorporated into them.	MNHS 2003: woodland < 750m from recognized feature. ONHS 2006: < 150m of non-wetland feature
7.Contains an area identified in the local official plans e.g. **Local ESAs (**Environmentally Significant Areas) identified in the 1970s or 1980s.	The natural heritage systems studies use modern landscape parameters. Verification that the old ESAs are being identified as locally important will occur.	ONHS 2006: Local OP designated habitats
8.Unique Intrinsic Characteristics (i.e., site level)	No field work or site visits are being conducted for this landscape study, so it is not possible to evaluate the intrinsic or site specific characteristics of *Vegetation Patches* at this fine scale.	LCNHS 2013: > 0.5 ha woodland with either - - unique species composition, - cover type, - age, and - structure. COL 2006: woodland with either – - mid to old age community, or - tree size > 50 cm DBH, or - > 16 m2/ha for trees >25 cm DBH, or - > 12 m2 / ha for trees > 10 cm DBH, or - All diameter class sizes represented or - community with MCC > 4.1, or - patch MCC > 3.9, or - > 1 community in good condition or - Community with SRANK > S4 or - > 1 northern / specialized habitat / tree / shrub species or - > 2 Carolinian tree / shrub species
9.Distance from development (e.g., permanent infrastructure and buildings) or matrix	Difficult to evaluate. Too complex for this study.	COL 2006: > 7% vegetation cover within 2 km radius from woodland centroid
10.Persistence or Threatened	A natural feature that persists through time is not necessarily more important or significant. However, it is interesting to compare 2006 to 2010 aerial photography to see what the trends are and why.	LCNHS 2013: > 0.5 ha woodland with high economic or social value
11.Porous or erodible soils	The aim of the PNHSS is to identify important biological natural heritage features, not to protect the ground water system.	MNHS 2003: woodland on porous soils COL 2006: patch on either- - 25% slope any soil - Remnant slope - >10% to <25% on clay, silty clay

Appendix E continued

Criteria	Rationale for Not Including	Use in Other Natural Heritage Studies*
12.*Vegetation Patch* contains **a large sized wetland** defined as: • Wooded wetlands > 4 ha based on Env. Canada • Wetland meadows and marshes > 10ha based on Env. Canada • Small wetland meadows and marshes adjacent to other *Vegetation Communities* may be vital to butterflies • Wetland thicket size determined by top 75th percentile distribution cutoff of all county wetland thicket sizes	The PNHSS has identified all wetlands ≥0.5 ha (MMU) as ecologically important, regardless of size or type.	HCNHS 2013: either - - 4 ha wooded wetland - 10ha wetland meadow or marsh - 2.5ha wetland shrubland COL 2006: woodland contains or contiguous to a wetland
13.*Vegetation Patch* contains a wetland that is **within 1,000m of another wetland;** distance based on S. Ont. Wetland Evaluation Manual where wetlands are scored based on their proximity to another wetland (Section 1.2.4) and receive points if they are within 1 km of another wetland. The 750m is for delineating wetland boundaries, not scoring wetlands.	PNHSS 2016 has identified all wetlands ≥0.5 ha (MMU) as ecologically important.	ONHS 2006: < 750 m from wetland HCNHS 2013: < 1000 m from wetland
14.*Vegetation Patch* contains a recently observed (post 1980) **Regionally Rare Plant**	Regional rarity was once tracked by MNR Aylmer but no longer. Data is difficult to find and confirm. Neither MNRF Aylmer nor NHIC have retained or digitized the historic data. Presently, no agency is responsible for ensuring the data is being updated and monitored for change in status	ONHS 2006: contains rare species COL 2006: Contains either: • Rare tree / shrub • Rare herbaceous • Regionally rare plant

Appendix E continued

Criteria	Rationale for Not Including	Use in Other Natural Heritage Studies*
15.*Vegetation Patch* contains **thicket with interior**	Although studies have shown that most shrub land birds avoid edges (Schlossberg and King 2008) and experience lower nesting success near edges (King et al. 2001, King and Byers 2003, King et al. 2009b), there is not a consistent definition of edge habitat. Rather, the size of a shrub land is used as a proxy measure of edge habitat.	
16.*Vegetation Patch* on an **Earth Science ANSI** that contributes to the presence of an uncommon *Vegetation Community*	Biodiversity planning requires an understanding of uncommon *Vegetation Communities* in terms of their distribution on significant/important areas. However, the presence of an ES ANSI does not mean there are unique *Vegetation Community* features that are resulting from the characteristics of the Earth Science ANSI. Soils have more of an influence on vegetation than deeper features. Uncommon Vegetation Communities are not usually identifiable from ortho-imagery. Field level analysis would be needed.	
17.Carolinian Canada **Big Picture Corridors**	Carolinian Canada's Big Picture has been accepted as a planning tool when no other landscape level studies were complete. Many of the rules used to identify Carolinian Corridors on the larger landscape (SW Ont) have been incorporated in the PNHSS criteria, but refined for the smaller County scale (e.g., valley land definition layer and proximity criteria). The Big Picture corridors incorporate areas that are <u>not</u> vegetated at present, as part of a restoration plan. The PNHSS captures only vegetated natural heritage patches, not farmland or other lands that could be restored or naturalized. Picking corridors at a larger scale is somewhat arbitrary. It is proposed that more current science and mapping be used to delineate corridors. Recommend as a followup step to the PNHSS or deal with it when there is a landuse change.	<u>MNHS 2003</u>: woodland within recognized corridor <u>COL 2006</u>: woodlands connected by either – - Watercourses - Gaps < 40m - Recognized corridors - Abandoned rail and utility lines - Open space greenways and golf courses - Active agriculture or pasture
18.Interior woodland habitat that is ≥ **0.5 ha in size** of continuous habitat	No patches were picked up with this criteria that were not already picked up by other criteria, therefore redundant. This criteria was used in the past when the woodland size cutoff of ≥ 10 ha (i.e., woodlands 4-10 ha that had interior were picked up).	<u>MNHS 2003</u>: has interior >100 m from edge <u>ONHS 2006</u>: has interior >100 m from edge <u>HCNHS 2013</u>: has interior > 0.5 ha that is > 100 m from edge <u>LCNHS 2013</u>: has interior >100 m from edge <u>COL 2006:</u> : has interior >100 m from edge

Appendix E continued

Criteria	Rationale for Not Including	Use in Other Natural Heritage Studies*
19.Species at Risk	• Includes plants, *Vegetation Communities*, birds, mammals, herptofaunal (frogs, toads, salamanders, turtles and snakes). Rare or uncommon species can be indicators of unusual and rare habitat and are often used to guide conservation strategies (Lesica and Allendorf 1995, Lomolino and Channell 1995). • Table 3-4 in the Natural Heritage Reference Manual (MNR, 2010) recognizes species rarity as an ecological function, and habitats that contain rare species are more valuable. MNR recommends that this be restricted to END and THR. • SAR have their own legislation for protection and an EIS needs to consider their presence This is not a criterion for the following reasons: - This is a landscape study rather than an intrinsic characteristics study and there is not a complete inventory - The absence of a species does not mean that suitable habitat or conditions are not present - Areas with END or THR species are already protected in the SAR Act while IUCN S1 – S3 are considered under SWH - Mapping limitations of the past limit accuracy in identifying locations. New species are added to the SAR over time. • These areas are not mapped currently but it is recommended that they be mapped as they are identified through site studies on the landscape and reported to the MNR and the appropriate Conservation Authority.	

Natural Heritage Studies Referenced above

COL – City of London (City of London, 2006)
- evaluation of woodlands, cutoffs based on medium to high rankings

HCNHS – Huron County Natural Heritage Study (County of Huron, 2013 Draft)
- based on more complete natural heritage system mapping and no field work

LCHNS – Lambton County Natural Heritage Study (County of Lambton *et al*., 2012 Draft)
- based only on woodlands and field work

MNHS – Middlesex Natural Heritage Study (UTRCA, 2003)
- based only on woodlands and field work

ONHS – Oxford Natural Heritage Study (County of Oxford, 2006)
- based on woodlands, floodplain meadows, watercourses and dated fieldwork

Perth – Perth County Official Plan Amendment #47 (County of Perth Official Plan. 2008. Section 11.5.5)
- regarding minimal woodland size

Appendix F. Metadata: Vegetation Patch and Group Criteria Mapping and Field Description

The following Information describes the feature classes (layers) and fields that are associated with criteria section of the report. The feature classes are being delivered in a file geodatabase format (name).

Naming Convention
A naming convention is being followed that should make data easy to understand and follow.

Table 1 describes short forms used for Groups:

Group Type	Short Form
Woodland	WDL
Meadow	MDW
Thicket	THK
Wetland	WTL
Connecting Features	CNF
Waterbody	WBY

Table 2 describes short forms used for Patch:

Patch	Short Form
Patch	PTC

Table 3 describes how the level of information are defined.

Level of Detail	Detail
Field provides criteria of the individual group	CR
Field provides supporting information that may be important to the group	INF

Study Area Features
Mapping was completed beyond the Elgin County boundary and study limits. The features (Communities, Groups and Patches) that were included in the study are represented by the "Study_Area" field in most layer.

Field Name (Included in most layers)	Short Form
Study_Area	0 =Not included in mapping and study calculations 1= Included in mapping and study calculations

Populated data and Field Structure
Field names are generally named in the following manner "Short Form"_"Detail"_Description (eg. Woodland_Criteria_Greater Than 1ha is WDL_CR_GT1ha)

Group, Patch and Information fields are *short integers* fields and are populated with 1 or 0, 0=Not applicable or 1=Applicable – See table below

"Short Form"_"CR"_Total– are short integers fields that indicate the total number of criteria met within the individual group

Appendix F continued

Table 4 provides field descriptions and field names within each group and patch feature class. It also provides information of what values are populated.

Feature Name and Field Description	Field Name	Value
Group_Woodland_Cluster		
Within valley land	WDL_CR_Valleyland	0= Not applicable, 1=applicable
Within 100m of the Lakeshore Bluff	WDL_CR_Shoreline_100	0= Not applicable, 1=applicable
Within Life Science ANSI	WDL_CR_ANSI	0= Not applicable, 1=applicable
Group within 30m of Watercourse	WDL_CR_Watercourse	0= Not applicable, 1=applicable
Any Woodland or Woodland Cluster >4ha	WDL_CR_GT4ha	0= Not applicable, 1=applicable
Any Woodland within 100m of a Woodland Cluster > 4ha	WDL_CR_100m_GT4ha	0= Not applicable, 1=applicable
Number of Significant Woodland Criteria Met	WDL_CR_Total	0 = Not applicable >0=Applicable
Wetland within Woodland	WDL_INF_Wetland	0= Not applicable, 1=applicable
Individual Woodland or Woodland within Cluster has Interior	WDL_INF_Interior	0= Not applicable, 1=applicable
1. Defines if a feature meets a group and system feature (meets one or more group criteria) 2. Defined if only meets a system criteria (is part of feature within the patch that meets patch criteria other than Group Woodland Criteria, does not include 1 above or 3 below) 3. Defines features that do not meet a group or system criteria. Does not include 1 or 2 above. Require further study beyond landscape level.	WDL_INF_Ecological_Level	1. Group and System Ecological Important 2. System Ecological Important 3. Candidate for Ecological Important
1. Defines if a feature meets a group and system feature (meets one or more group criteria) and meets Provincial Policy Statement (PPS) as Significant. 2. Defined if only meets a system criteria (is part of feature within the patch that meets patch criteria other than Group Woodland Criteria, does not include 1 above or 3 below). Recognized as part of the overall heritage system as defined by PPS but does not fall under level as significant. 3. Defines features that do not meet a group or system criteria. Does not include 1 or 2 above. Require further study beyond landscape level.	WDL_INF_Ecological_Status	1. Significant Ecologically Important 2. Ecological Important 3. Candidate for Ecological Important

Group_Meadow_Cluster		
Within valley land	MDW_CR_Valleyland	0= Not applicable, 1=applicable
Within 100m of the Lakeshore Bluff	MDW_CR_Shoreline_100	0= Not applicable, 1=applicable
Within Life Science ANSI	MDW_CR_ANSI	0= Not applicable, 1=applicable
Group within 30m of Watercourse	MDW_CR_Watercourse	0= Not applicable, 1=applicable
Any Meadow or Meadow Cluster >5ha	MDW_CR_5ha	0= Not applicable, 1=applicable
Any Meadow within 100m of a 4ha Woodland or 2ha Thicket	MDW_CR_Proximity	0= Not applicable, 1=applicable
Number of Meadow Significant Criteria Met	MDW_CR_Total	0 = Not applicable >0=Applicable
Wetland within Meadow	WDW_INF_Wetland	0= Not applicable, 1=applicable
Any Meadow or Meadow Cluster >10ha	MDW_INF_10ha	
1. Defines if a feature meets a group and system feature (meets one or more group criteria) 2. Defines if only meets a system criteria (is part of feature within the patch that meets patch criteria other than Group Meadow Criteria, does not include 1 above or 3 below) 3. Defines features that do not meet a group or system criteria. Does not include 1 or 2 above. Require further study beyond landscape level	MDW_INF_Ecological_Level	1. Group and System Ecological Important 2. System Ecological Important 3. Candidate for Ecological Important
Within valley land	THK_CR_Valleyland	0= Not applicable, 1=applicable
Within 100m of the Lakeshore Bluff	THK_CR_Shoreline_100	0= Not applicable, 1=applicable
With Life Science ANSI	THK_CR_ANSI	0= Not applicable, 1=applicable
Group within 30m of Watercourse	THK_CR_Watercourse	0= Not applicable, 1=applicable
Any Thicket or Thicket Group >2ha	THK_CR_GT2 ha	0= Not applicable, 1=applicable
Number of Significant Thicket Criteria Met	THK_CR_Total	0 = Not applicable >0=Applicable
Wetland within Thicket	THK_INF_Wetland	0= Not applicable, 1=applicable
1.Defines if a feature meets a group and system feature (meets one or more group criteria) 2.Defined if only meets a system criteria (is part of feature within the patch that meets patch criteria other than Group Thicket Criteria, does not include 1 above or 3 below) 3. Defines features that do not meet a group or system criteria. Does not include 1 or 2 above. Require further study beyond landscape level.	THK_INF_Ecological_Level	1. Group and System Ecological Important 2. System Ecological Important 3. Candidate for Ecological Important

Group_Wetland		
Within valley land	WTL_CR_Valleyland	0= Not applicable, 1=applicable
Within 100m of the Lakeshore Bluff	WTL_CR_Shoreline_100	0= Not applicable, 1=applicable
With Life Science ANSI	WTL_CR_ANSI	0= Not applicable, 1=applicable
Group within 30m of Watercourse	WTL_CR_Watercourse	0= Not applicable, 1=applicable
Any wetland >0.5 ha or Provincial Evaluated Wetland	WTL_CR_Wetland	0 = Not applicable >0=Applicable
Number of Significant Wetland Criteria Met	WTL_CR_Total	>0=applicable
Group_Connected_Feature		
Within valley land	CNF_CR_Valleyland	0= Not applicable, 1=applicable
Within 100m of the Lakeshore Bluff	CNF_CR_Shoreline_100	0= Not applicable, 1=applicable
With Life Science ANSI	CNF_CR_ANSI	0= Not applicable, 1=applicable
Group within 30m of Watercourse	CNF_CR_Watercourse	0= Not applicable, 1=applicable
Number of Connecting Features Significant Criteria Met	CNF_CR_Total	0 = Not applicable >0=Applicable
Wetland within Connecting Feature	CNF_INF_Wetland	0= Not applicable, 1=applicable
1. Defines if a feature meets a group and system feature (meets one or more group criteria) 2. Defines if only meets a system criteria (is part of feature within the patch that meets patch criteria other than Group Connected Vegetation Criteria, does not include 1 above or 3 below) 3. Defines features that do not meet a group or system criteria. Does not include 1 or 2 above. Require further study beyond landscape level.	CNF_INF_Ecological_Level	1. Group and System Ecological Important 2. System Ecological Important 3. Candidate for Ecological Important
Group_Waterbody		
Within valley land	WBY_CR_Valleyland	0= Not applicable, 1=applicable
Within 100m of the Lakeshore Bluff	WBY_CR_Shoreline_100	0= Not applicable, 1=applicable
With Life Science ANSI	WBY_CR_ANSI	0= Not applicable, 1=applicable
Group within 30m of Watercourse	WBY_CR_Watercourse	0= Not applicable, 1=applicable
Number of Waterbody Significant Criteria Met	WBY_CR_Total	0 = Not applicable >0=Applicable

1. Defines if a feature meets a group and system feature (meets one or more group criteria) 2. Defined if only meets a system criteria (is part of feature within the patch that meets patch criteria other than Group WBY Criteria, does not include 1 above or 3 below) 3. Defines features that do not meet a group or system criteria. Does not include 1 or 2 above. Require further study beyond landscape level.	WBY_INF_Ecological_Level	1. Group and System Ecological Important 2. System Ecological Important 3. Candidate for Ecological Important
Elgin_NH_Patch_2015_Cluster		
Patch contains at least one group significant from field list below (see field descriptions below in Patch Information) MDW_CR_Significant- patch meets a criteria THK_CR_Significant - patch meets a criteria WDL_CR_Significant- patch meets a criteria WTL_CR_Significant- patch meets a criteria CNF_CR_Significant- patch meets a criteria WBY_ CR_Significant- patch meets a criteria	PTC_CR_Group	0= Not applicable, 1=applicable
Vegetation Communities I) Patch contains more than one vegetation system, or ii) Patch contains more than two vegetation groups, or iii) Patch contains more than three vegetation communities	PTC_CR_Diversity	0= Not applicable, 1=applicable
Other patches that are within 100m of a patches that meet either/both a Group or Patch Diversity criteria	PTC_CR_Proximity	0= Not applicable, 1=applicable
Number of Patch Criteria Met	PTC_CR_Total	0= Not applicable, >0=Applicable
Patch contains a Woodland Group criteria	WDL_CR_Signficant	0= Not applicable, 1=applicable
Patch contains a Meadow Group criteria	MDW_CR_Signficant	0= Not applicable, 1=applicable
Patch contains a Thicket Group criteria	THK_CR_Signficant	0= Not applicable, 1=applicable
Patch contains a Wetland Group criteria	WTL_CR_Signficant	0= Not applicable, 1=applicable
Patch contains a Connecting Feature Group criteria	CNF_CR_Signficant	0= Not applicable, 1=applicable
Patch contains a Waterbody Group criteria	WBY_CR_Signficant	0= Not applicable, 1=applicable
Number of Group and Patch Criteria each Patch meets (including, Valley, ANSI, Shoreline, Watercourse)	PTC_Group_CR_Totals	0 -10

Appendix G. Metadata for Vegetation Communities and Vegetation Groups

The following information describes the feature classes (layers) and field names within the Study data.

Naming Convention

Table 1 describes short forms used for Groups:

Group Type	Short Form
Woodland	WDL
Meadow	MDW
Thicket	THK
Wetland	WTL
Connecting Features	CNF
Waterbody	WBY

Table 2 describes short forms used for Patch:

Patch	Short Form
Patch	PTC

Table 3 describes how the level of information are defined.

Level of Detail	Detail
Field provides criteria of the individual group	CR
Field provides supporting information that may be important to the group	INF

Study Area Features

Mapping was completed beyond the Elgin County boundary and study limits. The features (Communities, Groups and Patches) that were included in the study are represented by the "Study Area" field in most layer.

Field Name (Note: in most layers)	Short Form
Study_Area	0 =Not included in mapping and study calculations 1= Included in mapping and study calculations

Elgin_NHSS_Community_(Date)

The community feature class consists of all community features that allow them to be dissolved into individual Groups or create the overall Patch Feature Class. Zero in the field indicates that it is not applicable to the community or group/patch type and 1 indicates that it is applicable. Visible bluff or Deposition areas have been mapped but not all features can be defined so they have not been mapped as a group.

Field Name	Type	Parameters
NH_Community_ Type_2015	Text	Bluff or Deposition, Coniferous, Deciduous, Connected Vegetation Feature, Meadow Marsh, Meadow Upland, Mixed, Plantation Mature, Plantation Young, Thicket, Water Body, Watercourse
Status	Text	**Present 2015** - Feature is present on 2015
NH_Woodland	Short	0, 1
NH_Meadow	Short	0, 1
NH_Thicket	Short	0, 1
NH_Wetland	Short	0,1
NH_Water	Short	0, 1
NH_Connecting_ Features	Short	0 ,1
Vegetation_Group	Text	Bluff or Deposition Area, Connected Vegetation Feature, Meadow, Meadow and Wetland*, Thicket, Thicket and Wetland*, Water, Water and Wetland*, Woodland, Woodland and Wetland* * included in both groups
Vegetation_Ecosystem	Text	Aquatic, Wetland, Terrestrial Upland
WTL_Defined_By	Text	MNR
PSW	Text	0, 1
ELC_CODE	Text	Bluff or Deposition Area (BBO), Connecting Vegetation Feature (NA), Meadow (CUM), Meadow and Wetland (MAM), Thicket and Plantation Young(CUT), Thicket and Wetland, Plantation Young and Wetland (SWT), Water (OAO), Woodland: Conifer (FOC), Deciduous (FOD), Mixed (FOM), Mature Plantation (CUP); Woodland and Wetland: Conifer Swamp (SWC), Deciduous Swamp (SWD), Mixed Swamp (SWM) Plantation Swamp (CUT)
Study_Area	Short	0,1

Group Woodland
This feature class was created by exporting woodlands from the Elgin_NH_Community_"Date" feature class. Using values equal to one in the NH_Woodland field, data was exported to a new feature class and all communities were dissolved using the NH_Woodlands field equal to one to create a seamless polygon woodlands feature class. The woodlands less than 0.5 ha were then deleted using the Shape Area Field to create the Group_Woodland feature class. This feature class was then used to establish the Woodland Cluster Feature Class (see below) and perform the interior forest calculation.

Group_Woodland_Cluster
This feature class was created from the Group_Woodland Feature Class. The values in the WDL_Cluster_ID field were merged to create multipart features which act as a single woodland polygon.

This feature class supports the criteria information for the woodland group.

Zero in the field indicates that it is not applicable to criteria or information and 1 indicates that it is applicable.

Field Name	Type	Parameters
WDL_Cluster_ID	Short	Unique Value, values over 6000 have been clustered
WDL_CR_Valleyland	Short	0, 1
WDL_CR_Shoreline_100	Short	0, 1
WDL_CR_ANSI	Short	0, 1
WDL_CR_Watercourse	Short	0, 1
WDL_CR_GT_4ha	Short	0, 1
WDL_CR_GT_4ha_100m	Short	0, 1
WDL_INF_Wetland	Short	0, 1
WDL_INF_Interior	Short	0, 1
WDL_CR_Total	Short	0 to 7
Study_Area	Short	0,1

Group Meadow

This feature class was created by exporting meadows from the Elgin_NH_Community_"Date" feature class. Using values equal to one in the NH_Meadow field, data was exported to a new feature class and all communities were dissolved using the NH_Meadow field equal to one to create a seamless polygon meadow feature class. The Meadows less than 0.5 ha were then deleted using the Shape Area Field to create the Group_Meadow Feature Class. This feature class was then used to establish the Meadow Cluster Feature Class (see below).

Group_Meadow_Cluster

This feature class was created from the Group_Meadow feature class. The values in the MDW_Cluster_ID field were merged to create multipart features which act as a single meadow polygon.

This feature class supports the criteria information for the meadow group.

Zero in the field indicates that it is not applicable to criteria or information and 1 indicates that it is applicable.

Field Name	Type	Parameters
MDW_Cluster	Short	Unique Value, values over 6000 have been clustered
MDW_CR_Valleyland	Short	0, 1
MDW_CR_Shoreline_100	Short	0, 1
MDW_CR_ANSI	Short	0, 1
MDW_CR_Watercourse	Short	0, 1
MDW_CR_GT_5ha	Short	0, 1
MDW_CR_Proximity	Short	0, 1
MDW_INF_Wetland	Short	0, 1
MDW_CR_Total	Short	0 - 7
Study_Area	Short	0,1

Group Thicket

This feature class was created by exporting Thickets from the Elgin_NH_Community_"Date" feature class. Using values equal to one in the NH_Thicket field, data was exported to a new feature class and all communities were dissolved using the NH_Thicket field equal to one to create a seamless polygon Thicket Feature Class. The Thickets less than 0.5 ha were then deleted using the Shape Area Field to create the Group_Thicket Feature Class. This feature class was then used to establish the Group Thicket Cluster Feature Class (see below).

Group_Thicket_Cluster

This feature class was created from the Group_Thicket feature class. The values in the THK_Cluster_ID field were merged to create multipart features which act as a single Thicket polygon.

This feature class support the criteria information for the Thicket group.

Zero in the field indicates that it is not applicable to criteria or information and 1 indicates that it is applicable.

Field Name	Type	Parameters
Unique_Cluster	Short	Unique Value, values over 6000 have been clustered
THK_CR_Valleyland	Short	0, 1
THK_CR_Shoreline_100	Short	0, 1
THK_CR_ANSI	Short	0, 1
THK_CR_Watercourse	Short	0, 1
THK_CR_GT_2ha	Short	0, 1
THK_INF_Wetland	Short	0, 1
THK_CR_Total	Short	0 - 6
Study_Area	Short	0,1

Group Wetland_Source

This feature class was created by exporting Wetlands from the Perth_NH_Community_2015 Feature Class. Using values equal to one in the NH_Wetland field, data was exported to a new feature class and all communities were dissolved using the Wetland field equal to one to create a seamless polygon Wetland feature class. All wetlands that were identified are included in this layer. The Wetland_Group field identifies wetlands that are used to be identified as significant (greater than 0.5 ha or evaluated), where zero in the field indicates that it is not applicable and 1 indicates that it is applicable.

Field Name	Type	Parameters
WTL_Defined_By	Text	MNRF-County-Unevaluated, MNRF Unevaluated Other, MNRF-Evaluated Provincial, UTRCA-Unevaluated, UTRCA for LPRCA-Unevaluated
Group_Wetland	Short	0, 1

Group Wetland

This feature class was created from the Group Wetland_all feature class. The values equal to 1 in the Group Wetland field were selected and features were exported to a new layer Group Wetland.

This feature class supports the criteria information for the wetland group.

Zero in the field indicates that it is not applicable to criteria or information and 1 indicates that it is applicable.

Feature Class	Field Name	Type	Parameters
Group_Wetland	WTL_CR_Valleyland	Short	0, 1
	WTL_CR_Shoreline_100	Short	0, 1
	WTL_CR_ANSI	Short	0, 1
	WTL_CR_Watercourse	Short	0, 1
	WTL_CR_Wetland	Short	0, 1
	WTL_CR_Total	Short	1 to 5
	Study_Area	Short	0, 1

Group Connected Vegetation Features all

This Feature Class was created by exporting Connected Vegetation Features from the Perth_NH_Community_2015 Feature Class. Using values equal to one in the NH_ Connected_Featues field, data was exported to a new Feature Class and all communities were dissolved using the NH_Connecting_Features field equal to one to create a seamless polygon Group_Connected_Features, Feature Class.

Feature Class	Field Name	Type	Parameters
Group_Connecting_Features_all	Connecting_Feature	Short	0, 1
	Study_Area	Short	0,1

Group Connected Vegetation Features

This feature class was created from the Group_Connected_Feature_all, feature class. The values >0.5ha in shape field were exported to a new feature class.

This feature class support the criteria information for the Connected Vegetation Feature group.

Zero in the field indicates that it is not applicable to criteria or information and 1 indicates that it is applicable.

Field Name	Type	Parameters
CNF_CR_Valleyland	Short	0, 1
CNF_CR_Shoreline_100	Short	0, 1
CNF_CR_ANSI	Short	0, 1
CNF_CR_Watercourse	Short	0, 1
CNF_INF_Wetland	Short	0, 1
CNF_CR_Total	Short	0 to 5
Study_Area	Short	0,1

Group_Waterbody_All

This feature class was created by exporting Group_Waterbody_All from the Elgin_NH_Community_2015 Feature Class. Using values equal to one in the NH_Water field, data was exported to a new Feature Class and all communities were dissolved using the NH_Water field equal to one to create a seamless polygon Waterbody feature class.

Zero in the field indicates that it is not applicable to the Information being provided and 1 indicates that it is applicable.

Group _Waterbody

This feature class was created from the Group_Waterbody_all feature class. The values in the >0.5ha in shape field were exported to a new feature class.

This feature class support the criteria information for the Waterbody group.

Zero in the field indicates that it is not applicable to criteria or information and 1 indicates that it is applicable.

Field Name	Type	Parameters
WBY_CR_Valleyland	Short	0, 1
WBY_CR_Shoreline_100	Short	0, 1
WBY_CR_ANSI	Short	0, 1
WBY_CR_Watercourse	Short	0, 1
WBY_CR_Total	Short	0 to 4
Study_Area	Short	0,1

Valley_Shoreline_Landform

Valley Land data was created according to description in report. This layer represents the major valley areas within the County. The shoreline is defined using SWOOP 2015, estimated from top of bluff to 1 km into the lake.

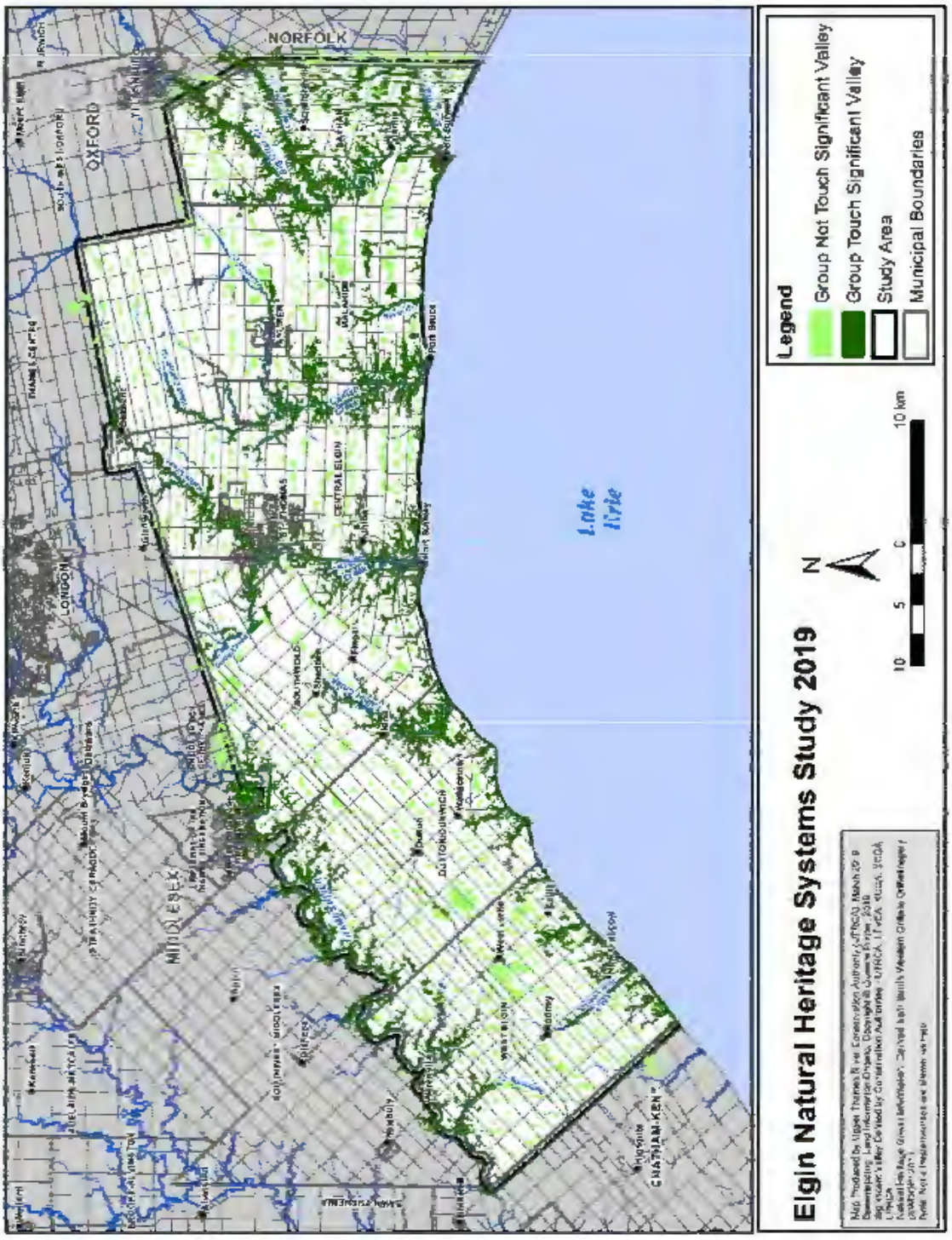
Field Name	Type	Parameters
CA	Text	Kettle Creek, Catfish Creek, Long Point Region, Lower Thames Valley
Landform	Text	Valley Landform, Great Lakes Bluff and Deposition (Shoreline Zone)

Elgin_NH_Patch_2015_Cluster

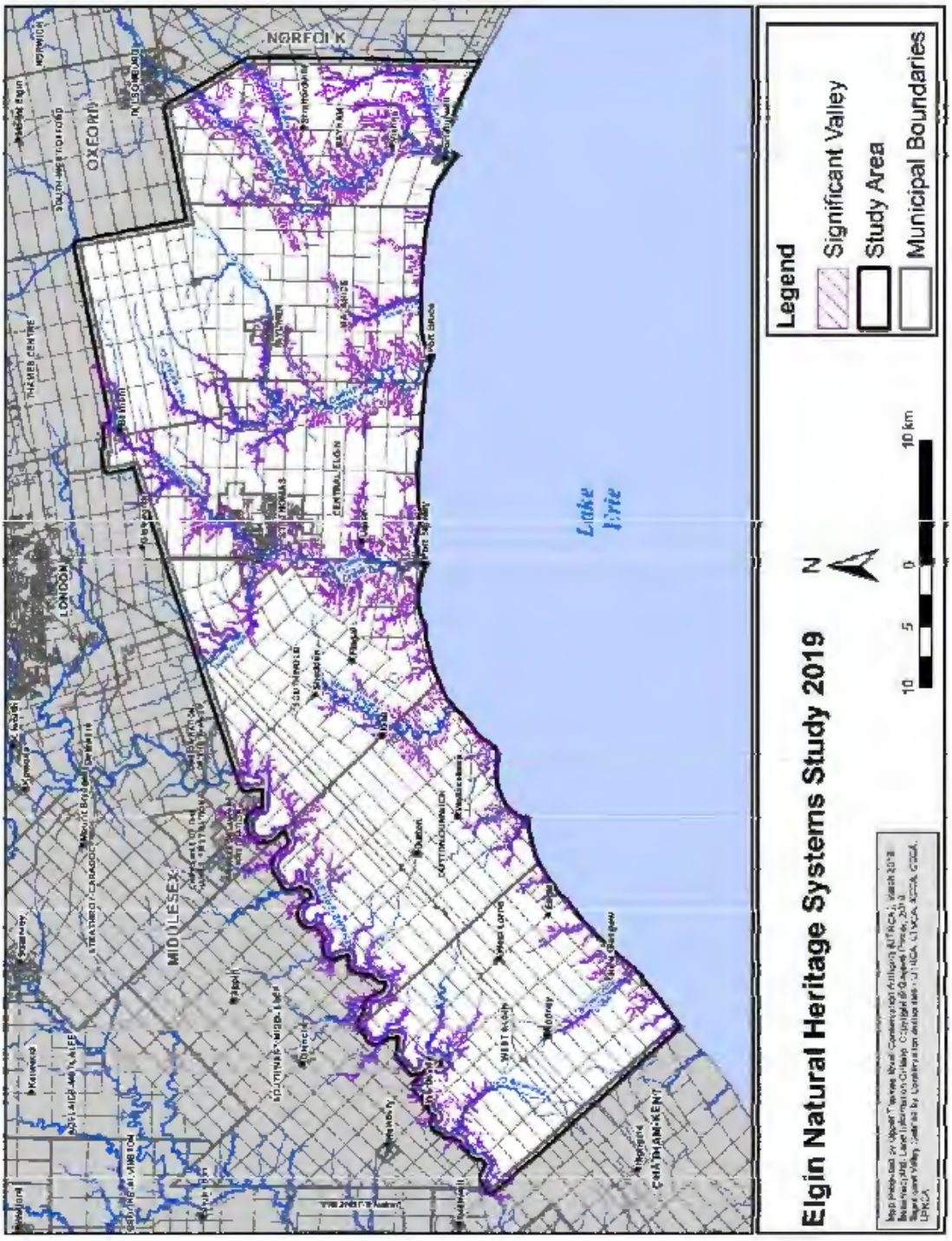
Elgin_NH_Patch_2015 Cluster feature class was created from Elgin_NHSS_Community_"Date" feature class. All communities were dissolved using the Patch Field that is equal to 1.

Field Name	Type	Parameters
Unique_ ID	Short	Unique Value, values over 6000 have been clustered
WDL_Cr_Significant	Short	0, 1
MDW_Cr_Significant	Short	0, 1
THK_Cr_Significant	Short	0, 1
WTL_Cr_Significant	Short	0, 1
WBY_Cr_Significant	Short	0,1
CNF_Cr_Significant	Short	0, 1
PTC_CR_Group	Short	0, 1
PTC_CR_Diversity	Short	0, 1
PTC_CR_Proximity	Short	0 ,1
PTC_CR_Total	Short	0, 1, 2
DIV_Community_Total	Short	0 to 15
DIV_Group_Total	Short	0 to 6
DIV_Ecosystem	Short	0 to 3
PTC_INF_GT_100ha	Short	0, 1
PTC_Group_CR_Total	Short	0 to 11
Study_Area	Short	0,1

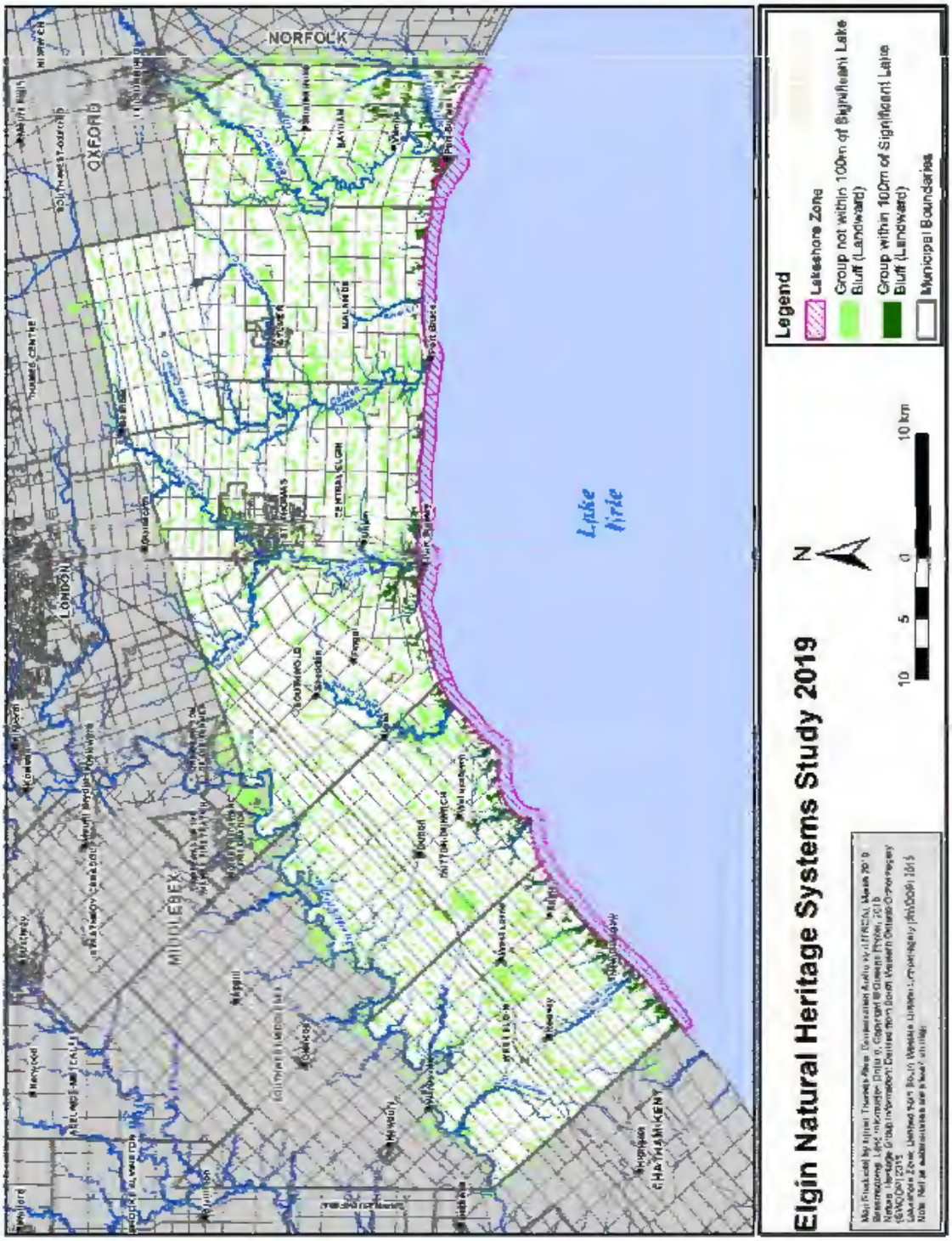
Appendix H-1. Criterion 1 Map, Vegetation Group within or touching a Significant Valleyland



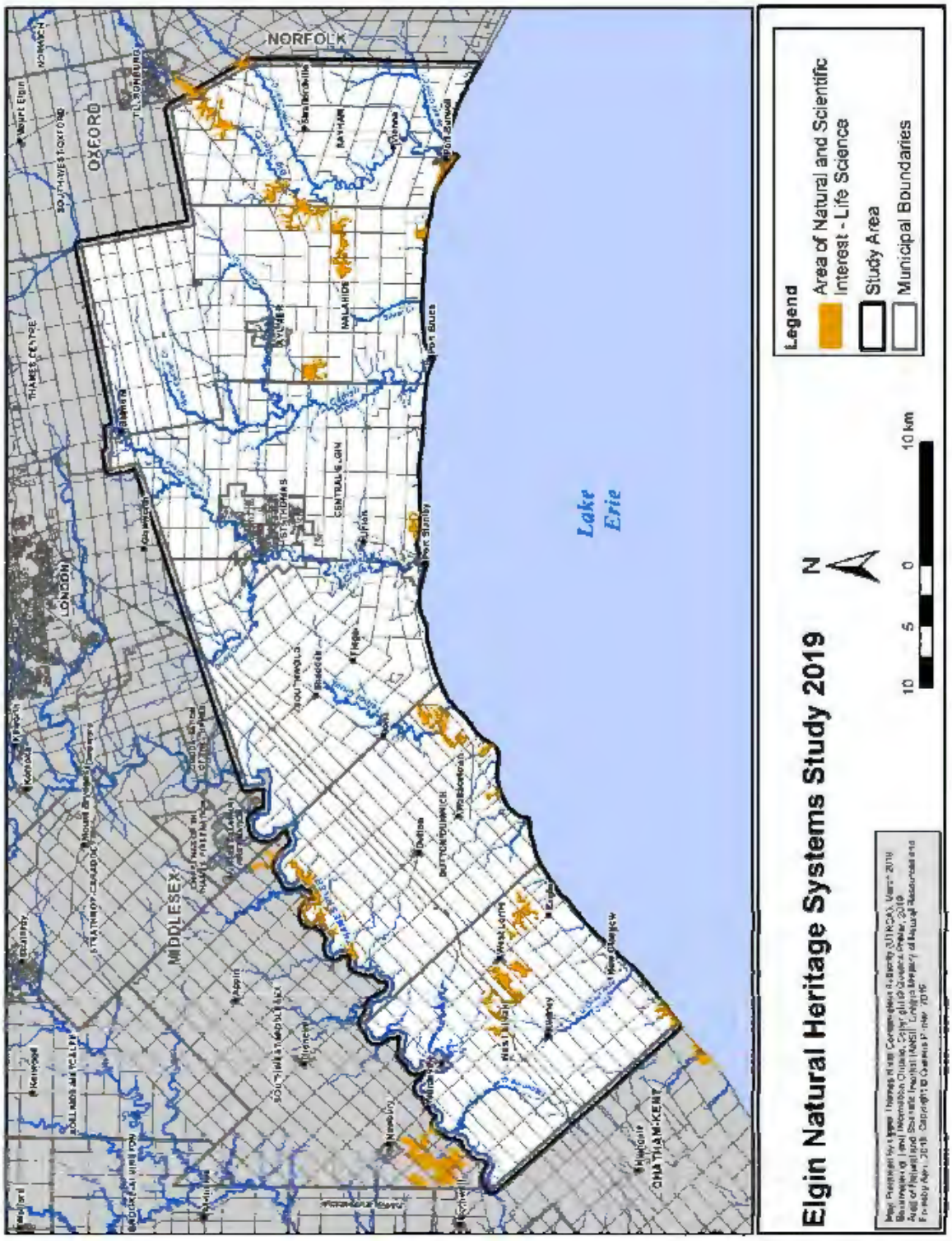
Appendix H-1-1. Significant Valleylands



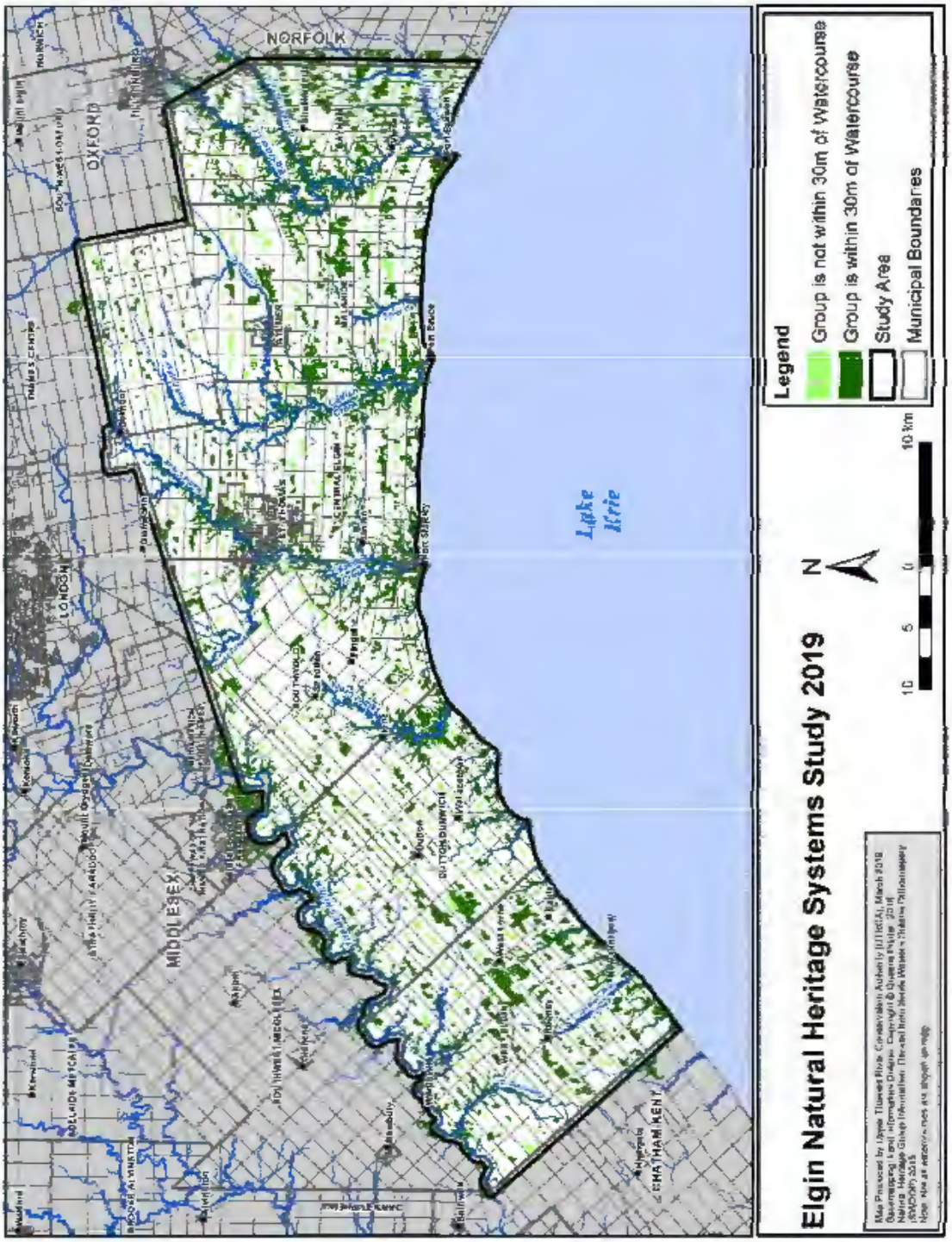
Appendix H-2. Criterion 2 Map, Vegetation Groups within 100m of the Shoreline Zone



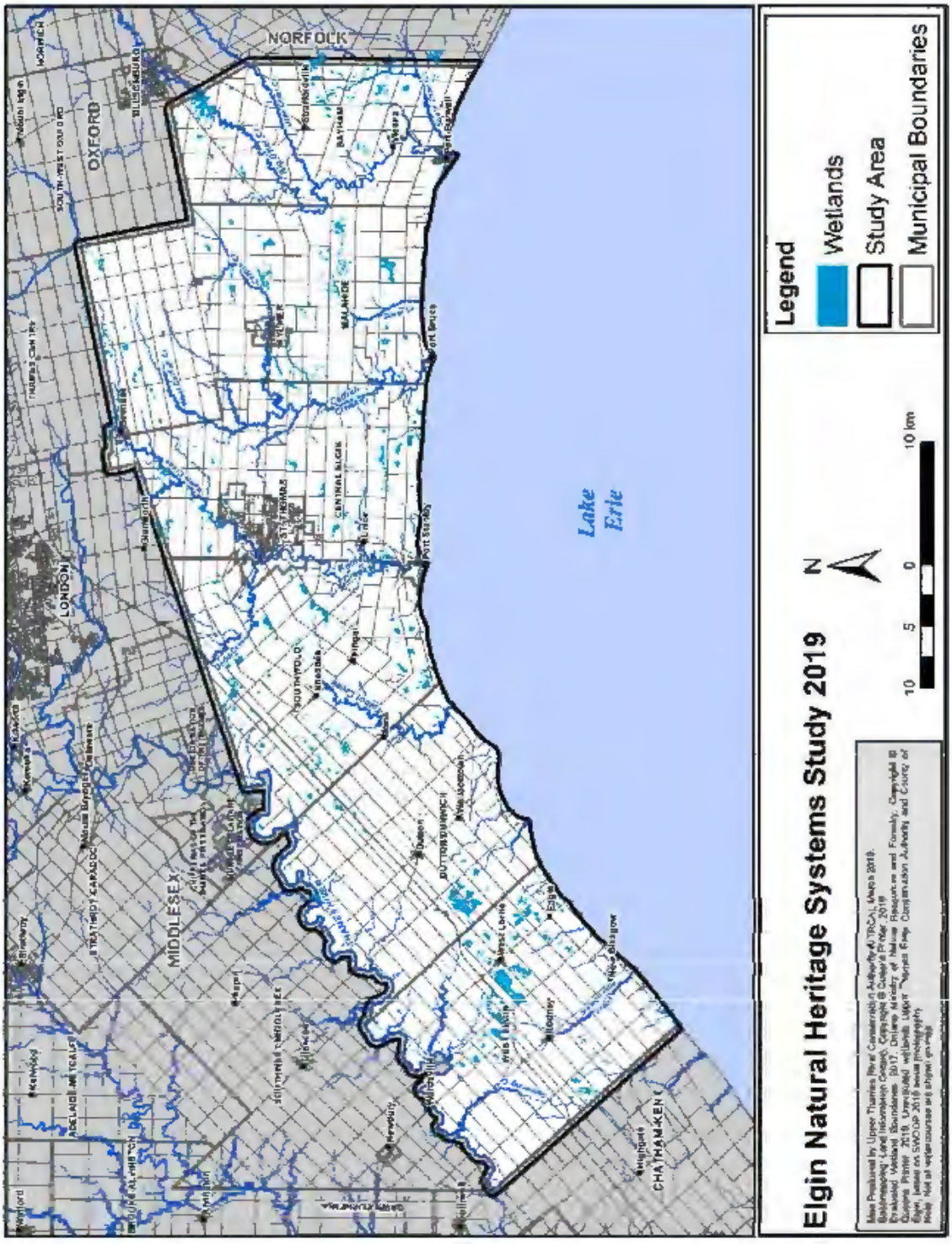
Appendix H-3. Criterion 3 Map, *Vegetation Groups* within or touching a Life Science ANSI



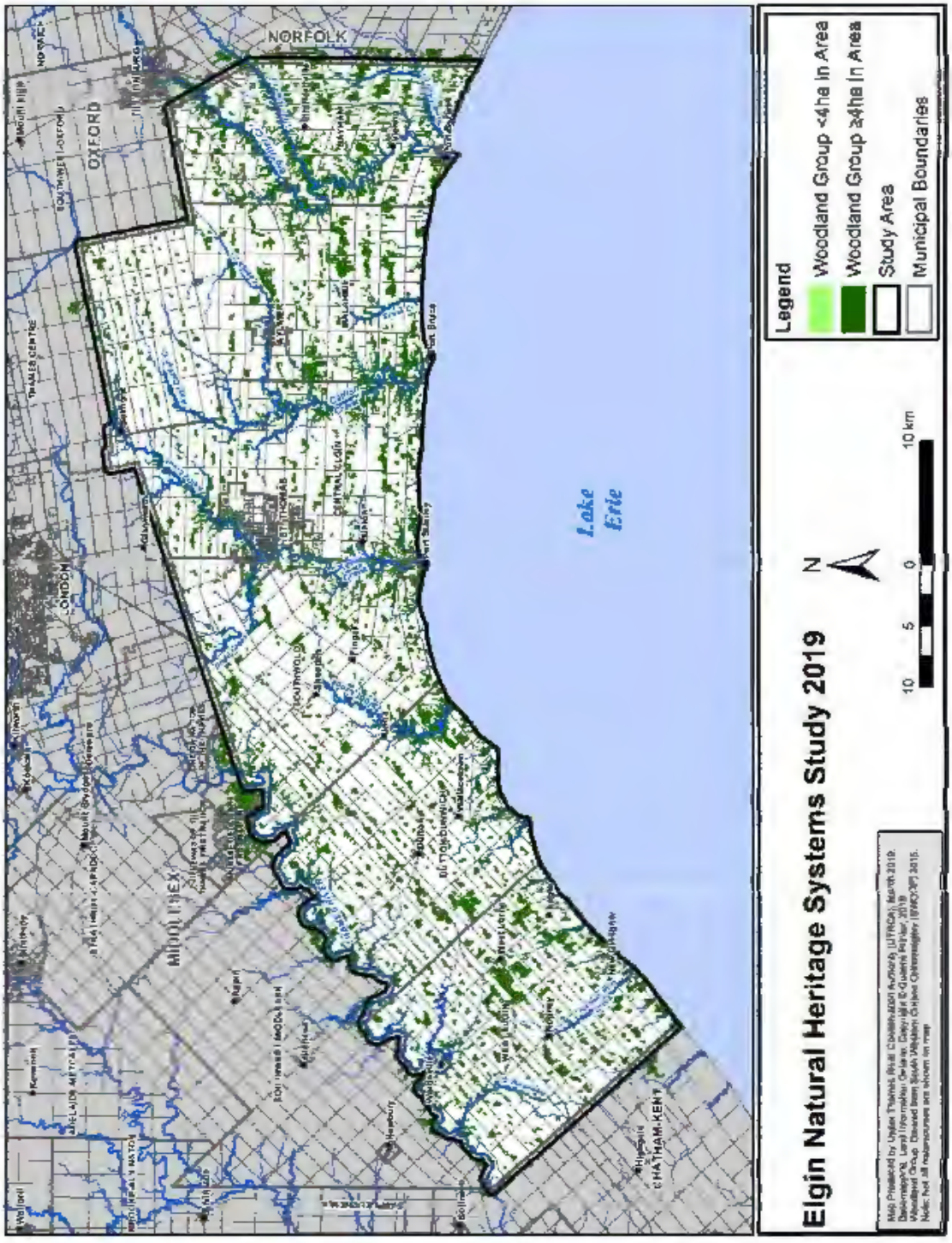
Appendix H-4. Criterion 4 Map, Vegetation Groups within 30 m of an open watercourse



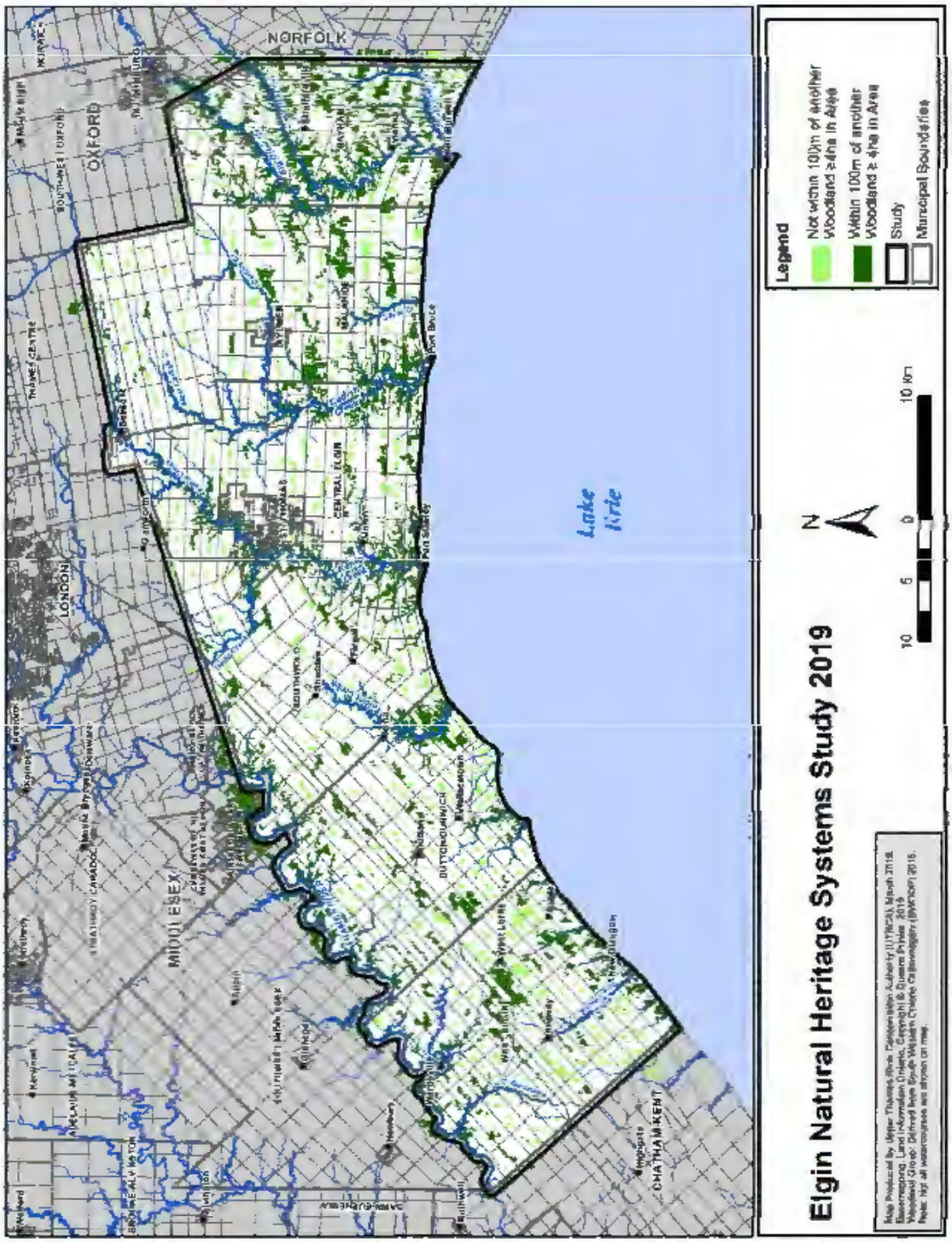
Appendix H-5. Criterion 5 Map, Wetlands (Evaluated)



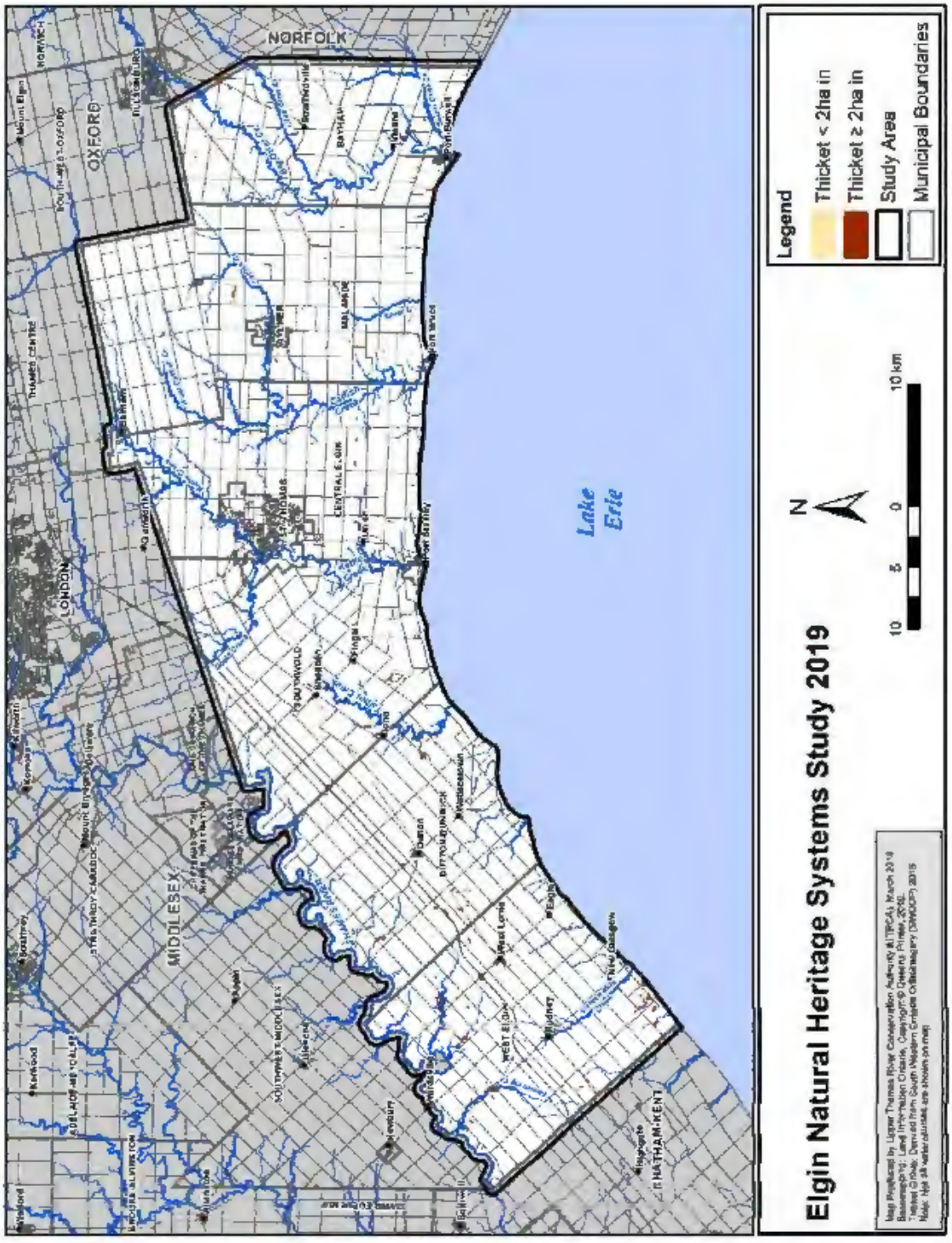
Appendix H-6. Criterion 6 Map, Woodland Size ≥ 4 ha



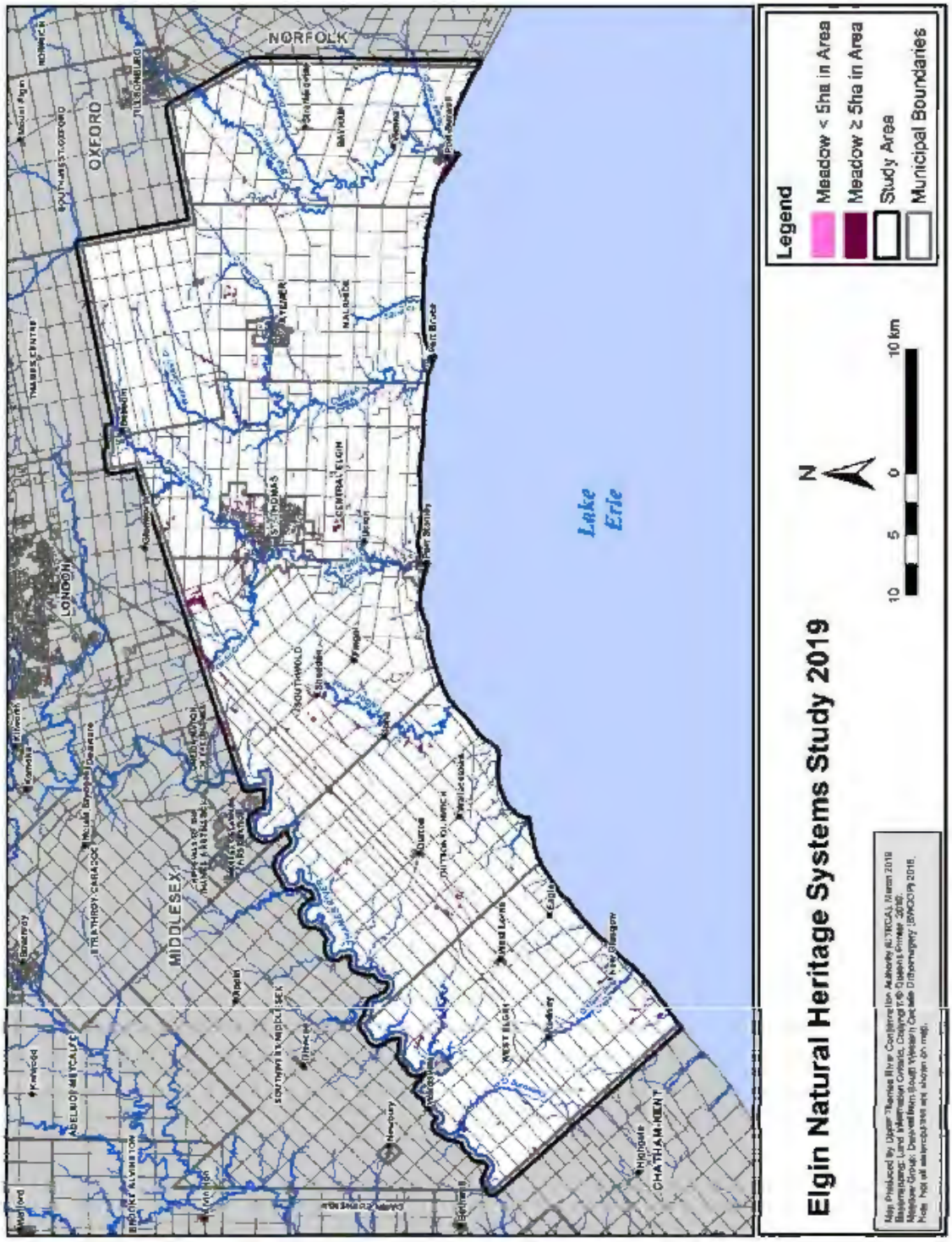
Appendix H-7. Criterion 7 Map, Woodlands within 100m of a >4 ha Woodland (Proximity)



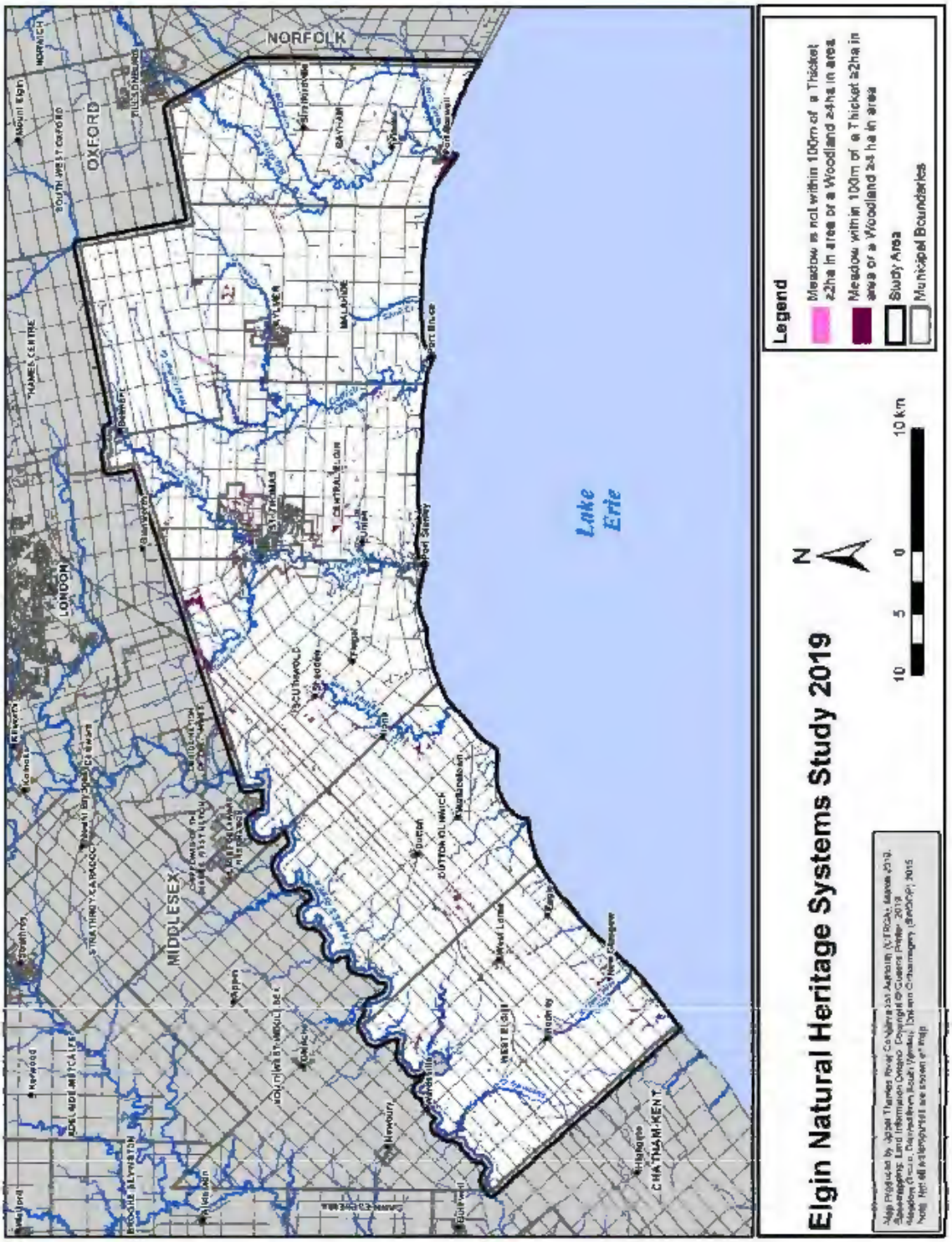
Appendix H-8. Criterion 8 Map, Thicket Group Size ≥ 2 ha



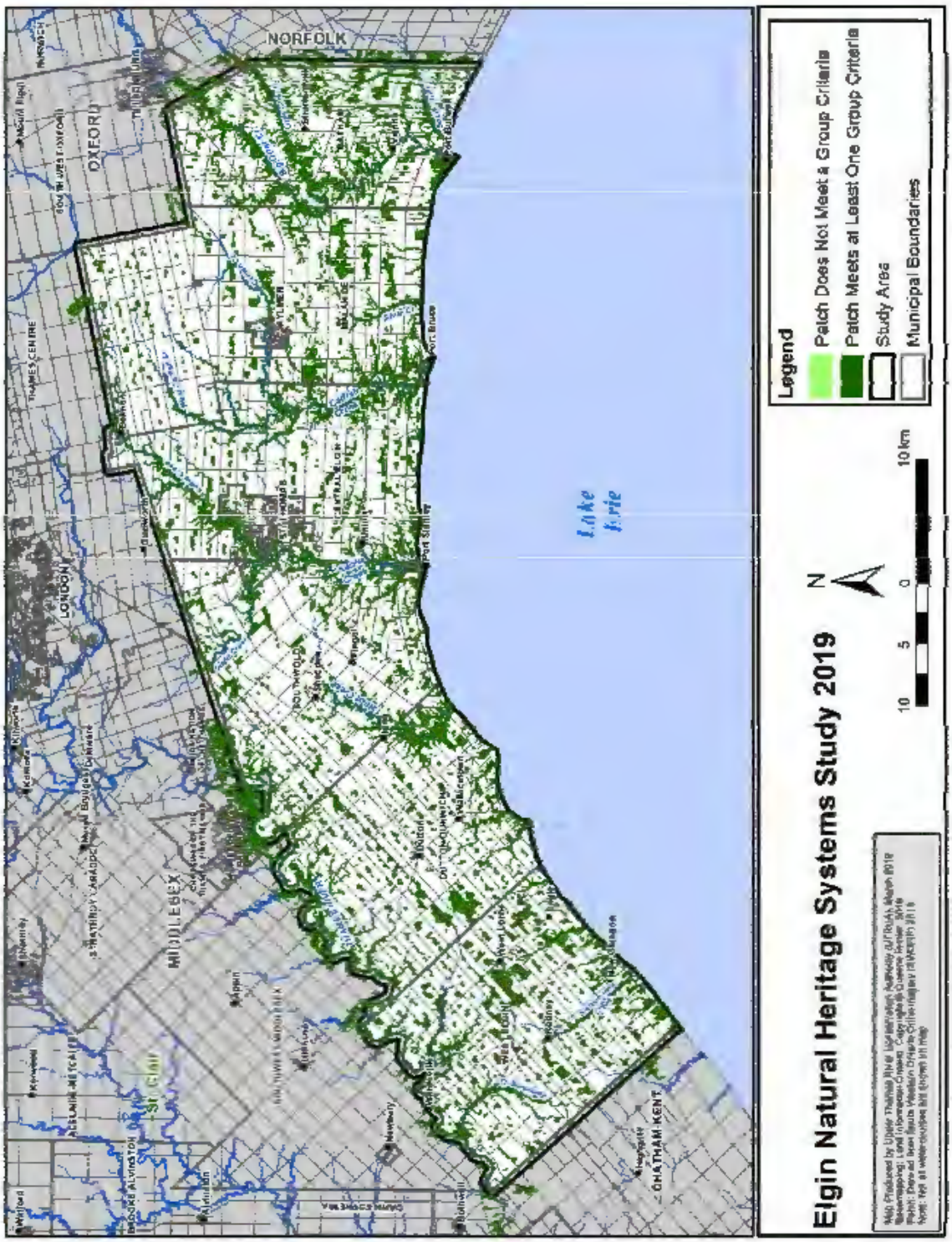
Appendix H-9. Criterion 9 Map, Meadow Size ≥ 5 ha



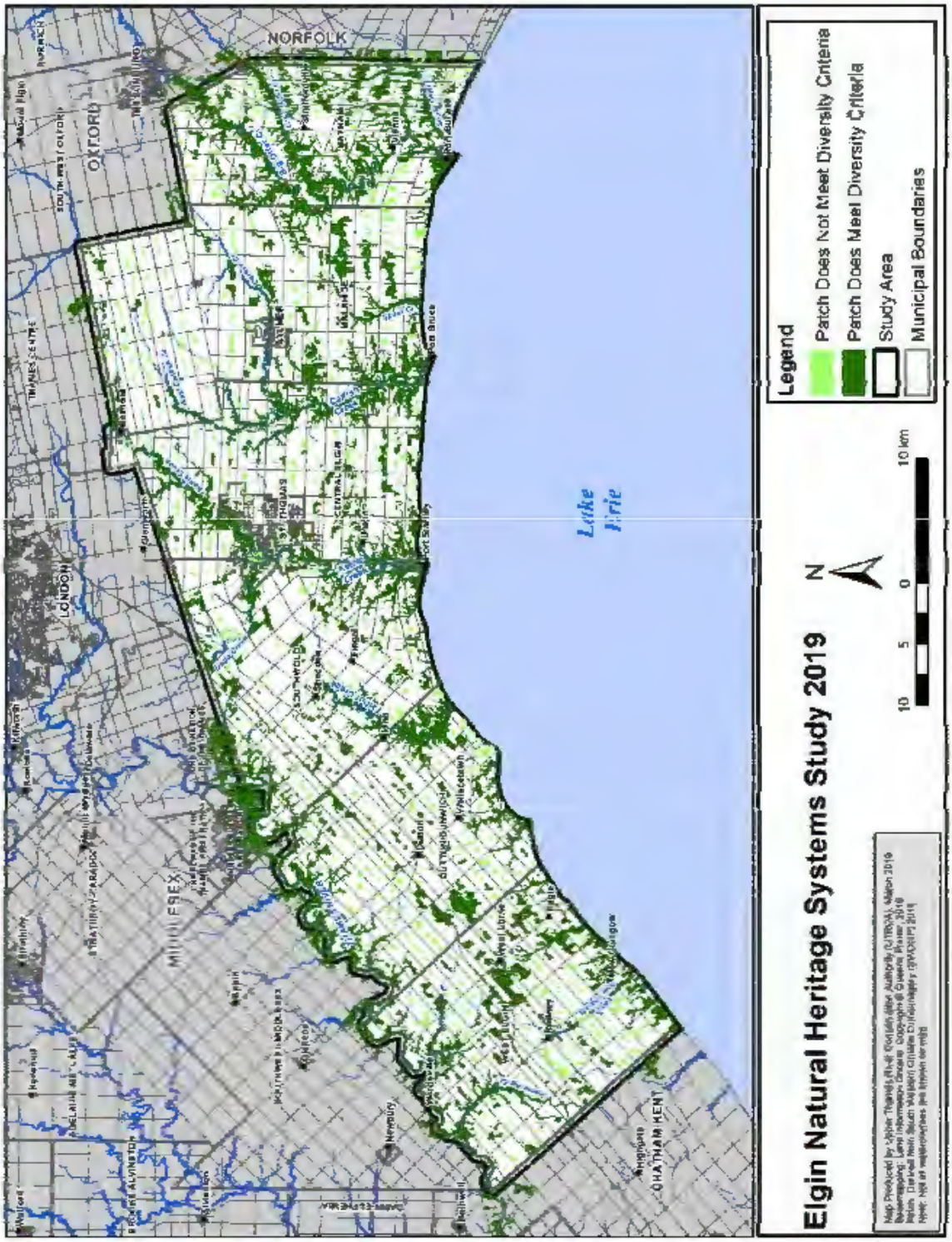
Appendix H-10. Criterion 10 Map, Meadow Group within 100m of a Thicket >2 ha or a Woodland >4 ha



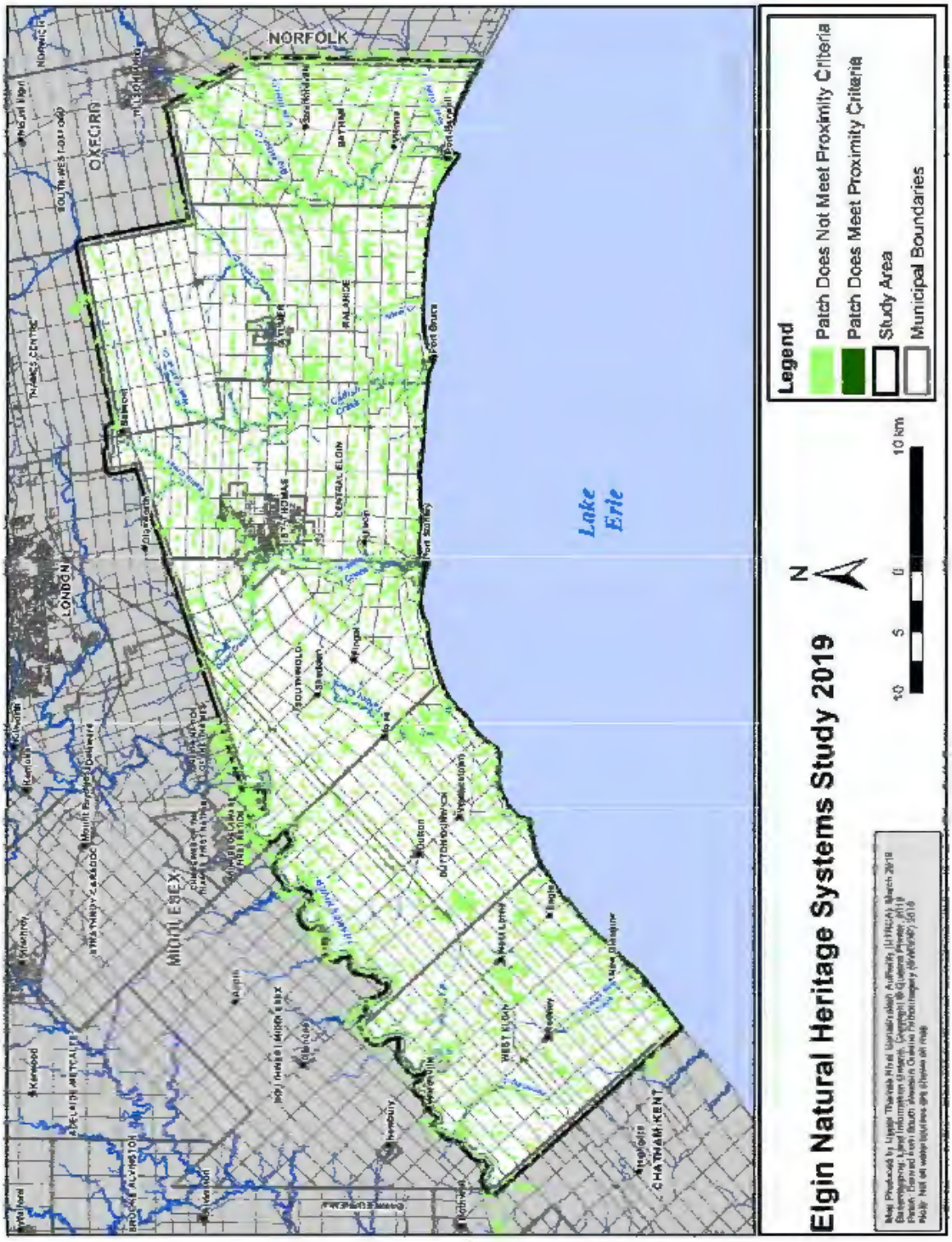
Appendix H-11. Criterion 11 Map, Patches that meet a Group Criteria



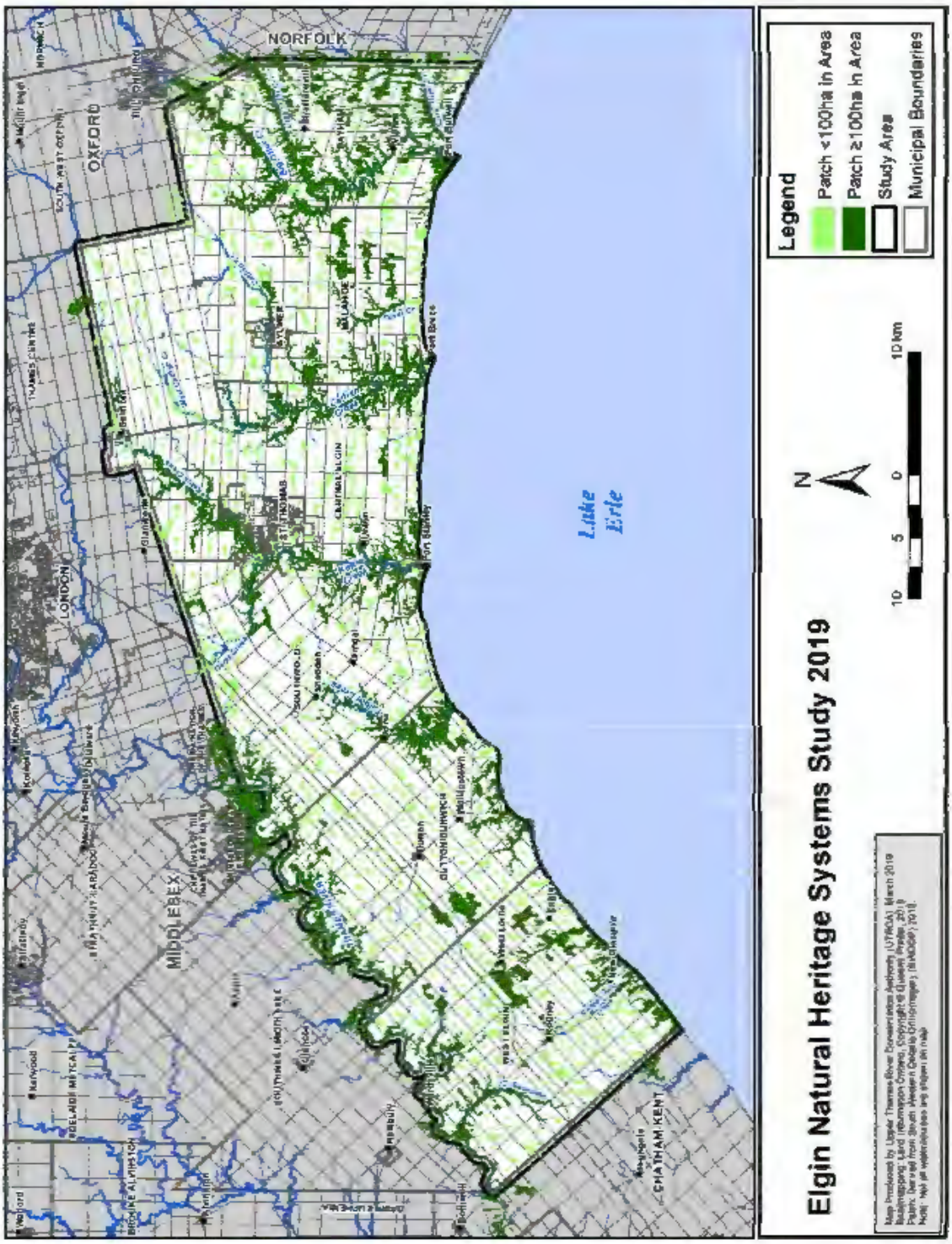
Appendix H-12. Criterion 12 Map, Diversity



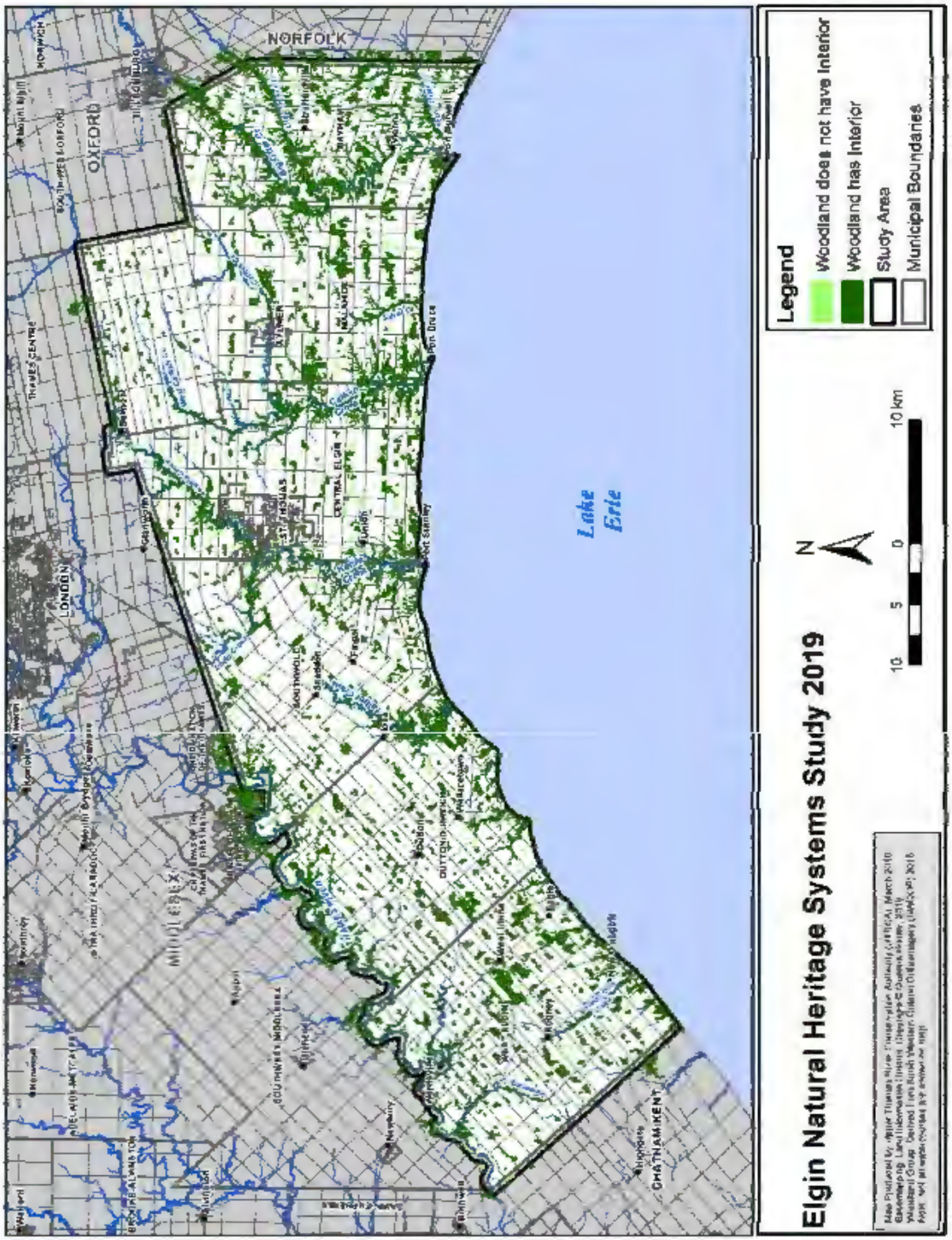
Appendix H-13. Criterion 13 Map, Patch Proximity



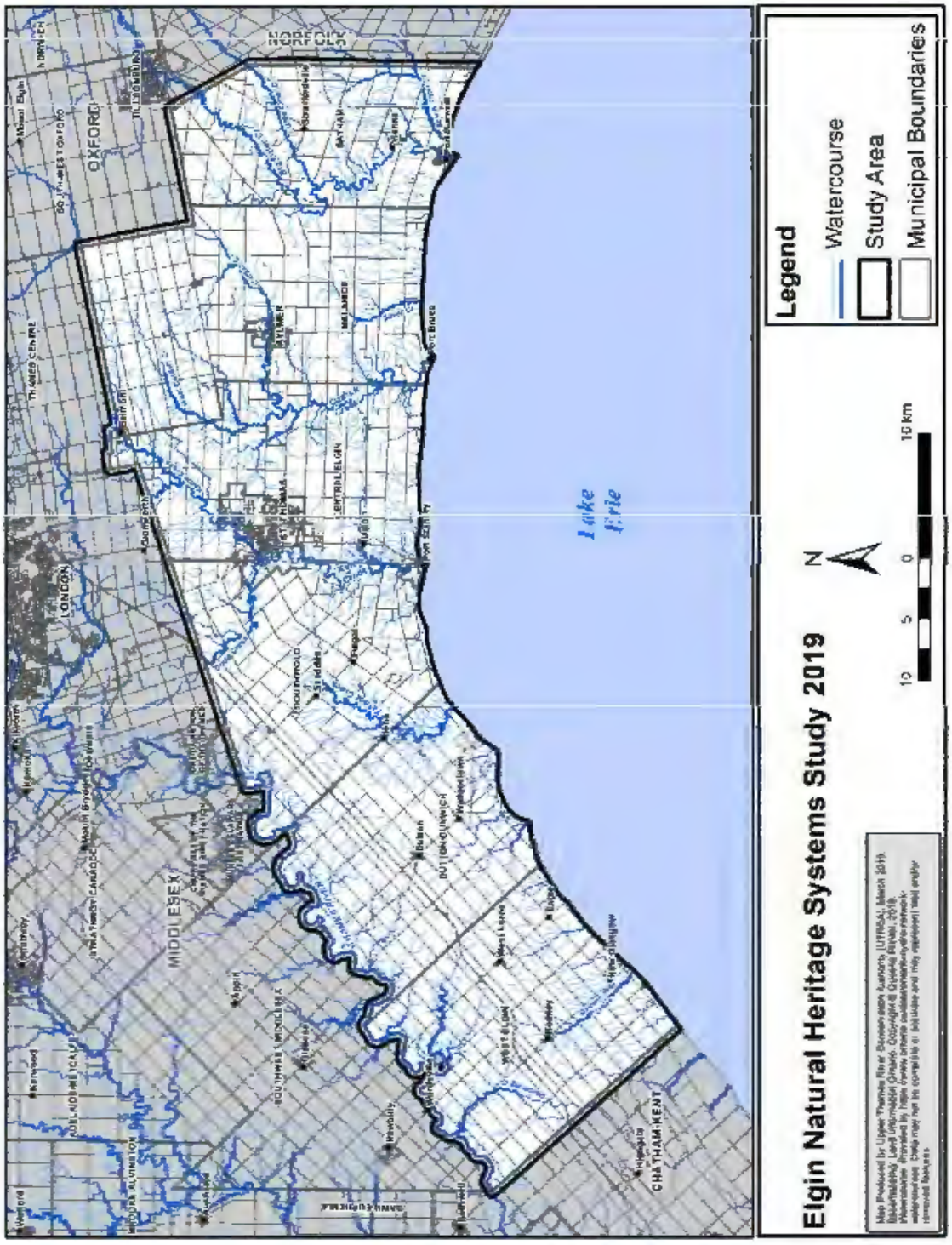
Appendix I-1. Map showing patches ≥100 ha



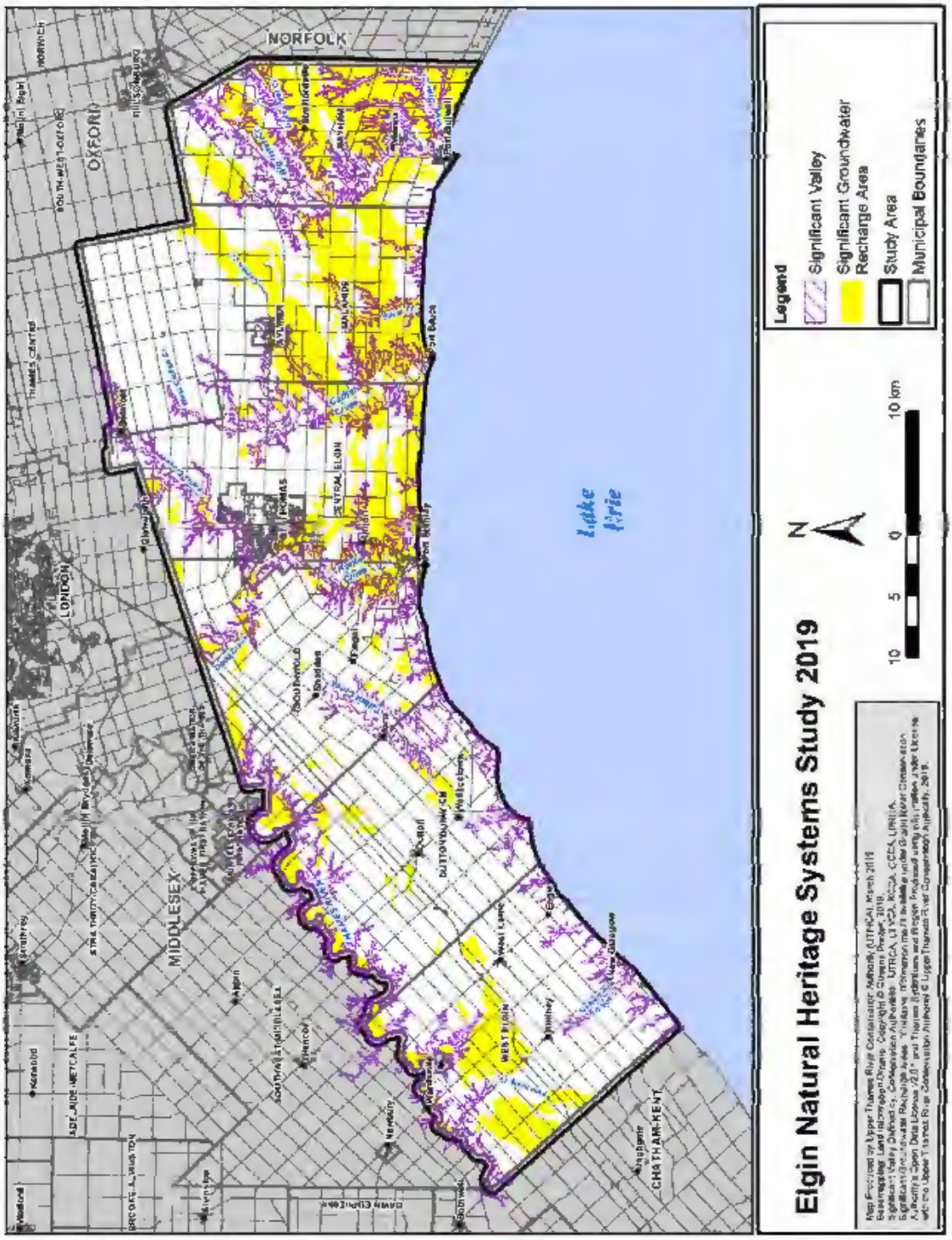
Appendix I-2. Map showing Woodlands that contain Woodland Interior



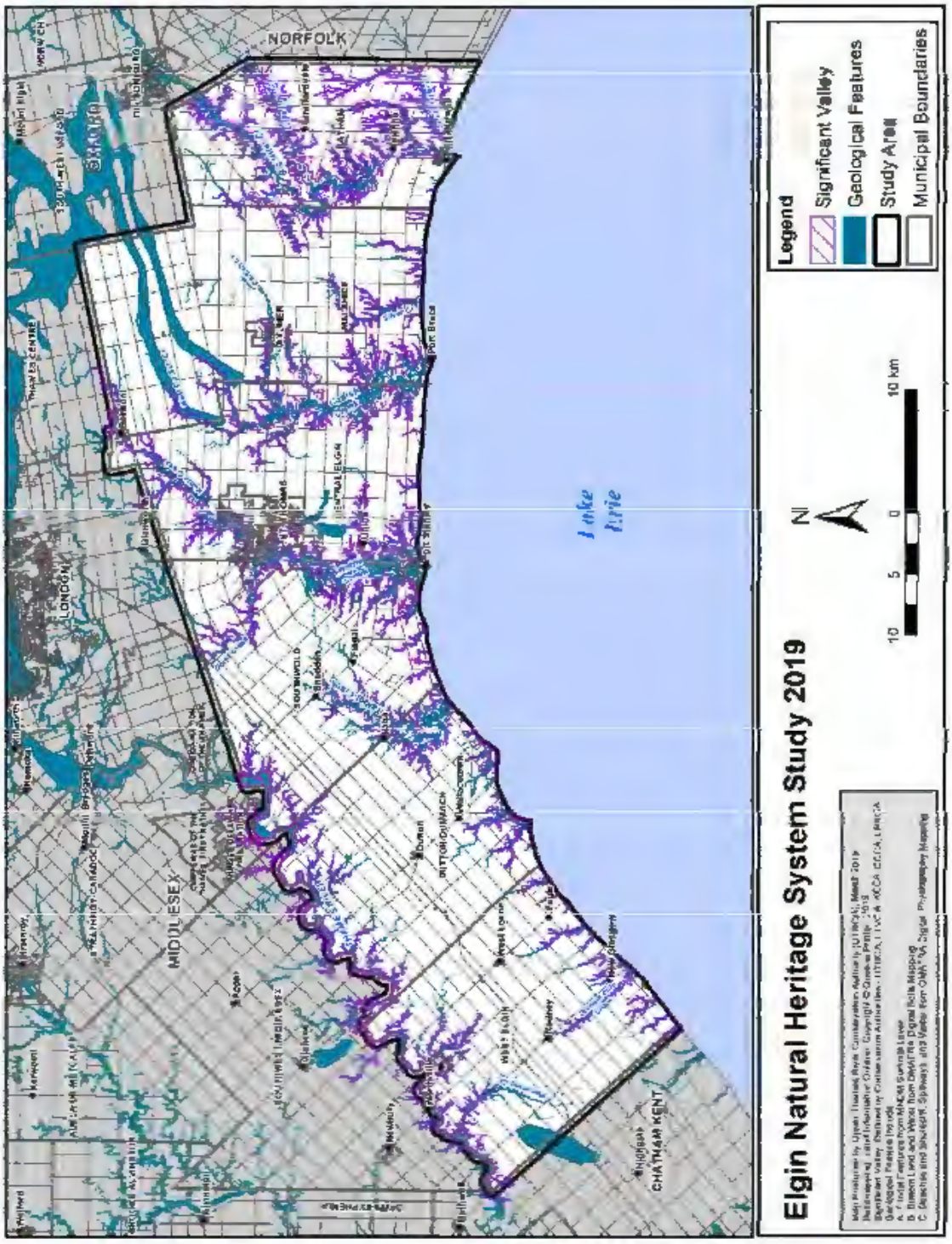
Appendix I-3. Map showing the watercourse layer (open and tiled)



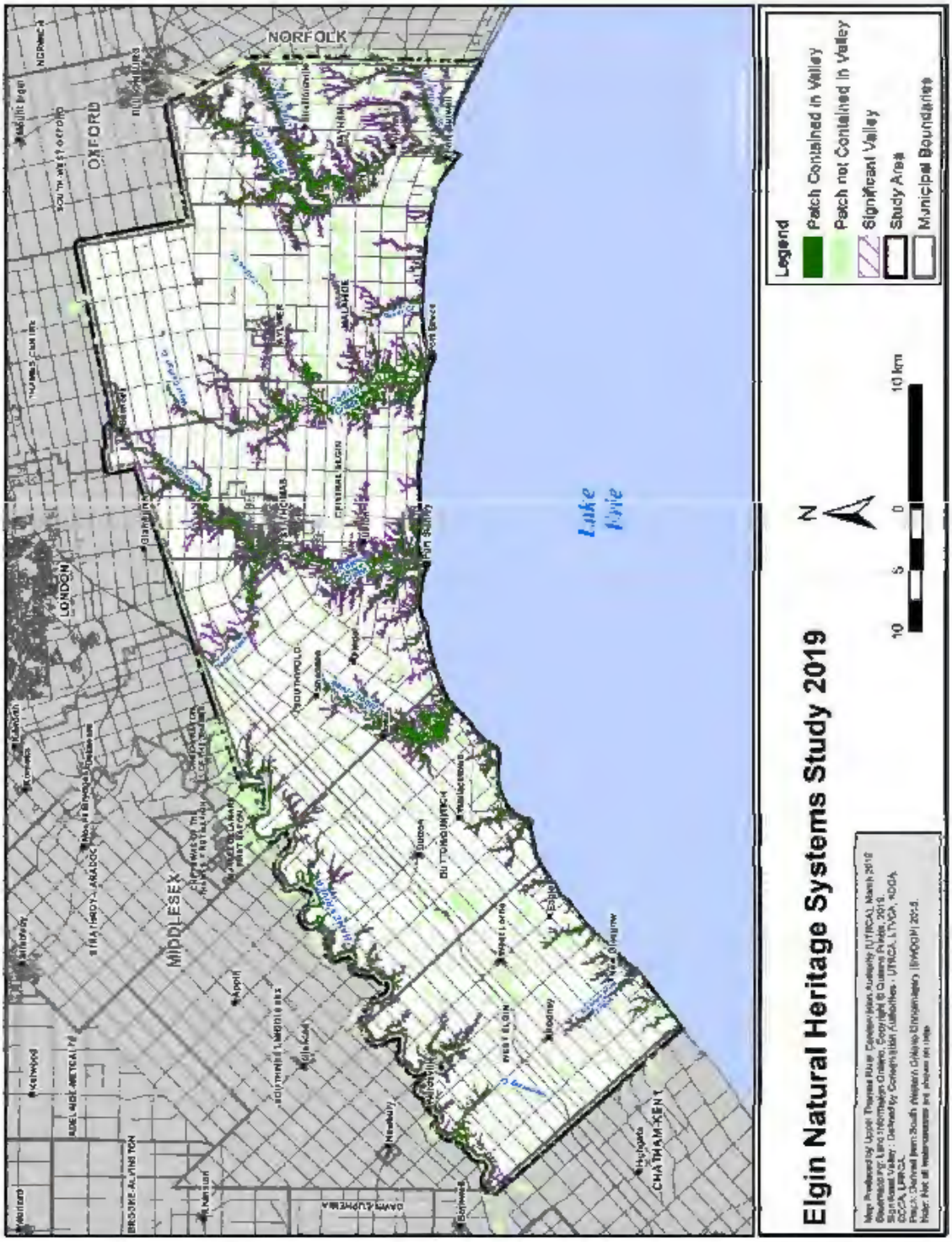
Appendix J-1. Valley in relation to Significant Groundwater Recharge



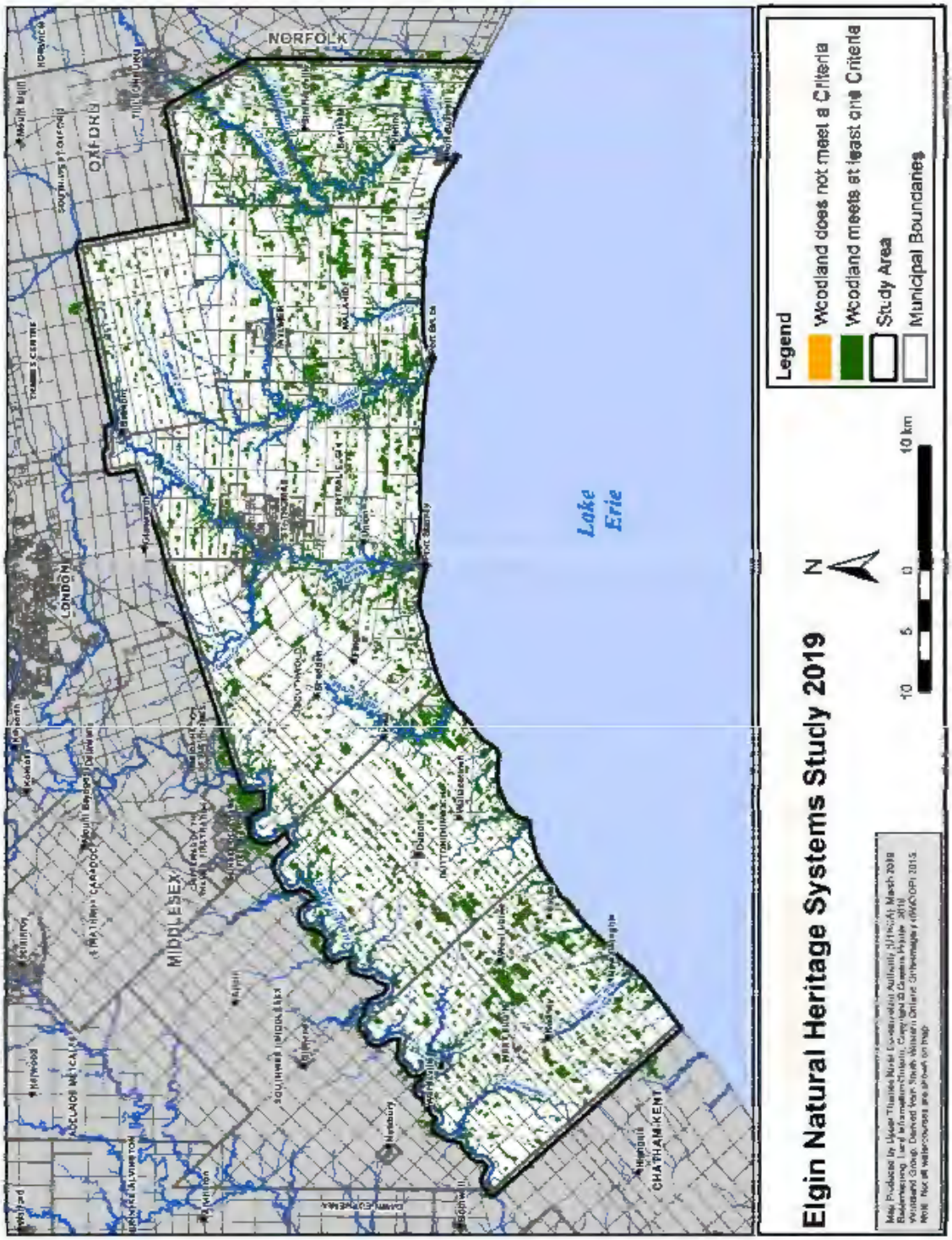
Appendix J-2. Valley in relation to Geological Features



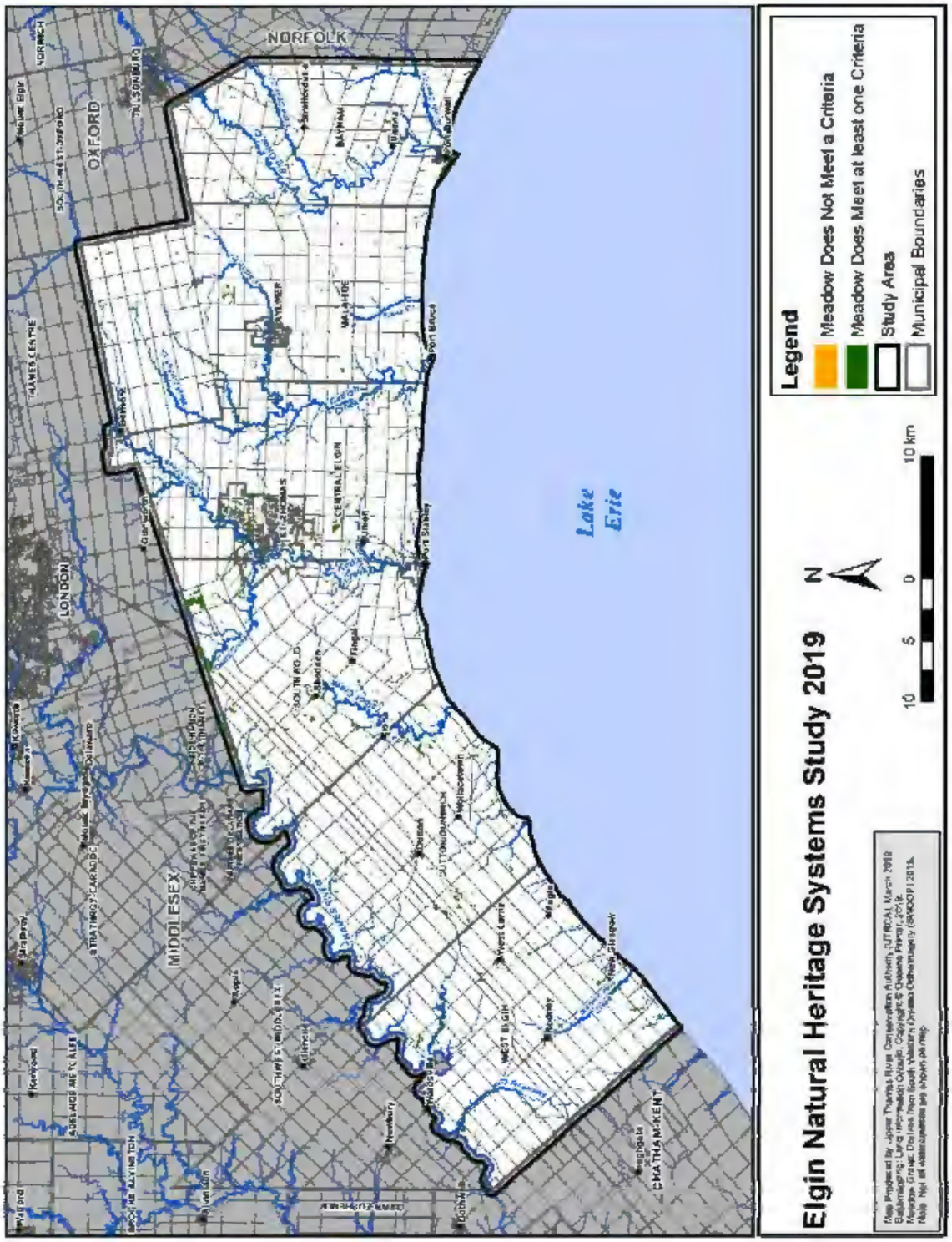
Appendix J-3. Valley in relation to vegetation patch cover



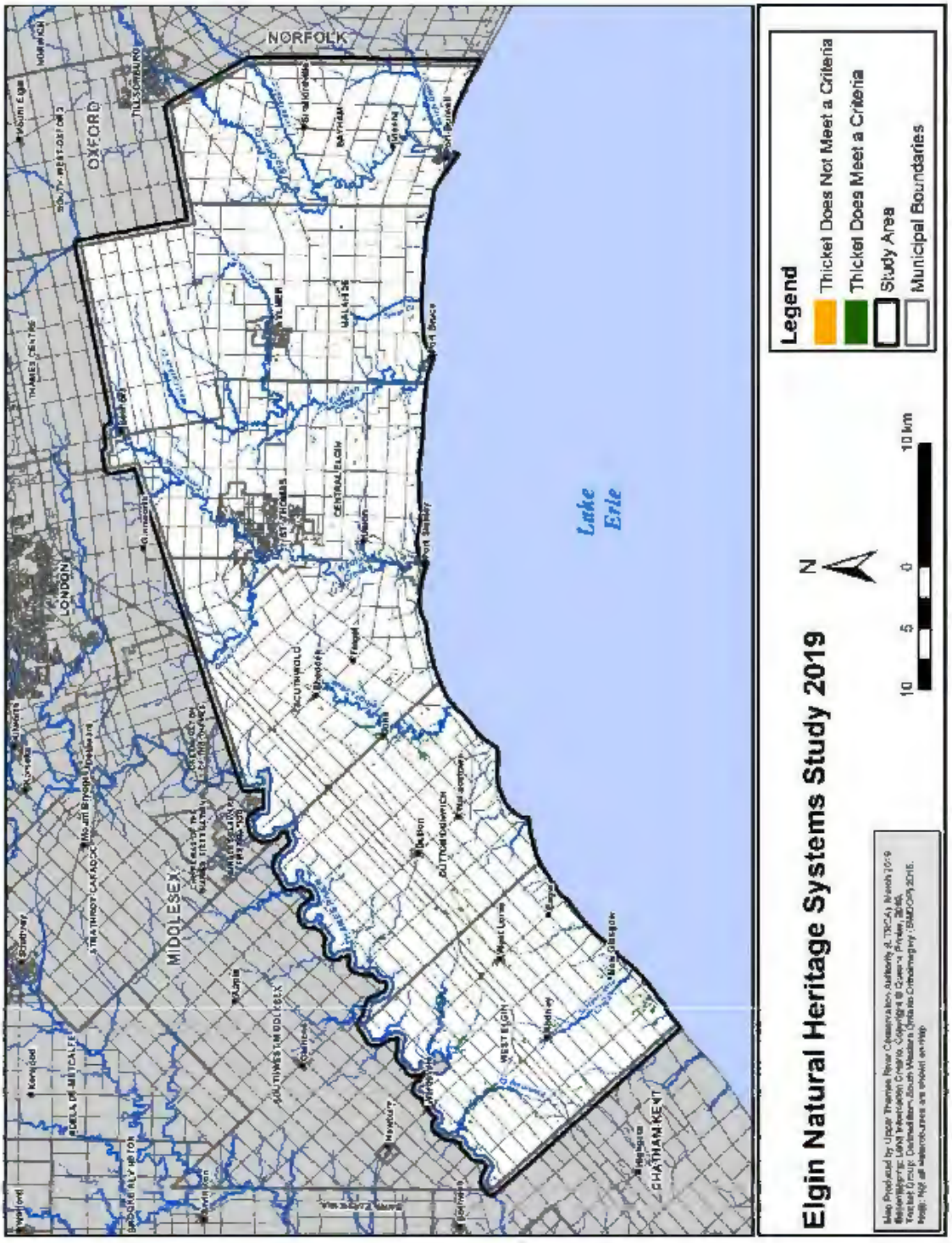
Appendix K-1. Woodland Groups that meet one or more criteria for Ecological Importance in Elgin



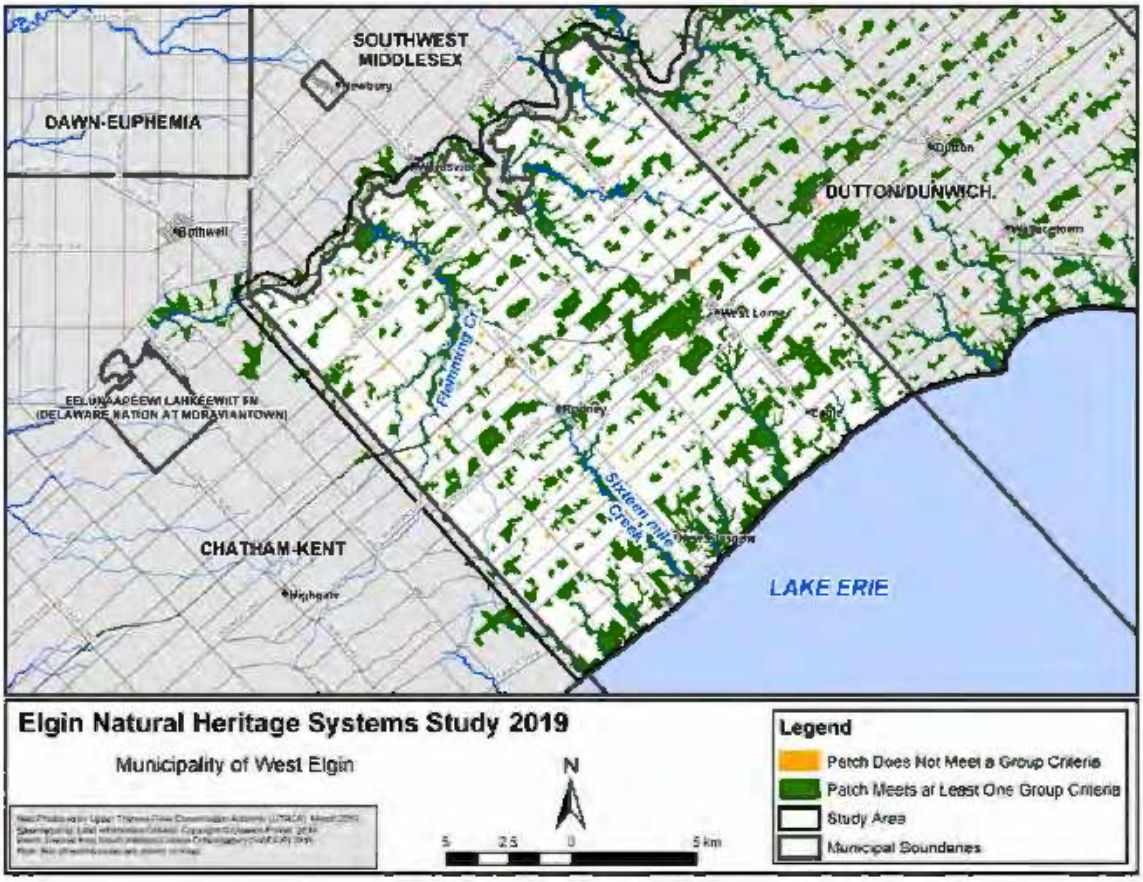
Appendix K-2. Meadow Groups that meet one or more criteria for Ecological Importance in Elgin



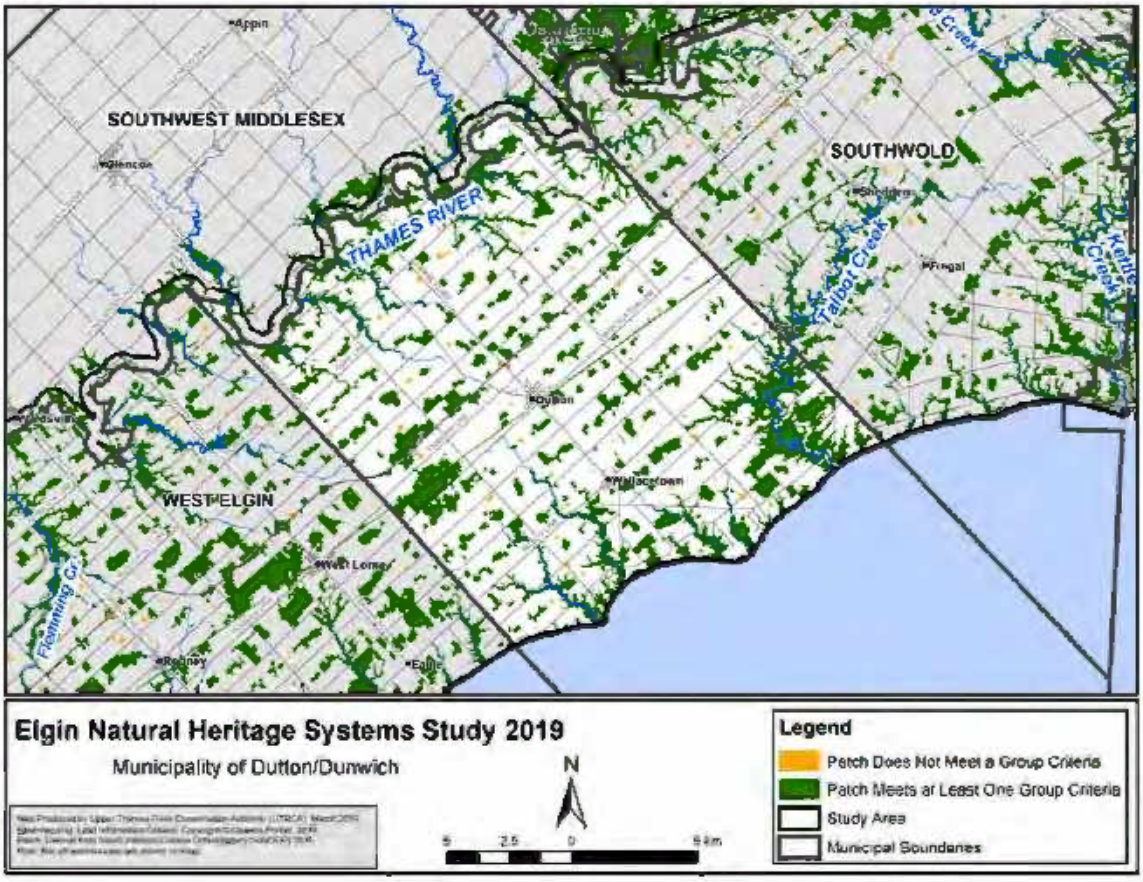
Appendix K-3. Thicket Groups that meet one or more criteria for Ecological Importance in Elgin



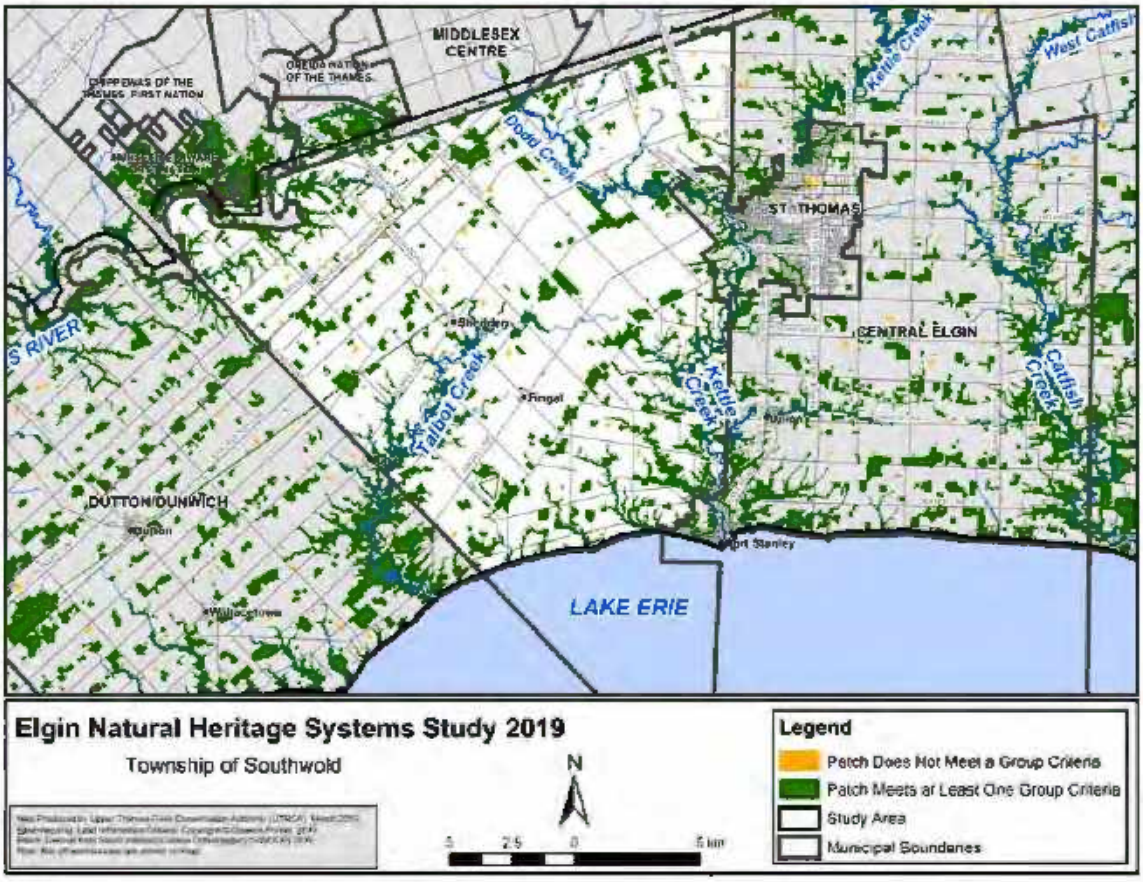
Appendix L-1. Patches that meet one or more criteria for Ecological Importance in West Elgin



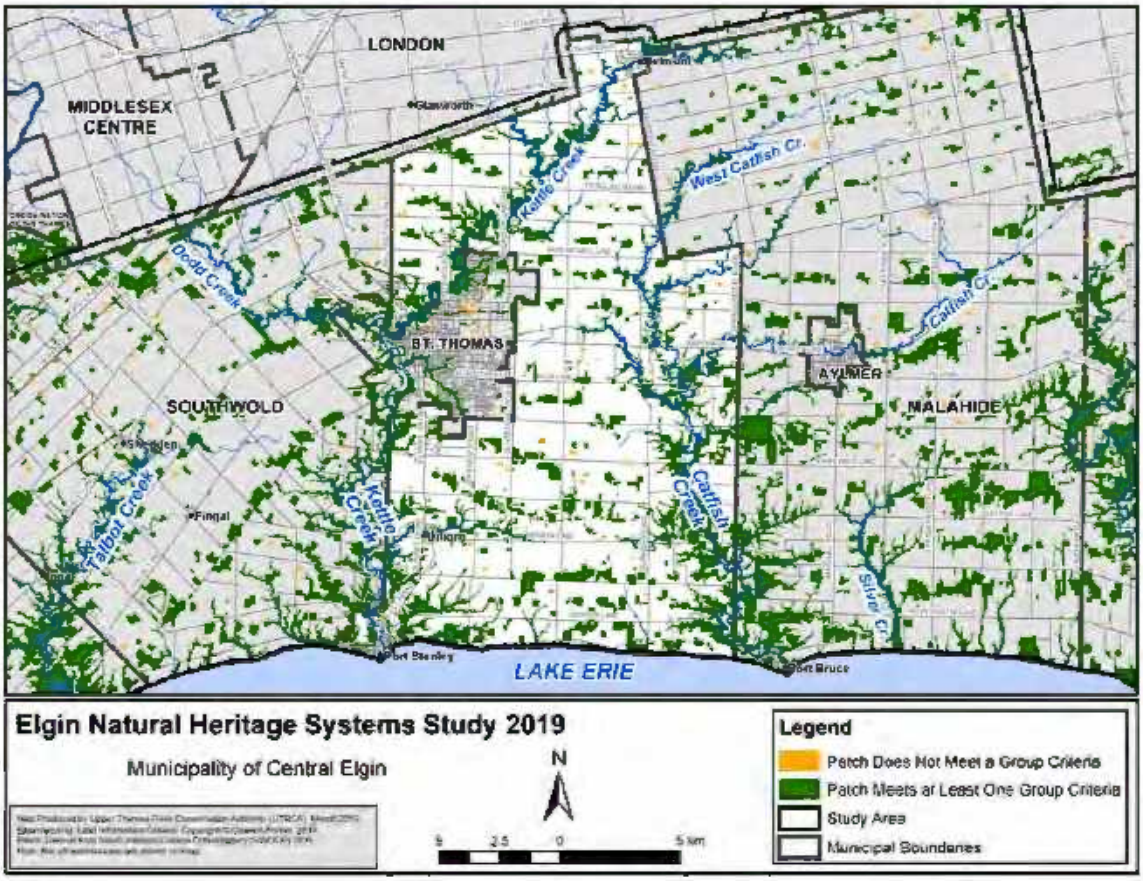
Appendix L-2. Patches that meet one or more criteria for Ecological Importance in Dutton/Dunwich



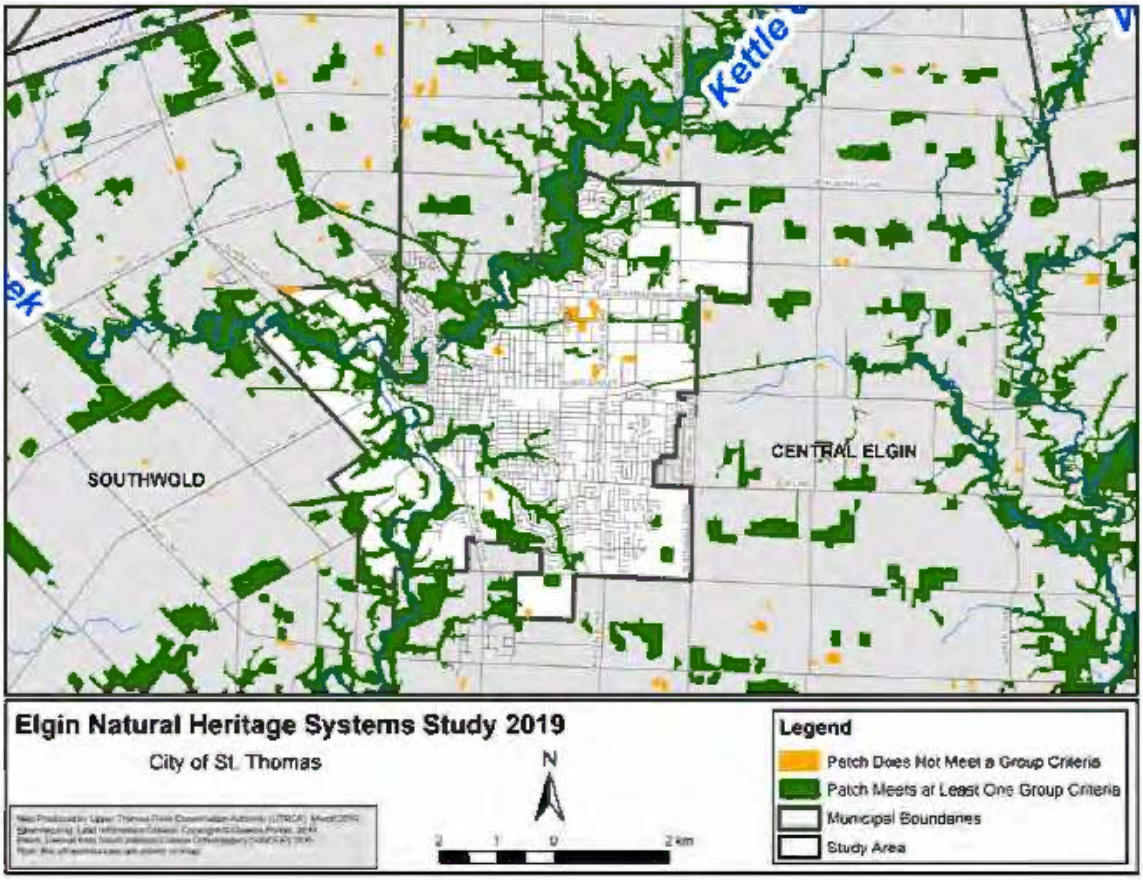
Appendix L-3. Patches that meet one or more criteria for Ecological Importance in Southwold



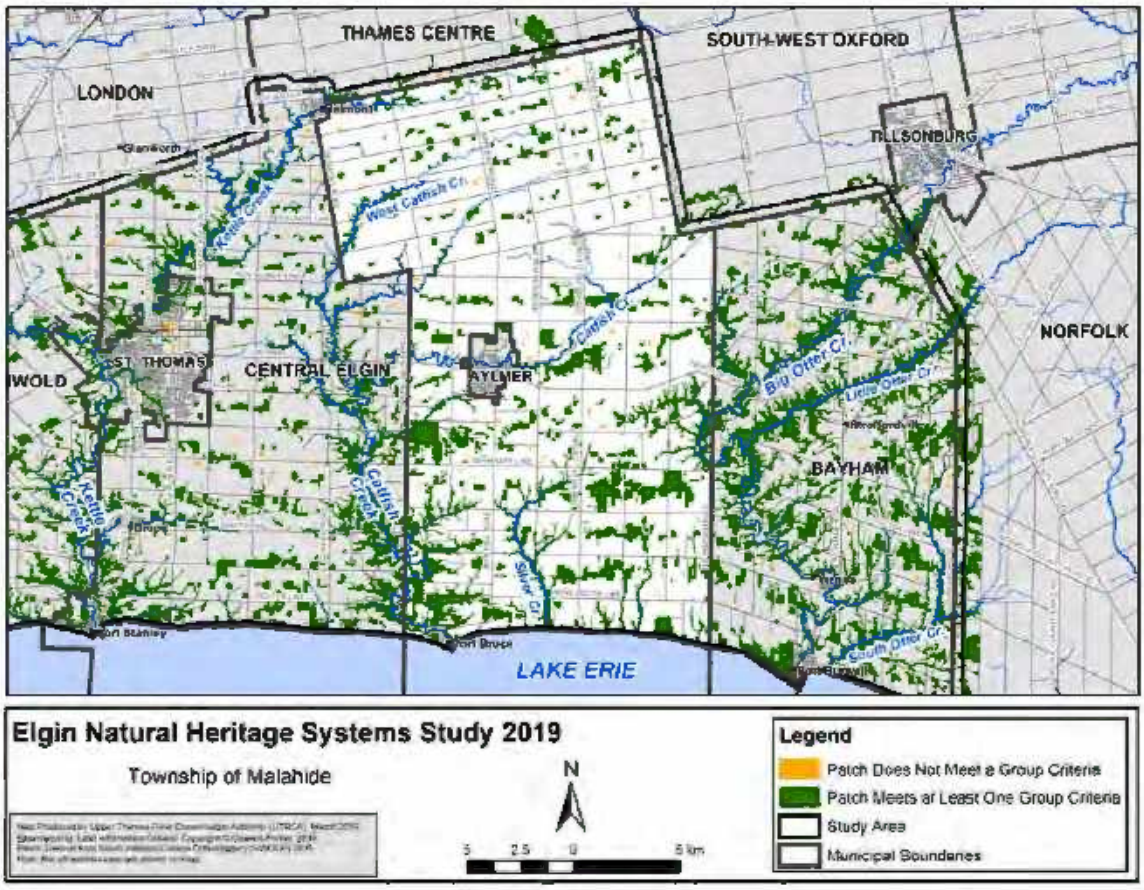
Appendix L-4. Patches that meet one or more criteria for Ecological Importance in Central Elgin



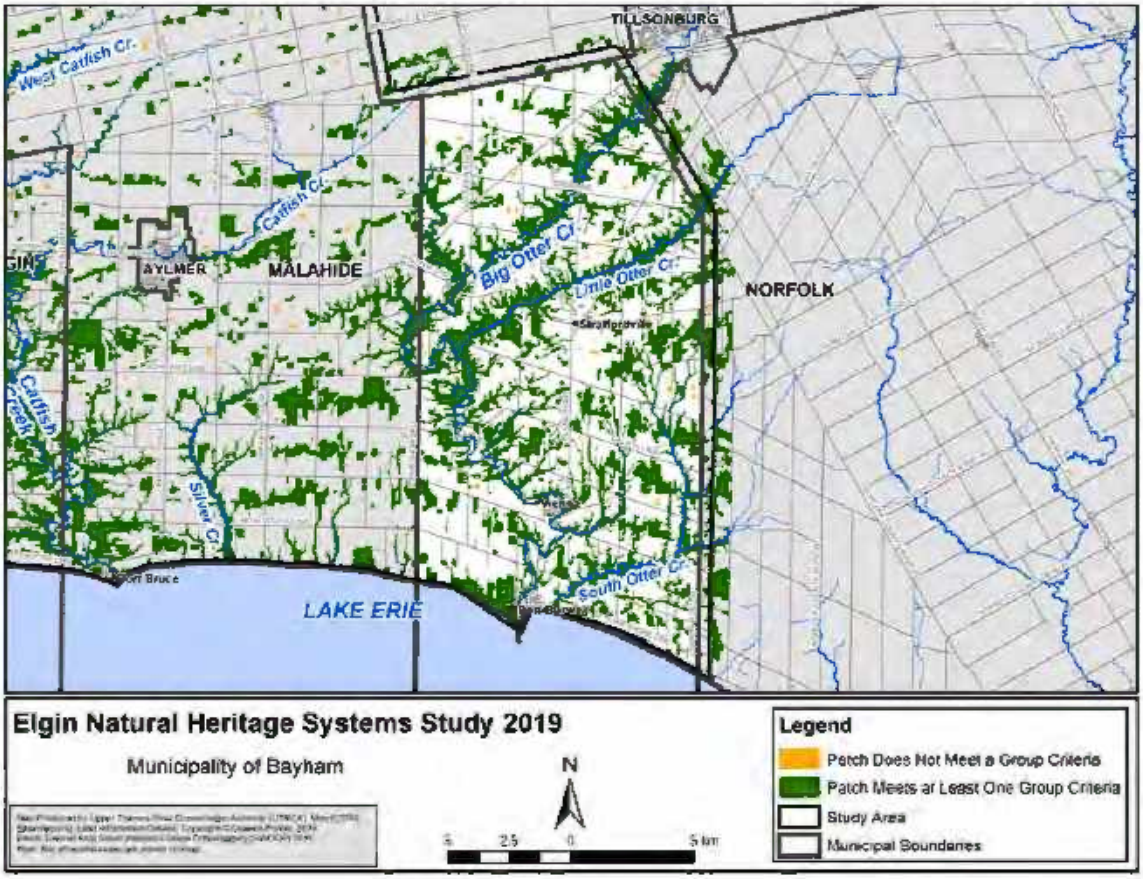
Appendix L-5. Patches that meet one or more criteria for Ecological Importance in St. Thomas



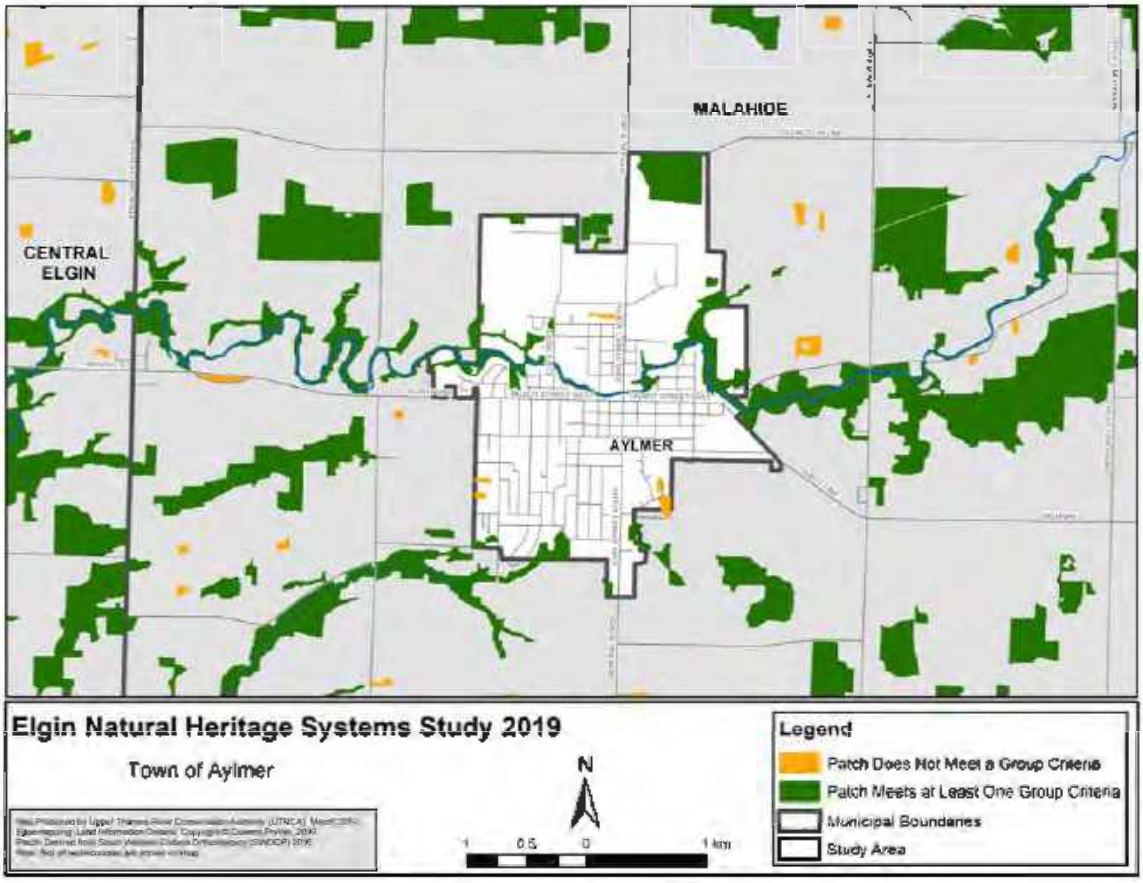
Appendix L-6. Patches that meet one or more criteria for Ecological Importance in Malahide



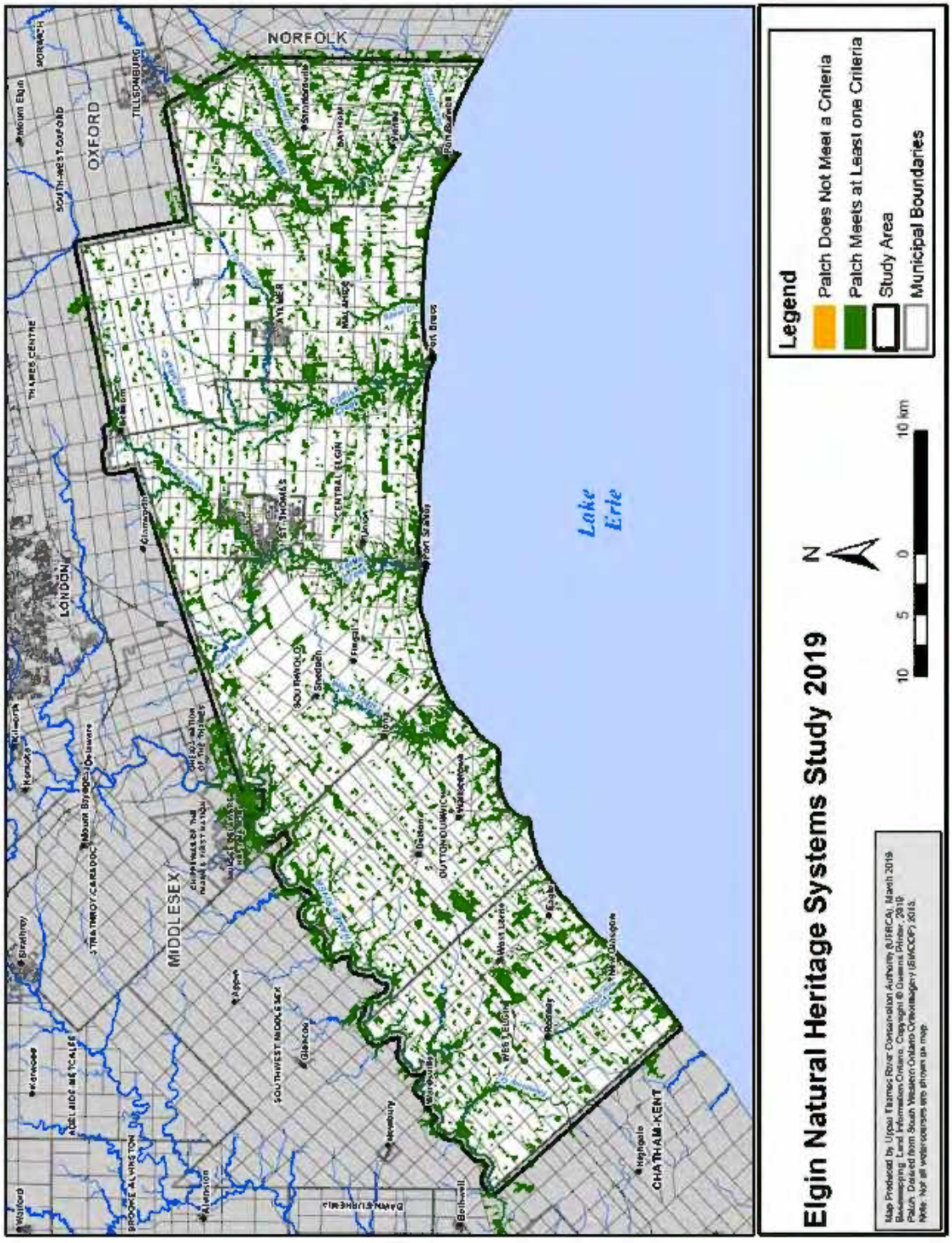
Appendix L-7. Patches that meet one or more criteria for Ecological Importance in Bayham



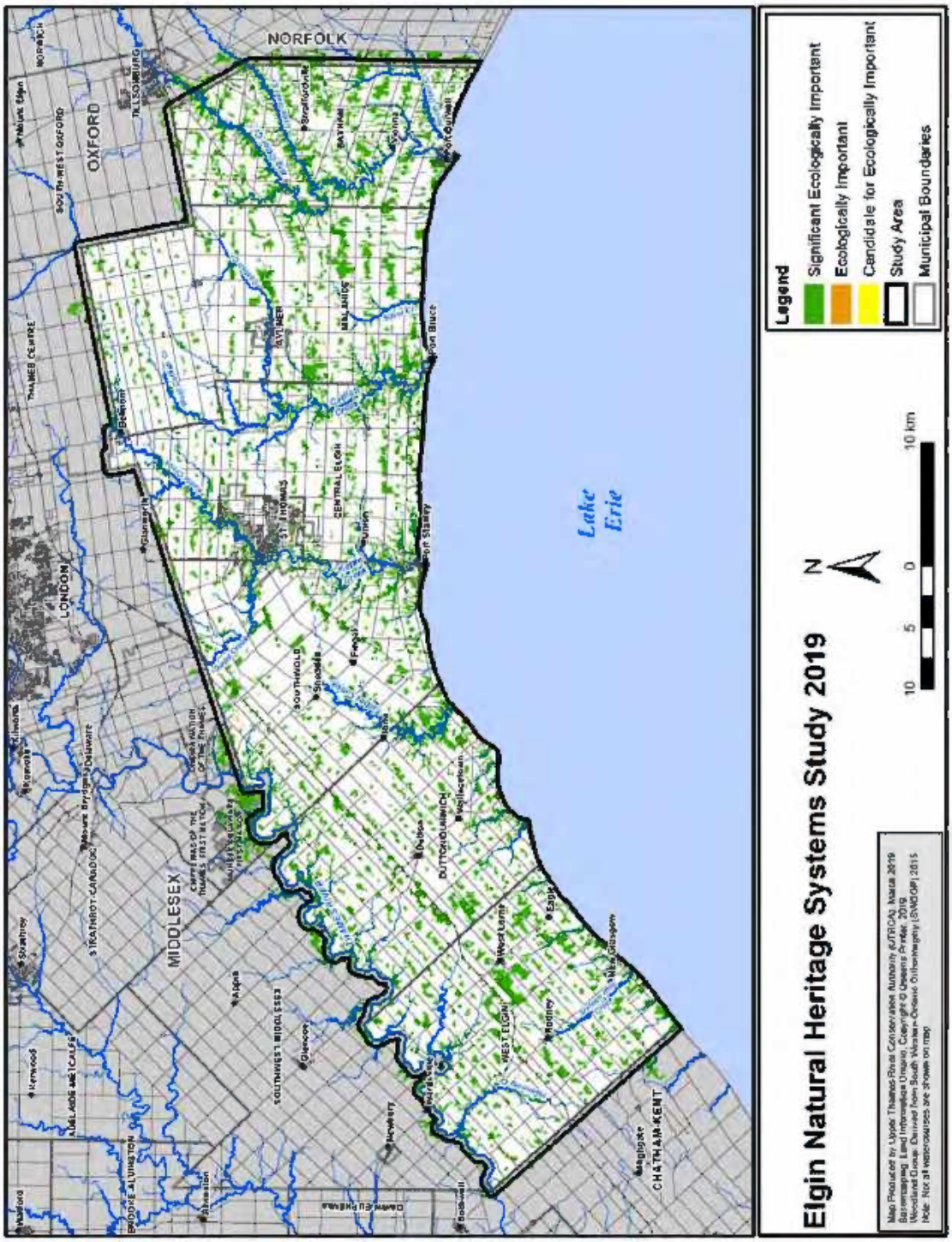
Appendix L-8. Patches that meet one or more criteria for Ecological Importance in Aylmer



Appendix L-9. Patches that meet one or more criteria for Ecological Importance in Elgin



Appendix M. Woodlands: Significant, Ecologically Important and Other in Elgin County



Appendix N. Other Natural Heritage Features and Areas Identified at the Site Level

There are natural features and areas that are important but that cannot be mapped at the GIS level or modelled, but instead must be identified at the site-level (e.g., during an EIS).

Significant Wildlife Habitat (SWH)

The Significant Wildlife Habitat Technical Guide (MNR 2010) describes four categories of significant wildlife habitat:

- Seasonal concentrations of animals
- Rare vegetation communities or specialized habitat for wildlife (includes IUCN S1-S3)
- Habitat of species of conservation concern (not including Endangered or Threatened species)
- Animal movement corridors

Criteria for Significant Wildlife Habitat (SWH) are provided by MNRF in the Significant Wildlife Habitat Technical Guide (MNR 2000b) and the Natural Heritage Reference Manual (MNR 2010). More detailed guidelines for evaluating habitat within Ecoregions 6E and 7E, including thresholds of number of species that designate an area as a SWH, have been provided in the January 2015 Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E and 7E (MNRF 2015). The MNRF also recommends that the IUCN (International Union for Conservation of Nature) class S1-S3 species be considered under Significant Wildlife Habitat.

Identification of this habitat can occur through field studies conducted through EISs or other field studies/inventories, and then reported to the MNRF.

Groundwater Dependent Ecosystems and Wetlands (GDEW)

Groundwater is not only an important water source to meet human consumptive needs, it also plays a critical role in supporting many ecosystems. However, the policies and regulations that protect groundwater for human consumption may not necessarily protect Groundwater-Dependent Wetlands (GDWs), a vital yet poorly understood sub-set of the natural environment (Howard and Merrifield 2010).

GDWs are ecosystems that require access to groundwater to maintain their communities of plants and animals, ecological processes and ecosystem services. Typical examples of these systems are springs, seeps, fens and perched groundwater wetlands.

In all of these systems, terrestrial vegetation interacts with the groundwater. Recognizing that the chemical composition of groundwater is closely related to the type of bedrock and surficial deposits through which it has moved, the groundwater contributes water and nutrients to maintain a rich and unique biodiversity adjusted to these special conditions (Howard and Merrifield 2010).

There has not been a great deal of study or conservation planning around groundwater-dependent ecosystems. Consequently, there is much that needs to be learned about these ecosystems. The increasing demand for groundwater resources due to the combined pressures of development, a variable climate, and a growing population threatens these ecosystems (Brussard *et al.* 1999, MacKay 2006). The availability of surface water to meet consumptive needs has declined and the pressure on groundwater resources is growing. GDWs are threatened by the alteration of the quality or quantity of groundwater discharge resulting from development in groundwater recharge areas and by heavy machinery either in the GDW itself or in its immediate vicinity. Heavy

machinery can create deep ruts that destroy the vegetation, alter the hydrology, and disturb resident amphibian species that spend their adult lives in or near water.

According to the NHRM (MNR 2010), woodlands should be considered significant if they are located within, or a specific distance from, a sensitive groundwater discharge area (e.g., springs, seepage slopes). Groundwater discharge is evident at the seep margin and provides a constant supply of water to the seep community, with flows at many seeps persisting even through the driest summer months. As a result of the continuous soil saturation, thin surface organic layers are generally present over saturated mineral soils.

Currently, areas of groundwater release tend to be small occurrences (i.e., not picked up by aerial photography). Groundwater ecosystems can be classified by their geomorphic setting (aquatic or terrestrial) and associated groundwater flow mechanism (deep or shallow). On this basis, Howard and Merrifield (2010) identified three groundwater dependent ecosystem types: springs and seeps, wetland ecosystems, and groundwater dependent streams.

Watercourse Bluff and Deposition Areas

Steep slopes, cliffs, valley bluffs, gravel bars and beaches are similar to upturned sections of earth and can create unique natural features for specialized assemblages of plants and animals.

Bluffs found along rivers can be devoid of life due to the arid conditions or full of rare and fragile plant life that grow sporadically along different soil layers. Bluffs of steep river banks are formed by river erosion on the outside of a meander. Erosion can also be the result of ground water movement and surface runoff. Bluffs can provide prime nesting quarters for all sorts of birds, including an assortment of swallows, Belted Kingfishers and Turkey Vultures.

The Bank Swallow that nests along naturally eroding slopes of streams, rivers, and lakes, has undergone significant population declines throughout Canada. In Ontario, Bank Swallows have declined at a rate of 4.7% annually over the last 40 years based on Breeding Bird Survey (BBS) data. Although the precise mechanisms driving the declines are unknown, the size and longevity of Bank Swallow colonies is dependent on bank erosion, which determines suitable nesting habitat. Declines are generally thought to be a consequence of habitat loss, changes in food source (i.e., aerial insects), and threats during migration or on the wintering grounds.

Depositional areas include gravel bars and beaches that form in watercourses where water flow is slower (e.g., inside river meander), allowing soil, sand and gravel to settle out of the water column. These features, while often small in scale, are prime nesting sites for turtles, especially Snapping Turtles and Spiny Softshell turtles. Bars and beaches can be unvegetated or support early successional plants, depending on how recent there has been flooding and re-shaping of the feature.

Proposed development along watercourses would require approval from the Conservation Authority. As part of the permit process an EIS may be required.

Appendix O. Lakeshore Zone

Conceptual diagram representing coastal and hinterland types. Hinterland landforms begin 100 m from top of bank. The diagram was prepared for the Huron Natural Heritage Plan (2018 draft).

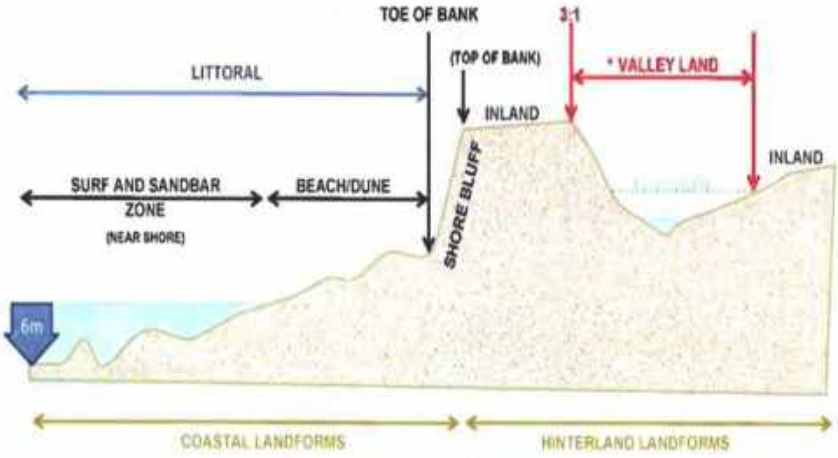


Figure 2 3. Conceptual diagram representing coastal and hinterland landform types. Hinterland landforms begin 100 m from top of bank. This figure is not intended to be a depiction of the organization of these landforms in Huron County. For example, in Huron active and relic dunes can be found several hundred metres inland.