Natural Heritage System & Restoration Strategy

for the Lake Simcoe watershed

2018

Lake Simcoe Region
conservation authority

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The Lake Simcoe Region Conservation Authority has developed the Natural Heritage System and Restoration Strategy (2018) to review and update the Natural Heritage System for the Lake Simcoe Watershed, Phase 1 (Beacon Environmental & LSRCA, 2007).

Many staff members of the Lake Simcoe Region Conservation Authority (LSRCA) contributed to the creation of this document including Shauna Fernandes Chagani, Kody Vickers, Jessica Chan, Megan Leedham, Charles Burgess, Kate Lillie, Rob Baldwin, Beverley Booth, Ben Longstaff, Bill Thompson, Christa Sharp, Rob Wilson, Phil Davies, Kevin Kennedy, Darren Campbell , Melissa Rosato, Nancie Knight, and Brian Kemp.

The data contained in the maps in this report have been compiled from various sources. While every effort has been made to accurately depict the information, data mapping errors may exist.

Conservation Authority Resolution

At the LSRCA Board of Directors' meeting on June 22, 2018, the Natural Heritage System and Restoration Strategy was approved by the Board of Directors through the following resolution:

RESOLVED THAT Staff Report No. BOD-099-18 regarding the Natural Heritage System and Restoration Strategy be received; and

FURTHER THAT the Natural Heritage System and Restoration Strategy contained herein be approved and implemented into LSRCA programs and services. CARRIED.

Moved by: Councilor Aviva Eek
Seconded by: Councilor Dave Kerwin

Executive Summary

The Lake Simcoe Region Conservation Authority (LSRCA) has developed a Natural Heritage System and Restoration Strategy (NHSRS) for the Lake Simcoe watershed. The development and implementation of the Strategy was identified as a priority action to achieve Goal One of the LSRCA Strategic Plan (2016-2020); to support a safer, healthier and more livable watershed through exceptional integrated watershed management. This Natural Heritage System (NHS) is an update to the previous LSRCA Natural Heritage System for the Lake Simcoe Watershed, Phase 1 (Beacon Environmental & LSRCA, 2007).

The Lake Simcoe watershed is located in south-central Ontario, an hour north of the City of Toronto and is approximately 3,400 km^2 with 20 municipalities and the First Nation's lands of the Chippewas of Georgina Island. It is home to 35 tributaries and important physiographic and hydrologic regions such as the Oak Ridges Moraine, Carden Alvar, Oro Moraine and the Trent-Severn Waterway.

This watershed provides habitat for approximately 500,000 residents and thousands of species including 141 birds and 1,250 vascular plants that call the urban, agricultural, and natural heritage areas home. The watershed is an economic, physiological, social, cultural and/or spiritual source for its inhabitants. From a natural heritage perspective, these ecosystem services are derived from natural heritage features. Some examples include woodlands, wetlands and watercourses all identified as natural heritage features. These features are inter-related and the identification of these connections to support ecosystem functions is defined by a natural heritage system.

Across the watershed, the protection of natural heritage systems is identified in acts, policies and plans at the federal, provincial and municipal level recognizing the need to protect these systems in order to mitigate the pressures of urban expansion and climate change. In addition, strategies such as How Much Habitat is Enough? and Ontario's Biodiversity Strategy reflect the need to identify targets to achieve sustainable natural heritage systems. When reading this report, it is important to note the Strategy should be read in conjunction with these relevant acts, policies, and plans. At the provincial scale, this includes the Provincial Policy Statement (2014), Lake Simcoe Protection Plan (2009) and the recent 2017 revised Greenbelt Plan, Growth Plan for the Greater Golden Horseshoe, and Oak Ridges Moraine Conservation Plan. Other provincial level acts include the *Conservation Authorities Act*, the *Public Lands Act*, the *Clean Water Act*, and the *Environmental Assessment Act*. In the Lake Simcoe watershed, upper, single and local tier municipal Official Plans (OPs) are the mechanism for natural heritage protection as delegated by the Province. Many recognize the need of their individual municipalities and extend beyond minimum policy framework to facilitate progressive and innovative system based policy development.

Progressive natural heritage systems and policies are vital to achieve healthy, sustainable communities that can tackle the challenges of landuse development pressures and climate change. This Strategy recognizes the specific policies and consideration of OPs in order to balance natural heritage features in urbanized settings. It intends to complement existing policies and where possible assist the natural

heritage support needs of municipalities to guide their public and stakeholders to extend beyond the status quo and recognize their watershed-wide role and responsibility.

This Natural Heritage System was developed with a three step approach:

1. Minimum policy standards;
2. Enhanced ecological system; and
3. Systems based approach

These support a natural heritage system that includes a combination of landscape and species spatial analysis incorporating both planning and science rationale to be defensible, flexible, measureable and repeatable. The development of the NHS reinforces the understanding that individual areas and features have strong ecological ties to each other that contribute to the overall landscape.

A geographic information system (GIS) approach defined and categorized the Natural Heritage System into core features, targeted areas that enhance the NHS, and buffers. Core features are those considered critical to the NHS whose protection and longevity are imperative to ecosystem functions and services of the Lake Simcoe watershed. The core features identified in Table 1 are included in the NHS.

Table 1: Core Feature* distribution in the Lake Simcoe watershed.

Core Features	Total Area in the Watershed (ha)	Total % of the Watershed**
Watercourses and Fish Habitat	38,415	13%
NAALS	7,027	2%
Shoreline	760	0.3%
Wetlands	50,831	18%
Woodlands	100,937	35%
Valleylands	8,918	3%
ANSI	17,425	6%

*Core features may overlap in the NHS. Core features also include Endangered and Threatened species habitat, significant wildlife habitat and some valleyland criteria that were not mapped through this exercise.

** The watershed excluding Lake Simcoe

Core features are distributed across the watershed and account for 128,805 ha, approximately 45% of the watershed excluding the Lake, and are further categorized by 87% natural cover based upon Ecological Land Classification (ELC) and 13% other land uses like agriculture, industrial, residential or manicured open space. It is recommended these features be protected in perpetuity.

Targeted features that enhance the NHS include grassland habitat, corridor restoration, restoration opportunities in the floodplain and linkages. The amount of coverage these features have in the watershed has been determined (**Table 2**). These areas support achieving the LSRCA's NHS goals and improving the biodiversity of the watershed. It is recommended these features are brought into the NHS when land use designations change in the future, are acquired for restoration and/or long-term management opportunities initiated with current landowners, LSRCA land securement, and/or

stewardship programs. In addition, 30 m buffers are recommended in order to support the NHS core features and reduce impacts to the Natural Heritage System.

Table 2: Targeted Areas that Enhance the NHS.

Targeted Areas that Enhance the NHS	Coverage in the Watershed
Grasslands	12,661 ha
Corridor Restoration	3,944 ha
Restoration in the Floodplain	9,113 ha
Local Linkages	1,657 connections
Regional Linkages	59 connections

This Natural Heritage System and Restoration Strategy has a vision for a sustainable and resilient Natural Heritage System that supports natural heritage features and functions while providing services vital to human well-being. This vision is the basis of the NHSRS that leads to setting NHS targets for the watershed based upon the existing NHS, and policy and scientific recommendations.

Table 3: Assessment of the Natural Heritage System Targets in Existing Conditions and Implementation Potential of the NHSRS

Feature Type	Target for the Watershed	Existing Conditions in NHS	Opportunity in the NHS	NHS Implementation Potential
All Core Features	• No net loss of features • Pursue a net gain of features	Ecological Offsetting Plan (EOP) substantiates the net gain associated with any loss of features across the watershed	The NHS will support implementation of the EOP	A net gain to the NHS in quality and quantity
Wetlands	• 40% of historic watershed wetland coverage • Minimum 20% of watershed	• Historic wetland habitat remaining is 20-25% • Watershed wetland habitat is 18%	Approximately 9,113 ha of floodplain restoration	Wetland habitat could increase to 20.5% of the watershed
Watercourses and Fish Habitat	• 75% of stream length should be naturally vegetated with minimum 30 m vegetation protection zone	Watershed riparian vegetation is 62% of the 30 m vegetation protection zone	Approximately 11,985 ha of restoration area	Watershed riparian vegetation habitat could increase to 92% of the 30 m vegetation protection zone
Woodlands	• 40% forest at a watershed scale • 130 forest patches >200 ha • Interior forest should account for a minimum 10% of watershed	• Watershed woodland cover is 34.9%. • There are 110 forest patches >200 ha and 22 patches within 25 ha of 200 ha • Interior forest cover is 12.5% of watershed.	Approximately 3,944 ha of restoration area within the corridor restoration and 9,113 ha of floodplain restoration	• Watershed woodland cover could increase to 39.5%. • Forest patches >200 ha could increase to 132 • Interior forest cover could increase to 14%

Feature Type	Target for the Watershed	Existing Conditions in NHS	Opportunity in the NHS	NHS Implementation Potential
Lake Simcoe Shoreline	• Minimum 30 m vegetated protection zone along shoreline	Shoreline natural vegetation coverage is 27% of the shoreline	Approximately 11,985 ha of restoration area	Shoreline natural area could increase to 52% of the total area
Corridors	• 100 m in width for main stem watercourse corridors	Total area in corridor widths is 15,363 ha	Approximately 3,944 ha of corridor restoration	Corridor restoration area could increase the overall NHS by 1%

Implementation of the Natural Heritage System and Restoration Strategy will be achieved through a series of 39 actions led by the LSRCA, and shared and supported by its watershed-wide municipal partners and the extended community. The implementation strategy focuses on the organization's programs and services through actions of:

- Protection;
- Land planning and management;
- Data collection and monitoring;
- Research and tools;
- Outreach and education;
- Partnerships; and
- Strategy evaluation.

The Natural Heritage System does not exist on its own but as part of a connected matrix of land uses (agricultural, urban, park lands, infrastructure, etc.) that require balance in order to support communities. Feasibility and financial support are of the utmost importance to achieve and maintain a robust NHS through implementation. With respect to the Strategy, restoration is a broad definition that includes protection, enhancement, restoration and creation. Actions include, but are not limited to, implementing the NHSRS through plan review, engaging municipalities to adopt the NHS into Official Plans, incorporating protection of the NHS into Strategic Plan initiatives such as the Climate Change Adaptation Plan and the Carbon Reduction Strategy. Other actions include undertaking monitoring in the NHS, prioritizing land acquisition areas within the NHS and supporting private landowner restoration activities within the NHS.

Finally, reporting on the performance of the NHSRS and its progress will occur on a five year basis. This assessment will document quantitative and qualitative gains achieved through the action tasks. A monitoring plan will be developed to evaluate the effectiveness of the NHSRS including targets, key performance measures and feasibility based upon the anticipation of implemented actions by the LSRCA programs. This will allow new information and monitoring data to be used to assess the effectiveness of the NHSRS being embedded in LSRCA programs and services, and refine goals, targets and actions of the NHSRS as necessary.

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Chapter 1

1.0 Introduction

The Lake Simcoe watershed (**Figure 1.1**) is located in south-central Ontario, approximately 60 km north of Toronto and 30 km southeast of Georgian Bay. The watershed is approximately 3,400 km^2 and is comprised of 20 municipalities (within the Regional Municipalities of York, Durham and Peel, the County of Simcoe, the City of Barrie, City of Orillia and the City of Kawartha Lakes) and the First Nation's lands of the Chippewas of Georgina Islands.

The watershed is divided into 20 subwatersheds supporting 35 tributaries of approximately 8,620 km of watercourses (**Figure 1.2**). Six major tributaries account for the bulk of the Lake Simcoe drainage: the West Holland River, East Holland River, Black River, Pefferlaw Brook, Talbot River and the Beaver River. The majority of these watercourses originate on the Oak Ridges Moraine (ORM) and flow in a northerly direction, emptying into Lake Simcoe. Lake Simcoe occupies approximately 20% (722 km^2) of the watershed and is the largest inland lake in southern Ontario, apart from the Great Lakes. The lake, which is part of the Trent-Severn Waterway which connects its waterways to Georgian Bay, has an average depth of 15 m and a maximum depth of 41 m. The watershed is within the jurisdictional boundary of the Lake Simcoe Region Conservation Authority (LSRCA) with four surrounding Conservation Authorities.

The watershed extends from the ORM and continues north to the southern border of the Oro Moraine. Detailed physiographic regions of the watershed (**Figure 1.3**) include the Oak Ridges Moraine, Schomberg Clay Plain, the Simcoe Lowlands, the Simcoe Uplands, the Carden Alvar and the till plains on the Peterborough Drumlin Field (Chapman & Putnam, 1984). Significant erosional glacial events have resulted in unique features like the deepwater areas of Cook's Bay and Kempenfelt Bay. The wise use and management of the watershed's natural resources is essential to ensure a sustainable and healthy watershed that will continue to satisfy the needs of a growing population.

The current population of the watershed is approximately 500,000. The Growth Plan for the Greater Golden Horseshoe (GPGGH) (2017) anticipates the population will increase by 50% and the urban area double in size by 2041. In addition to its urban centres, the watershed contains a significant component of the provincial Greenbelt, comprised of natural and agricultural resources including the Holland Marsh. The watershed supports a large recreational community along the shores of the Lake, with a total recreational value estimated to be $487 million annually (Wilson, 2017). The watershed is also a clean source of drinking water for six municipalities.

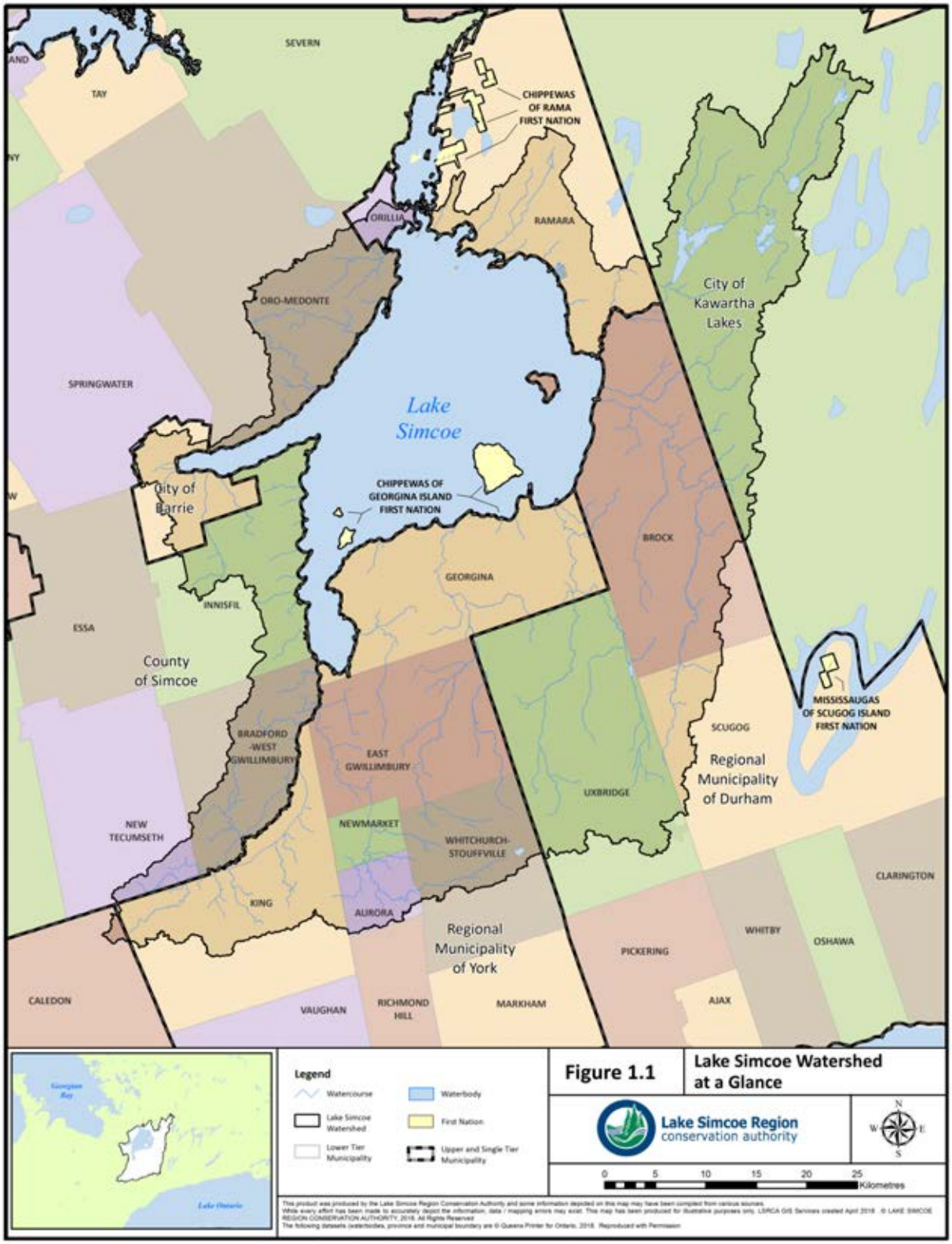


Figure 1.1 Lake Simcoe Watershed at a Glance. The watershed is located an hour north of Toronto and is comprised of First Nations lands and upper, single and local Tier municipalities.

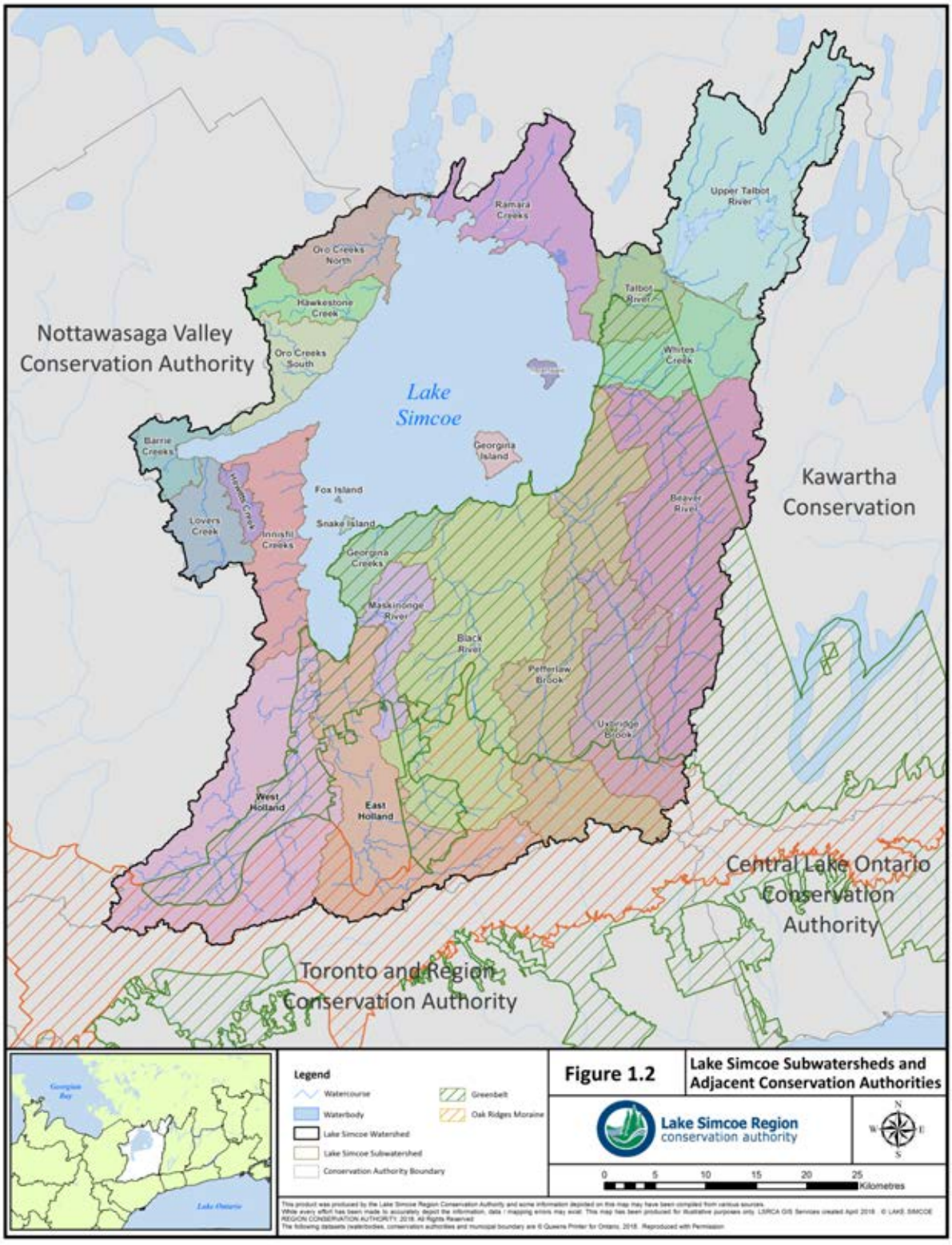


Figure 1.2 Lake Simcoe Subwatershed and Adjacent Conservation Authorities. The watershed is divided into 20 subwatersheds including the smallest, Hewitt's Creek, and the largest, Black River. It is within the regulatory boundary of the Lake Simcoe Region Conservation Authority. Land use plan areas include the Oak Ridges Moraine and the Greenbelt in addition to the Lake Simcoe Protection Plan and white belt.

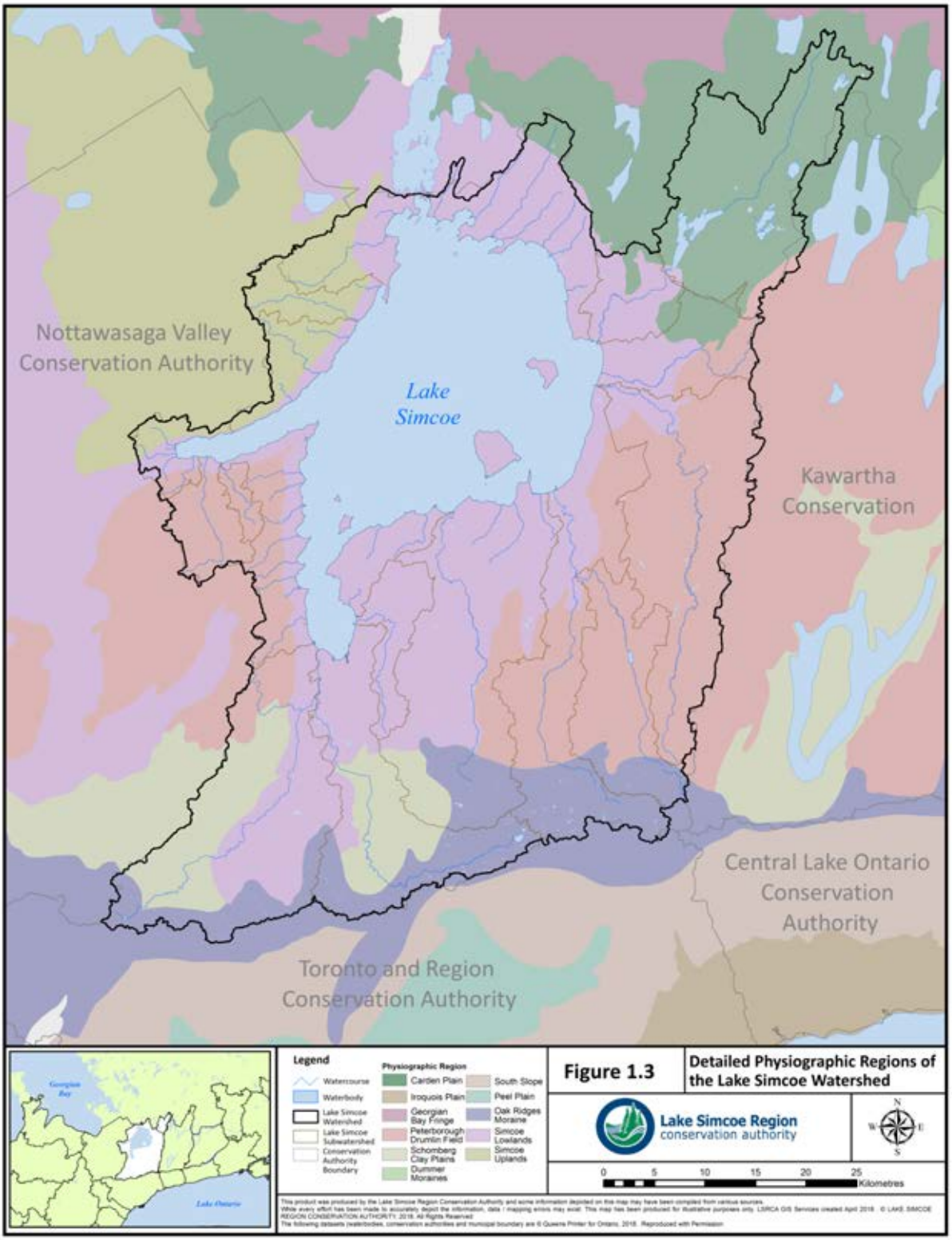
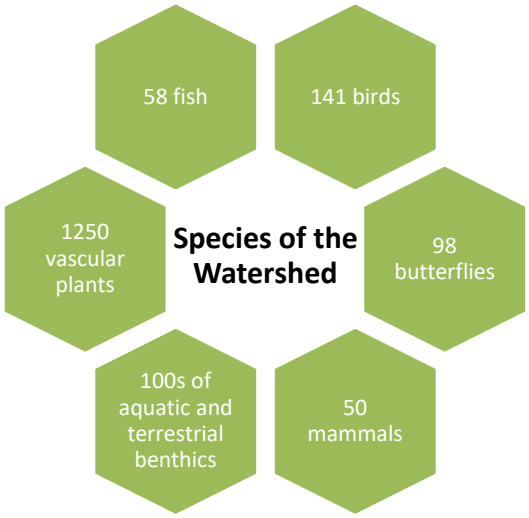


Figure 1.3 Detailed Physiographic Regions of the Lake Simcoe watershed. The ORM, Simcoe Uplands, Carden Plain and Peterborough Drumlin Field comprise the topographically elevated areas of the watershed, while the Schomberg Clay Plains and Simcoe Lowlands make up the low-lying areas of the watershed (Chapman & Putnam, 1984).

People are not the only inhabitants that depend on a healthy watershed. Thousands of identified species enrich the biodiversity of the natural heritage features in the watershed including wetlands, woodland, alvars, grasslands and watercourses. Many species with specific habitat preferences like the Eastern Red Backed Salamander, Brook Trout, Olive-sided Flycatcher, Bog Laurel, Western Chorus Frog, and the White Fringed Orchid have found homes in the Lake Simcoe watershed. Approximately 427 native local species are regionally rare to the watershed and 65 are provincial or national species at risk (SAR) in the watershed.



Large scale conservation and protection efforts have been occurring in the watershed for decades. In the 1990s, multi-agency collaboration between the LSRCA, Ministry of the Environment and Climate Change (MOECC; formerly Ministry of the Environment (MOE)), Ministry of Natural Resources and Forestry (MNRF; formerly Ontario Ministry of Natural Resources (OMNR)), Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), Ministry of Municipal Affairs and Housing (MMAH), Ministry of Energy and Infrastructure (formerly Ministry of Public Infrastructure Renewal (MPIR)), municipalities, the Chippewas of Georgina Island First Nation, Environment and Climate Change Canada (formerly Environment Canada) and Fisheries and Oceans Canada (DFO) collaborated for the Lake Simcoe Environmental Management Strategy (LSEMS). This program spanning over 20 years achieved phosphorus level reductions entering the Lake from the average 100 tonnes per year to an average of 67 tonnes per year through the completion of 55 water quality improvement projects, and the creation of a State of the Watershed report (2003) that identified existing conditions and emerging issues.

During this movement, the Natural Heritage System for the Lake Simcoe Watershed: Phase 1 (Beacon Environmental & LSRCA, 2007) was developed to define natural heritage features and existing ecological linkages. This strategy, which provided policy direction, was adopted into Official Plans (OPs) in Simcoe County, City of Barrie, Town of Innisfil, and the Town of East Gwillimbury.

The LSRCA Strategic Plan (2016-2020) sets the direction of a thriving environment that inspires and sustains generations to come. The development and implementation of a Natural Heritage System and Restoration Strategy (NHSRS) was identified as a priority action to achieve goal one of the Plan; to support a safer, healthier and more livable watershed through exceptional integrated watershed management.

1.1 Context for a Natural Heritage System

The Lake Simcoe watershed is home to a variety of species including: American Toad (*Bufo americanus*) (top), Bloodroot (*Sanguinaria canadensis*) (middle), and Cedar Waxwing (*Bombycilla cedrorum*) (bottom).

In southern Ontario, land use changes have resulted in the large-scale conversion of pre-settlement landscapes for intensive land use changes (i.e. agriculture, urban and industrial development) (Beacon Environmental & LSRCA, 2007; Mason et al., 2007; Spang et al., 2012). An estimated 80% of woodlands, 72% of wetlands and 99% of native grasslands were cleared or developed. The Lake Simcoe watershed continues to be one of the fastest growing regions in Canada. The increasing population and urban expansion in the Lake Simcoe watershed requires agencies to be prepared so that growth can be accommodated in a planned manner that maintains natural heritage, encourages healthy living and preserves quality of all life. A natural heritage system (NHS) approach to protecting and connecting natural areas across the watershed is a recognized strategy for addressing these crises. This active atmosphere has prompted the LSRCA to move forward with development of the NHSRS identified through the LSRCA Strategic Plan (2016 – 2020).

Natural heritage systems aim to sustain threatened ecosystems, provide ecological functions over a long period of time, enable movement of species, and address issues such as destruction of habitat, loss of biological diversity, degradation of water quality, erosion, and flood damage (Searns, 1995; OMNR, 2010). When natural heritage systems are connected to a drainage network, they can be used to buffer surface water and riparian species from the influences of adjacent landscapes (Ahern, 1995; Searns, 1995; Bryant, 2006).

Ontario's Biodiversity Strategy (Ontario Biodiversity Council, 2011) envisions a future where biodiversity loss is halted and recovery advanced. It reflects international targets such as Aichi Biodiversity Target 11, that by 2020 at least 17% of terrestrial and aquatic systems are conserved through well-connected networks of protected areas and other effective area-based conservation measures. Of importance was the 2015 target that NHS plans and biodiversity conservation strategies are developed and implemented at the municipal and landscape levels (Wise et al., 2014).

1.2 Natural Heritage Planning in Ontario

Natural heritage protection has existed for a number of years, however; the framework for pursuing systems based planning versus individual features was enacted in 2005 (MMAH, 2005). Policy regime was strengthened with the updated Provincial Policy Statement (PPS) (2014) requiring the identification of natural heritage systems in ecoregions 6E (where the Lake Simcoe watershed is located) and 7E. In keeping with the PPS, broader land use Provincial plans promote the protection of natural heritage systems while advancing specific regional based protection. The Lake Simcoe Protection Plan (LSPP) (2009) addresses the importance of connectivity by addressing features based upon policy themes such as aquatic life, water quality, water quantity, shorelines and natural heritage.

Natural heritage systems are made up of natural heritage features and areas, linked by natural corridors, which are necessary to maintain biological and geological diversity, natural functions, viable populations of indigenous species and ecosystems. These systems can include lands that have been restored and areas with the potential to be restored to a natural state (MMAH, 2014) (Figure 1.4).

They include:

- **wetlands**
- **coastal wetlands**
- **fish habitat**
- **woodlands**
- **valleylands**
- **habitat of endangered species and threatened species**
- **significant wildlife habitat (SWH)**
- **areas of natural and scientific interest (ANSI)**

Recently, the Province has revised a number of plans related to the Lake Simcoe watershed, including the Greenbelt Plan (GBP), the Oak Ridges Moraine Conservation Plan (ORMCP), and the Growth Plan for the Greater Golden Horseshoe (GPGGH). Each Provincial Plan is accompanied by a compendium of technical guidelines, reference manuals, and/or mitigation support tools that focus on technical information as opposed to policy direction.

The GBP protects sensitive environmental and agricultural lands in the Greater Golden Horseshoe (GGH) from urban development and/or sprawl. The plan covers approximately 58% of the land area in the watershed (MOE, 2009). Identified Protected Countryside lands including the Greenbelt NHS are intended to enhance the spatial extent of agricultural and environmental protected lands, while also improving linkages between areas across the Niagara Escarpment Plan (NEP) and the ORMCP. The identified natural system lands support natural heritage and hydrologic features and functions, including providing for pollinator habitat, an essential component to agricultural production and ecosystems.

The ORMCP provides land use and resource management guidelines to provincial ministers/ministries, agencies, municipalities and landowners on how to protect the Moraine's ecological and hydrological features and functions to maintain clean and abundant water resources, healthy and diverse plant and animal habitat, attractive landscapes, prime agricultural areas and sand and gravel resources close to market. The division of land use designations such as Natural Core Areas and Natural Linkages Areas

recognizes the protection of the greatest concentrations of key natural heritage features and important linkages. Over 85% of the key natural features are within Natural Core Areas and Natural Linkages connecting them to the natural heritage systems of the GBP and the NEP.

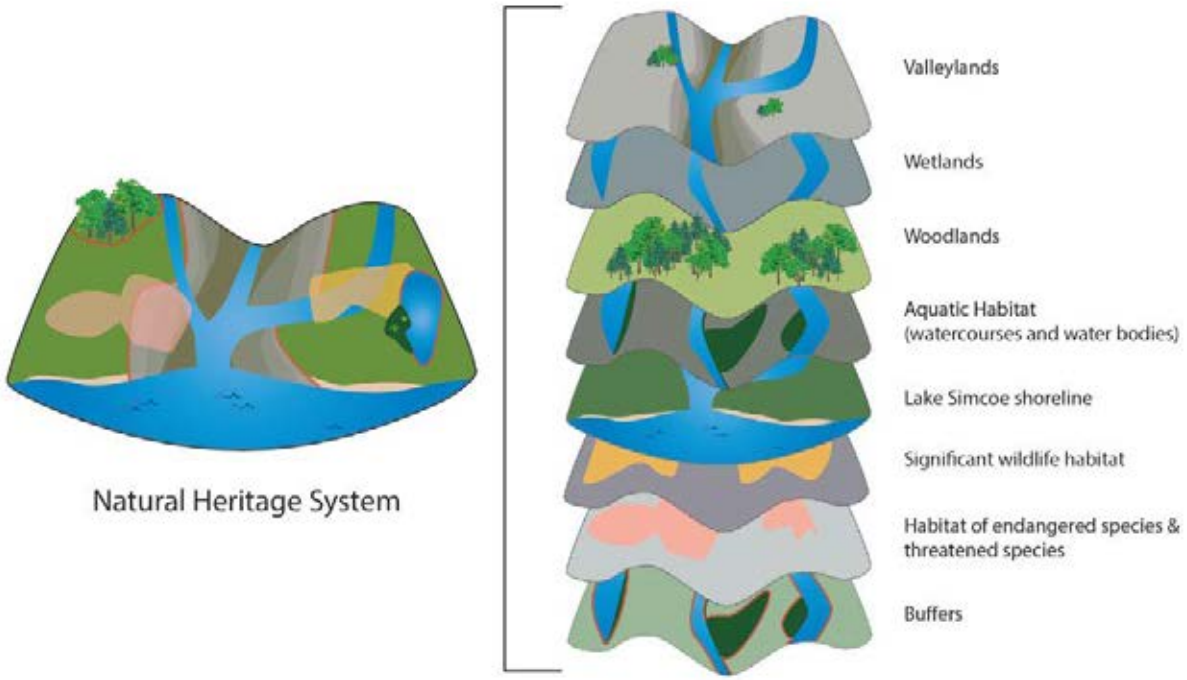


Figure 1.4 Components of a Natural Heritage System. Natural heritage systems can include natural heritage features such as valleylands, woodlands, watercourses and wetlands.

The Growth Plan for the Greater Golden Horseshoe focuses on the GGH area, a dynamic and fast-growing region in North America. It supports long-term vision for managing growth through the development of more compact and complete communities. The GGH extends into the plan areas of the GBP, ORMCP and the NEP and provides the platform for building healthy and balanced communities in the wake of change. As part of the recent updates, the Province mapped a NHS for the GGH to support an integrated, comprehensive, and long-term approach to planning for the protection of the region's natural heritage system and biodiversity (MNRF, 2017b). It is recommended that municipalities incorporate the NHS as an overlay into their OPs and apply the appropriate policies to maintain, restore, and enhance the systems and their long-term ecological and hydrological functions.

Municipalities govern land use at the regional and local level in accordance with provincial planning. They play a vital role in protecting natural heritage systems and the services they provide their residents. Through municipal planning, more specifically OPs, the inter-relationship between the natural and built environments are managed to preserve ecological, cultural, social, economic and health benefits. Many upper, single and local tier municipalities have made significant investments into identifying natural heritage systems of the watershed through Official and Secondary Plans by identifying areas for protection and restoration including around the Lake itself. Policy varies across the watershed to ensure that the features are protected, subject to setbacks as determined according to the

plan policies, and ensure that practices within a certain distance do not propose negative impacts on the features. In addition to protecting natural heritage systems, guidelines for adjacent land use practices have evolved to manage stress loads on the watershed by upgrading sewage treatment plants, stormwater management (SWM) retrofits/low impact developments (LID), source water protection (SWP), and public protection of natural heritage features in perpetuity through land acquisition.

The LSRCA also takes on the responsibility of protecting the natural environment within the Lake Simcoe watershed as a regulatory body, and a planning and technical reviewer. Under the *Conservation Authorities Act*, Ontario Regulation 179/06, the LSRCA regulates development and interference with wetlands and alterations to shorelines and watercourses in an effort to conserve and enhance the natural resources within the watershed. The LSRCA Watershed Development Guidelines (LSRCA, April 2015) ensure appropriate implementation of the regulation by the LSRCA. Through review, the LSRCA is able to provide advice and guidance to its member municipalities on the implementation and application of federal and provincial planning documents in an effort to further enhance and protect the natural heritage system in the watershed.

Beaver River Wetlands

Chapter 2

2.0 A Watershed Perspective

2.1 Human Health and the Natural Heritage System

Natural heritage systems play a key role in improving quality of life. The watershed provides its 500,000 residents over $922.7 million of ecosystem services annually (Wilson, 2017). These ecosystem services are economic, social, cultural, spiritual and support overall human wellness.

Ecosystem goods and services are the benefits people obtain from the natural environment that are measurable and improve human well-being (Wilson, 2017). These benefits are dependent on ecosystem processes (physical, chemical and biological) or attributes that maintain ecosystems and the species that live within them. People are reliant on the capacity of natural processes and systems to provide for human and wildlife needs. These include products received from ecosystems (e.g. food, fibre, clean air and water), benefits derived from processes (e.g. nutrient cycling, water purification, climate regulation) and non-material benefits (e.g. recreation and aesthetic benefits) (**Table 2-1**) (Wilson, 2008). The Lake provides drinking water for six municipalities, promotes a significant tourism and recreation industry, and hosts agricultural lands including the Holland Marsh. The total recreational value provided by the Lake Simcoe watershed annually is estimated to be $487 million, which includes activities such as fishing, birding, cycling and mountain biking, hiking, climbing, and horseback riding (Wilson, 2017).

Ice fishing is a popular recreational activity that takes place on Lake Simcoe during the colder months of the year

Table 2-1: Ecosystem functions and services provided to the Lake Simcoe watershed residents.

Ecosystem Functions and Services	Description
Gas regulation	UVb ozone protection and maintenance of air quality
Climate regulation	Maintenance of favourable climate and carbon regulation
Disturbance prevention	Storm protection, flood control and drought recovery
Water regulation	Drainage, natural irrigation, and transportation
Water supply	Provision of water by watersheds, reservoirs and aquifers
Soil retention	Prevention of soil loss/damage from erosion/siltation and storage of silt in lakes and wetlands
Nutrient cycling	Maintaining healthy soils, productive soils and nitrogen fixation
Waste treatment	Pollution control/detoxification, filtering of dust and abatement of noise pollution
Pollination	Wild plant species and crops pollination
Biological control	Control of pests and diseases and reduction of crop damage
Habitat	Biological and genetic diversity, nurseries, refugia and habitat for migratory species
Food production	Provision of food and harvest of wild species
Raw materials	Lumber, fuels, fodder, fertilizer, and ornamental resources
Genetic resources	Improve crop resistance to pathogens and pests
Recreation	Ecotourism, wildlife viewing, sport fishing, swimming, boating, camping etc.
Education, culture and spirituality	Provides opportunities for cognitive development: cultural motivation, environmental education, spiritual and scientific value & First Nation's lands

An assessment of ecosystem service values was completed in 2017 based on the concept of natural capital, which recognizes that social and economic systems depend on the natural environment. Natural capital is defined as the stock of natural "assets" in a region, including the woodlands, wetlands, grasslands, air, water, soil, and the assemblage of flora and fauna found within these ecosystems (Wilson, 2017). These natural capital stocks (e.g. trees in a woodland) can provide a physical flow of ecosystem services (e.g. water storage and flow regulations), which in turn produce measurable benefits (e.g. lower flood risk) that can be translated into a measurable economic value (e.g. the value of avoided flood damages) (**Figure 2.1**). Because the concept of natural capital focuses on the benefits nature provide humans, its economic value is dependent on who benefits and where beneficiaries are located relative to the ecosystem service flows (Wilson, 2017). Although this method may not provide a complete portrayal of the values of all ecological services, such as habitat for endangered species or level of biodiversity, this method for calculating ecosystem service values produces accurate values that are defensible and repeatable.

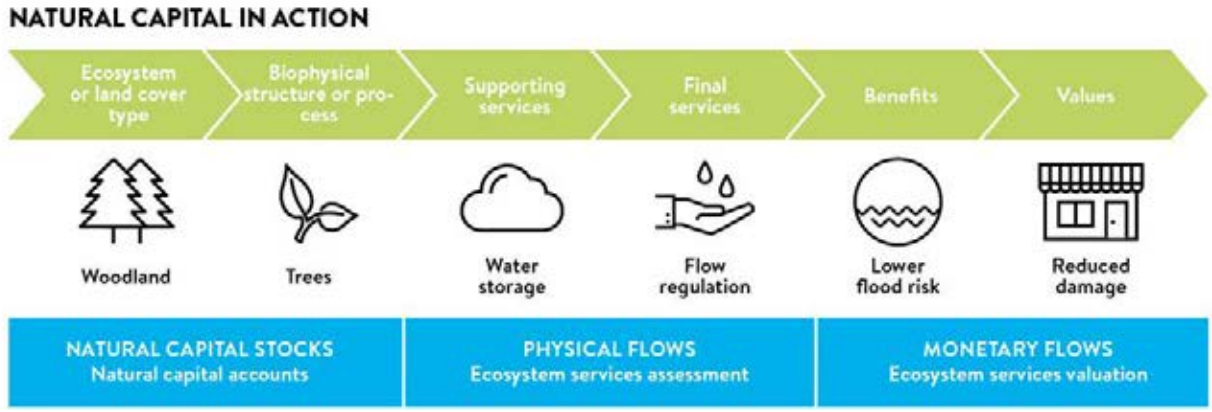


Figure 2.1 The pathway from natural capital stocks to economic value (Aecom, 2016)**.**

The conceptualization of natural capital helps to measure and track the ways humans rely on and impact the environment. For example, business and economic activities rely on natural capital assets to provide inputs into production such as clean water, minerals, and timber. Natural capital also provides essential services such as pollination, a service that is worth $45 million annually in support of plant cultivation in the Lake Simcoe watershed (Wilson, 2017). Woodlands and forests in the watershed maintain air quality by regulating atmospheric gasses and removing airborne pollutants, which result in significant health benefits to the surround population. Wilson (2017) estimates that the City of Barrie benefits by the gas regulation services provided by the natural environment by avoiding $1.2 million annually related to human health care costs. Climate change mitigation is another important ecosystem service provided by natural capital through the sequestration and storage of carbon dioxide and other greenhouse gases, which benefits humans by avoiding severe weather events. In addition, natural capital is important to human social well-being by providing recreational and spiritual opportunities. Thus, the natural assets in the Lake Simcoe watershed should be conserved and carefully managed to ensure the flow of ecosystem services can be sustained for current and future residents of the watershed.

The value of these services will increase over time as they become increasingly scarce due to added pressures. For example, water supply may decrease in availability but increase in demand as climate change and population growth alter availability (Wilson, 2008). Recognizing the value of ecosystem services can provide information on the potential impact of changing land use practices and can facilitate making decisions that minimize impacts on ecosystems and people. Green infrastructure investment into natural and human-made elements that provide ecological and hydrological functions and services (e.g. natural heritage features and systems, vegetation and landscaping, street trees and other urban forest elements, green roofs, etc.) can increase financial cost savings and increase sustainability of ecosystem functions and services in the face of climate change. The province of Ontario encourages the use of green infrastructure solutions as a means to better manage stormwater, decrease energy use and increase carbon storage in vegetation. Green infrastructure also plays a role in improving air and water quality, preserving biodiversity and the health of pollinators and reducing flood impacts, all resulting in improved quality of life for humans (MNRF, 2017d).

From a human health and well-being perspective, studies show that human connections with nature improve our physical, mental, spiritual and social well-being in a number of ways (**Figure 2.2**).

Figure 2.2 Physical, spiritual and mental benefits associated with nature (Ulrich et al., 1991; Taylor et al., 2001; Fjørtoft, 2004; Maller et al., 2005; Ambra, 2007; Ryan et al., 2010; Wise et al., 2014; Bratman et al., 2015)**.**

2.2 Partners at a Glance

The Lake Simcoe watershed is supported by a large number of partners who play a role in protecting natural heritage features, building responsible growth, and enhancing a resilient natural heritage system through sustainable adjacent land use practices and education.

2.2.1 Agricultural Community

In addition to the production of food, fiber and fuel, the agricultural community is an active participant in the watershed. Approximately 35% of the watershed is comprised of row crops, fields, pastures, horse and cattle farms and other farm related activities. While growing food, farmers have adapted many ways of becoming environmental stewards that benefit both nature and farming. Organizations such as the Ontario Federation of Agriculture and its local chapters (Simcoe County, York Region, Peel and Durham Region Federation of Agriculture), the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), as well as nonprofits support the implementation of strategies to limit negative impacts on the soil, air and water in the watershed.

The majority of features in the Natural Heritage System are within private land holdings with a large portion owned by members of the agricultural community. These tracts of land are not directly profitable to these land owners; they still maintain these features and assist in the overall preservation of the NHS. Natural areas adjacent to agriculture can provide protection to crops from wind and water erosion, improve microclimate and soil fertility.

The agricultural community often implements best management practices to reduce negative environmental impacts with programs such as the 4R's (right source, right rate, right time and right place) for nutrient stewardship. This method ensures the fertilizer is applied to the crop and soil where it is required leading to an increase in crop production and farmer profitability while protecting the environment from wind dispersal and runoff. The creation, preservation or restoration of buffers to natural heritage is also used to aid in filtering contaminants in water and air. In addition to preventing contaminates from leaving their land, farmers also assist in the sequestration and containment of carbon through the practice of no till. By tilling land, decomposing materials come in contact with oxygen and release their carbon into the atmosphere. When no tilling occurs in a field, this material is able to remain in the soil as carbon.

In the past five years, LSRCA has partnered with agricultural landowners to complete over 50 best management practice projects within the Lake Simcoe watershed that included clean water diversions, irrigation water management, managing manure, and restricting livestock from watercourses. Through the implementation of these programs and others, farmers are able to improve the protection of the environment while growing the food, fuel and fiber required by society. By employing practices such as the adjustment of mowing to prevent the disruption of nesting grassland birds and through the maintenance of naturalized spaces to be used as wildlife corridors, the agricultural community is partnering to enhance our existing environment.

2.2.2 Chippewas of Georgina Island First Nation

The Chippewas of Georgina Island First Nation are an Anishnaabe people who are descendants of a larger group known as the Chippewas of Lakes Huron and Simcoe. The ancestors of the Chippewas of Georgina Island were inhabitants of the Lake Simcoe region long before the arrival of European settlers. Lake Simcoe has always played an important role in the Chippewas' lifestyle, by providing food, access to clean water, and a means of reaching the mainland. Fish has been a staple food for the Chippewas people for many years and is still harvested today by community members and distributed to the elders and other community members. Before running water arrived to the island in the 1960's, the Lake provided families with water for cooking, bathing and cleaning. Today, the Chippewas people own and manage three islands in the southern portion of Lake Simcoe: Snake, Fox and Georgina Island.

The majority (88%) of the islands' land cover is characterized by natural heritage features, such as forests, wetlands, and grasslands. The forest on Georgina Island is one of the largest remaining in the Greater Toronto Area and covers 70% of the island while supporting over 400 species of flora and fauna, including several locally, regionally and provincially rare species. Fox Island is the second largest island, covering an area of approximately 135 ha and Fox Island is the smallest at 20 ha. Both islands also have large untouched forests that support a number of flora and fauna species.

Understanding the importance of the natural heritage features on their islands, the Chippewas of Georgina Island First Nation partnered with the Lake Simcoe Region Conservation Authority to prepare a subwatershed plan for Georgina, Fox and Snake Islands. This plan aimed to identify the impacts on the islands' natural heritage features while ensuring that the cultural values of the First Nation as keepers of Mother Earth are recognized and integrated into the efforts put forth for future generations. The plan also aimed to deliver consistent on-going efforts within the Lake Simcoe watershed. The Chippewas of Georgina Island have undertaken a number of initiatives to protect the natural heritage found on their lands, including:

- Undertaking a wetland evaluations program which surveyed and delineated 735 ha of wetlands, and identified measures to protect these areas and their ecological functions;
- Completing a forest management plan to identify the islands' forests habitats and manage them to help ensure that water quality is protected (i.e., forested lands help hold soils in place and prevent erosion, help to take up nutrients and prevent them from draining into the lake);

- Ash tree monitoring and management on all three islands with 170 trees selected for treatment;
- Wild rice restoration, a program that started in 2012 and provides ecological benefits such as providing food and shelter for a variety of waterfowl, providing cover and structure for various fish species, reducing algal blooms, improving water quality, and creating a buffer for shoreline erosion; and
- Gerties Creek Restoration, which aimed to enhance and stabilize the shoreline, improve fish and benthic invertebrate habitat, improve water quality, and mitigate flooding effects from climate change.

2.2.3 Non-Profit Organizations

There are many non-profit organizations that play a vital role in the conservation, restoration, and promotion of the Lake Simcoe watershed. Many of these organizations successfully manage projects either across Canada or throughout Ontario with in-depth experience understanding the importance of maintaining the natural environment in the Lake Simcoe watershed. These organizations are often able to accomplish large-scale projects with a smaller budget made possible by grant funding, donations, fundraising and partnerships.

There are a number of different groups within the Lake Simcoe watershed (at least 12 prominent) that focus on protecting, promoting and sharing our local environments. A large non-profit organization that has contributed greatly to the health of the watershed is Ducks Unlimited Canada. Ducks Unlimited Canada strives to conserve, restore and manage wetlands and grasslands to benefit waterfowl, wildlife, and people to ensure that they are abundant for future generations to enjoy. This organization undertook a multiyear project to assist in reducing the phosphorus loading within Lake Simcoe by improving the health of the wetlands in the Black River subwatershed. The Nature Conservancy of Canada (NCC) is an organization that protects and conserves important natural areas and biological diversity across Canada for their intrinsic value and for the benefits of future generations. The NCC has worked to improve the watershed by purchasing and preserving 312 ha of woodland within Happy Valley Forest and 3,200 ha in the Carden Alvar, a large portion of which is located within the LSRCA watershed. These parcels of land will be protected and restored as necessary for productive woodlands and grasslands, respectively. Ontario Nature, a non-profit organization that assists many groups across the province in preventing and reversing the decline of biodiversity in Ontario, has been protecting significant natural areas since 1961. The Cawthra Mulock Nature Reserve in the Township of King is one of these protected nature reserves which hosts a diversity of habitats including wetland, meadows, mature hardwood and mixed forests within its 108 ha property.

2.2.4 Municipalities

The Lake Simcoe watershed spans across 20 municipalities through York and Durham Regions, Simcoe County and the cities of Kawartha Lakes, Barrie and Orillia. Municipalities protect the natural resources found in the watershed by governing land use at the regional and local level in accordance with provincial planning. Many municipalities have made significant investments into identifying natural

heritage systems by identifying areas for protection and restoration in their Official and Secondary Plans. By adopting natural heritage policies into Official Plans, the inter-relationship between the natural and built environments are managed to preserve ecological, cultural, social and economic benefits. These policies vary across the watershed but they all aim to protect natural heritage features, provide appropriate setbacks and buffers as determined according to plan policies, and prevent the negative impacts from certain practices on the natural environment.

Both regional and local municipalities protect natural areas through land holdings and the creation of parks and open spaces that are available to residents to enjoy and connect with nature. Municipalities also offer a network of trails for joggers, hikers and bikers to promote a healthy lifestyle and bring the community together to enjoy the natural environment. For example, the York Regional Forest is made up of 2,300 ha of protected land and 18 properties with more than 120 km of trail available to the public. These properties support a variety of outdoor recreational activities including hiking, bird watching, horseback riding, snowshoeing, cross country skiing, and mountain biking which attract a number of visitors every year. In addition to acquiring land for restoration and conservation, municipalities also manage their properties which can include tree planting, sustainable harvesting and tending. Municipalities also often host outdoor education programs for a variety of groups and organizations to teach participants about the forest ecosystem and its importance to the community.

2.2.5 Lake Simcoe Region Conservation Authority

Under the *Conservation Authorities Act*, Regulation 179/06, the LSRCA is responsible for regulating development and interference with wetlands and alterations to shorelines and watercourses. Under this Act, the LSRCA provides advice and guidance to its member municipalities on the implementation and application of federal and provincial planning documents in an effort to further enhance and protect the natural heritage system in the watershed. Through its relationships with municipalities, the LSRCA also provides review and advice on official plan updates for matters related to natural heritage, natural hazards and water resources.

The LSRCA also has in place Land Securement Strategies which provide direction for securing lands to protect the watershed's natural heritage features. The LSRCA currently owns 1,602 ha of lands which are dominated by natural heritage features like woodlands, wetlands and watercourses but also include 75 km of trail. In addition, programs in planning and development, education, stewardship and science and monitoring support the protection and management of the natural environment and overall watershed health.

2.3 Stressors on the Lake Simcoe Watershed and Ecosystems

The watershed is an interconnected matrix of important natural, urban and agricultural systems with unique areas such as the Oak Ridges Moraine, Greenbelt and the Holland Marsh. The active atmosphere means the natural environment is subject to a significant range of interrelated pressures such as land

use change, climate change, and pathogens, pests and invasive species. These are serious issues that require attention and collaboration in order to achieve successful mitigation or adaptation solutions.

Similar to other services necessary for society, agricultural practices can result in negative impacts to natural heritage features. The historical clear-cutting of land for the creation of fields, the runoff of fertilizers and pesticides along with alterations of the natural water balance through water taking and tile drainage practices all had negative effects on the environment. Since then, the agricultural community has adopted many programs to help reduce these negative impacts associated with agricultural practices to the surrounding natural environment. Programs such as the 4R's work to reduce any stresses cause by fertilization, and the adoption of best management practices bring environmental stewardship and agricultural practices together (OMAFRA, 2017). Although great strides have been made in protecting the natural environment, consistent effort will be required to continue to increase protection of natural heritage features.

Urban areas consist of residential, commercial and industrial land uses and the supporting infrastructure of roads, highways and rail ways. Large areas of impervious surfaces are generally associated with urban landscapes such as roads, parking lots, houses, roofs and even manicured lawns. These greatly alter quality and quantity of surface and groundwater flows. Considering natural heritage systems as a land use within a complex southern Ontario matrix, urban areas are considerable barriers to migration of biological species in the watershed. In addition to fragmentation across the landscape including the shoreline, road mortalities associated with vehicle collisions are amplified in urban spaces. The importance of viable connectivity in urban natural heritage systems is essential to maintaining a functional and resilient NHS. The introduction of non-native species, pets, erosion, garbage dumping, unauthorized recreational use and contamination are all associated with the expansion of urban areas. All of these land use changes contribute to indirect impacts such as noise, increased lighting, dust and vibration. Recreational land uses such as golf courses, parks, camping grounds, and recreational uses such as fishing can remove natural heritage features and resources from the ecosystem beyond its renewable resources ability.

Phosphorus is a key water quality concern in Lake Simcoe and annual loading in the Lake continues to stunt healthy water conditions that sustain natural lake fish species. Phosphorus loading from the watershed streams account for 56%, followed by the atmosphere, sewage treatment plants, septic and the Holland Marsh and smaller polders (4%). Although phosphorus reductions in the Lake have

advanced, the current average annual loading of 85 tonnes is still greater than the 45 tonnes annual target.

Since monitoring began in the 1970's, chloride levels in Lake Simcoe as well as in the tributaries and groundwater within the watershed have shown a steady increase (LSRCA, 2017b). The majority of this increase in salinity is caused from the use of salt on roads, sidewalks and parking lots in the winter. Salt is applied to reduce the risk of ice on roads and walkways; however as snowmelts occur the remaining salt is washed into waterways. This increase in the salinity is causing a change in the species composition found in watercourses in as much as 64% of the watershed (LSRCA, 2017b). With this recent research showing the high amount of stress salt is causing on the watershed, strategies are ensuing to attempt to mitigate these effects.

Flooding in Aurora, June 2017

Climate change has begun to alter, and will continue to cause dramatic effects on the water quality, quantity and aquatic life within the Lake Simcoe watershed. Increasing air temperatures cause water temperatures to rise, altering the species dynamic of streams, wetlands, lakes and other water bodies. From 1980 to 2012, an air temperature increase of 1.6^{o}C within the watershed has led to warmer water temperatures (MOECC, 2017). Along with the changing temperatures, the increase and temporal variability in dramatic rainfall events alter the water quality in the watershed by causing an increase in pollutants, nutrients (phosphorus and salt concentrations) and sediments (suspended solids) being washed into streams and lakes. This combination will continue to cause a decline in the availability of cold water fish species habitat and an increase in warm water fish species, affecting aquatic food webs and may lead to a decline in aquatic biodiversity. In addition, warmer air temperatures are causing an increase in surface water temperatures and are leading to a shorter duration of winter ice cover, likely causing a reduction in the coverage of fish spawning ground, an increase in evaporation and infiltration, and an increase in shoreline erosion.

Changes to the average temperature and precipitation patterns due to climate change are anticipated to alter the distribution and abundance of flora and fauna species within the Lake Simcoe watershed. The ranges of many species are extending into areas where previously they were unable to survive due to cooler or altered moisture conditions. Although, this may seem beneficial to an ecosystem as it would increase the area's biodiversity, there may also be many negative effects from this change. An increase in the number of species at one trophic level can cause an imbalance in the area's food web and may lead to the elimination of other species. Additionally, the warmer weather will allow invasive species to expand into new habitats causing degradation and elimination of habitat. The introduction of new parasites and diseases and competition with indigenous species could cause them to disappear from their native range. Changing temperatures brought on by climate change may reduce distribution of some species such as the Black Spruce, White Spruce and Balsam Fir within the Lake Simcoe watershed

as warming temperatures limit their ability to survive in southern regions and will drive the population to more northern areas (Lemieux et al., 2012).

Climate change is projected to have various social impacts, including effects on recreational activities, infrastructure and agriculture. Winter recreation activities will be affected due to decreases in ice thickness, duration of ice cover, and shifts in species distribution. These changes will substantially reduce the ice fishing, alpine and Nordic skiing, and snowmobiling season, with studies showing a reduction of at least 52% in ice fishing season by 2050 (Scott et al., 2002).In the winter of 2001 and 2012, Lake Simcoe did not freeze over due to milder winter temperatures. Projected increased temperatures and longer periods of warmer weather may increase interest in visiting natural heritage areas, with Lemieux et al. (2012) predicting annual visits to Sibbald Point Provincial Park increasing by 19-28% by the 2050s. This increased interest may place higher pressures on public park resources in the Lake Simcoe watershed triggering negative environmental effects. These altered weather patterns may also have dramatic effects on agriculture in the Lake Simcoe watershed such as increased insect species harmful to humans and crops that will threaten food production and the economy. Extreme weather events are predicted to cause damage to infrastructure within the Lake Simcoe watershed; homes and commercial buildings, road and crossing systems, stormwater drainage systems, drinking water and water treatment services, hydro transmission lines, and natural gas pipelines are expected to be susceptible to deterioration. Climate change may also result in drinking water concerns due to increases in algal blooms and pollution, which may result in a decline of groundwater recharge and reduce consumption availability. Climate change is likely to amplify all current pressures and stressors on the Lake Simcoe watershed.

Invasive species are some of the largest threats to Lake Simcoe's ecosystems. Species such as Quagga Mussel, Round Goby, Garlic Mustard, Dog-strangling Vine, Common Reed, and Emerald Ash Borer have achieved widespread loss of native quality in natural heritage features and decreased their ecosystem resiliency. Invasive species once established are difficult and costly to manage and have the ability to spread aggressively. The opportunity to manage these threats immediately and use preventative measures that enable them to prosper is of continued importance.




From left to right: Himalayan Balsam *(Impatiens glandulifera*), Common Reed (*Phragmites australis ssp. australis*), European Buckthorn (*Rhamnus cathartica*), and Purple Loosestrife (*Lythrum salicaria*) are all invasive species in the Lake Simcoe watershed

Chapter 3

3.0 Developing the Natural Heritage System and Restoration Strategy

The approach to the Natural Heritage System (NHS) was based upon a three step process:

Minimum policy standards based upon the Provincial Policy Statement, Greenbelt Plan, Oak Ridges Moraine Conservation Plan and Lake Simcoe Protection Plan were used as the foundation to define the NHS and illustrate the current state of protection in the watershed. It is important to acknowledge that Regional and Local Municipal Official Plans were reviewed and considered through the development of the NHS however the variation of these plans were applicable only to the boundaries of their respective municipalities but should be considered in addition to the NHS presented in this Strategy. Further, this Strategy acknowledges that features identified through the Natural Heritage System and Restoration Strategy (NHSRS) are intended for protection; however some existing settlement policies allow for development and should be considered if applicable. This Strategy is intended to complement these areas by promoting science-based decision making in order to achieve watershed targets, where possible, such as infill in greenfields where NHSRS recommendations potentially exceed municipal policies but should be supported. It is important to note that simply using minimum policy standards as the basis of an NHS pre-dates current approaches and recommendations in scientific literature.

An enhanced ecological system is intended to use the current state of the NHS and take into consideration scientific information available to define a holistic system including principles of NHS ecology (**Table 3-1**). This includes identifying the NHS targets for the watershed and the enhancement areas that would contribute to achieving targets. Lands intended for ecological restoration were identified to increase the size of the NHS and the support to the core areas. Finally, a system's based approach considers connecting the landscape by increasing the size of core areas and the connectivity between core features based upon scientific principles of landscape ecology and focused spatial analysis of the watershed land use. These resulting areas, in addition to the targets identified in this NHSRS will provide direction for sustaining ecosystem functions and services in a sustainable resilient system.

Table 3-1: Natural Heritage System Principles according to South Central Ontario Conservation Authorities (SCOCA)

Natural Heritage System Principles	Description
Shape	The shape of the patch determines the amount of interior habitat present and the influences of edge effect, with a circle being the most optimal patch shape.
Matrix	The influences from the surrounding landscape can have both positive or negative effects on the patch depending on land use or habitat type.
Connectivity	The connections between patches via corridors and close proximity allow the dispersal of flora and fauna creating healthier habitats.
Diversity/Quality	A productive landscape includes a high diversity of flora and fauna native to the area with limited non-native and invasive species.
Approach	By approaching the creation, enhancement or restoration of a natural heritage system with the goal of improving the overall landscape, a much healthier ecosystem will result.
Scale	The size and temporal state of a natural heritage system should complement and flow well with other systems of various sizes and in all seasons.
Cover/Distribution	The amount of cover and its distribution can provide benefits such as the improvement of soil, water and air quality as well as promotes biodiversity.
Size	As patch size increases, the negative impacts of other patch factors become less significant.

Development of a NHS reinforces an understanding that individual areas and features have strong ecological ties to each other, as well as physical attributes of the overall landscape. Of importance is recognizing vital landforms in the Lake Simcoe watershed that should be preserved permanently such as the ORM or the Oro Moraine. With respect to this Strategy, the landform conservation is captured through the features identified as part of the NHS in order to support their long-term ecological integrity.

Defining the Natural Heritage System included a combination of landscape and species spatial analysis incorporating both planning and science rationale to be:

- **Defensible** - using current policy including the recently revised four Provincial Plans and current science;
- **Flexible** - to complement and when necessary supplement municipal Official Plans, restoration initiatives occurring in the watershed, and the diversity of services the LSRCA provides;
- **Measurable** - with targets that can quantify success as a result of the implemented strategy; and
- **Repeatable** - to be able to continue to build and evolve the Strategy

As such, the NHS is based on an ecosystem and watershed scale approach, which recognizes the strong inter-relationship between natural features within and beyond the watershed limits. The Restoration Strategy extends further beyond enhancing degraded conditions and applies a broad definition of restoration to encompass protection, enhancement, restoration and creation.

3.1 Vision, Goal and Objectives

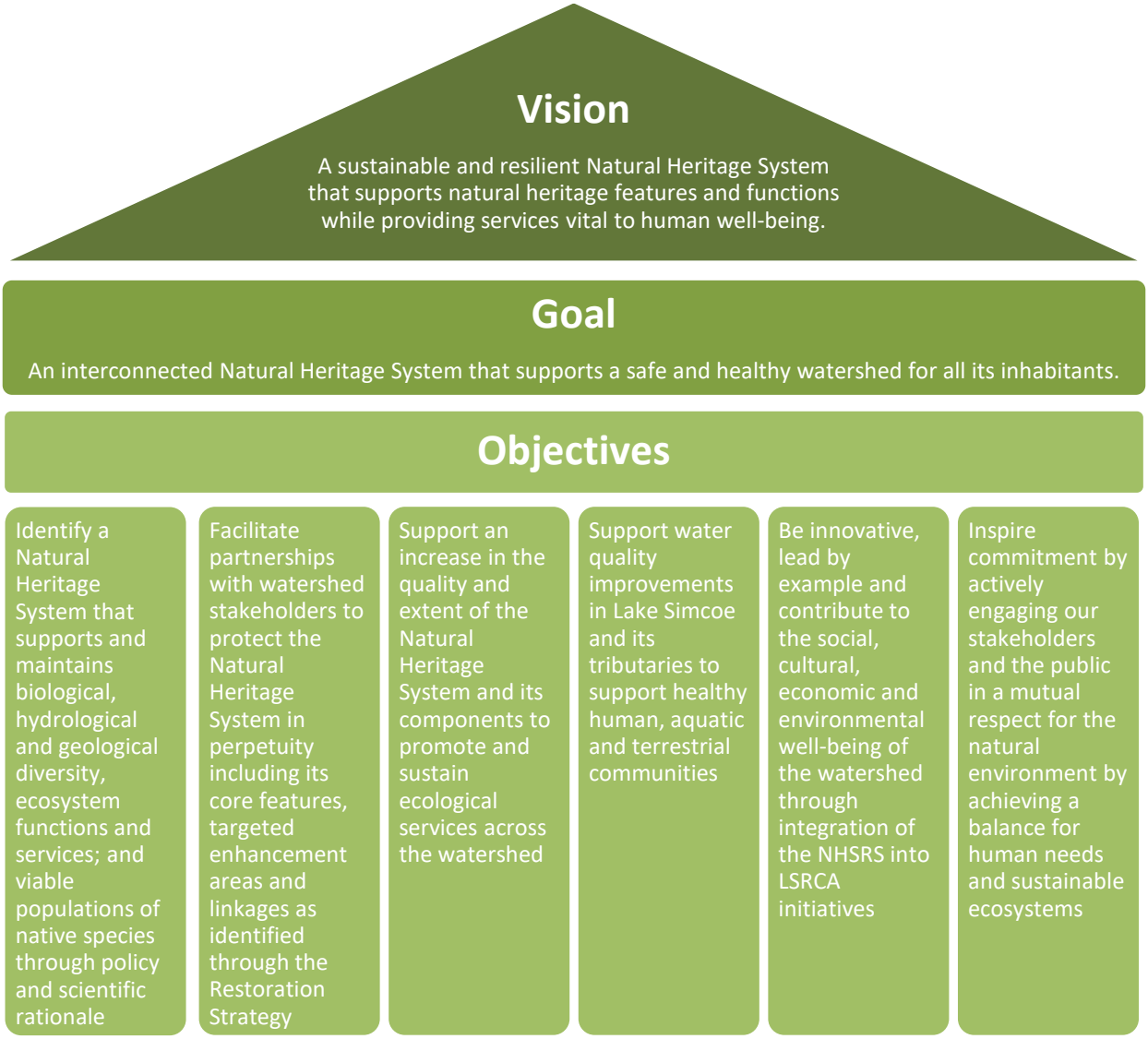


Figure 3.1 Vision, Goal and Objectives of the Natural Heritage System and Restoration Strategy. The vision, goal and objectives of the NHSRS accompany the targets as per Section 3.2 of this Strategy. The vision, goal, and objectives are likely to be achieved if the targets are accomplished.

3.2 Targets

Setting targets is a critical part of the management of the NHS that enables the ability to monitor progress through repeated measurement and assess the success of natural heritage management programs and actions. Setting targets is still a relatively new approach for Conservation Authorities in order to provide support to their internal programs and the broader watershed community.

In order to determine the NHS targets and goals of the watershed, a review of existing scientific and policy information was conducted. First and foremost, the Lake Simcoe Region Conservation Authority (LSRCA) supports the principle of "no net loss" strengthened by a "net gain" as an important step towards achieving environmental sustainability in Ontario. Publications, such as Key Issues in Biodiversity Offset Law and Policy (Poulton, 2015), provide valuable context and background on the implementation of ecological offsetting, both locally and within an international setting. The use of municipality management plans such as York Region's Forest Management Plan (York Region, 2016) help to assist in setting goals and devising actions plans such as achieving maximum woodland cover. In addition, the Valuing Natural Capital in the Lake Simcoe Watershed report (Wilson, 2017) provides an assessment of the value of the watershed's natural capital. These values are essential for recognizing the comprehensive cost of impacts to natural heritage features.

Guidance documents such as How Much Habitat is Enough (Environment Canada, 2013), Ontario's Biodiversity Strategy (Ontario Biodiversity Council, 2011), Biodiversity: It's in our Nature – Ontario Government Plan to Conserve Biodiversity 2012 – 2020 (OMNR, 2012), LSRCA subwatershed plans, and existing literature provide baseline conditions for the watershed recognizing these values are minimum thresholds to support a sustainable NHS.

The targets identified for the Lake Simcoe watershed (**Table 3-2**) are representative of current and predicted environmental conditions with the best information available. These targets will guide implementation goals and services provided in the watershed while considering feasibility. A geographic information system (GIS) approach was used to accurately define the existing conditions by isolating natural heritage features defined by the Ecological Land Classification (ELC) from urban, agricultural and infrastructure land uses.

Table 3-2: Natural Heritage Watershed Targets for the Lake Simcoe Watershed

Feature Type	Target for the Watershed	Existing Conditions in NHS
All Core Features	• No net loss of features • Pursue a net gain of features	Ecological Offsetting Plan substantiates the net gain associated with any loss of features across the watershed
Wetlands	• 40% of historic watershed wetland coverage • Minimum 20% of watershed	• Historic wetland habitat remaining is 20-25% • Watershed wetland habitat is 18%
Watercourses and Fish Habitat	• 75% of stream length should be naturally vegetated within the coverage area of the minimum 30	Watershed riparian vegetation is 62% within the coverage area of the 30 m vegetation protection zone

Feature Type	Target for the Watershed	Existing Conditions in NHS
	m vegetation protection zone	
Woodlands	• 40% forest at a watershed scale • 130 forest patches >200 ha • Interior forest should account for a minimum 10% of watershed	• Watershed woodland cover is 34.9%. • There are 110 forest patches >200 ha and 22 patches within 25 ha of 200 ha • Interior forest cover is 12.5% of watershed.
Lake Simcoe Shoreline	• Minimum 30 m vegetated protection zone along shoreline	Shoreline natural vegetation coverage is 27% of the shoreline
Corridors	• 100 m in width for main stem watercourse corridors	Total area in the corridor widths is 15,363 ha

3.3 Approach

In order to define the NHS, an extensive digital library was assembled of existing natural heritage data and mapping layers. All available data was collected from internal resources and Land Information Ontario (LIO) and assessed towards the development of a NHS. These included, but are not limited to, ortho-rectified aerial photographs (2013), topographic contours, watercourses, roads, railways, wetlands, landcover, floodplain, and meander belts to name a few.

A literature review was then conducted that included existing natural heritage policies, scientific literature and other approaches to NHS delineation (SCOCA principles, **Table 3-2**). The scientific review explored several components of the NHS, the stressors, impacts and effects of the natural heritage systems. In addition, a review of existing natural heritage systems (e.g. Region of York, Toronto and Region Conservation Authority, Greenbelt Plan, etc.) were reviewed to maintain consistency for opportunities to connect natural heritage systems across and beyond the watershed. The literature review facilitated interpretation of the NHS components and criteria to define the features which were translated into a GIS platform through produced mapping. Where data gaps existed, surveys were conducted in 2016 and 2017 to field-truth attributes or features of the NHS.

The GIS mapping was largely based upon the landcover layer (internal LSRCA data) (**Figure 3.2**) which includes Ecological Land Classification (ELC) to community series, other land uses (agriculture, urban, estate etc.), and impervious areas across the watershed. This layer was updated to 2013 ortho-photography mapping and ELC boundaries refined in urban areas to 2015 to capture land use changes such as secondary plan area developments and the extension of Highway 404. A field checking exercise was conducted to review potential successional changes in the ELC layer, and where necessary, revised as part of this exercise. GIS techniques were used to develop each individual layer using criteria translated into algorithms. Criteria of each layer included a combination of attributes such as size, shape, landcover, proximity to other features and adjacent land uses. Each layer was examined for quality assurance and quality control (QA/QC) to reduce redundancy (hedgerows in woodlands, road fragmentation, impervious areas etc.). Finally, each layer was superimposed in order to evaluate and identify the relationships and connections resulting in the NHS.

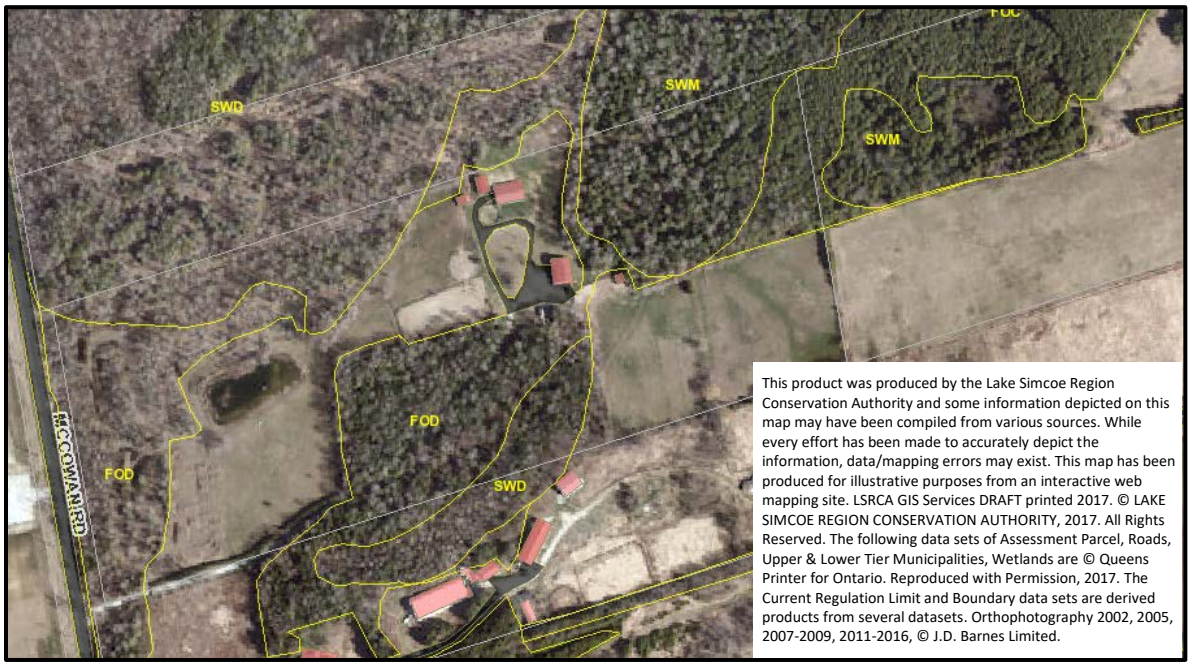


Figure 3.2 LSRCA Landcover Layer. An aerial photograph with the landcover layer overlaid. This layer identifies natural areas, urban built areas, agricultural areas and impervious cover (shown in red) in the watershed.

In addition, these layers were assessed against existing NHS information in the watershed such as the Greenbelt Protected Countryside and NHS, York Region Significant Woodlands, Simcoe County woodlands, ORM woodland, wetland and natural core and linkage areas. Based upon the recent release of the NHS mapping for the Greater Golden Horseshoe, it is likely that the LSRCA NHS will overlay fairly seamlessly, however where refinement is required the NHSRS will refine these boundaries through mapping update intervals.

3.4 Consideration of Provincial, Regional and Municipal Plans

When reading this report, it is important to note the Strategy should be read in conjunction with relevant acts, policies, and plans. At the provincial scale this includes the Provincial Policy Statement (2014), Lake Simcoe Protection Plan (2009) and the recent 2017 revised Greenbelt Plan, Growth Plan for the Greater Golden Horseshoe, and Oak Ridges Moraine Conservation Plan. Other provincial level acts include the *Conservation Authorities Act*, the *Public Lands Act*, the *Clean Water Act*, and the *Environmental Assessment Act*.

The land use planning responsibilities lie with the approval Authority as delegated by the province of Ontario. In the Lake Simcoe watershed, upper, single and local tier municipal OPs are the mechanism for natural heritage protection. Generally across the watershed, these plans are in conformity with existing Provincial plans and in some cases recognize the need of their individual municipalities and extend beyond minimum policy framework. Some examples include meadow protection in the Town of Newmarket OP, identified local and regional corridors in the Town of East Gwillimbury and Township of

Oro-Medonte OP, and restoration areas in the Town of Aurora and Town of Georgina OP. These specific feature identification or policies facilitate progressive and innovative system based policy development.

Progressive natural heritage systems and policies are vital to achieve healthy, sustainable communities that can tackle the challenges of land use development pressures and climate change. This Strategy recognizes the specific policies and consideration of OPs in order to balance natural heritage features in urbanized settings. It intends to complement existing policies and zoning designations and where possible assist the natural heritage support needs of municipalities to guide their public and stakeholders to extend beyond the status quo and recognize their watershed-wide role and responsibility. Where draft plan approvals exist for land parcels, the Ecological Offsetting Plan tool can support a net gain in the watershed.

3.5 Consultation

Consultation with a wide range of stakeholders is a key part in the implementation of the LSRCA NHSRS and its potential achievable success. The role of watershed protection is shared through relationships with stakeholders that evolve into on-the-ground action. The development of the NHSRS was guided by an internal working group of senior management and technical staff to identify the needs of the watershed across all disciplines. A focused technical working group was created to assemble data and review methodologies used in the development of the NHS. Presentations to the LSRCA Board of Directors helped shape the Strategy and ensure input from a variety of positions were taken into account. The draft version of the NHSRS was available for review for a two month period and posted on the LSRCA website for public review. This was followed up by focused consultation through presentations at representative organization Board meetings, workshops, coordinated meetings, and one-on-one interviews with regional, single and local tier municipalities (County of Simcoe, Region of York, Township of Ramara, City of Barrie, City of Kawartha Lakes, City of Oro-Medonte, Town of Innisfil, Town of Newmarket, Town of Aurora, Township of King, Town of Whitchurch-Stouffville, Town of Georgina, Town of East Gwillimbury, Township of Brock), Conservation Authorities (Credit Valley Conservation Authority, Toronto and Region Conservation Authority, Ganaraska Region Conservation Authority), Ontario Federation of Agriculture, Durham Region Federation of Agriculture, Simcoe County Federation of Agriculture, York Region Federation of Agriculture, Building and Land Development Industry Association, First Nations (Chippewas of Georgina Island First Nations), and many additional organizations (Nature Conservancy of Canada, Ducks Unlimited Canada, Ontario Nature). Through the public review process, additional comments or letters of support were received from EcoSpark, Save the Oak Ridges Moraine Coalition (STORM), North Gwillimbury Forest Alliance, Friends of the Rouge, Innisfil District Association, Ontario Headwaters Institute, Alton Grange Association, Concerned Walkerton Citizens, Coalition on the Niagara Escarpment, Earthroots, Sierra Club of Canada-Peel Group, York Region Environmental Alliance and the general public. Comments received through the consultation process were assessed and as a result were integrated into the report where appropriate.

Chapter 4

4.0 The Natural Heritage System

4.1 Categorization of Natural Heritage Features

The Natural Heritage System (NHS) has been defined using a systems based approach, which through identification emphasizes the protection of associated ecological functions and services. The NHS is categorized into core features with supporting targeted areas that enhance the NHS, and buffers. In some cases, protection limits may extend beyond the physical boundaries of a feature. For example, functional linkages that support flora and fauna dispersal patterns may be captured in the NHS, or groundwater zone of influences that support wetlands likely extend beyond the physical vegetation boundaries.

Core features are those considered critical to the NHS whose protection and longevity are imperative to ecosystem functions and services of the Lake Simcoe watershed. They include features like wetlands, watercourses and woodlands, and must be retained on the landscape through policy protection. In some cases, negative impacts or land use changes may be permitted in natural heritage features such as those related to the installation of necessary infrastructure. Opportunities to first avoid impacts to the NHS should be pursued where possible since natural heritage feature replacement is difficult and some features are essentially irreplaceable. Where feature losses in the Lake Simcoe watershed cannot be avoided, feature creation on the landscape is required, subject to the LSRCA Ecological Offsetting Plan (LSRCA, 2017a) and must achieve a net ecological gain which can include replacement and enhancements. The distribution of core features, according to each subwatershed and municipality in the watershed, are discussed in the report; however, the tables and graphs are provided in **Appendix A** of this Strategy.

Targeted areas are those important to achieving a resilient NHS, either through recognizing additional natural heritage features for protection or restoration of these areas. These areas may include grasslands, restoration areas and regional and local linkages. Current policies that govern land use in these areas are unlikely to support natural heritage feature restoration or protection. It is recommended that stewardship is promoted with landowners, including best management practices for land management. These lands should be restored and incorporated into the NHS should existing land use practices that limit restoration be discontinued.

Through this NHSRS, the following is recommended:

- Core features be protected and retained for the future;
- Targeted areas that support the NHS including corridors and linkages are enhanced including protection and restoration;
- Buffers are applied to the core features; and
- Environmental management recommendations are implemented to protect, restore and enhance the NHS.

4.2 Core Features

4.2.1 Watercourses and Fish Habitat

Beaver River Wetland Conservation Area

The importance of watercourses and fish habitat is most evident in Ontario where lakes, rivers, streams and other waterbodies support some of the highest fish species biodiversity in Canada, yet, they are heavily at risk because of human-related impacts (Chu et al., 2003). In the Lake Simcoe watershed, there are approximately five main stem watercourses that are fed by 35 tributaries, all draining into Lake Simcoe.

Maintaining or restoring watercourses protects aquatic species, improves downstream water quality and secures the aesthetic and natural values that communities consider important. From a fisheries perspective, watercourses can range in features and characteristics including varying thermal regimes, spawning habitat, nursery habitat, overwintering habitat, and migration routes. Of importance are the functions and services that watercourses and other waterbodies provide such as, but not limited to, erosion and flooding protection, water filtration services, recreation activities and drinking water sources.

Approaches to watercourse policy protection across the Lake Simcoe watershed are consistent by protecting watercourses and adjacent riparian areas defined physically from the meander belt width, normal high water mark or centerline of the channel. In the Natural Heritage System and Restoration Strategy (NHSRS), multiple feature layers were applied to define this core feature, including existing watercourses, fisheries data and meander belt width. Most watercourses are protected as per the Provincial Policy Statement and where applicable, they are also protected through policies of the Greenbelt Plan, Oak Ridges Moraine Conservation Plan and Lake Simcoe Protection Plan. Watercourses and their associated riparian zones were delineated in the NHS using two methods. For meandering watercourses, a 30 m riparian zone was identified from the meander belt. For non-meandering watercourses and other waterbodies, a 30 m riparian zone was identified from the normal high water mark.

Approximately 8,620 km of watercourses exist in this NHS with a core feature area of approximately 38,415 ha comprised of watercourses, fish habitat and riparian zones (**Figure 4.1**). Riparian natural areas include Ecological Land Classification habitat types such as woodlands, wetlands, thickets, meadows and alvars, and and accounts for 61% of the watercourse riparian zone in the NHS with 64% of these natural areas being wetland.

Brook Trout (Salvelinus fontinalis) found in the Lake Simcoe watershed

TheLake Simcoe Region Conservation Authority (LSRCA) has set a goal to achieve a minimum 75% natural cover for riparian areas (30 m width or greater). Implementing restoration in the NHS could elevate the quality of the riparian area to achieve a maximum of 94% natural area excluding the existing impervious and infrastructure. A breakdown of watercourses, fish habitat and riparian area identified by municipality and subwatershed is presented in **Appendix A**.

4.2.2 Lake Simcoe, Natural Areas Abutting Lake Simcoe and the Shoreline

The Lake Simcoe has a surface area of 722 km^2 and is the largest lake in Southern Ontario aside from the Great Lakes. As an important natural, social and economic resource, it supports a thriving tourism and recreational industry ($200 million annually) and provides drinking water for six municipalities. Over the years, an increase in human activities and population growth continues to affect the health and quality of the Lake and its tributaries, such as increased phosphorous loading in the Lake that impacts coldwater fisheries. Coldwater species in the Lake include Lake Trout, Lake Whitefish, Lake Herring and Burbot that are at risk in deepwater zones due to depletion of O_2 (**Figure 4.2**). The LSRCA is focused on managing contributions to the Lake through improving land and nearshore practices which includes adaptive management of the Lake by LSRCA and partners such as the MNRF, MOECC and upper, single and local tier municipalities. The Lake is further at risk as climate patterns change annually and the ecological web is disrupted by invasive species like Quagga and Zebra Mussels. Although not quantified as a core feature, the Lake is equivalent to and should be managed with improved best management practices.

Natural areas abutting Lake Simcoe (NAALS) refers to land that extends from the Lake Simcoe shoreline with natural self-sustaining vegetation of any plant form or potential natural community, but does not include vegetation communities maintained by anthropogenic-based disturbances (e.g. land for agricultural uses, manicured lawns or ornamental plantings) (MNRF, 2015). NAALS are defined as areas of continuous vegetation community class that have a minimum size of 1 ha and are wholly or partially within the 30 m buffer zone of the Lake Simcoe shoreline. According to the technical guidelines (MNRF 2015), these areas may include a narrow band of vegetation along the shoreline or they may cover larger areas, which extend a greater distance from the shoreline.

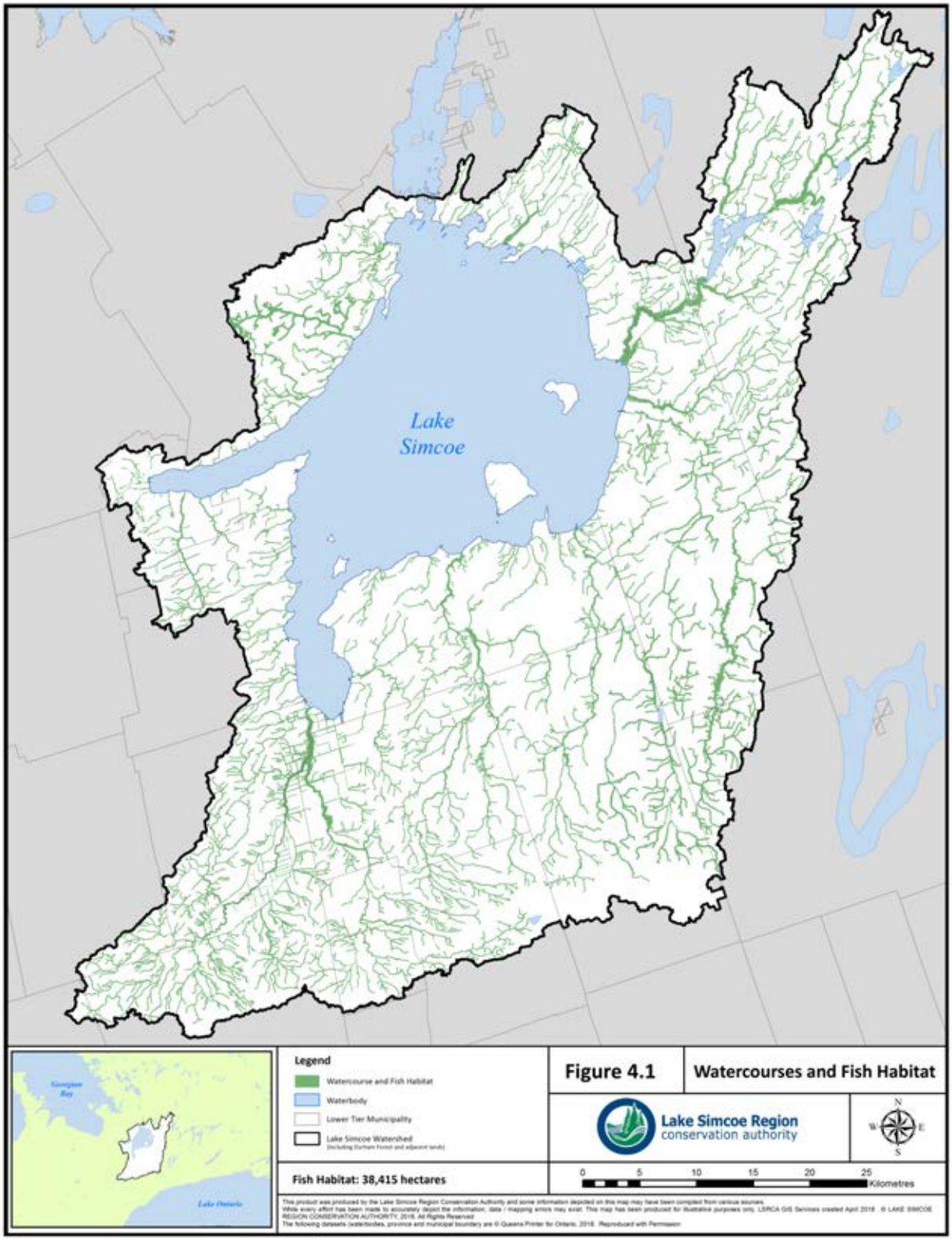


Figure 4.1 Watercourses and Fish Habitat in the Lake Simcoe NHS. A total of 38,415 ha of watercourses and fish habitat are identified as core features.

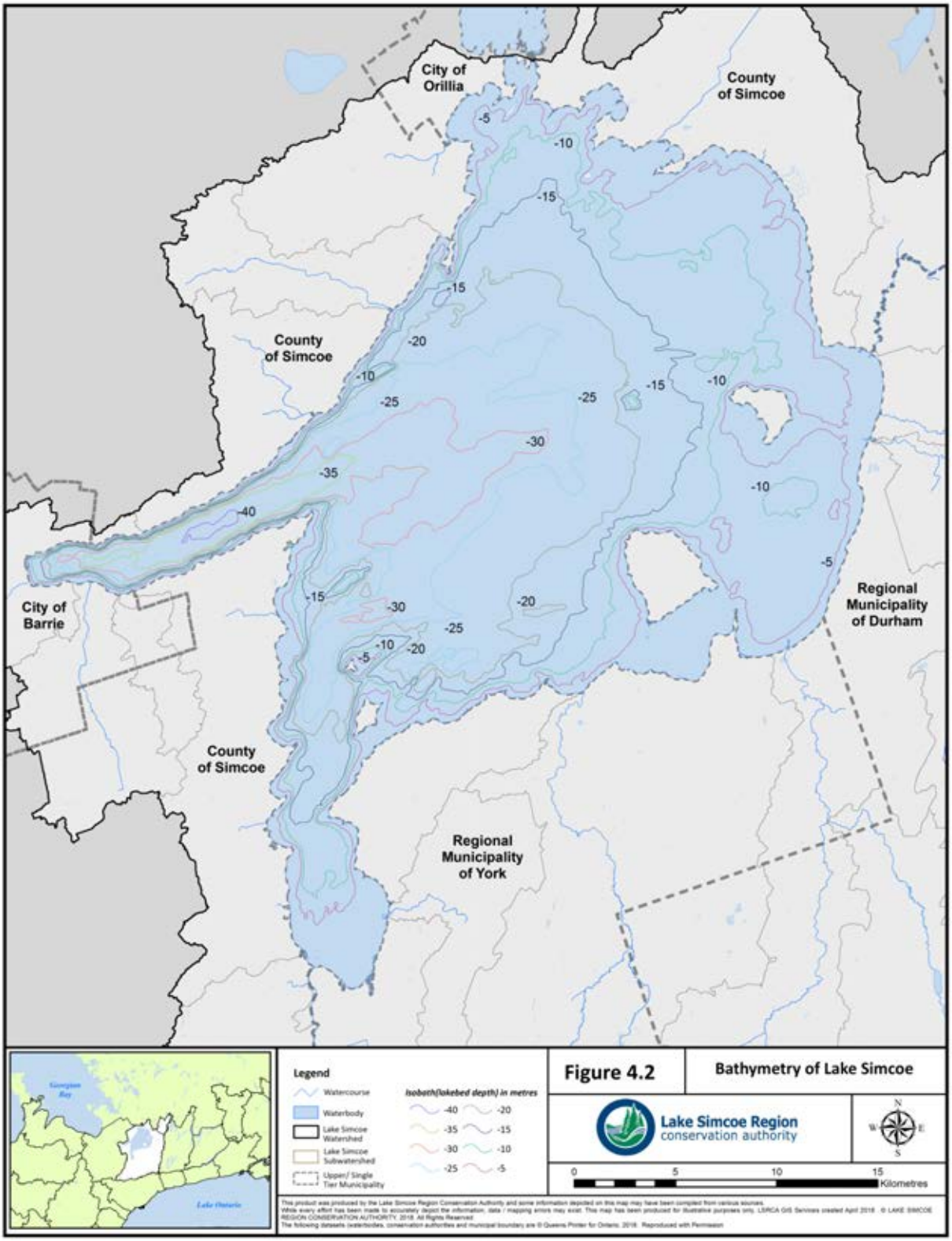


Figure 4.2 Bathymetry of Lake Simcoe (South Georgian Bay – Lake Simcoe Source Protection Committee, 2015). The depths of the Lake range from an average width of 15 m to its deepest area at 41 m, and include various temperate zones supporting warm, cool and coldwater fish species.

Using the criteria in the Lake Simcoe Protection Plan (LSPP) technical guideline, the LSRCA GIS landcover layer was used to generate the boundary and area of NAALS. For the purposes of the NHS, GIS polygons identified to community series according to the ELC (1st Approximation) were isolated within 30 m of the shoreline. These areas were further refined to exclude openings greater than 10 m wide that bisect vegetation communities. Where the bisecting area was less than 10 m, the opening was not considered separate; however, the bisecting opening (e.g. a road, trail or rail line) was excluded from the total area calculation area for NAALS.

This core feature area is applied to the jurisdictional boundaries of the LSPP rather than the entire watershed. This ensures that the NHS is defensible based on the policies of the LSPP. It is acknowledged that in the existing settlement boundaries, the urban settlement policies and those of regional and municipal Official and Secondary Plans would be applicable however the identification of NAALS is intended to strengthen the regional and municipal plans by identifying natural areas deemed important by the Province.

NAALS were identified in the Whites Creek, Talbot River, Ramara Creeks, Oro Creeks North and South, Hawkestone Creek, Barrie Creeks, Lovers Creek, Hewitts Creek, Innisfil Creeks, West Holland and East Holland subwatersheds (**Figure 4.3**), totaling 7,027 ha in area and accounting for 2.4% of the watershed. A summary by municipality and subwatershed is presented in **Appendix A**. The majority of these areas overlap with other core features such as woodlands, wetlands, watercourses and valleylands.

The Lake Simcoe shoreline encompasses the zone between the Lake and inland areas and functions to decrease erosion, support seasonal climate patterns and provide fish spawning habitat. A 30 m buffer was extended from the shoreline inland encompassing a total area of 760 ha of which 28% is natural area defined by ELC. This area is applied to the entire area surrounding the Lake and the low percentage cover is attributed to the land ownership and conversion of the shoreline by private residential dwellings (approximately 55%).

Lake Simcoe and Strawberry Island in Ramara

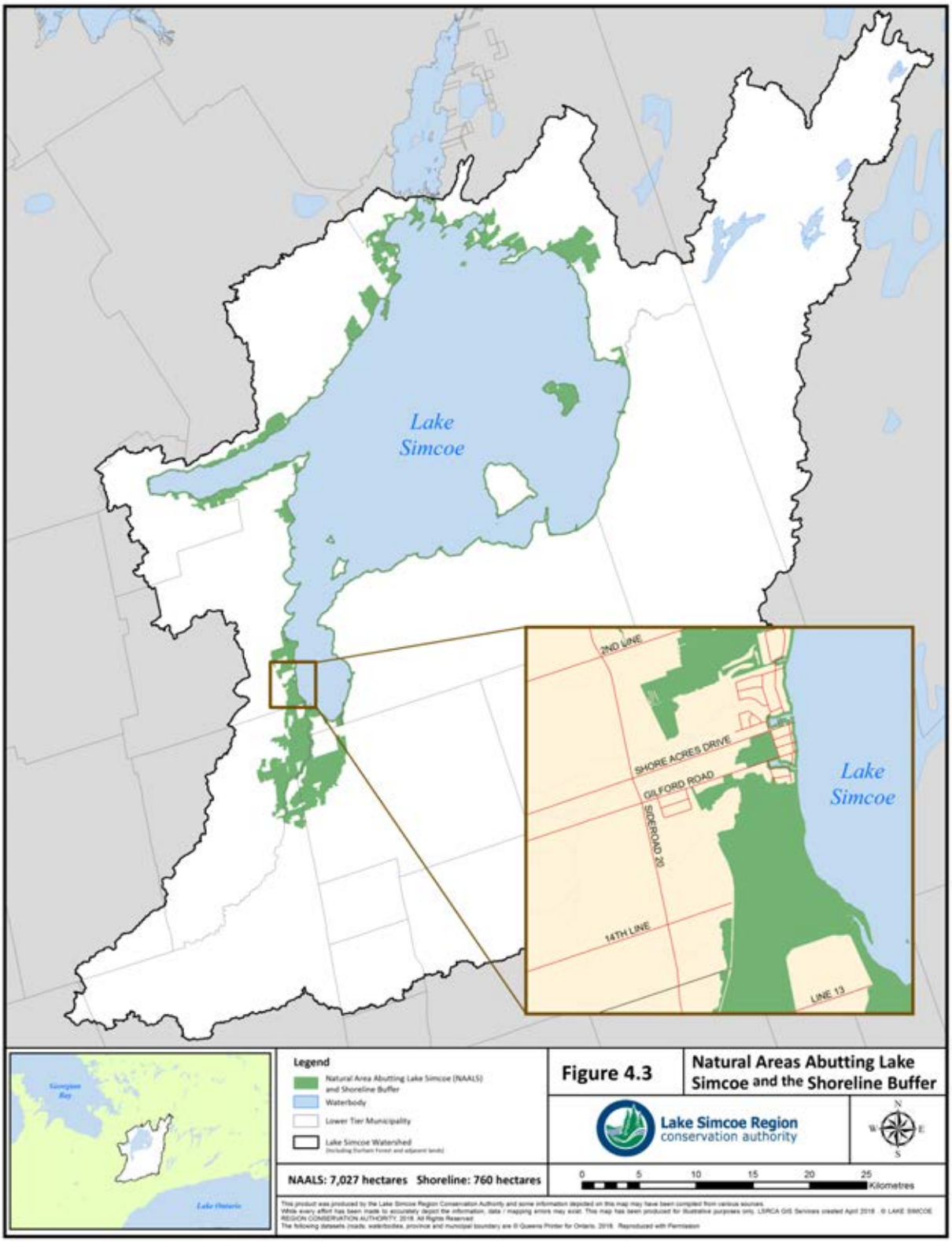


Figure 4.3 Natural Areas Abutting Lake Simcoe and the Shoreline Buffer. This area totals 7,787 ha across the watershed.

4.2.3 Wetlands

As per the Provincial Policy Statement (2014), wetlands are lands that are seasonally or permanently covered by shallow water, as well as lands where the water table is close to or at the surface. In either case, the presence of abundant water has caused the formation of hydric soils, and has favoured the dominance of either hydrophytic plants or water tolerant plants. In the Lake Simcoe watershed, all four major types of wetlands (swamps, marshes, bogs and fens) are present (Beacon Environmental & LSRCA, 2007; MOE, 2009). In Ontario, wetlands can be further defined as a Provincially Significant Wetland (PSW), evaluated non-PSW and unevaluated wetland (OMNR, 2010; OMNR, 2013).

Ontario wetlands are among Canada's most important natural features, accounting for 25% of Canadian wetlands and 6% of global wetlands, providing many functions to the surrounding natural environment and global wetland diversity (Zedler & Kercher, 2005; McInnes, 2013; MNRF, 2017a). According to a recent report, since the pre-settlement days, wetland loss in the northern section of the Lake Simcoe watershed ranges between 45% - 65%, while in the southern sections of the watershed, it accounts for an astounding 65% - 85% (MNRF, 2017a).

Many of the functions associated with wetlands support the communities in the Lake Simcoe watershed, contributing $374 million in annual ecosystem services (Wilson, 2017), and should be protected to allow for these services to be used in future years (McInnes, 2013). Wetlands provide flood retention abilities by storing large volumes of water during flood events (OMNR, 2010; Acreman & Holden, 2013; OMNR, 2013). This water is eventually returned to the hydrologic cycle through evaporation, evapotranspiration, and the slow release into connected streams. A combination of these processes reduces the peak flow during a storm event and allows the flow of water downstream to be more consistent overtime (Hillman, 1998; MNRF, 2017a). Investing in natural infrastructure, like wetlands, will be important for climate change mitigation as they produce at least $14 billion in economic benefits annually for Ontario residents, including carbon sequestration and pollution uptake. It has been estimated that maintaining wetlands on the landscape can reduce flooding financial costs by up to 38% (MNRF, 2017a).

Bog habitat found in Herrell Ecological Preserve

Wetlands offer a variety of habitats to support a wide range of species, such as aquatic and terrestrial plants, microbes, insects, amphibians, fish, reptiles, mammals and birds (Junk et al., 2006; OMNR, 2010). Because wetlands are highly productive areas, they are able to provide habitat for breeding, cover for protection from predators, and food for foraging. Wetlands support high species diversity within wetlands and surrounding areas, which leads to an overall healthier environment and long-term storage of carbon (Loreau, 1998; Tilman, 1999).

Wetlands in the NHS total 50,831 ha further divided by:

- **Bog – 135 ha**
- **Fen – 443 ha**
- **Marsh – 6,016 ha**
- **Swamp – 41,188 ha**

Wetlands have the ability to filter water from contaminants, nutrients, and unwanted suspended solids through a variety of processes including the settlement of suspended solids, nutrient uptake by micro-organisms and vegetation, bacterial transformations as well as decomposition within wetland soils (Verhoeven & Meulaman, 1999; Hoagland et al., 2001; Stottmeister et al., 2003). By allowing the natural purification of water by wetlands to occur, waterways downstream will become healthier and support a higher biodiversity (Richardson et al., 2011).

In order to determine wetland boundaries in the NHS, a layer was obtained from Land Information Ontario (LIO), which identifies PSW, evaluated non-PSW and unevaluated wetlands. Integrating existing wetlands policies, such as the Lake Simcoe Protection Plan, Greenbelt Plan, and Oak Ridges Moraine Conservation Plan, the LSRCA NHS has incorporated the following wetland criteria into core features:

- All Provincially Significant and evaluated non-PSW wetlands;
- All unevaluated wetlands greater than 0.5 ha; and
    - Where less than 0.5 ha, if the wetland was located within 30 m of a core feature, it was incorporated into the NHS.

It is estimated that 18% (50,831 ha) of the Lake Simcoe watershed is comprised of wetlands that should be protected as core features (**Figure 4.4**). Of this total, 52% (26,571 ha) of these wetlands are designated PSW, 6% (3,208 ha) evaluated non-PSW, and the remaining 41% (21,052 ha) of the wetland areas are unevaluated. The Holland Marsh and Holland Marsh Wetland Complex is the largest wetland habitat in the watershed (2,835 ha). A breakdown by municipality and subwatershed is presented in **Appendix A**. In comparison with the 2007 NHS study, it might appear that wetland coverage across the watershed is larger; however, this is misleading as the criteria for wetland protection differed during the previous study. It did not protect as much wetland as current policies, and did not include the additional area in the Upper Talbot subwatershed.

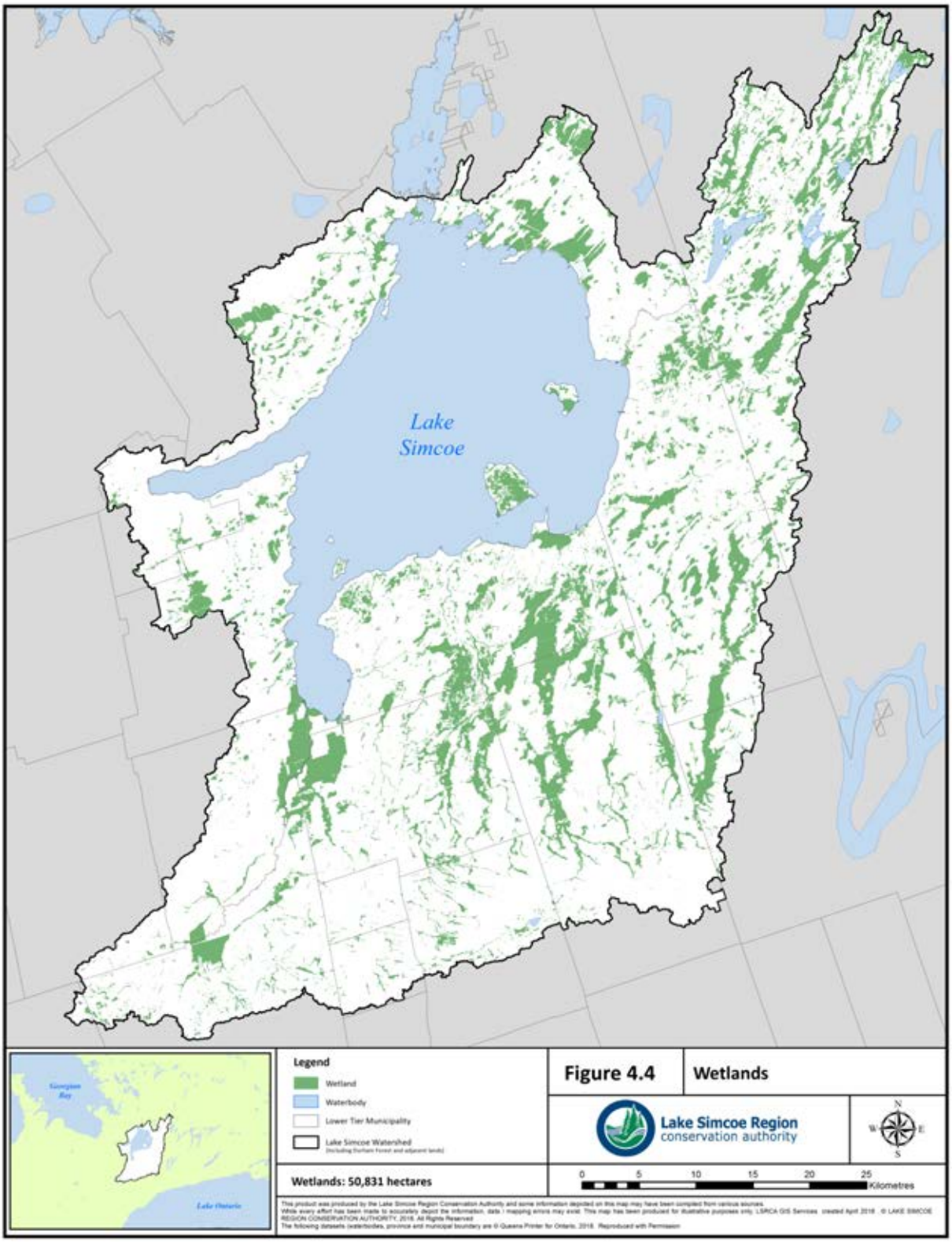


Figure 4.4 Wetlands in the Lake Simcoe NHS. Approximately 50,831 ha of wetlands are identified as core features in the NHS.

4.2.4 Woodlands

The provincial Ecological Land Classification (ELC) guide (Lee et al., 1998) currently defines woodland as "a treed community with 35% to 60% cover of coniferous or deciduous trees" and a forest as "a terrestrial vegetation community with at least 60% tree cover". However, for the purpose of this Strategy, woodlands include treed areas, woodlots and forested areas that provide environmental and economic benefits to both private landowners and the general public. These benefits can include erosion prevention, hydrological and nutrient cycling, provision of clean air and the long-term storage of carbon, wildlife habitat, outdoor recreational opportunities, and the sustainable harvest of a wide range of woodland products (OMNR, 2010). The significance of woodlands varies at the local, regional and provincial levels where attributes are considered ecologically important such as species composition, age of trees, location, size, and interior habitat and overall forest cover in a planning area (OMNR, 2010).

In the NHSRS, a review of broader scientific literature and watershed policies, like the Greenbelt Plan, Oak Ridge Moraine Conservation Plan, and Lake Simcoe Protection Plan, was conducted in order to identify woodland in the NHS. Using ELC, natural communities of treed vegetation (excluding active tree, fruit and nut plantations and hedgerows) were assimilated to develop a woodland layer. Recognizing the importance of succession on the landscape for woodlands and natural heritage systems, it was assumed that most thicket communities identified in the past have now developed into woodland communities. A field test was completed in 2016 to determine if succession into a woodland occurred for all thickets that were identified through aerial photography from 2007. Although the test found varying results in succession in different thickets, the LSRCA recognized the important role thickets play in the ecosystem and therefore are included in the NHS as woodlands. Any 20 m bisecting gaps resulting from infrastructure, such as roads or rail lines, were recognized as physical barrier used to further refine woodland polygons.

The LSRCA NHS has incorporated the following woodland criteria into core features based upon the existing policies:

- In the ORM > 4 ha in the Countryside or Settlement Areas and >0.5 ha in the Natural Core and Natural Linkage Areas;
- In the Greenbelt area and remainder of the watershed >0.5 ha

In the Greenbelt area and the remainder of the watershed, two data sets were originally reviewed (>4 ha and in the south region, including East Gwillimbury 0.5 ha – 4 ha). It was determined the areas >0.5 ha should be incorporated into the NHS for the following reasons; many were contiguous or in proximity to other core features or existed in areas of overall low woodland cover and smaller thresholds would be necessary in order to achieve NHS targets.

Woodland Composition of the NHS:

- **Alvar Scrubland/Shrubland – 1,519 ha**
- **Bog – (Shrub and Treed) – 135 ha**
- **Cultural (Plantation, Thicket and Woodland) – 18,932 ha**
- **Fen – (Shrub and Treed) – 152 ha**
- **Upland (Deciduous, Mixed, Thicket and Coniferous) – 36,039 ha**
- **Swamp (Deciduous, Mixed, Thicket and Coniferous) – 44,160 ha**

A total of 100,937 ha of woodland were identified in the NHS, made up of 5,003 woodland patches with the largest contiguous woodland area 2,071 ha in size. Six woodland patches identified in the Upper Talbot, Ramara Creeks and Georgina Island subwatersheds were of a patch size that is considered high diversity for avian and mammal species (greater than 1000 ha) . While two woodlands greater than 750 ha were identified in the Upper Talbot River and Pefferlaw Brook subwatershed. Smaller woodland patch sizes were generally associated with areas in urban or agricultural systems that were fragmented or isolated. Woodland cover is distributed across the watershed and accounts for 34.9% of the watershed. A full summary of woodland cover across municipalities and subwatersheds is located in **Appendix A**. Woodland in the NHS is composed of 44% swamp, 36% upland forest and 19% cultural woodland (plantations, thickets, and woodlands).

4.2.4.1 Interior Forest

Interior forests are woodlands with ideal circular or square shape that can provide habitat for a number of species that are area-sensitive and require large patches of habitat. These areas are devoid of edge effects and resulting impacts from soil and air moisture, light levels, wind and temperature exposure.

These impacts can extend over 100 to 300 m into a forest. Treed swamp areas 100 to 400 ha in size can provide habitat for all forest-dependent bird species, areas greater than 1,000 ha can support forest-dependent mammals and areas greater than 10,000 ha are considered to support fully functional ecosystems (Environment Canada, 2013). Upland forest areas that are 50 to 75 ha can support some area-sensitive avian species, areas greater than 200 ha can support approximately 80% of area-sensitive species (Environment Canada, 2013) like Scarlet Tanager, Ovenbird, Black-throated Green Warbler and Veery.

In the NHS, a 100 m was buffered in from the edge of woodland boundaries to determine where interior forest habitat exists. A total of 2,199 interior forest patches were identified in the NHS ranging from <1 ha to 1,372 ha. Two interior forest patches greater than 1,000 ha were identified in the Upper Talbot River and Black River subwatersheds.

4.2.4.2 Urban Forests

Urban forests are vital to communities because of the abundance of ecosystem services that they provide. They directly support human health and well-being by filtering pollution, alleviating heat island effects, supporting mental and physical health, sequestering carbon, and supporting recreational and social needs of people. Progression in science has identified the need to focus on urban forests as their own component of a NHS that establishes separate objectives, targets and goals. This may include following the goals of York Region in their forest management plan (York Region, 2016) and recognizing and enhancing the role of trees in urban settings within and outside of natural heritage systems.

While municipalities are successful in bringing sections of the NHS into public ownership and engaging the community (landowners and public groups) with stewardship activities, much of the NHS remains in private ownership. In large growth areas such as York Region, urban forest systems are dominated by smaller young trees and fewer mature trees (York Region, 2016) reducing the ability to provide services that combat urban centre impacts such as heat island effects. In the NHS, some woodlands that are core features overlap with urban forest systems. Management of woodlands in these areas should incorporate existing urban forest strategies or principles. This may include creating natural cover in pseudo-green spaces and implementing innovative vegetation cover opportunities.

While managing urban forests in the coming years, it is important to incorporate evolving information like the Adapting Forestry Programs for Climate Change report (LSRCA, 2018). The current strategies for producing healthy urban forests may not be as successful in the coming years due to the changing climate. Altering planting lists to include species that were traditionally found in more southern regions of Ontario may prove to be more successful in the coming years with a predicted increase in average temperatures and change in precipitation. Looking at urban forest strategies of municipalities in the current Carolinian zone will provide insight onto how to adapt current principals to be more successful in the future Lake Simcoe watershed.

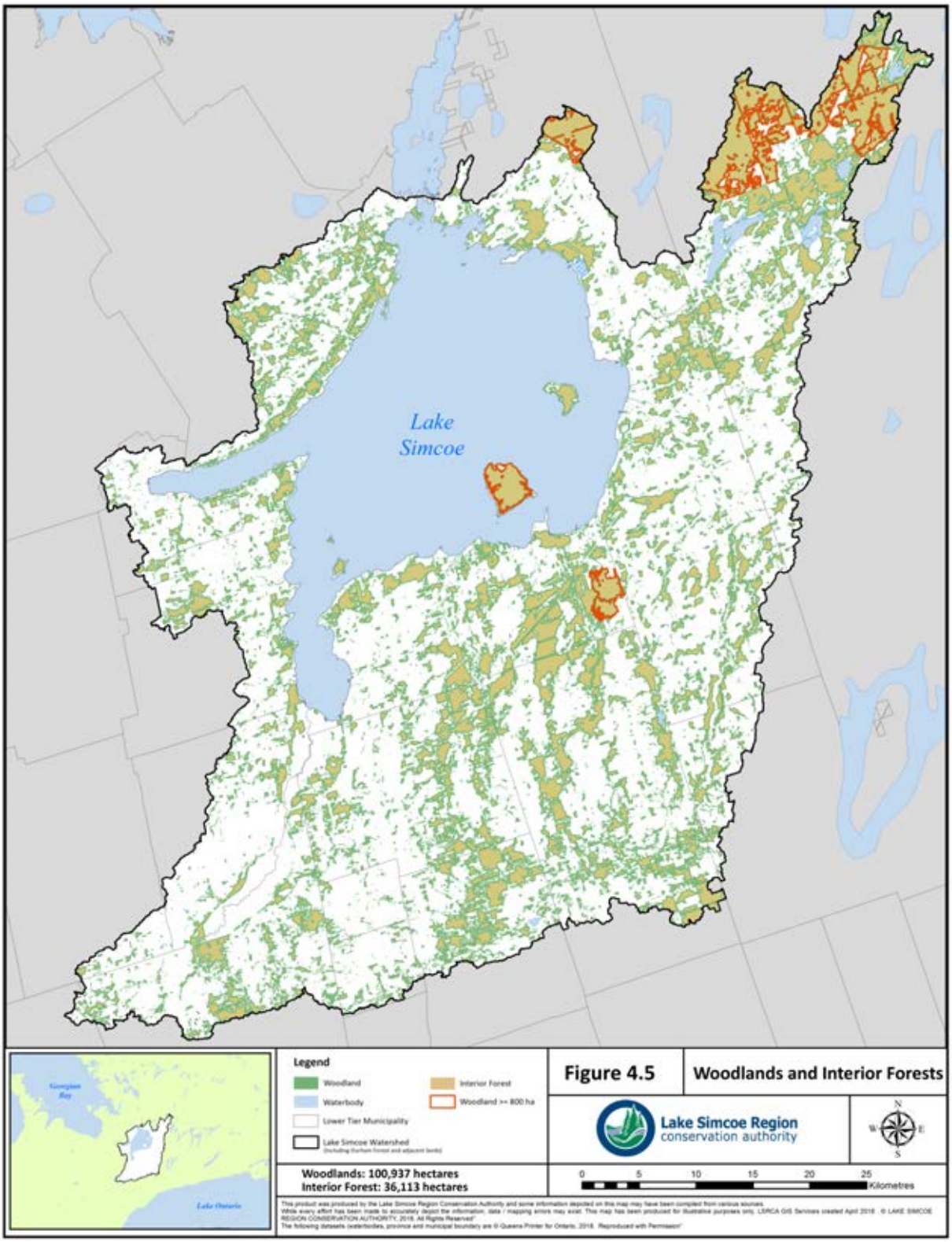


Figure 4.5 Woodlands and Interior Forest in the Lake Simcoe NHS. Approximately 100,937 ha of woodlands are identified as core features in the Lake Simcoe watershed.

4.2.5 Valleylands

A valleyland is a natural area that occurs in a valley or other landform depression that has water flowing through or standing for some period of the year (OMNR, 2010). In the Lake Simcoe watershed, these can range in size from tiny headwater features to wide valleys containing substantial rivers and extensive wetlands. Also known as a floodplain or a riparian corridor, a valleyland has various terrestrial and aquatic habitats, which leads to their high biodiversity and productivity (Naiman & Décamps, 1997; Ward et al., 1999; Tockner & Stanford, 2002; Opperman et al., 2010) and in some cases, the fauna are more diverse in the floodplain (Boulton & Llyod, 1991; Ward et al., 1999).

Valleylands perform an important ecological function by connecting natural areas within the landscape over large distances, which provides migration and dispersal corridors for terrestrial, aquatic and avian species (Naiman & Décamps, 1997; OMNR, 2010). They can provide stopover sites for avian migrants (Skagen et al., 1998), and spawning and rearing fish habitat (Sommer et al., 2001; Jeffres et al., 2008; Opperman et al., 2010; Burgess et al., 2013). They can improve water quality through transporting and cycling sediments and nutrients, and acting as natural drains for storm and freshet events (MOECC, 2015).

In addition to their ecological importance, valleylands hold a great economic and social value. Despite occupying only 1.4% of the Earth's land surface area, valleylands contribute more than 25% of all terrestrial ecosystem services, including disturbance regulation (37% of their total value), water supply (39%), and waste treatment (9%) (Tockner & Stanford, 2002; Opperman et al., 2010). In addition, valleylands hold recreational and aesthetic values by providing activities such as nature appreciation, hiking, fishing, hunting, swimming, parks and golf courses (Naiman & Décamps, 1997; Tockner & Stanford, 2002; OMNR, 2010). Because of their significant economic advantages and recreational benefits, in addition to the benefits associated with increased biodiversity and productivity, it is evident that valleylands should be protected and restored across Ontario.

Significant valleylands are protected in the Provincial Policy Statement (2014), Lake Simcoe Protection Plan (2009), Greenbelt Plan (2017) and the Oak Ridges Moraine Conservation Plan (2017). Significant valleylands are considered a core feature in the NHSRS and are delineated based on the following criteria, which is consistent with existing policy:

- Streams with well-defined valley morphology (i.e. floodplains, meander belts and valley slopes) with an average width of 25 m or more;
- All streams and ravines with the presence of flowing or standing water greater than 50 m in length; 25 m in average width and two valley walls of 15% slope or greater with a minimum height of 5 m; and
- Additional features identified by the approval Authority that are consistent with one or more of the functions above.

For the purposes of this report, only streams and ravines greater than 50 m in length, 25 m in average width and with slopes greater than 15% were defined. It is acknowledged that the remainder were

captured as valleylands in stream corridors. Valleylands occupy 8,918 ha in the Lake Simcoe watershed, are distributed fairly evenly throughout the watershed and are mostly associated with streams in steep slope such as the ORM or Peterborough Drumlin Field (**Figure 4.6**). Approximately 76% of valleylands is natural vegetation cover as defined by ELC, 20% is agriculture or open space and 4% is urban.

4.2.6 Areas of Natural and Scientific Interest

Areas of natural and scientific interest (ANSIs) are identified areas of land and water containing natural landscapes or features that have life science or earth science values related to protection, scientific study or education (OMNR, 2010). In Ontario, the identification and maintenance of these feature boundaries are managed by the Ministry of Natural Resources and Forestry. These areas are considered a critical complement to provincial parks and conservation reserves. To date, more than 500 areas are identified across Ontario, which can be further classified as provincially, regionally or locally significant (OMNR, 2010).

Life science ANSIs can include specific types of forests, valleys, prairies, savannahs, alvars and wetlands, their native plants and animals, and their supporting environments. They are generally undisturbed areas that are provincially significant. Earth science ANSIs are geological in nature and consist of the most significant examples of bedrock, fossils and landforms in Ontario (OMNR, 2010).

Evaluation of ANSIs is based upon five selection criteria: representation, condition, diversity, other ecological considerations and special features. A confirmed ANSI recognizes the Province's interest in and commitment to the conservation of the identified features and values (earth and life science) (OMNR, 2010).

For the Lake Simcoe watershed, these layers were obtained through Land Information Ontario (LIO), a metadata management tool, and incorporated into the NHS. ANSIs are protected under the Provincial Policy Statement (2014), as well as the Oak Ridges Moraine Conservation Plan (2017), the Lake Simcoe Protection Plan and the Greenbelt Plan. This layer, obtained in 2016, identifies the most up-to-date information available.

Within the Lake Simcoe watershed, all ANSIs, irrespective of classification, were incorporated into the NHS as core features. This area amounts to approximately 17,425 ha and 14% of the watershed. Some ANSIs in the watershed include the Holland River Marsh, Derryville Bog, Thorah Island Wetlands, Zephyr Creek Swamp (the largest ANSI based upon size), and the Pottageville Swamp. In many instances, the ANSIs recorded in the watershed overlap with other identified core features.

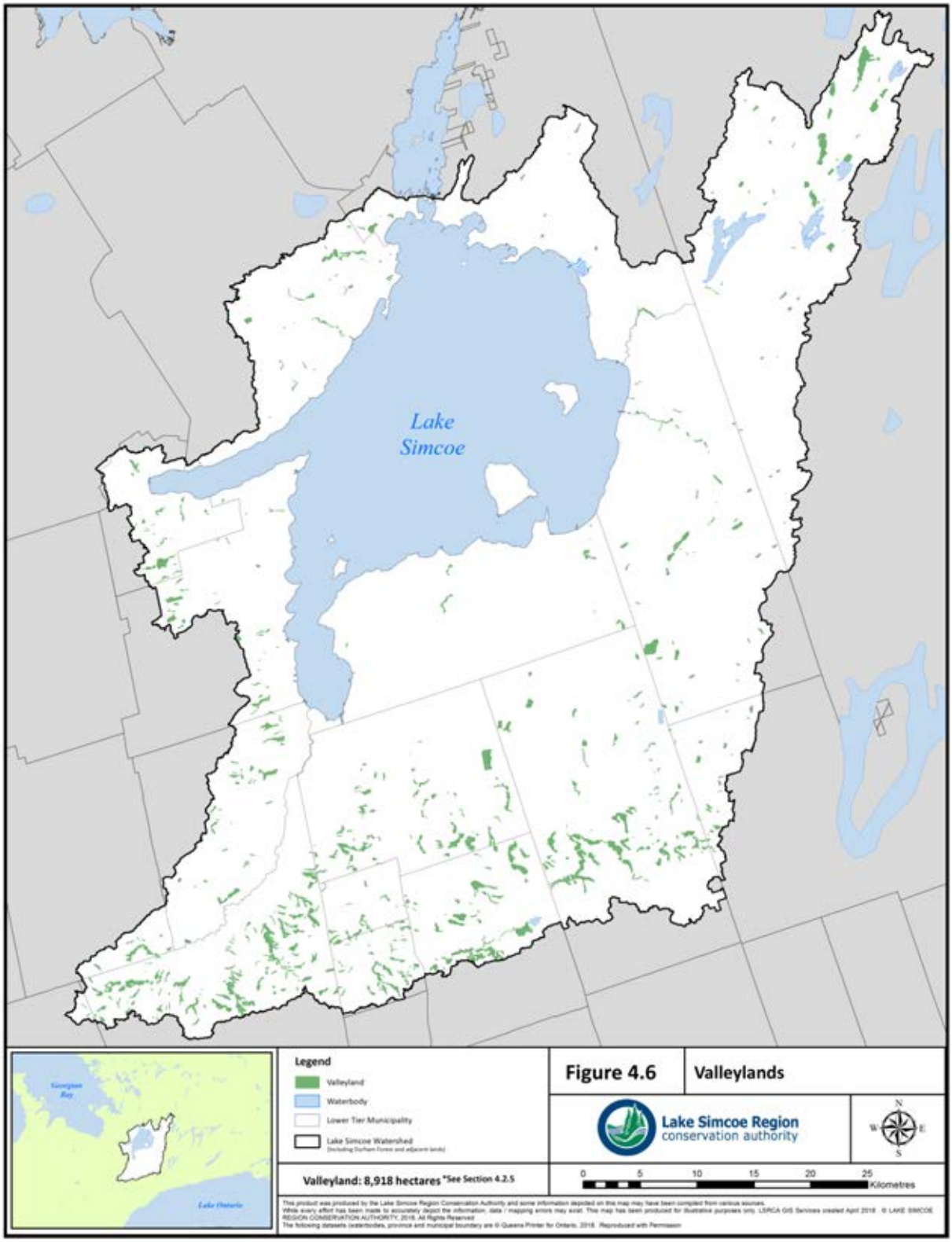


Figure 4.6 Valleylands in Natural Heritage System. Approximately 8,918 ha of valleylands were identified in the Lake Simcoe watershed as core features.

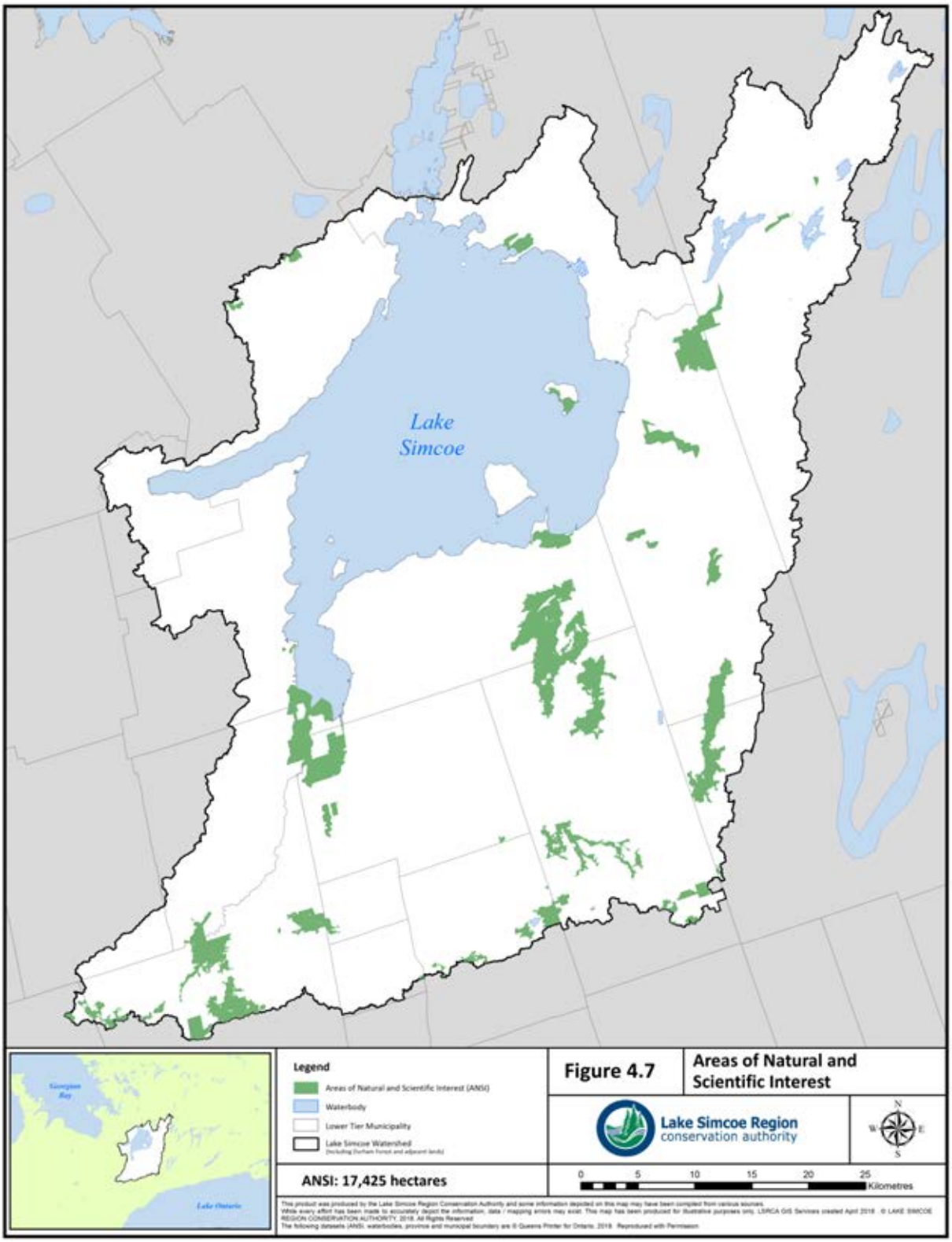


Figure 4.7 Areas of Natural and Scientific Interest (ANSIs) are identified by the Ministry of Natural Resources and Forestry.

4.2.7. Significant Wildlife Habitat

Considered a key natural heritage feature, Significant Wildlife Habitat (SWH) is defined under the Provincial Policy Statement (PPS) (2014) as "areas where plants, animals and other organisms live, and find adequate amounts of food, water, shelter and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a vulnerable point in their annual or life cycle; and areas which are important to migratory or non-migratory species" (MMAH, 2014). Significant, in terms of the PPS (2014), means "…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".

The Significant Wildlife Habitat Technical Guide (OMNR, 2000), which accompanies the PPS (2014), describes four categories of SWH:

Table 4-1: Significant Wildlife Habitat types

1. Habitats of seasonal concentrations of animals	
• Waterfowl stopover and staging areas	• Reptile hibernaculum
• Shorebird migratory stopover area	• Colonial nesting bird breeding habitat
• Raptor wintering area	• Migratory butterfly stopover areas
• Bat hibernacula	• Landbird migratory stopover areas
• Bat maternity colonies	• Deer yarding areas
• Bat migratory stopover areas	• Deer winter congregation areas
• Turtle wintering areas	
2. Rare vegetation communities or specialized habitat for wildlife	
• Cliffs and talus slopes	• Bald eagle and osprey nesting, foraging and perching habitat
• Sand barren	• Woodland raptor nesting habitat
• Alvar	• Turtle nesting areas
• Old growth forest	• Seeps and springs
• Savannah	• Amphibian breeding habitat
• Tallgrass prairie	• Woodland area sensitive bird breeding habitat
• Other rare vegetation communities	
• Waterfowl nesting area	
3. Habitat of species of conservation concern	
• Marsh bird breeding habitat	• Terrestrial crayfish habitat
• Open country bird breeding habitat	• Special concern and rare wildlife species habitat
• Shrub/early successional bird breeding habitat	
4. Animal movement corridors	
• Amphibian movement corridors	• Deer movement corridors

Outlined in the PPS (2014), SWH identification is the responsibility of the municipality. In some cases, through development applications, the onus to determine the existence of SWH is on the proponent, especially where resources and information is unavailable. Throughout the LSRCA watershed, most

planning authorities have not identified or mapped SWH in their Official Plans; however OPs will include policies consistent with the PPS (2014) to protect SWH.

Heronry in Georgina

Due to the lack of available data and evolving use of species habitat, it is not feasible to map many of the SWH types at the watershed scale; however, through its work in the watershed, the LSRCA continues to support the identification of SWH through area-specific studies (i.e. subwatershed studies, secondary plans, environmental impact studies, etc.). The lack of identification of SWH in an area does not signify that it does not exist.

Through the NHSRS study, the Significant Wildlife Habitat Technical Guide (OMNR, 2000) and the Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E (MNRF, 2015) were reviewed to gain insight into SWH in the Lake Simcoe watershed and to understand which types would be captured within existing natural heritage features identified as core areas through this Strategy. Most SWH is likely captured in the NHS under valleylands, wetlands, woodlands, watercourses and fish habitat, natural areas abutting Lake Simcoe, or Lake Simcoe shoreline; however, in some instances, certain SWH types were not captured. These SWH types were further explored through this NHSRS and captured through the following actions:

- Alvars: incorporated into the NHS as a core feature
- Tallgrass Prairies: incorporated into the NHS as a core feature
- Sand barrens: incorporated into the NHS as a core feature
- Open country bird breeding habitat: refined to a watershed perspective and incorporated into target areas to enhance the NHS through grassland habitat (**Section 4.3.1.**)
- Animal movement corridors: refined at a holistic approach and incorporated into targeted areas to enhance the NHS through local and regional linkages (**Section 4.3.5.**)

Pertaining to the NHSRS, where SWH is identified as an outlier adjacent to the core feature or targeted area for enhancement, it is recommended to be protected as part of the NHS.

4.2.8 Endangered and Threatened Species and Species at Risk Habitat

In the Lake Simcoe watershed, 47 Ontario species at risk (SAR) are historically found, or could be currently present (MNRF, 2017d). These SAR are designated into four categories: extirpated, endangered, threatened, and special concern (**Table 4-2**). A number of these species are also protected federally under the *Species at Risk Act (SARA),* 2002.

Table 4-2: Species at Risk existing or potentially in the LSRCA Watershed

Common Name	Scientific Name	Federal Status	Provincial Status
Amphibians and Reptiles			
Jefferson Salamander	Ambystoma jeffersonianum	Endangered	Endangered
Snapping Turtle	Chelydra serpentine	Special Concern	Special Concern
Blanding's Turtle	Emydoidea blandingii	Threatened	Threatened
Northern Map Turtle	Graptemy's geographica	Special Concern	Special Concern
Eastern Hog-nosed Snake	Heterodon platirhinos	Threatened	Threatened
Massasauga Rattlesnake	Sistrurus catenatus	Not Assessed	Threatened
Eastern Musk Turtle	Sternotherus odoratus	Threatened	Threatened
Eastern Ribbonsnake	Thamnophis sauritus	Special Concern	Special Concern
Mammals			
Eastern Small-footed Myotis	Myotis leibii	Not Assessed	Endangered
Little Brown Myotis	Myotis lucifugus	Endangered	Endangered
Northern Myotis	Myotis septentronalis	Endangered	Endangered
Fish			
Redside Dace	Clinostomus elongatus	Endangered	Endangered
Northern Brook Lamprey	Ichthyomyzon fossor	Special Concern	Special Concern
Birds			
Henslow's Sparrow	Ammodramus henslowii	Endangered	Endangered
Grasshopper Sparrow	Ammodramus savannarum	Special Concern	Special Concern
Eastern Whip-poor-will	Antrostomas vociferous	Threatened	Threatened
Short-eared Owl	Asio flammeus	Special Concern	Special Concern
Chimney Swift	Chaetura pelagica	Threatened	Threatened
Black Tern	Chlidonias niger	Not at Risk	Special Concern
Eastern Wood-Pewee	Contopus virens	Special Concern	Special Concern
Yellow Rail	Coturnicops noveboracensis	Special Concern	Special Concern
Cerulean Warbler	Dendroica cerule	Endangered	Threatened
Bobolink	Dolichonyx oryzivorus	Threatened	Threatened
Acadian Flycatcher	Empidonax virescens	Endangered	Endangered
Peregrine Falcon	Falco peregrinus	Special Concern	Special Concern
Bald Eagle	Haliaeetus leucocephalus	Not at Risk	Special Concern
Barn Swallow	Hirundo rustica	Threatened	Threatened
Wood Thrush	Hylocichla mustelina	Threatened	Special Concern
Yellow-breasted Chat	Icteria virens	Endangered	Endangered
Least Bittern	Ixobrychus exilis	Threatened	Threatened
Loggerhead Shrike	Lanius ludovicianus	Endangered	Endangered
Red-headed Woodpecker	Melanerpes erythrocephalus	Threatened	Special Concern

Common Name	Scientific Name	Federal Status	Provincial Status
King Rail	Rallus elegans	Endangered	Endangered
Bank Swallow	Riparia rioaria	Threatened	Threatened
Louisiana Waterthrush	Seiurus motacilla	Special Concern	Special Concern
Eastern Meadowlark	Sturnella magna	Threatened	Threatened
Golden-winged Warbler	Vermivora chrysoptera	Threatened	Special Concern
Canada Warbler	Wilsonia canadensis	Threatened	Special Concern
Insects			
Rusty-patched Bumble Bee	Bombus affinis	Endangered	Endangered
Monarch	Danaus plexippus	Special Concern	Special Concern
Rapids Clubtail	Gomphus quadricolor	Endangered	Endangered
West Virginia White	Pieris virginiensis	Not Assessed	Special Concern
Flora			
Butternut	Juglans cinerea	Endangered	Endangered
Purple Twayblade	Liparis liliifoliia	Threatened	Threatened
American Ginseng	Panax quinquefolius	Endangered	Endangered
Broad Beech Fern	Phegopteris hexagonoptera	Special Concern	Special Concern
Eastern Prairie Fringed-Orchid	Platanthera leucophaea	Endangered	Endangered

View the most current list of SAR in Canada here.
View the most current list of SAR in Ontario here.

Redside Dace (*Clinostomus elongates)*

Barn Swallows (*Hirundo rustica*)

Blanding's Turtle (*Emydoidea blandingii*)

The provincial *Endangered Species Act (ESA)* (2007) and *SARA* identifies species at risk based on the best available scientific information. The *ESA* provides legal protection to species classified as endangered or threatened and their habitat and promotes the recovery of all species at risk (OMNR, 2008). Special concern species are of equal importance since their populations are on the verge of being at greater risk to vulnerabilities leading to their status being uplisted. The protection of special concern species is reinforced through Significant Wildlife Habitat identification and protection under the PPS (2014).

The predominant threat to the majority of species at risk in the Lake Simcoe watershed, especially woodland and grassland birds, is habitat loss and fragmentation as a result of land use practices like urbanization, agriculture and infrastructure. Other threats include land use changes, changes to species ranges due to climate change, and the presence of invasive species. Species at risk not included in **Table 4-2** are naturally uncommon in the LSRCA watershed due to narrow habitat ranges or they are sensitive to habitat disturbance. Both the federal and provincial governments issue recovery strategies for the populations of these species in order to mitigate and, where possible, proactively protect their habitat. The listings presented in **Table 4-2** is representative of the SAR at the time of this report and is subject to revisions that the governing bodies deem necessary, dependent on the threat status to species in

Ontario and Canada. It is for this reason, and the safety of many of the species, that the locations of species at risk habitat are not identified through mapping in the LSRCA NHS, but rather supported through the text. Species at risk and their habitat, as determined by the MNRF and Government of Canada, is considered a core feature for protection in the LSRCA NHS.

4.3 Targeted Areas that Enhance the Natural Heritage System

4.3.1 Grassland Habitat

Grasslands are able to provide many services and functions for the local environment and community, many of which hold high market value (Sala & Paruelo, 1997). However, through past practices, many grasslands have been converted to agricultural fields and other land uses which remove or limit the ability of these areas to provide these services (Stephens et al., 2008).

Grasslands are one of the major carbon sinks found on our planet and have the ability to store up to 33% of total carbon stored in terrestrial systems through the plant intake of CO_2 during photosynthesis (United Nations Development Program, 2000). With the high turnover of plant material at the end of the growing season, carbon filled plant matter is incorporated into the soil and accumulates as soil organic matter (United Nations Development Program, 2000). Because grassland soils are not often disturbed the decomposition process is slowed down, preserving large amounts of carbon within the soil and limiting the amount released as CO_2 (Conant et al., 2001; Yang & Kay, 2001). If this grassland soil becomes disturbed through the alteration of land use or management, much of the carbon stored will be released back into the atmosphere as CO_2, contributing to climate change (Sala & Paruelo, 1997; Lal, 2003). Although similar land uses such as farmland contribute to the sequestration process and are able to provide positive impacts by storing carbon, grasslands are superior at this process and should be given high priority to be preserved.

The Carden Alvar in Upper Talbot is dominated with alvar habitat and is rich and diverse in grassland bird species

One of the key services grasslands provide is habitat for grassland birds and pollinator species. Many species of birds, including multiple species at risk, use grasslands to find food, build nests and escape predators. With the decline in available grassland habitats, the majority of grassland bird species are experiencing a decline in population size and range (Brennan & Kuvlesky, 2005; McCracken, 2005). Many species of birds have resorted to using farmland as opposed to their preferred habitats of meadows, prairies and savannahs as a result of this lack of availability. In some species, this is a viable option though nesting success is decreased due to pesticide use, disturbance and lack of food resources (Boutin et al., 1999; McMaster & Davis, 2001; McMaster et al., 2005). For pollinators, a reduction of food and habitat in grasslands along with other factors such as an increase in non-native species, the spread of pathogens and climate change, lead to the recent decline of bee species and butterfly populations (Potts et al., 2010; Brower et al., 2011; Pleasants & Oberhauser, 2012). Grasslands also provide ideal habitat for the growth of Milkweed which supplies food for Monarch butterflies. Without having access to these unique habitat features found in grasslands, populations of pollinator species will continue to decline.

Bobolink (*Dolichonyx oryzivorus*)

The conservation and restoration of native grasslands and prevention of fragmentation is imperative to maintaining these services and supporting the local and global environment. Using patch size criteria >50 ha and >100 ha (Environment Canada, 2013) and available landcover information, 12,661 ha were identified in the NHS for protection. Breeding bird surveys were conducted in the summer of 2017 to further support and refine the layer. Species such as Vesper Sparrow, Grasshopper Sparrow, Bobolink and Eastern Meadowlark were among the many observed. Grassland birds in the watershed are not limited to size criteria and have been observed at smaller habitats where proximity with each other creates cluster type habitats. Cultural meadows, tallgrass prairies and alvars were assessed across the landscape and incorporated in the grassland layer. Cultural meadows accounted for 26% of the layer, whereas the latter two integrated into the NHS made up 0.06% of the watershed and 1.4% of grassland habitats across the watershed. The Carden Alvar, located in the watershed, is considered a bird hub that supports some of the greatest grassland bird diversity in Ontario. A low percentage of natural grassland habitat observed in the watershed has demonstrated the surrogate importance of agricultural habitats. Agricultural farmland such as pastures and fallow fields meeting patch size criteria comprises the remainder of the grassland habitat layer used for the NHS (72%).These lands are considered the most important drivers for grassland bird habitat today. Opportunities to manage agricultural needs and grassland bird habitat can be accomplished through cost-saving techniques like environmentally friendly management plans that support both the farmer and the surrounding environment as well as conservation incentives through the LSRCA or other groups.

Monarch Butterfly (*Danaus plexippus*)

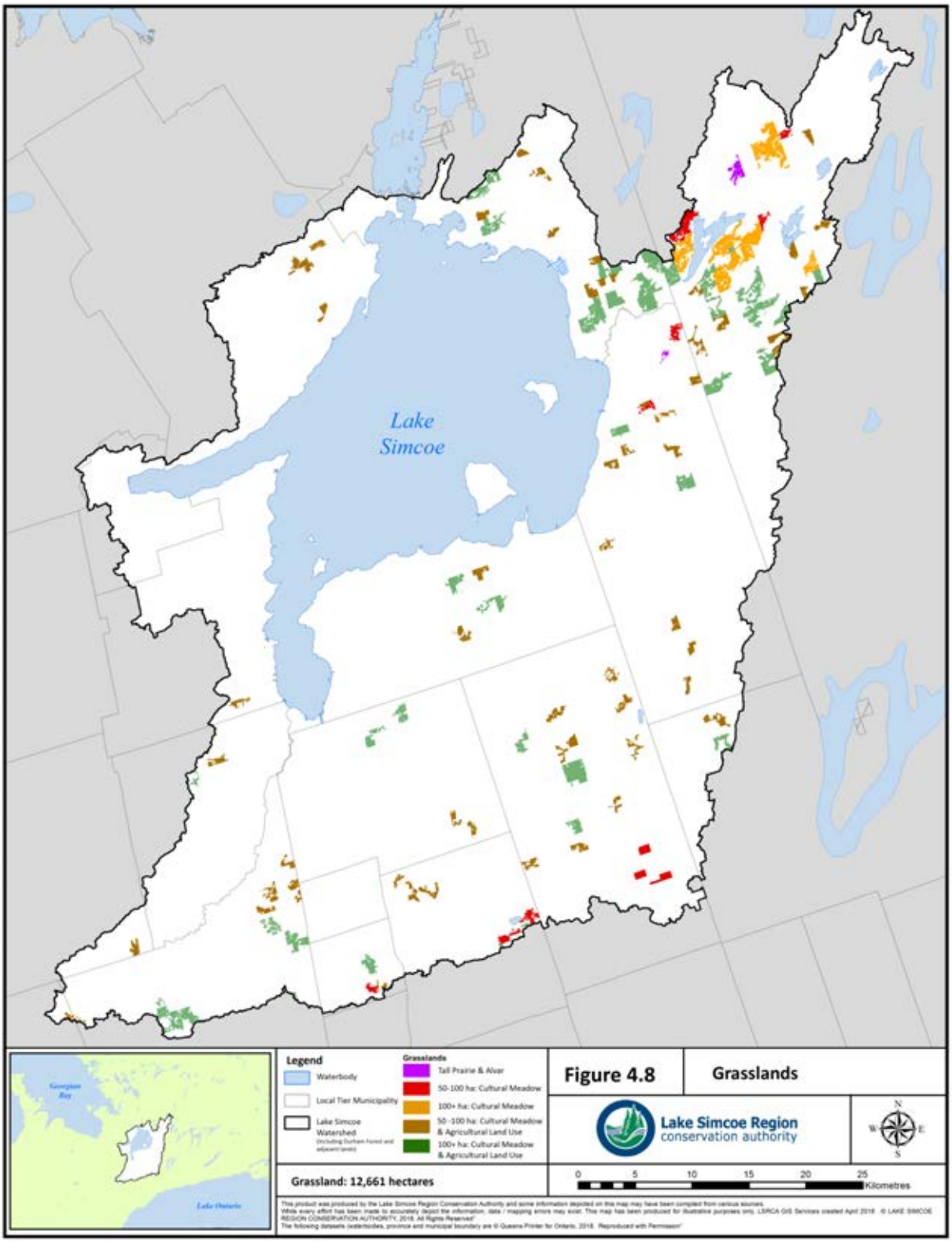


Figure 4.8 Grassland habitat in the NHS. Grassland birds use a variety of meadow, alvar, tallgrass prairie and non-intensive agriculture as habitat.

4.3.2 Enhancement Opportunities in the Floodplain

The inclusion of areas such as floodplains where development cannot occur into the NHS is good ecosystem based planning (OMNR, 2010). These areas are usually connected to the NHS, cost-effective (Hulse & Gregory, 2004) and highly functional for wetland restoration. This could include marshes, swamps and where applicable, fringe upland habitat. Restoration of these areas can improve flood storage, flood conveyance, erosion control, natural crops, pollution control, species habitat, groundwater recharge, recreation and ecotourism to name a few (Hughes & Rood, 2003; Kusler, 2003). In urbanized areas, especially downstream receiving reaches, the investment into restoration achieves broader water management goals such as “grey to green” infrastructure (Zedler & Kercher, 2005; MNRF, 2017a). A recent study examining carbon sequestration suggests that restored wetlands increased the amount of carbon storage at higher rates (MNRF, 2017a).

Through this Strategy, these areas were identified adjacent to the core features. The majority of these areas are located in old fields, estate lots, or agriculture (intensive or non-intensive). These areas should be targeted for acquisition and restoration or where current land uses are in practice, assistance provided to landowners. For example, the encouragement of wetlands rather than pond creation is an opportunity to explore with private landowners. A total of 9,113 ha were identified in the watershed with opportunities in each LSRCA subwatershed and municipality. In particular, the Holland Marsh is identified as an area with restoration potential focused on working with land owners in areas adjacent to the core areas, acquiring lands for protection and should agricultural processes be discontinued in the future, integrated into the NHS. Implementing full restoration of all floodplain areas identified would increase the NHS core area by 7.1%.Enhancements can include tree plantings, wetland creation or meadow marsh habitats with added wildlife supporting features (bird boxes, snake hibernaculum, amphibian refuge, etc.) that would suit the needs of the local area.

Wetland restoration project at Scanlon Creek Conservation Area

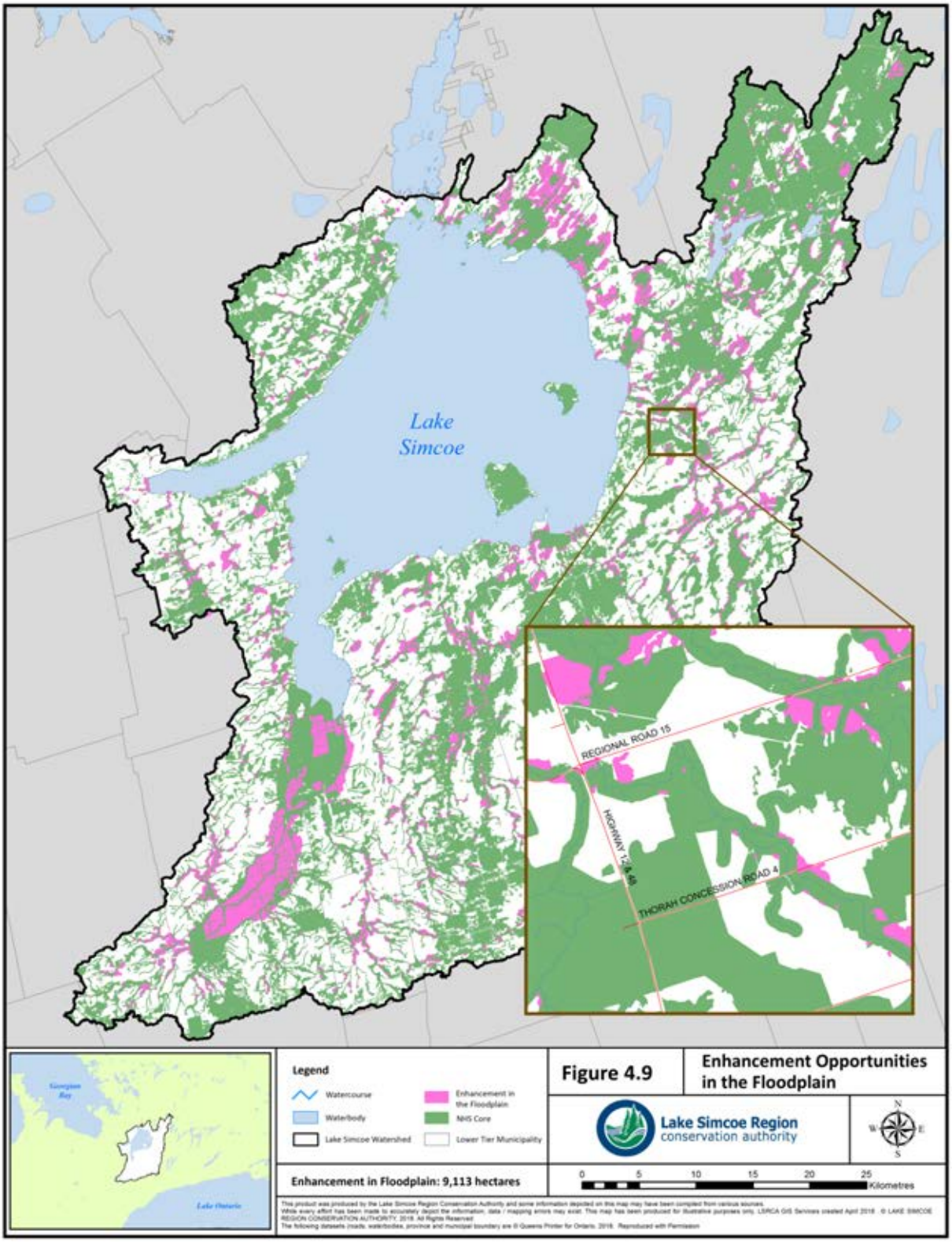


Figure 4.9 Enhancement Opportunities in the Floodplain. A total of 9,113 ha of restoration opportunities exist in the floodplain including around the Holland Marsh working with landowners in areas adjacent to the NHS.

4.3.3 Ecologically Significant Groundwater Recharge Areas

Ecologically Significant Groundwater Recharge Areas (ESGRAs) are identified as areas of land that are responsible for supporting groundwater systems that sustain sensitive features like coldwater streams and wetlands (**Figure 4.10**). To establish the ecological significance of the recharge area, a linkage must be present between the recharge area and the ecologically significant feature (i.e. a reach of a coldwater stream, a wetland, or an area of natural and scientific interest (ANSI)). The identification of an ESGRA is not related to the volume of recharge that may be occurring, rather they represent pathways in which recharge, if it occurred, would reach that feature. The Lake Simcoe Protection Plan includes policies to identify and protect significant groundwater recharge areas (SGRAs) which include both ESGRAs and source water protection (SWP) SGRAs. ESGRAs and SWP SGRAs are not mutually exclusive, the areas where they do coincide support high volumes of recharge and support ecologically sensitive features.

Figure 4.11 identifies the areas of importance where ESGRAs and the core features of the NHS overlap. The protection and restoration of these areas are important and should be incorporated into municipal Official Plan policies. The identification of ESGRAs in the Beaver River, Pefferlaw Brook and Uxbridge Brook subwatersheds are currently underway.

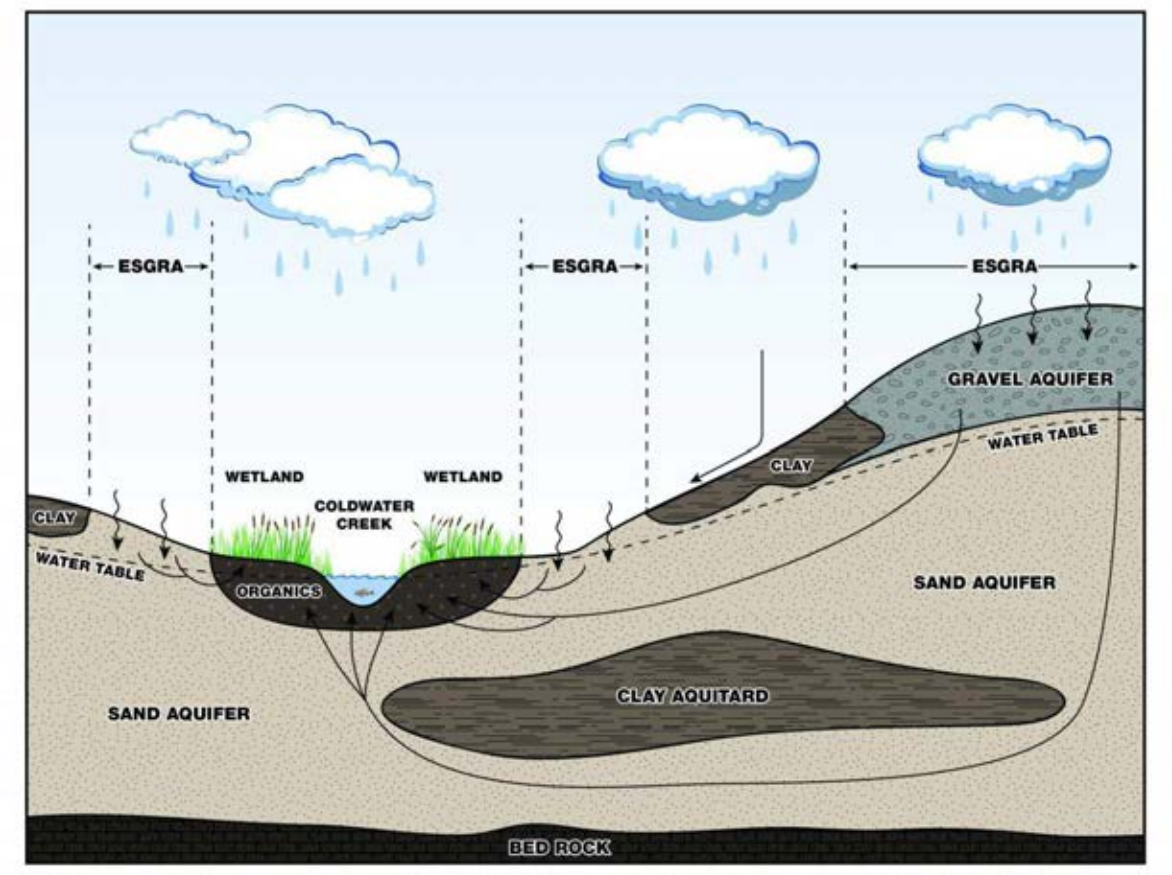


Figure 4.10 A conceptual diagram illustrating areas of the landscape that are considered to be ESGRAs (LSRCA, 2014)**.**

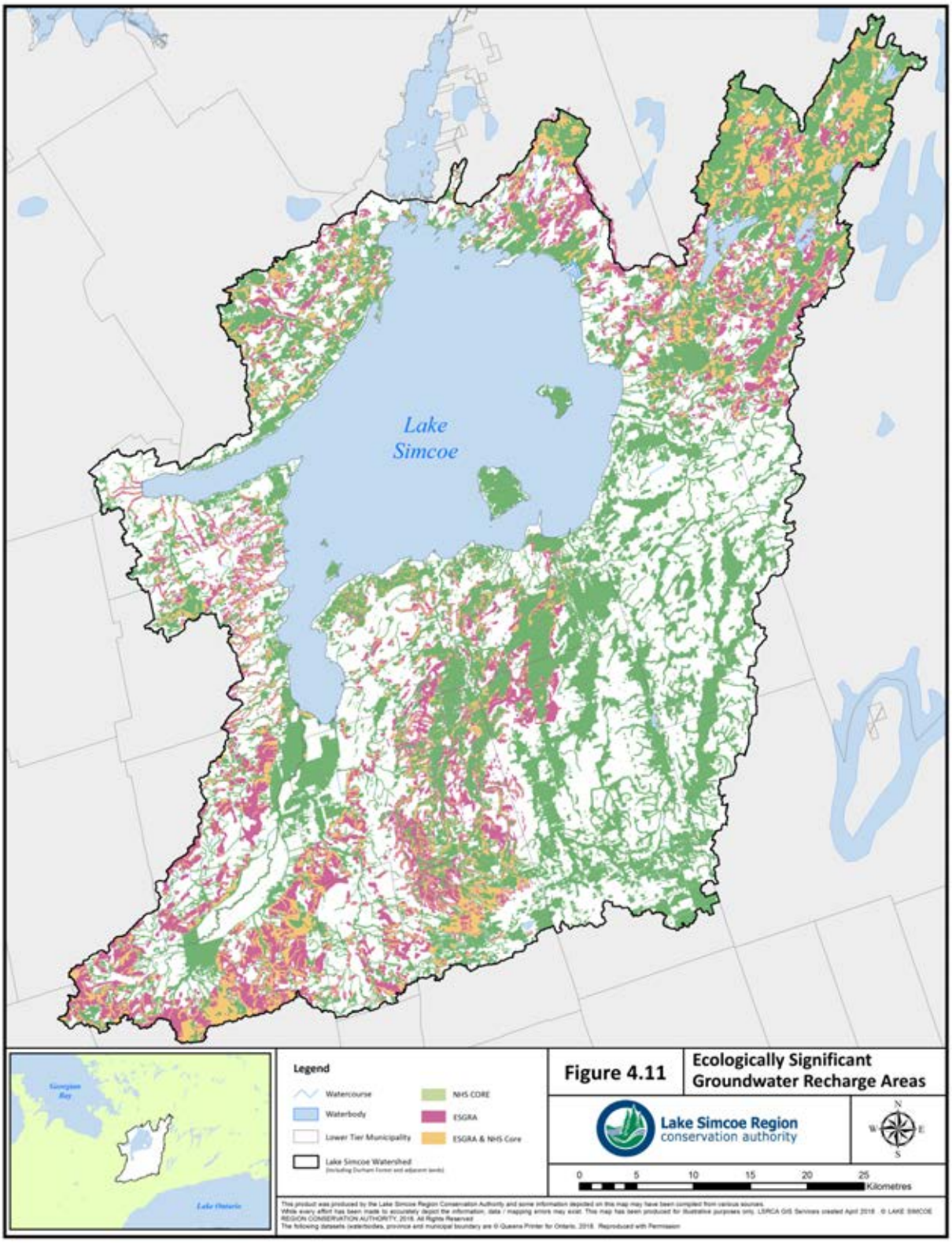


Figure 4.11 Ecologically Significant Groundwater Recharge Areas and Core Features in the NHS.

4.3.4 Corridor Restoration

Corridors should be of sufficient width, especially in proportion to the length to accommodate natural movement of plants and animals (OMNR, 2010). This habitat can include lands with natural cover and those with restoration potential, such as park spaces, farmlands and SWM ponds.

Wider corridors coupled with forest connectivity is likely to contain larger mammals such as fox, coyote and deer (Schiller & Horn, 1997) in addition to increased use by avian migrants in comparison to isolated fragments (Petit, 2000). Fragmented corridor widths can decrease attractiveness for use leading to diminished species range, changes in physiological cycles like breeding and a reduction in food availability. An increase in road collisions between people and animals is also expected as species search for new habitats. Species migration and connectivity should be protected in areas that support wildlife in suitable habitat and do not lead to inhospitable areas (i.e. urban areas, or infrastructure barriers).

In this Strategy, the main channel of each watercourse originating from Lake Simcoe was evaluated to identify where weaknesses in the corridor function existed by assessing corridor widths. Opportunities were identified to strengthen the corridor width to a minimum of 250 m where feasible (**Figure 4.12**). The strengthening of 250 m would establish interior habitat in the corridor. If protected and restored, this area would add 3,944 ha to the NHS in approximately 19 subwatersheds and 18 municipalities. Prioritizing these areas followed by those identified in the Stewardship Priorities and Opportunities Tool (SPOT) (**Figure 4.12**) will improve corridor function.

Volunteer tree planting event to restore the stream bank

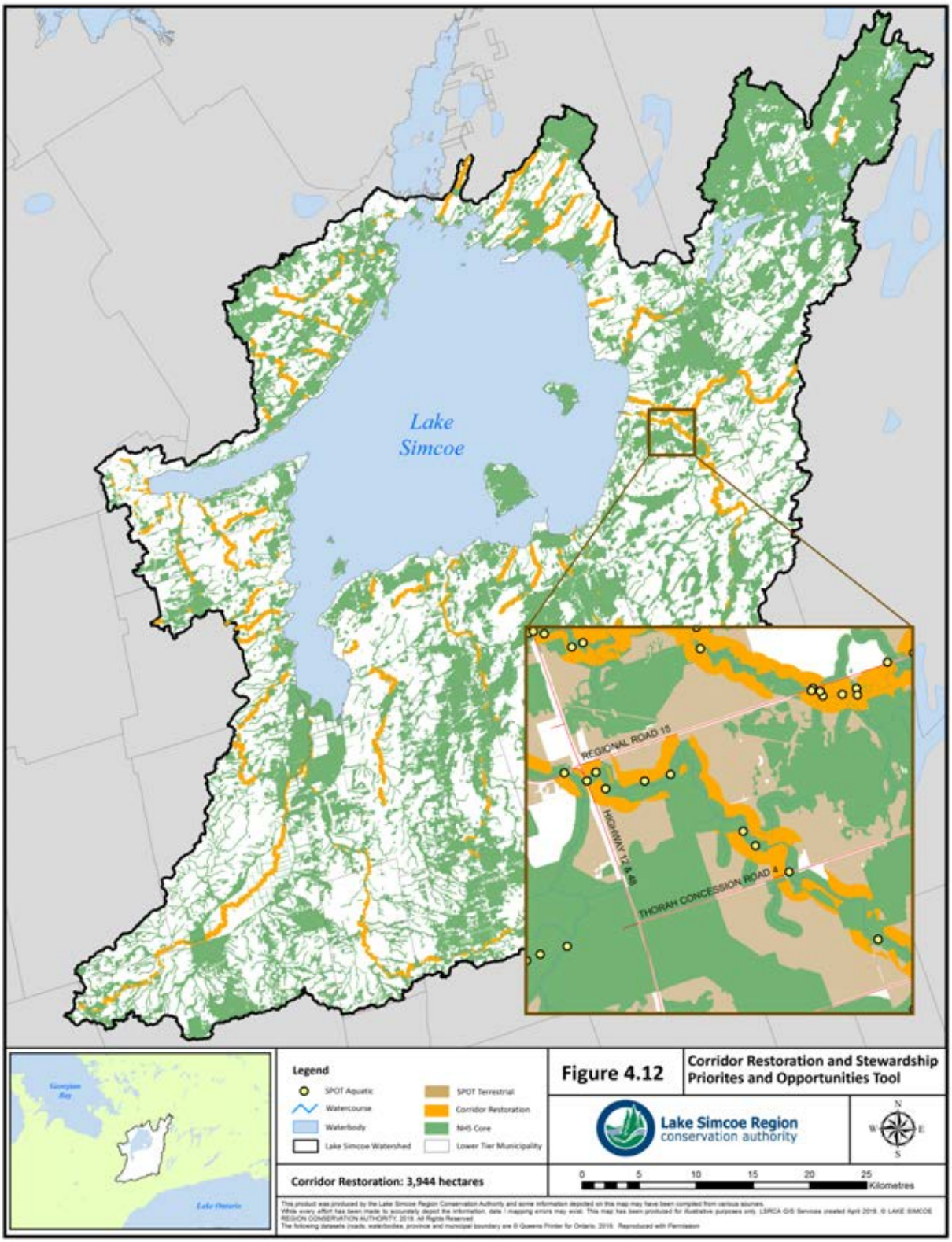


Figure 4.12 Corridor Restoration and Stewardship Priorities and Opportunities Tool (SPOT). A total of 3,944 ha of areas were identified to strengthen the main corridors of the watershed. The internal LSRCA SPOT identifies aquatic and terrestrial opportunities across the watershed.

4.3.5. Regional and Local Linkages

An objective of a NHS is to provide functional ecological linkages that maintain the relationship between species and the landscape at spatial and temporal scales necessary to maintain biodiversity and ecosystem function.

A linkage is an area intended to provide connectivity supporting a range of community and ecosystem processes, allowing plants and animals to move between core areas and other larger areas of habitat over a period of generations (OMNR, 2010). These linkage connections should be designed to reflect the needs of the local and regional biota. This refinement requires expertise to identify the potential of the linkages.

A number of linkage feature characteristics were considered (OMNR, 2010) to identify local and regional linkages in the NHS:

- Ecological function – ensuring the wildlife movement corridors overlapped in these areas based upon LSRCA internal data.
- Scale – the length of the linkages and connections
- Built-in redundancy – opportunities for multiple linkages and alternative pathways to give species options for movement
- Ecological appropriateness – the composition of the existing linkage is natural between core features
- Suitability of path – the ability to connect core features without barriers
- Ability of surrounding land uses to mitigate negative impacts – consideration of the surrounding land use to support the function by increasing animal migration
- Connection to landforms and area with high restoration potential – the linkage connects areas that could provide habitat in the future
- Associated with two or more core areas - the connection for movement between core areas
- Water features – land-water interface support high levels of biodiversity and benefit multiple species

This NHSRS identifies the linkage potential across the watershed at three scales. These areas were further refined to remove redundancy of linkages based upon available wildlife corridor migration information (LSRCA, 2015b). Biodiversity is likely to decline in small, unconnected core features and natural areas, owing to the inability of species to maintain viable populations from adjacent land use (agricultural, urban or industrial development) stress. Local proximity linkages connect these isolated core features within 60 m of each other and to the larger NHS, approximately 1,657 opportunities were identified across the watershed. Local linkages are those of importance within a subwatershed such as the main stem corridor where restoration and enhancement potential is identified (**Figure 4.13**). The Lake Simcoe Protection Plan promotes the enhancement and restoration of functional wildlife corridors between key natural heritage features or key hydrologic features 240 m from the Lake Simcoe shoreline upstream. Regional linkages which promote the flow of genes and diversity are those connections

identified in the NHS between subwatersheds with natural cover or the potential for restoration within 300 m. A review was conducted for the recent Greater Golden Horseshoe Natural Heritage System mapping to locate regional linkages outside of the watershed. A total of 59 opportunities were identified between 18 subwatersheds including Oro Creeks North and South, Hawkestone Creek, Ramara Creek, Upper Talbot River, Talbot River, Whites Creek, Beaver River, Pefferlaw Brook, Uxbridge Brook, Black River, Maskinonge River, Georgina Creeks, East Holland, West Hollands, Innisfil Creeks, Hewitts Creek and Lover's Creek and outside of the watershed boundary.

4.4 Buffers and Vegetation Protection Zones

Buffers are the physical areas separating natural features and the limits of land use activities. This zone is the key mechanism for reducing impacts of land use changes on adjacent natural features. Buffers are referred to as "vegetation protection zones" in the Oak Ridges Moraine Conservation Plan (ORMCP) (2017), the Greenbelt Plan (GBP) (2017), and the Lake Simcoe Protection Plan (LSPP) (2009). They can contribute significantly to the protection of wetlands, woodlands, valleylands and other natural heritage features. The width of the buffer can vary based upon the sensitivity of the feature and function in relation to the adjacent activities (OMNR, 2010).

Buffer benefits can include, but are not limited to, (OMNR, 2010):

- Reduction of encroachment;
- Reduction of light and noise;
- Space for tree fall;
- Protection of root zones;
- Enhancement of woodland interior for wildlife habitat;
- Location for public trails;
- Attenuation of runoff;
- Minimization of the risk of soil erosion;
- Shoreline protection;
- Reduction of flooding; and
- Improvement of water quality

A 30 m buffer was applied to the boundaries of core features except watercourses, fish habitat and shoreline where the riparian area was considered a setback to the features (**Figure 4.14**). This is consistent with vegetation protection zone widths identified in the ORMCP, GBP and LSPP. It is recognized that in settlement boundaries there are policies in place through Official or Secondary Plans or an Environmental Impact Study approved by a planning authority that would allow for buffers to be determined through the plan review process. The 30 m buffer recommendation in this NHSRS is intended to complement these policies where current science is yet to be translated into policy approaches and to go beyond the baseline policies of the Provincial Policy Statement (2014). For example, greenfield lands and where lands are brought into development, 30 m buffers should be applied.

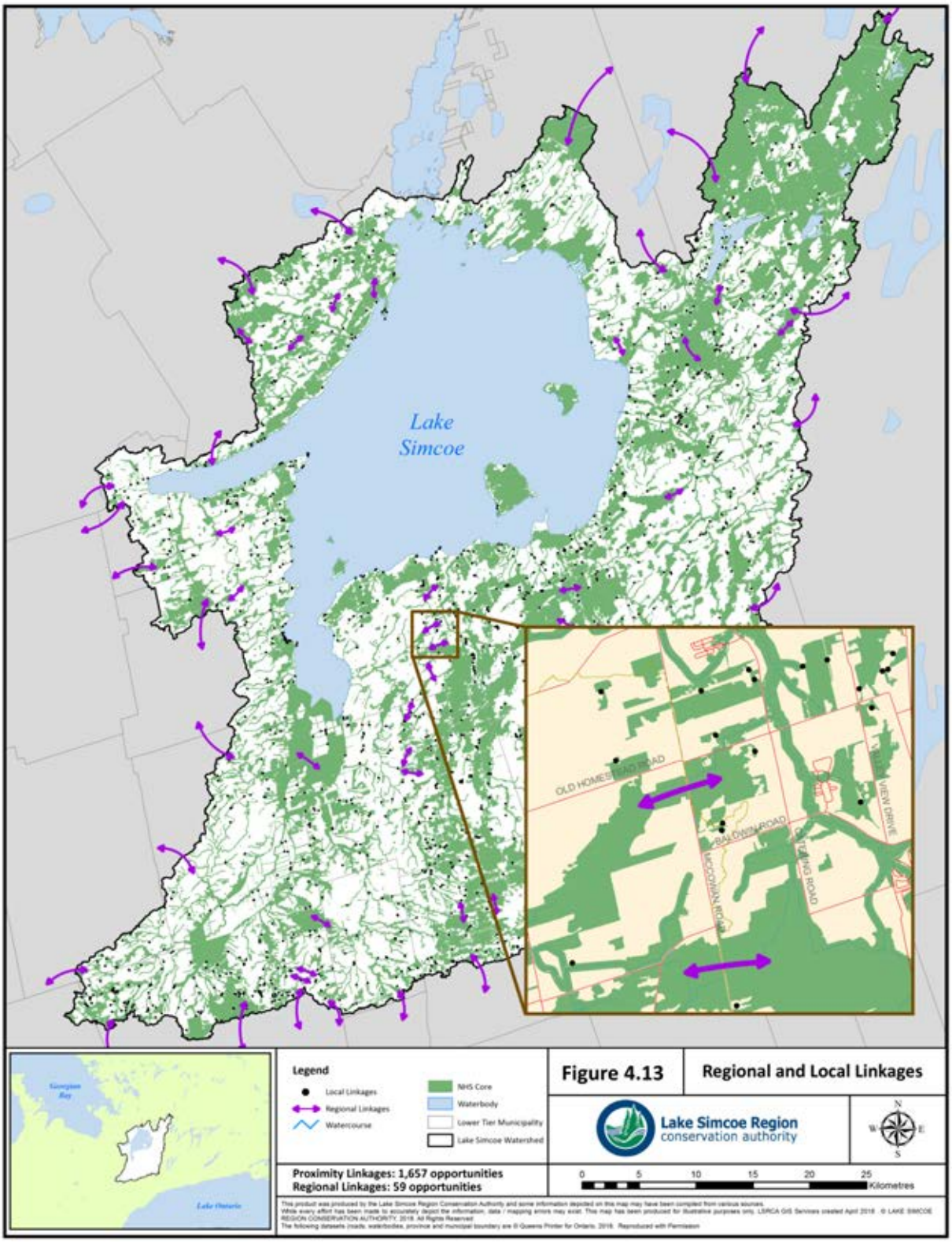


Figure 4.13 Regional and Local Linkages. Approximately 1,657 local linkages and 59 regional linkages were identified across the watershed.

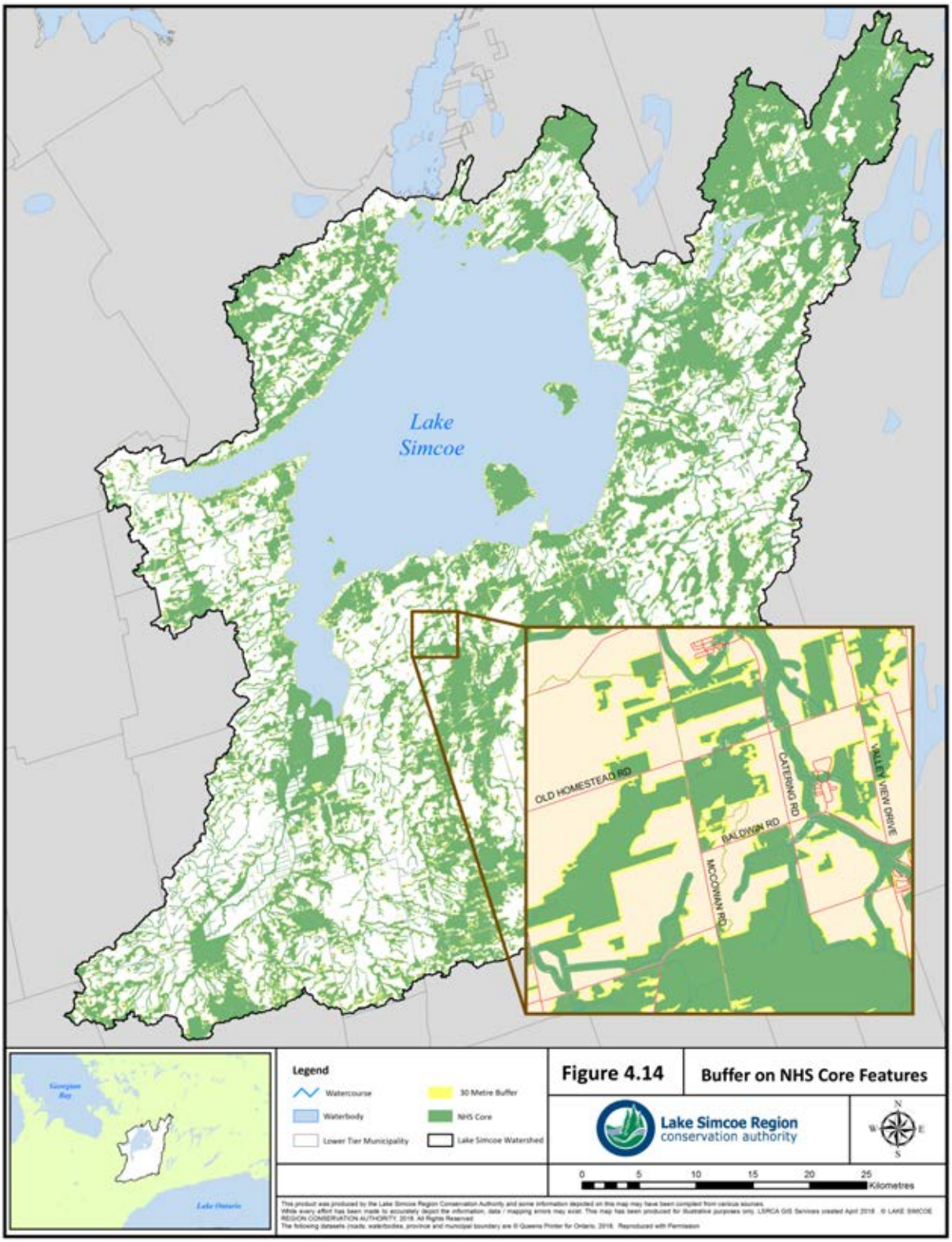


Figure 4.14 Buffers on the Core Features of the NHS. A 30 m buffer is recommended for the NHS.

4.5 Quality Cover in the Natural Heritage System

Natural heritage systems require the consideration of both quantity and quality in order to build resilient systems that withstand the impacts of climate change and habitat fragmentation. The Lake Simcoe Protection Plan (LSPP) suggests a minimum target of 40% high quality natural vegetation cover in the watershed. This requires environmental management to focus on cover that demonstrates a number of characteristics that influence the functional ability of a feature such as shape, age, structure and area of cover (MOE, 2009). The Province suggests achieving a greater proportion of natural vegetation cover in large high quality patches, identifying anchor sites (high quality connected natural features) to support stewardship strategies and mapping high quality natural cover areas.

While the intent of the definition of high quality is clear, the scientific criteria to define these areas vary in the literature suggesting using indicators of plant biomass, species diversity and density, native species indicators, habitat type and extent and ecological functions. It is for this reason that high quality areas are not identified through mapping in the NHS but are an integral part of restoration at the LSRCA. Considerations are made for enhancements through all programs to improve the quality and function of the environmental features such as restoring degraded areas, managing invasive species, installing wildlife habitat features and restoring buffers to features. The LSRCA produces and implements Conservation Area management plans and provides direction on surrounding natural areas based on the species and communities present. These plans serve as direction to restore NHS functions and services for the long-term. These ingrained approaches in the practices of the LSRCA will support seamless integration into program services when they are identified at the watershed scale. Although identifying high quality areas is under the management of the MNRF and MOECC, the LSRCA will continue to be an active partner and share information in order to achieve goals set out by the LSPP.

4.6 Watershed Natural Heritage System

The Lake Simcoe watershed NHS identified in this report incorporates existing natural heritage policies, current scientific literature and approaches to natural heritage planning. The system based NHS integrates core features, targeted areas that enhance the NHS and linkages across the watershed, and buffers (**Figure 4.15**, an insert map at the end of this report).

The system includes 128,805 ha of core features broken down by wetlands, watercourses and fish habitat, areas of natural and scientific interest (ANSIs), valleylands, woodlands, shoreline and natural areas abutting Lake Simcoe (NAALS) (**Table 4-3**). Although not quantified in the report, core features may include some areas of endangered species habitat, significant wildlife habitat and the Lake Simcoe. Core features amount to 45% of the Lake Simcoe watershed and are further categorized by 87% natural cover based upon ELC and 13% other land uses like agriculture, industrial, residential or manicured open space. Many of these features overlap, highlighting the intricate and complex relationships in the watershed. It is recommended these features be protected in perpetuity.

Table 4-3: Core Feature* distribution in the Lake Simcoe watershed.

Core Features	Total Area in the Watershed (ha)	Total % of the Watershed**
Watercourses and Fish Habitat	38,415	13%
NAALS	7,027	2%
Shoreline	760	0.3%
Wetlands	50,831	18%
Woodlands	100,937	35%
Valleylands	8,918	3%
ANSI	17,425	6%

*Core Features may overlap in the NHS

** The watershed excluding Lake Simcoe

Core areas range in size from <0.5 ha to 3,897 ha and are distributed across all subwatersheds (**Table 4-4**) with the largest core areas located in the Upper Talbot River, Black River, West Holland, Pefferlaw Brook and Beaver River subwatersheds. Of importance is the identification of 21 large core areas that are greater than 1,000 ha. These size habitats are not generally located in southern Ontario and are important for conservation purposes. Interior forest habitat accounts for approximately 12% of the watershed and should be maintained and enhanced since large effort is required to incrementally increase interior habitat.

Interior forest habitat can provide a wide range of habitat types and offers space for a wide diversity of species to forage, hunt, migrate, breed and survive. Interior forest habitat is used by many species that are area sensitive and are not able to thrive in areas close to development. Without large forest patch sizes, these habitats types would not be available for flora and fauna and the overall ecosystem diversity would decline.

Table 4-4: Distribution of Core Areas by Subwatershed and Watershed.

CORE AREAS BY SUBWATERSHED	HECTARES	PERCENTAGE OF SUBWATERSHED	PERCENTAGE OF WATERSHED
Barrie Creeks	723.0	19.26%	0.25%
Beaver River	11,804.8	36.07%	4.08%
Black River	18,760.3	49.98%	6.49%
Durham Forest and Surrounding Area	301.7	95.65%	0.10%
East Holland	8,863.0	35.86%	3.07%
Fox Island	16.7	81.96%	0.01%
Georgina Creeks	2,165.7	43.90%	0.75%
Georgina Island	1,143.2	88.54%	0.40%
Goffatt Island	3.7	79.51%	<0.01%
Grape Island	7.8	74.40%	<0.01%
Hawkestone Creek	2,856.7	59.72%	0.99%
Hewitts Creek	391.9	22.38%	0.14%
Innisfil Creeks	3,947.3	36.84%	1.37%
Lake Simcoe	337.9	0.47%	0.12%
Lovers Creek	2,041.5	34.05%	0.71%

CORE AREAS BY SUBWATERSHED	HECTARES	PERCENTAGE OF SUBWATERSHED	PERCENTAGE OF WATERSHED
Maskinonge River	1,561.0	24.60%	0.54%
Oro Creeks North	3,317.2	44.07%	1.15%
Oro Creeks South	2,747.8	47.88%	0.95%
Pefferlaw Brook	13,002.7	45.64%	4.50%
Ramara Creeks	6,075.6	44.25%	2.10%
Snake Island	111.1	81.98%	0.04%
Strawberry Island	8.3	81.38%	<0.01%
Talbot River	3,512.4	50.08%	1.22%
Thorah Island	382.2	86.96%	0.13%
Upper Talbot River	20,417.4	72.19%	7.07%
Uxbridge Brook	6,542.6	40.55%	2.26%
West Holland	13,205.8	37.52%	4.57%
Whites Creek	4,555.5	43.22%	1.58%

By municipality, core features range in area from 0.4 ha to 24,699 ha (**Figure 4.16**). This is important to acknowledge since the shared role of protecting and restoring features should be identified in the context of a watershed while recognizing the individual municipal needs. A breakdown by municipality is provided in **Appendix A** of this Strategy.

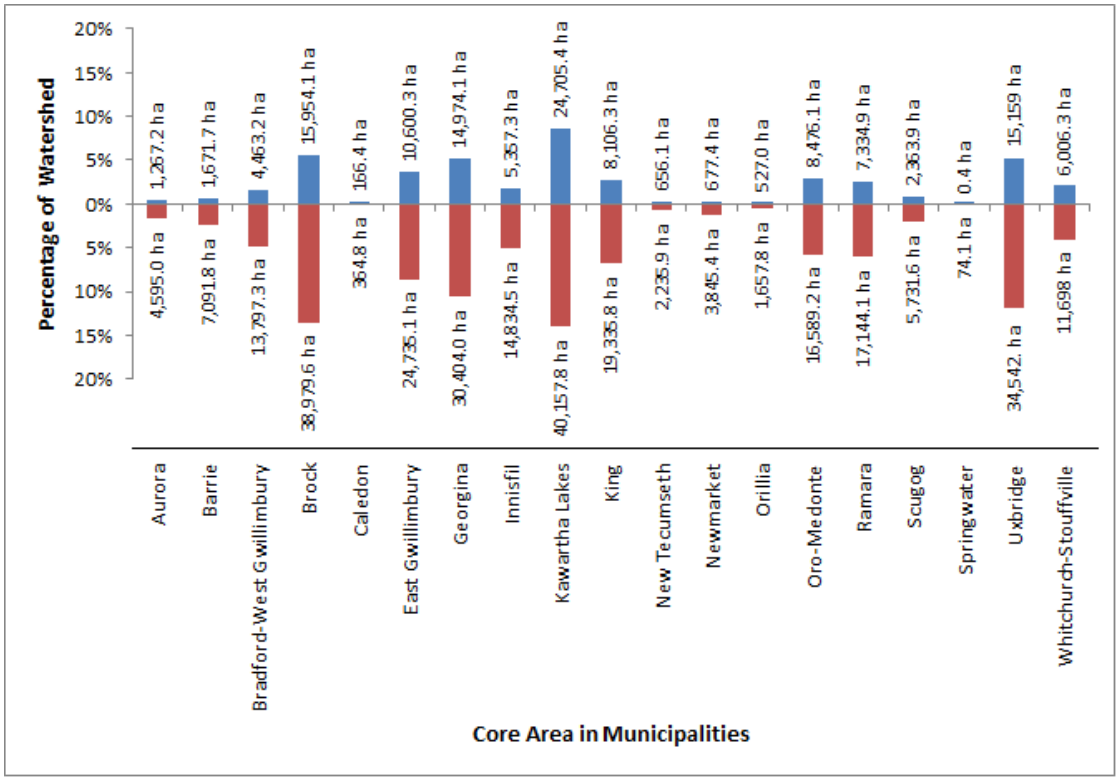


Figure 4.16 Core Feature distribution by municipality. Blue bars are representative of core areas in the municipality in correlation with the municipal area percentage within the Lake Simcoe watershed (red bars).

Targeted features that enhance the watershed include grassland habitat, corridor restoration, restoration opportunities in the floodplain and linkages (**Table 4-5**). These areas support achieving the LSRCA's NHS goals and improving the biodiversity of the watershed. Currently, many of these areas are subject to land use practices that do not support NHS functions. It is recommended these features are brought into the NHS when land use designations change in the future, acquired for restoration or long-term management opportunities initiated with current landowners. Finally, 30 m buffers are recommended in order to support the NHS core features and reduce impacts to the Natural Heritage System.

Table 4-5: Targeted Areas that Enhance the NHS.

Targeted Areas that Enhance the NHS	Coverage in the Watershed
Grasslands	12,661 ha
Corridor Restoration	3,944 ha
Restoration in the Floodplain	9,113 ha
Local Linkages	1,657 connections
Regional Linkages	59 connections

There are some limitations to the NHS that needs to be considered, however the overall goal of the NHSRS can still be met. These should be identified so that future use of the NHS can be appropriately evaluated. Landcover data related to ELC will evolve naturally through landscape succession, however these features will still encompass a component of the NHS (i.e. thickets or scrubland will grow into woodlands, meadows may succeed into thickets). The scale at which the NHS was developed is not conducive to the establishment of development limits in order to create subdivisions plans. Additional work should be completed as part of the normal planning process to establish precise boundaries. Additional field studies could support further refinement of the boundaries of isolated features. The current extent of development activities on the landscape was delineated as of spring 2016. There are other development plans and approvals across the watershed between this date and the published date of the report that are not captured through the NHS. These areas will result in modification of the NHS captured at the next five year interval of the report.

4.7 Connectivity to Adjoining Natural Heritage Systems

In reviewing the NHS, it is important to recognize the watershed within a network of landscapes. The NHS boundary is not limited but extends outside of the Lake Simcoe watershed boundaries. The Oak Ridges Moraine traverses east of the watershed boundary to Trent River and west to the Niagara Escarpment. The Oro Moraine connects further northwest spanning drainage that supports both the Lake Simcoe and Georgian Bay. The newly identified Greater Golden Horseshoe Natural Heritage System mapping identifies core area within the Lake Simcoe watershed at a broader scale and its connection to the Niagara Escarpment and the ORM. The Lake Simcoe watershed connects to Regional natural heritage systems in York, Durham and Simcoe County and is important in engaging communities in the protection of natural heritage features since people enjoy services across and beyond their region. NHS connections with First Nation communities are important in maintaining the unique relationship with

people, the land and its resources. Inter-watershed connections to adjacent Conservation Authorities ensures similar approaches to the NHS framework which could connect these systems over the larger southern Ontario landscape in order to understand impacts at a provincial scale. The LSRCA is fortunate to be embedded in an extensive ecological system with the ability to partner across the province.

4.8 How to Read this Report with other Plans

When reading this report, it is important to note the Strategy should be read in conjunction with relevant acts, policies, and plans. At the provincial scale this includes the Provincial Policy Statement (2014), Lake Simcoe Protection Plan (2009) and the recent 2017 revised Greenbelt Plan, Growth Plan for the Greater Golden Horseshoe, and Oak Ridges Moraine Conservation Plan. Other provincial level acts include the *Conservation Authorities Act*, the *Public Lands Act*, the *Clean Water Act*, and the *Environmental Assessment Act*.

The land use planning responsibilities lie with the approval Authority as delegated by the province of Ontario. In the Lake Simcoe watershed, upper, single and local tier municipal OPs are the mechanism for natural heritage protection. Generally across the watershed, these plans are in conformity with existing Provincial plans and in some cases recognize the need of their individual municipalities and extend beyond minimum policy framework. Some examples include meadow protection in the Town of Newmarket OP, identified local and regional corridors in the Town of East Gwillimbury and Township of Oro-Medonte OP, and restoration areas in the Town of Aurora and Town of Georgina OP. These specific feature identification or policies facilitate progressive and innovative system based policy development.

This Strategy recognizes the specific policies and consideration of OPs in order to balance natural heritage features in urbanized settings however since they were not incorporated into the criteria for identifying the NHS they must be reviewed in conjunction with this Strategy. It intends to complement existing policies and where possible assist the natural heritage support needs of municipalities to guide their public and stakeholders to extend beyond the status quo and recognize their watershed-wide role and responsibility. In some cases, due to the timing of this report or previous approvals, zoning designations and draft plan approvals may be in place and will be reviewed in the conjunction with the recommended Strategies of this report. In these situations use of the Ecological Offsetting Plan may be an appropriate tool to support a net gain in the watershed.

Chapter 5

5.0 Restoration and Implementation

Restoration and implementation of the Natural Heritage System and Restoration Strategy (NHSRS) will be achieved through actions led by the Lake Simcoe Region Conservation Authority (LSRCA), and shared and supported by its watershed partners and the extended community. Aligning with the goal and objectives, the strategy for implementation focuses on the organization's programs and services through actions of:

- Protection;
- Land planning and management;
- Monitoring and data collection;
- Research and tools;
- Outreach and education;
- Partnerships; and
- Strategy evaluation.

A series of actions to support management of the Natural Heritage System (NHS) are summarized in **Section 5.4.7** of this report, including duration of tasks and program roles and responsibilities.

The NHS does not exist on its own but as part of a connected matrix of land uses (agricultural, urban, park lands, infrastructure, etc.) that require balance in order to support communities. Feasibility and financial support are of the utmost importance to achieve and maintain a robust NHS.

Implementation of the NHSRS will recognize the system at different scales that transcend the watershed boundary, such as across the Province and across watersheds. It will also recognize the NHS within subwatersheds, within municipalities and at the micro-habitat level.

5.1 Restoration Strategy

This restoration strategy intends to achieve overall, long-term benefits to the NHS in the Lake Simcoe watershed while recognizing the need to evolve a natural heritage system as effects of climate change and land use practices change over time. It is important to support self-sustaining systems that can evolve naturally with minimal human intervention, and maintain healthy populations.

The fundamentals of this strategy include the following:

- Secure protection of existing natural heritage features as identified in the NHS in perpetuity by acquiring through public ownership, appropriate zoning, easements and covenants and/or stewardship opportunities;
- Create habitats such as woodlands, wetlands, shoreline, grasslands in areas adjacent to the existing natural heritage system, when not able to connect to the NHS create habitat that is sized for sustainability and will not isolate floral or faunal populations;
- Restore existing degraded natural heritage features to improve ecological function and resilience to climate change; and
- Design based on native and naturalized species, provide systems with the ability to be resilient to change, increase productivity, and species diversity.

5.2 Role in Mitigating Stressors

The stressors on the watershed, such as climate change, invasive species, urbanized land uses and natural disasters will continue to put pressure on the NHS and, with time, will only increase in intensity.

Implementing the NHSRS will mitigate the pressure from these stressors by protecting core features and enhancing the NHS. Restoring targeted areas will result in more resilient ecosystems with enhanced ecological function and a healthy watershed that continues to support a multitude of ecosystem services. An assessment of impacts from stressors will require routine review to accurately capture the changes to the watershed.

5.3 Assessment of the Natural Heritage System, Targets and Existing Conditions

The following is a continuation of **Section 3.2** to assess the targets for the NHS, the existing environmental state of the Lake Simcoe watershed and the potential of the implemented NHSRS (**Table 5-1**). It is intended that as much of the NHS area as possible is restored to its natural state over the long-term in order to improve the watershed health for today and future generations.

Table 5-1: Assessment of the Natural Heritage System Targets in Existing Conditions and Implementation Potential of the NHSRS

Feature Type	Target for the Watershed	Existing Conditions in NHS	Opportunity in the NHS	NHS Implementation Potential
All Core Features	• No net loss of features • Pursue a net gain of features	Ecological Offsetting Plan (EOP) substantiates the net gain associated with any loss of features across the watershed	The NHS will support implementation of the EOP	A net gain to the NHS in quality and quantity

Feature Type	Target for the Watershed	Existing Conditions in NHS	Opportunity in the NHS	NHS Implementation Potential
Wetlands	• 40% of historic watershed wetland coverage • Minimum 20% of watershed	• Historic wetland habitat remaining is 20-25% • Watershed wetland habitat is 18%	Approximately 9,113 ha of floodplain restoration	Wetland habitat could increase to 20.5% of the watershed
Watercourses and Fish Habitat	• 75% of stream length should be naturally vegetated with minimum 30 m vegetation protection zone	Watershed riparian vegetation is 62% of the 30 m vegetation protection zone	Approximately 11,985 ha of restoration area	Watershed riparian vegetation habitat could increase to 92% of the 30 m vegetation protection zone
Woodlands	• 40% forest at a watershed scale • 130 forest patches >200 ha • Interior forest should account for a minimum 10% of watershed	• Watershed woodland cover is 34.9%. • There are 110 forest patches >200 ha and 22 patches within 25 ha of 200 ha • Interior forest cover is 12.5% of watershed.	Approximately 3,944 ha of restoration area within the corridor restoration and 9,113 ha of floodplain restoration	• Watershed woodland cover could increase to 39.5%. • Forest patches >200 ha could increase to 132 • Interior forest cover could increase to 14%
Lake Simcoe Shoreline	• Minimum 30 m vegetated protection zone along shoreline	Shoreline natural vegetation coverage is 27% of the shoreline	Approximately 11,985 ha of restoration area	Shoreline natural area could increase to 52% of the total area
Corridors	• 100 m in width for main stem watercourse corridors	Total area in corridor widths is 15,363 ha	Approximately 3,944 ha of corridor restoration	Corridor restoration area could increase the overall NHS by 1%

In its ideal state, implementation of the entire NHSRS would maintain and achieve a number of feature targets on the landscape, however; in some cases this would not be sufficient enough to reach long-term targets. It should be noted that the targets have been set using scientific methods and staff expertise understanding the Lake Simcoe watershed to represent the minimum target for a natural heritage system to function. In the cases where the existing conditions are high, it is still always in the best interest of the System to improve these conditions, regardless of the targets. Once targets are achieved, features should continue to be restored, enhanced and protected to improve quality of the system.

Existing wetland habitat identified in the NHS is measured at 18%, implementation of the NHS could increase wetland habitat in the watershed to 20.5%.On the other hand, historical wetland conditions are well below their minimum thresholds and are unlikely to return to their pre-settlement conditions, and

therefore any further wetland loss would result in unachievable targets. There is a large opportunity to increase quality woodland across the watershed (with the corridor restoration and floodplain enhancement) in the form of increasing are to patch sizes just below minimum threshold sizes or through large patch restoration. Similarly, interior forest targets are above minimum limits however woodland targets are well below optimal conditions. In order to meet goals of the NHSRS, targets will need to be considered holistically including the implementation of the Ecological Offsetting Plan to demonstrate a net gain to the NHS when appropriate. Protection of existing features and acquisition of lands for restoration will be essential to a long-term sustainable system. In reality, legal uses and landowner objectives play a large role in implementation of a long-term NHS. The LSRCA commits to assisting landowners in best management practices to achieve ecological gains.

Quality cover recommendations for the LSRCA are discussed in **Section 4.5** of this report. The LSRCA will defer to the MNRF in the identification of 40% high quality cover as per the targets set out in chapter 6 in the LSPP and policy number 6.48. LSRCA can provide MNRF with assistance in data collection, assessment or partnership. Once the benchmarks for quality cover are determined, targets will be incorporated into subsequent NHSRS updates; however, the LSRCA commits to the improvement of habitat quality through all practices where feasible.

5.4 Implementation Action in the LSRCA

At its core, the Lake Simcoe Region Conservation Authority is an organization committed to protecting and restoring the Lake Simcoe watershed by leading research, policy and action. The identified NHS, including its targeted areas, is designed to protect the ecological and hydrological watershed over the long-term. Implementation of the NHSRS through LSRCA programs and services will follow a strategy hierarchy of protection, restoration, mitigation and feature creation. Protection of existing natural heritage features and areas, and their functions, is the most cost-effective and efficient way to maintain ecological and hydrological functions, while restoration and enhancement approaches are critical to achieving desired targets for natural cover and function.,

The sections below are organized by implementation themes, and associated actions for implementation of the NHS (shaded side boxes). These actions incorporate recommendations received through the stakeholder consultation on the NHSRS. The implementation actions (summarized in Section 5) are intended to occur over the next five years while others are ongoing for the long term. Review of the NHSRS is recommended every five years to incorporate new science, policy or tools for implementation of the NHS and to ensure that the NHS is integrated into new programs and services. Moving forward, the LSRCA will ensure that each program clearly understands its responsibilities and reporting requirements for monitoring purposes.

5.4.1 Protection

Natural heritage protection and environmental management is secured through strategic planning and policies that integrate and coordinate governing institution responsibilities and programs to protect, restore and create ecosystem services and functions for a sustainable environment.

The LSRCA is actively involved in the protection of the NHS and its associated components through its roles as a regulatory body, planning and technical reviewer, and a landowner where applicable.

Under the *Conservation Authorities Act*, it is the responsibility of the LSRCA, under Ontario Regulation 179/06, to regulate development and interference with wetlands and alterations to shorelines and watercourses. The LSRCA Watershed Development Guidelines (LSRCA, April 2015) enhance consistency and administrative decision-making as per the *Act*. A principle mandate of these Guidelines is to prevent the loss of life and property damage due to natural hazards, and to conserve and enhance natural resources.

The Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Ontario Regulation 179/06 is a key tool used to fulfill this mandate as it allows the LSRCA to regulate development in areas where the control of flooding, erosion, dynamic beaches, pollution or the conservation of land may be affected. Natural heritage features such as valleylands, wetlands, watercourses and shorelines are identified in the NHS. These features will receive further protection through integration of the NHS into the Watershed Development Guidelines and LSRCA's regulatory role.

Through the NHSRS, LSRCA commits to the following actions:

- Implement the NHSRS through review and comment of land development applications under the *Planning Act*, *Environmental Assessment Act* and *Conservation Authorities Act*
- Encourage the incorporation of the NHSRS and its recommendations into Provincial Plans and regional and local Official Plans
- Engage stakeholders of the watershed to protect, restore and enhance the targeted areas of the NHS in addition to core features
- Integrate the NHS and associated strategies into subwatershed plans and implementation guidelines
- Assist partners to protect, restore and enhance grassland habitat identified in the NHS
- Protect, maintain or enhance ecologically significant groundwater recharge areas
- Integrate the NHSRS into existing and future LSRCA strategies, plans and guidelines, where appropriate
- Incorporate the NHSRS into sustainable centered strategies, projects and programs such as LID guidelines, RainScaping program, and Carbon Reduction Strategy

Through review, the LSRCA provides advice and guidance to its member municipalities on the implementation and application of the Provincial Policy Statement (2014) under the *Planning Act* and the applicable provincial plans, including the Growth Plan of the Greater Golden Horseshoe (2017), the Greenbelt Plan (2017), the Oak Ridges Moraine Conservation Plan (2017), the Lake Simcoe Protection Plan (2009), as well as various technical guidelines provided by the

MNRF. This role also permits assistance to coordinate regulatory requirements including, but not limited to, Ontario Regulation 176/06, *Environmental Assessment Act*, and *Clean Water Act*. In addition, where applicable, Memorandums of Understanding (MOUs) with member municipalities also include delegated responsibility for enforcing policies within the South Georgian Bay Lake Simcoe Source Protection Plan (2015) related to WHPA-Q2 policies.

Regional and local OPs are the central vehicle to implement provincial policies and plans at the local level. Through its relationships with municipalities, the LSRCA provides review and advice on OP updates for important matters related to natural heritage, natural hazards and water resources. The LSRCA Board of Directors (BOD) approved the Natural Heritage System for the Lake Simcoe Watershed, Phase 1 (Beacon Environmental & LSRCA, 2007) and it was adopted into the City of Barrie, Town of East Gwillimbury, Town of Innisfil and Simcoe County Official Plans. This NHSRS is an updated version of the Phase 1 report and focuses on the core and targeted areas that make up the NHS for the Lake Simcoe watershed NHSRS. It is important for municipalities to continue this progression of adopting and incorporating the NHSRS into official plans; not only does this establish municipal support for achieving the watershed goals of restoring and expanding the NHS, but it also enforces the long-term protection of the NHS.

At the subwatershed scale, planning initiatives are further refined to focus on the macro-environmental needs of the region. The LSRCA subwatershed studies identify specific priority actions, focused action plans, monitoring requirements and evaluation of results. These series of plans can include recommendations on:

- Stormwater and floodplain management;
- Protection of hydrological and hydrogeological functions and services;
- Protection, restoration and creation of natural heritage features and corridors;
- Land-use planning; and
- Climate change mitigation.

As subwatershed studies are updated, they will be developed or revised to reflect the NHS identified in the NHSRS. Refinements to the NHS may be conducted to support local scale data with feedback mechanisms that support the overall watershed wide strategy evaluation.

Protection as a tool extends to exploring and implementing innovative alternative ways to manage stressors on the watershed in the form of strategies and plans that are directed into programs. For example, LSRCA's Ecological Offsetting Plan (2017a) pursues a "net gain" where the land-use planning process results in an unavoidable loss of feature. This is an important step towards maintaining the NHS and, where possible, growing the system.

The RainScaping program is a comprehensive way to manage stormwater in the watershed for new developments. This hands-on approach includes partnering with municipalities, the Province and the private sector to implement low impact development (LID) and improve water quantity and quality,

while reducing flooding risks and building climate change resiliency. This approach incorporates LID technology early in the design process and applies leading stormwater management (SWM) industry guidelines. The LSRCA Technical Guidelines for Stormwater Management Submissions (LSRCA, 2016) endeavors to enhance protection of the natural environment, improve infrastructure resiliency to climate change and requires designs to better reflect natural hydrology. In addition to these benefits, the application of consistent SWM standards streamlines the review process and improves client service.

The Lake Simcoe Watershed Salt Reduction Strategy (2017b) has outlined multiple objectives to implement in the watershed to improve the water quality. Encouraging the reduction in salt use by municipalities and the private sector along with improving community awareness of the impacts of salt will improve the NHS as well as the water quality within Lake Simcoe.

The carbon reduction strategy currently underway was identified as a priority through the LSRCA Strategic Plan (2016 – 2020). This strategy will provide technical guidance that will improve the quality and extent of the NHS. The incorporation of the NHSRS into applicable LSRCA strategies, plans and guiding documents will enable the diversity of programs and services to exist while working towards a unified goal.

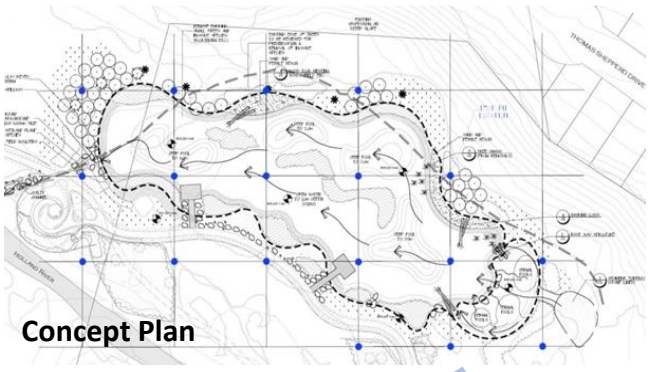
5.4.2 Land Planning and Management

LSRCA's conservation lands programs undertake long-range planning activities and coordinate land development, operational initiatives and activities on LSRCA owned, managed and conservation easement properties throughout the watershed (a total of 2,428 ha across the watershed).
These programs are rooted, where available, through the direction of the management plans that identify the short- and long-term goals of the property based upon the capabilities and constraints. It is the general goal of these plans to protect and restore natural heritage features while promoting a connection with nature. Roles can include land and water stewardship, infrastructure management (roads, trails, buildings, etc.), program delivery (outdoor education, public and external partner programs), and securing additional land.

Through the NHSRS, LSRCA commits to the following actions:

- Incorporate the NHS into Conservation Area Management Plans and land holding assessments
- Incorporate the NHS into the Land Strategy prioritizing areas for acquisition, restoration and creation
- Create trail guidelines that lessen impacts to the NHS while bringing communities to natural areas
- Implement green infrastructure such as parklands, LID SWM systems, street trees, urban forests, natural channels, permeable surfaces and green roofs

The LSRCA Land Securement Strategies provide the basis and direction for securing interests in lands through purchases, donations, conservation easements, leases and agreements, trade lands, exchanges and other similar methods to protect the watershed's natural heritage features. The strategy outlines target land securement areas and implementation tools for the securement and disposition of land owned by the LSRCA. To date, the LSRCA currently owns 1,602 ha of lands within the Natural Heritage System or enhancing the NHS. These lands are dominated by natural heritage features like woodlands, wetlands and watercourses but also include 5 ha of office/workshop space, 75 kms of trail and 1 ha of permanent seasonal interpretive facility. Between 2011 and 2015, the Land Securement Strategy achieved its goal of securing approximately 116 ha of land in the NHS or lands restored to the NHS. An updated Strategy for 2016-2020 is currently underway which will incorporate the NHS and its targeted areas. Of importance will be protecting land in perpetuity by bringing it into public ownership and purchasing land in the identified core areas and targeted areas for natural heritage creation. Through the implementation of an updated Land Securement Strategy priority areas and targets will be further refined to meet the needs of the Conservation Lands programs and services.



The wetland creation project at Rogers Reservoir Conservation Area in East Gwillimbury, Ontario.

In areas where natural heritage systems are highly urbanized and land is scarce, to increase the NHS alternative means should be implemented where feasible. This includes a mix of natural and human-made elements that provide ecological and hydrological functions and services such as urban NHS, streetscaping, green roofs, LID, permeable surfaces and urban forest elements. This is keeping in line with Provincial action to improve stormwater, decrease energy use, improve carbon storage and improve air and water quality. Projects undertaken by the urban restoration program will align with improving resiliency and sustainability in the NHS located in urban areas.

5.4.3 Data Collection and Monitoring

The LSRCA conducts a range of data collection in support of monitoring programs or special projects. Collection of scientific data across the watershed occurs in partnership with watershed stakeholders and targets abiotic and biotic aspects of the environment to investigate and build an understanding of ecological function and services across the watershed. To support the assessment of aquatic and terrestrial ecosystem health, data collection and monitoring programs record and gather information on water quality and quantity, flora and fauna populations, lake indicators, and barriers in the watershed.

Data collection for special projects may include inventories of natural heritage features (wetlands, woodlands, aquatic habitats, etc.), species surveys for properties of interest, or data collection related to road ecology and migration trends. This information is vital to understanding the function and impacts occurring across the landscape in turn facilitating the long-term protection of the NHS. Data collection and monitoring programs inform resource management initiatives in the watershed.

These initiatives, in partnership with the watershed community, rely on accurate and current scientific information pertaining to the health of the Lake Simcoe watershed. The data from annual LSRCA monitoring programs, including surface, groundwater, aquatic and terrestrial monitoring, can be used to identify trends over time and, in turn, this information can be used to inform decisions in the watershed. LSRCA will consider opportunities to investigate public health evidence to support research and monitoring for health supportive policies. Use of collected data and monitoring programs assist in assessing key performance indicators. The importance of setting monitoring locations centered on the NHS for current and future data collection and monitoring will improve the ability to measure the success of the NHSRS.

Through the NHSRS, LSRCA commits to the following actions:

- Integrate current and future data collection and monitoring programs with the NHS to maintain high quality and useful database records
- Integrate the NHS into long-term monitoring programs including prescribed targets that align with the restoration strategy such as the Watershed Health Report Card
- Inventory areas that will be vulnerable to changes in land use practice and/or climate change and develop mitigation measures and management opportunities
- Continue monitoring programs within the NHS that collect information regarding aquatic and terrestrial barriers in order to determine management opportunities
- Update the landcover layer on a five year monitoring cycle and assess changes to NHS cover and related causal factors
- Partner with the MNRF & MOECC, or similar Lake Simcoe watershed programs to identify high quality areas in the Lake Simcoe watershed and initiate a monitoring program to monitor the quality of the NHS at the regional and local scale

5.4.4 Research and Tools

Research in evolving science is important for the NHSRS to address the impacts of existing and future stressors on the Lake Simcoe watershed. Scientific research conducted by the LSRCA in partnership with universities, agencies, conservation authorities, First Nation communities, municipalities, non-government organizations (NGO), and private and public community organizations builds knowledge regarding landscape and ecosystem management, allowing the LSRCA to keep up with trends and remain at the scientific forefront. As a science-based organization, this information is pertinent to the adaptation of LSRCA's programs and services specific to the watershed.

Similar to data collection and monitoring, areas of research and the resulting tool development is relevant to current and anticipated issues that may vary in topic but be directly or indirectly related to the NHS. Through the LSRCA Strategic Plan (2016-2020), research to support the development of a number of plans and tools are currently underway, such as the Climate Change Adaptation and Mitigation Plan (CCAMP), Carbon Reduction Strategy and Adapting Forestry Programs for Climate Change. The CCAMP and Adapting Forestry Programs for Climate Change will provide mitigation measures, implemented through LSRCA programs and services, which will mitigate risks and vulnerabilities in the watershed associated with impacts from climate change on surface and groundwater, and aquatic and terrestrial ecosystems.

Integrating the protection of the NHS in areas of research like environmental flows (e-flows), urban restoration, LID, offsetting (ecological, water balance and phosphorus), human health and well-being, and nutrient management will result in effective tools the LSRCA can utilize in the watershed but also communicate and contribute to other research being completed in the scientific community.

Through the NHSRS, LSRCA commits to the following actions:

- Integrate the NHS into the Climate Change Adaptation and Mitigation Plan and the Adapting Forestry Programs for Climate Change report to assist with identifying priority areas for migration corridors and afforestation that both sequester carbon and promote biodiversity resilience in the NHS
- Develop a tributary Fisheries Management Plan and accompanying Coldwater or Brook Trout Recovery Strategy
- Utilize the NHS to support the initiatives of the LSRCA Restoration Funding Program
- Develop tools for restoration, such as planting guidelines and edge management plans
- Utilize the NHSRS as a tool to achieve targets for Lake Simcoe, like reducing nutrient and pollutant loading and improving ecological health
- Utilize the NHSRS to drive research in carbon reduction, climate change, urban restoration, natural capital, LID macro-economic modelling, e-flows, phosphorous offsetting, ecological offsetting, water balance offsetting and salt reduction
- Develop and implement tools that reduce pressures and enhance ecosystem services in urban systems
- Explore the benefits of human health and nature with partners in the watershed to support planning and decision making of resource capital

Internal tools, such as the Stewardship Priorities Opportunity Tool (SPOT), in conjunction with the NHS targeted areas identified in this report, will prioritize enhancement of the NHS. This includes the removal and mitigation of aquatic and terrestrial barriers that prevent the physical and genetic migration of species in the watershed while also protecting against the spread of invasive species. The NHSRS is an excellent avenue for tool development to improve efficiency and consistency in environmental management.

Developed urban restoration and urban forestry tools will set specific objectives and goals aligned with the NHSRS to meet the needs to maintain natural heritage systems in the urban centres, like achieving canopy cover targets and retrofitting stormwater management.

- Use research from urban forest studies to promote enhancement in targeted NHS supporting areas within settlement boundaries
- Prioritize opportunities within the NHS using the SPOT to achieve targets of the NHSRS
- Prioritize removal of aquatic and terrestrial barriers in the NHS identified with the SPOT to improve migration corridors
- Develop a GIS viewer tool for staff to support program uptake of the NHSRS

Most important is the sharing of the NHSRS and NHS map layers within the LSRCA departments as well as with partner municipalities through the use of an interactive GIS tool for uptake into programs and services.

5.4.5 Outreach and Education

Outreach programs are intended to engage communities, landowners, education disciplines and the general public across and beyond the watershed.

Landowner Outreach

The LSRCA provides technical and funding support for restoration projects that contribute to protecting, restoring or enhancing aquatic and terrestrial habitats in the NHS. Through technical expertise and funding, projects that create and/or restore wildlife habitat, increase native biodiversity, and/or expand, connect or buffer natural heritage features are encouraged and supported. With a focus on water quality improvements, soil conservation and natural heritage enhancement, these projects can include:

- Cropland erosion control;
- Wildlife habitat enhancement;
- Stream improvements and online pond retrofits;
- Wetland restoration and enhancement;
- Grassland restoration and enhancement; and/or
- Community action.

In addition, the LSRCA forestry program seasonally undertakes tree planting efforts to assist landowners with restoring woodland ecosystems on their properties. By aligning target areas in the NHS, outreach efforts and opportunities, projects can be refined to focus on the priority areas.

Through the NHSRS, LSRCA commits to the following actions:

- Provide support for restoration projects to protect, connect and enhance core NHS and supporting areas on rural agricultural, residential, conservation authority, and public properties
- Develop new and/or expand existing stewardship incentives to watershed stakeholders that encourage land and water best management practices
- Incorporate the NHSRS into landowner outreach materials and programs
- Engage stakeholders of the watershed, including residents, corporations, and academia institutions, in the protection, enhancement and restoration of the NHS
- Integrate objectives of the NHSRS into citizen science programs to fill data gaps, improve observations in the watershed and support monitoring of the watershed, including BioBlitz events and research activities
- Develop or modify education materials to engage school and community programs and build appreciation and recognition of the NHS
- Report results of the NHSRS in LSRCA communication materials, such as annual reports, watershed health reports and science newsletters

Incentive-based programs will promote and where possible cultivate the support of the public community for natural heritage protection with financial support, education and recognition of ecosystem services to foster collaboration across the watershed. Large gains in ecological support would be essential for grassland habitat.

Community Outreach

Engaging with the public is a great way to build awareness. By gaining broad support from and forming partnerships with the public and private sector, the objectives and targets of the NHSRS will be attainable. Building on existing partnerships will facilitate information sharing and allow LSRCA to pursue joint initiatives and coordinate responses to shared environmental threats. This can occur through a variety of tools and resources, including community planting events or BioBlitzes, effective communication through social media and promotional material to expand appreciation and knowledge of the NHS. Most importantly, it includes supporting community groups to ensure their environmental initiatives are successful.

The community can participate in meaningful scientific research through citizen science programs and provide high value data to fill gaps and improve observations in the watershed where resources are limited. The ability to use this information in tracking the NHS is a vital component of community collaboration.

Education

The LSRCA environmental education program delivers engaging curriculum-connected programs that stimulate and encourage community members, such as adults, students and families. The goals of the program are to make lasting impressions and build relationships with people and their surrounding natural environment through hands-on and digital education materials. The incorporation of the NHS and its importance into presentations, experiential programs, and environmental education programs will create opportunities for the community to engage in positive environmental actions that will benefit the NHS today and for the long-term.

5.4.6 Partnerships

The NHSRS identifies goals and objectives for protecting, restoring and growing the Natural Heritage System. This guides LSRCA programs and services to be focused on priorities and target setting while maintaining organizational effectiveness and the efficient use of public funds. The role of implementation is vital and one that is shared across the watershed with all stakeholders; it transcends LSRCA boundaries. Enhanced environmental awareness and information is essential for building community-wide understanding that is imperative for protecting the Lake Simcoe NHS. It requires active communication to share knowledge, goals and opportunities that will lead to creative environmental initiatives, achieving the ideal protection of the NHS, and a healthy, more livable watershed.

Through the NHSRS, LSRCA commits to the following actions:

- Build on existing partnerships with watershed stakeholders to collaborate on the protection, restoration, management and monitoring objectives of the NHSRS
- Collaborate with municipalities, First Nation's communities, conservation authorities, NGOs, public organizations and the Province to connect natural heritage systems and promote consistent protection for natural heritage systems across the watershed and southern Ontario

5.4.7 Summary of Implementation Actions

The following 39 actions will be completed by the LSRCA in partnership with stakeholders of the Lake Simcoe watershed to achieve a sustainable and resilient NHS.

Action Number	Action	Timeframe	LSRCA Programs						
			Corporate Services	Ecological Management	Education & Engagement	Greenspace Services	Planning & Development Services	Water Risk Management	Watershed Studies & Strategies
Protection									
1	**Implement the NHSRS through review and comment of land development applications under the *Planning Act*, *Environmental Assessment Act* and *Conservation Authorities Act***	Ongoing					x	x	
2	**Encourage the incorporation of the NHSRS and its recommendations into Provincial Plans and regional and local Official Plans**	Ongoing	x				x		
3	**Engage stakeholders of the watershed to protect, restore and enhance the targeted areas of the NHS in addition to core features**	Ongoing	x	x	x	x	x	x	x

Action Number	Action	Timeframe	LSRCA Programs						
			Corporate Services	Ecological Management	Education & Engagement	Greenspace Services	Planning & Development Services	Water Risk Management	Watershed Studies & Strategies
4	**Integrate the NHS and associated strategies into subwatershed plans and implementation guidelines**	Ongoing							x
5	**Assist partners to protect, restore and enhance grassland habitat identified in the NHS**	Within 5 years		x		x	x		x
6	**Protect, maintain or enhance ecologically significant groundwater recharge areas**	Ongoing	x			x	x	x	x
7	**Integrate the NHSRS into existing and future LSRCA strategies, plans and guidelines, where appropriate.**	Ongoing	x	x		x	x	x	x

Action Number	Action	Timeframe	LSRCA Programs						
			Corporate Services	Ecological Management	Education & Engagement	Greenspace Services	Planning & Development Services	Water Risk Management	Watershed Studies & Strategies
8	**Incorporate the NHSRS into sustainable centered strategies, projects and programs such as Low Impact Development (LID) guidelines, RainScaping program, and Carbon Reduction Strategy**	Ongoing	x				x	x	x
Land Planning and Management									
9	**Incorporate the NHS into Conservation Area Management Plans and land holding assessments**	Within 3 years				x			
10	**Incorporate the NHS into the Land Management Acquisition Strategy prioritizing areas for acquisition, restoration and creation**	Within 3 years				x			

Action Number	Action	Timeframe	LSRCA Programs						
			Corporate Services	Ecological Management	Education & Engagement	Greenspace Services	Planning & Development Services	Water Risk Management	Watershed Studies & Strategies
11	**Create trail guidelines that lessen impacts to the NHS while bringing communities to natural areas**	Within 3 years				x	x		
12	**Implement green infrastructure such as parklands, LID SWM systems, street trees, urban forests, natural channels, permeable surfaces and green roofs**	Ongoing	x	x		x	x	x	x
Monitoring and Data Collection									
13	**Integrate current and future data collection and monitoring programs with the NHS to maintain high quality and useful database records**	Ongoing	x	x	x	x	x	x	x
14	**Integrate the NHS into long-term monitoring programs including prescribed targets that align with the restoration strategy such as the Watershed Health Report**	Ongoing	x	x			x	x	

Action Number	Action	Timeframe	LSRCA Programs						
			Corporate Services	Ecological Management	Education & Engagement	Greenspace Services	Planning & Development Services	Water Risk Management	Watershed Studies & Strategies
	Card								
15	**Inventory areas that will be vulnerable to changes in land use practice and/or climate change and develop mitigation measures and management opportunities**	Within 5 years		x			x	x	x
16	**Continue monitoring programs within the NHS that collect information regarding aquatic and terrestrial barriers in order to determine management opportunities**	Ongoing		x			x		x
17	**Update the landcover layer on a 5 year monitoring cycle and assess changes to NHS cover and related causal factors**	Ongoing	x				x		x
18	**Partner with the MNRF & MOECC, or similar Lake Simcoe watershed programs to identify high quality areas**	Ongoing		x			x		x

Action Number	Action	Timeframe	LSRCA Programs						
			Corporate Services	Ecological Management	Education & Engagement	Greenspace Services	Planning & Development Services	Water Risk Management	Watershed Studies & Strategies
	in the Lake Simcoe watershed and initiate a monitoring program to monitor the quality of the NHS at the regional and local scale								
Research and Tools									
19	**Integrate the NHS into the Climate Change Adaptation and Mitigation Plan and Adapting Forestry Programs for Climate Change to assist with identifying priority areas for migration corridors and afforestation that both sequester carbon and promote biodiversity resilience in the NHS**	Within 3 years		x					x
20	**Develop a tributary Fisheries Management Plan and accompanying Coldwater or Brook Trout Recovery Strategy**	Within 5 years		x					

Action Number	Action	Timeframe	LSRCA Programs						
			Corporate Services	Ecological Management	Education & Engagement	Greenspace Services	Planning & Development Services	Water Risk Management	Watershed Studies & Strategies
21	**Utilize the NHS to support the initiatives of the LSRCA Restoration Funding Program**	Ongoing		x					
22	**Develop tools for restoration, such as planting guidelines and edge management plans**	Within 3 years		x			x		
23	**Utilize the NHSRS as a tool to achieve targets for Lake Simcoe like reducing nutrient and pollutant loading and improving ecological health**	Ongoing		x			x	x	x
24	**Utilize the NHSRS to drive research in carbon reduction, climate change, urban restoration, natural capital, LID macro-economic modelling, e-flows, phosphorous offsetting, ecological offsetting, water balance offsetting and salt reduction**	Ongoing	x	x			x	x	x

Action Number	Action	Timeframe	LSRCA Programs						
			Corporate Services	Ecological Management	Education & Engagement	Greenspace Services	Planning & Development Services	Water Risk Management	Watershed Studies & Strategies
25	**Explore the benefits of human health and nature with partners in the watershed to support planning and decision making of resource capital**	Ongoing	x			x	x		
26	**Develop and implement tools that reduce pressures and enhance ecosystem services in urban systems**	Ongoing		x			x	x	x
27	**Use research from urban forest studies to promote enhancement in targeted NHS supporting areas within settlement boundaries**	Within 5 years		x			x		
28	**Prioritize opportunities within the NHS using the SPOT to achieve targets of the NHSRS**	Within 1 year					x		x
29	**Prioritize removal of aquatic and terrestrial barriers in the NHS identified with the SPOT to improve migration corridors**	Within 1 year		x			x		x

Action Number	Action	Timeframe	LSRCA Programs						
			Corporate Services	Ecological Management	Education & Engagement	Greenspace Services	Planning & Development Services	Water Risk Management	Watershed Studies & Strategies
30	**Develop a GIS viewer tool for staff to support program uptake of the NHSRS**	Within 1 year	x				x		
Outreach and Education									
31	**Provide support for restoration projects to protect, connect and enhance core NHS and supporting areas on rural agricultural, residential, conservation authority, and public properties**	Ongoing		x					
32	**Develop new and/or expand existing stewardship incentives to watershed stakeholders that encourage land and water best management practices**	Within 5 years	x	x					
33	**Incorporate the NHSRS into landowner outreach materials and programs**	Within 2 years	x	x			x		

Action Number	Action	Timeframe	LSRCA Programs						
			Corporate Services	Ecological Management	Education & Engagement	Greenspace Services	Planning & Development Services	Water Risk Management	Watershed Studies & Strategies
34	**Engage stakeholders of the watershed, including residents, corporations, and academia institutions, in the protection, enhancement and restoration of the NHS**	Ongoing	x	x		x	x		x
35	**Integrate objectives of the NHSRS into citizen science programs to fill data gaps, improve observations in the watershed and support monitoring of the watershed, including BioBlitz events and research activities**	Ongoing		x	x	x	x		
36	**Develop or modify education materials to engage school and community programs and build appreciation and recognition of the NHS**	Within 3 years	x		x		x		
37	**Report results of the NHSRS in LSRCA communication materials, such as annual reports, watershed health reports and science**	Ongoing	x				x		

Action Number	Action	Timeframe	LSRCA Programs						
			Corporate Services	Ecological Management	Education & Engagement	Greenspace Services	Planning & Development Services	Water Risk Management	Watershed Studies & Strategies
	newsletters								
Partnerships									
38	**Build on existing partnerships with watershed stakeholders to collaborate on the protection, restoration, management and monitoring objectives of the NHSRS**	Ongoing	x	x	x	x	x	x	x
39	**Collaborate with municipalities, First Nation's communities, conservation authorities, NGOs, public organizations and the Province to connect natural heritage systems and promote consistent protection for natural heritage systems across the watershed and southern Ontario**	Ongoing	x	x	x	x	x	x	x

Chapter 6

6.0 Strategy Evaluation

The Natural Heritage System and Restoration Strategy (NHSRS) implementation actions provide one way to measure success; however, they do not fully capture how the Lake Simcoe Region Conservation Authority (LSRCA) programs and services will evolve to reach these targets or the extent to which the watershed community will be engaged in supporting the Strategy.

Reporting on the performance of the NHSRS and its progress will occur on a five year basis. This will document any quantitative and qualitative gains achieved through the action tasks. It is important that these results are measureable and produce tangible outcomes.

In developing a monitoring program, targets, benchmarks, standards and criteria should incorporate an adaptive management approach. This will allow new information and monitoring data to be used to assess the effectiveness of the NHSRS being embedded in LSRCA programs and services, and refine goals, targets and actions of the NHSRS as necessary.

Strategy evaluation will include the following:

- Complete QA/QC of the NHS mapping and maintain accurate and up-to-date boundaries through mapping updates
- Develop a monitoring plan to evaluate the effectiveness of the NHSRS, including targets, key performance measures and feasibility based upon the anticipation of implemented actions by the LSRCA programs
- Review NHS criteria, mapping and policy strategies at five year intervals to incorporate existing and emerging science, technology and trend responses to stressors on the watershed
- Assess cumulative success of the NHS and recommend actions for protection, creation, restoration and mitigation at five year review intervals

Chapter 7

7.0 Acronyms and Glossary

ANSI	Area of Natural and Scientific Interest
BILD	Building, Industry and Land Development Association
BOD	Board of Directors
CCAMP	Climate Change Adaptation and Mitigation Plan
ELC	Ecological Land Classification
ESGRAs	Ecologically Significant Groundwater Recharge Areas
GBP	Greenbelt Plan
GGH	Greater Golden Horseshoe
GIS	Geographic information system
GPGGH	Growth Plan for the Greater Golden Horseshoe
LID	Low Impact Development
LIO	Land Information Ontario
LSEMS	Lake Simcoe Environmental Management Strategy
LSPP	Lake Simcoe Protection Plan
LSRCA	Lake Simcoe Region Conservation Authority
MMA	Ministry of Municipal Affairs (formally known as MMAH)
MMAH	Ministry of Municipal Affairs and Housing
MNRF	Ministry of Natural Resources and Forestry (formally known as OMNR)
MPIR	Ministry of Public Infrastructure Renewal
MOE	Ministry of the Environment
MOECC	Ministry of the Environment and Climate Change (formerly known as MOE)
MOU	Memorandum of Understanding
NAALS	Natural Areas Abutting Lake Simcoe
NCC	Nature Conservancy of Canada
NEP	Niagara Escarpment Plan
NGOs	Non-government organizations
NHS	Natural heritage system
NHSRS	Natural Heritage System and Restoration Strategy
OMAFRA	Ontario Ministry of Agriculture, Food and Rural Affairs
OMNR	Ontario Ministry of Natural Resources
OPs	Official Plans
ORM	Oak Ridges Moraine

ORMCP	Oak Ridges Moraine Conservation Plan
PPS	Provincial Policy Statement
PSW	Provincially Significant Wetland
QA/QC	Quality Assurance/Quality Control
SAR	Species at Risk
SCOCA	South Central Ontario Conservation Authorities
SGRAs	Significant Groundwater Recharge Areas
SPOT	Stewardship Priorities Opportunity Tool
SWH	Significant Wildlife Habitat
SWM	Stormwater Management
SWP	Source Water Protection
UVb	Ultraviolet b

Alvar (Community Class): Bedrock-controlled sites on more or less level expanses of limestone. There is a patchy mosaic of exposed limestone "pavement" and scant soil which mainly accumulates in cracks or "grykes". There is seasonal inundation of water alternating with extreme drought in the summer.

Area of Natural and Scientific Interest (ANSI): Identified area of land and water containing natural landscapes or features that have life science or earth science values related to protection, scientific study or education.
Bathymetry: The measurement of the depth of water in oceans, rivers, or lakes. On bathymetric maps, lines connect points of equal depth.

Best Management Practices (BMPs): Practices that are determined to be effective and practicable (including technological, economic, and institutional considerations) without sacrificing productivity.

Biodiversity: The variability among organisms from all sources including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

Bog (Community Class): Ombrotrophic peatlands, generally unaffected by nutrient-rich groundwater, that are acidic and often dominated by heath shrubs and *Sphagnum* mosses and that may include open-growing, stunted trees. Tree cover is less than 25%.

Buffer: An area or band of permanent vegetation, preferably consisting of native species, located adjacent to a natural heritage feature and usually bordering lands that are subject to development or site alteration. The purpose of the buffer is to protect the feature and its function by mitigating impacts of the proposed land use and allowing an area for edge phenomena to continue. (Also refer to *Vegetation Protection Zone*).

Carbon sink: A forest, ocean, or other natural environment viewed in terms of its ability to absorb and store carbon dioxide from the atmosphere.

Connectivity: The degree to which natural heritage features are connected across the landscape, by links such as plant and animal movement corridors, hydrological and nutrient cycling, genetic transfer, and energy flows through food webs.

Core features: Those considered critical to the Natural Heritage System whose protection and longevity are imperative to ecosystem functions and services of the Lake Simcoe watershed. They include features like wetlands, watercourses, and woodlands.

Corridor: An area intended to provide connectivity (at the regional or site level), supporting a range of community and ecosystem processes, enabling plants and smaller animals to move between core areas and other larger areas of habitat over a period of generations. (Also called *linkages*).

Ecological Land Classification (ELC): The Canadian classification of lands from an ecological perspective; an approach that attempts to identify ecologically similar areas.

Ecological restoration: The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.

Ecologically Significant Groundwater Recharge Areas (ESGRAs): Areas of land that are responsible for supporting groundwater systems that sustain sensitive features like coldwater streams and wetlands.

Ecosystem goods: The products of the processes and interactions of natural systems.

Ecosystem processes: The physical, chemical and biological actions or events that link organisms and their environment (e.g. decomposition).

Ecosystem services: The interactions among organisms and their natural environments that humans are able to use and capitalize on (e.g. purification of air and water).

Endangered: A species that lives in the wild in Ontario but is facing imminent extinction or extirpation.

Erosion: A natural process which results in the continual loss of earthen material (i.e. soil) over time as a result of water and wind.

Extinct: A species that no longer lives anywhere in the world

Extirpated: A species that lives somewhere in the world, lived at one time in the wild in Ontario, but no longer lives in the wild in Ontario.

Fauna: A general term for animals; a list of the animal species present in an area.

Fen (Community Class): Wetland with a peat substrate and nutrient-rich waters, and primarily vegetated by shrubs and graminoids. Tree cover is less than 25%.

Floodplain: The area, usually lowlands adjoining a watercourse, which has been, or may be covered by flood waters.

Flora: A general term for plants; the entire complement of the plant species growing spontaneously in a region.

Forest (Community Class): A terrestrial vegetation community with at least 60% tree cover.

Freshet: The flood of a river from heavy rain or melted snow.

Geographic Information System (GIS): A computer-based tool that captures, analyzes, stores, manipulates and visualizes spatial and geographic data, usually in the form of a map.

Grassland: Open area of land where grasses and grass-like plants are the dominant species.

Greater Golden Horseshoe (GGH): The geographic area identified as the Greater Golden Horseshoe Growth Plan area in Ontario Regulation 416/05 under the *Places to Grow Act, 2005*.

Green infrastructure: Natural- and human-made elements that provide ecological and hydrological functions and processes. Green infrastructure can include components such as natural heritage features and systems, parklands, stormwater management systems, street trees, urban forests, natural channels, permeable surfaces, and green roofs.

Greenbelt area: The geographic area identified as the Greenbelt Area in Ontario Regulation 59/05 under the *Greenbelt Act, 2005*.

Greenfield: Undeveloped land either used for agriculture, landscape design, or left to evolve naturally. These areas of land are usually agricultural or amenity properties being considered for urban development.

Heat island: A metropolitan area that is hotter than the rural areas surrounding it due to the heat created by energy from all the people, cars, buses, trains and insulation from buildings in that area.

Holland Marsh: A 2,915 ha (7,200 acres) low-lying area of organic (muck) soils that are associated with the West Holland River. Sections of the Holland Marsh have been designated as “specialty crop areas” by the Province under the Greenbelt Plan, recognizing the areas’ importance as a major producer of vegetables grown in the province.

Hydric: A term for soils that develop under conditions of poor drainage in marshes, swamps, seepage areas or flats.

Hydrologic features: Wetlands, permanent and intermittent streams, lakes other than Lake Simcoe and in some cases may include seeps and springs.

Hydrophytic: Any plant able to grow normally in water or on a substrate at least periodically deficient in oxygen as a result of excessive water content.

Impervious soil: A soil medium through which water, air or roots cannot penetrate.

Indigenous species: see *Native species*.

Integrated Watershed Management (IWM): The process of managing human activities and natural resources on a watershed basis.

Interior forest: Woodland with ideal circular or square shape that can provide habitat for a number of species that are area-sensitive and require large patches of habitat. These areas are devoid of edge effects and resulting impacts from soil and air moisture, light levels, wind and temperature exposure.

Invasive species: Species of plants, animals, and micro-organisms introduced by human action outside their natural past or present distribution whose introduction or spread threatens the environment, the economy, or society.

Linkage: see *Corridor*.

Low Impact Development (LID): An innovative approach to land development that mimics the natural movement of water in order to manage stormwater (rainwater and urban runoff) close to where it falls.

Marsh (Community Class): A wetland with a mineral or peat substrate inundated by nutrient-rich water and characterized by emergent vegetation. Tree and shrub coverage is less than 25%.

Meadow (Community Series): Open terrestrial communities characterized by grasses or forbs; usually originating or maintained by cultural disturbances such as mowing, burning or grazing.

Meander belt: The lateral containment of a river channel on a land surface. Technically, the meander belt width is quantified as the distance normal to tangential lines drawn to outside bends of the meanders within the reach of interest.

Native species: A species whose presence in that region is the result of only natural processes, with no human intervention. (Also called *indigenous species).*

Natural Areas abutting Lake Simcoe (NAALS): Land that extends from the Lake Simcoe shoreline with natural self-sustaining vegetation of any plant form or potential natural community, but does not include vegetation communities maintained by anthropogenic-based disturbances (e.g. land for agricultural uses, manicured lawns or ornamental plantings)

Natural core areas: Lands with the greatest concentrations of key natural heritage features which are critical to maintaining the integrity of the ORM as a whole. Only existing uses and very restricted new resource management, agricultural, low intensity recreational, home businesses, transportation and utility uses are allowed in these areas (ORMCP, 2017).

Natural heritage features and areas: Features and areas, including significant wetlands, significant coastal wetlands, fish habitat, significant woodlands, significant valleylands, significant habitat of endangered species and threatened species, significant wildlife habitat, and significant areas of natural and scientific interest, which are important for their environmental and social values as a legacy of the natural landscapes of an area.

Natural heritage system (NHS): 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 or indigenous species, and ecosystems.

Natural linkages areas: Critical natural and open space linkages between the natural core areas and along rivers and streams. The only uses that are allowed are those allowed in natural core areas, plus some aggregate resource operations (ORMCP, 2017).

Niagara Escarpment: A prominent geological feature which extends 725 km from Queenston on the Niagara River to the islands off Tobermory on the Bruce Peninsula.

Oak Ridges Moraine (ORM): Ridge stretching 160 km from the Trent River in the east to the Niagara Escarpment in the west. The Moraine has a unique concentration of environmental, geological and hydrological features that make its ecosystem vital to south-central Ontario.

Official Plan (OP): The upper, local or single-tier municipal council's policies on how land in a community should be used.

Orthorectification: The process of correcting the geometry of an image so that it appears as though each pixel were acquired from directly overhead. Orthorectification uses elevation data to correct terrain distortion in aerial or satellite imagery.

Physiographic region: Topographically similar landscapes with similar relief, structural geology and elevation at a mapping scale of 1:1,000,000 to 1:3,000,000.

Plantation (Community Series): A deciduous or coniferous treed community in which the majority of trees have been planted. Tree species are usually even-aged, planted in linear rows and have little or no shrub or ground vegetation. The definition of plantation excludes plantations that are managed for the production of fruits, nuts, Christmas trees or nursery stock.

Prairie (Community Class): An area of native grassland controlled by a combination of moisture deficiency and fire.

Protected Countryside lands: Lands identified in the Greenbelt Plan that are intended to enhance the spatial extent of agriculturally and environmentally protected lands covered by the Niagara Escarpment Plan and the Oak Ridges Moraine Conservation Plan while also improving linkages between these areas and the surrounding major lake systems and watersheds.

Provincially Significant Wetland (PSW): A significant wetland that is identified or confirmed by the Ministry of Natural Resources and Forestry and scores a total of 600 or more points, or 200 or more points in either the biological component or the special features component based on the Ontario Wetland Evaluation System (OWES). In some cases may be part of a wetland system that is complexed.

Regulatory boundary: The extent of land within the Lake Simcoe watershed that is regulated by the Lake Simcoe Region Conservation Authority for a number of natural hazards, including flooding and erosion.

Riparian: Communities adjacent to, or associated with, a river or stream as opposed to a lake or pond.

Sand Barren (Community Class): Usually open sites on sand where the major limiting factor is drought. Stunted trees and tall shrubs may be present but tallgrass prairie species are not.

Savanah (Community Class): A treed community with 11 to 35% cover of coniferous or deciduous trees.

Significant Wildlife Habitat (SWH): Areas where plants, animals and other organisms live, and find adequate amounts of food, water, shelter and space needed to sustain their populations (e.g. areas where species concentrate at a vulnerable point in their annual or life cycle; areas which are important to migratory or non-migratory species).

Source Water Protection (SWP): An initiative to protect Ontario's drinking water from overuse and contamination and complements water treatment and monitoring by reducing risks to water supplies in the first place.

Special Concern: A species that lives in the wild in Ontario, is not endangered or threatened, but may become threatened or endangered because of a combination of biological characteristics and identified threats.

Species at Risk (SAR): Species that are listed on the Species at Risk in Ontario (SARO) List as extirpated, endangered, threatened or special concern.

Subwatershed: An area that is drained by a tributary or some defined portion of a stream.

Swamp (Community Class): A mineral-rich wetland characterized by a cover of deciduous or coniferous trees greater than 25%.

Targeted areas: Areas that are important to achieving a resilient Natural Heritage System, either through the protection or restoration of these areas. These areas may include grasslands, restoration areas and linkages.

Thicket (Community Series): A terrestrial vegetation type that is characterized by <10% tree cover and >25% tall shrub cover.

Threatened: A species that lives in the wild in Ontario, is not endangered, but is likely to become endangered if steps are not taken to address factors threatening to lead to its extinction or extirpation.

Urban area: An area defined by the respective municipality in their Official Plan mapping as "urban".

Valleyland: A natural area that occurs in a valley or other landform depression that has water flowing through or standing for some period of the year.

Vegetation Protection Zone: A vegetated buffer area surrounding a key natural heritage feature or key hydrologic feature. (Also refer to *buffer*).

Watercourse: An identifiable depression in the ground in which a flow of water regularly or continuously occurs.

Watershed: An area of land drained by a river and its tributaries.

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

Woodland: Treed areas that provide environmental and economic benefits to both the private land owner and the general public, such as erosion pretension, hydrological and nutrient cycling, provision of clean air and the long term storage of carbon, provision of wildlife habitat, outdoor recreational opportunities, and the sustainable harvest of a wide range of woodland products. Woodlands include treed areas, woodlots, or forested areas and vary in their level of significance at the local, regional, and provincial levels.

When referring to the ELC Community Class: A treed community with 35 to 60% cover of coniferous or deciduous trees.

Chapter 8

8.0 References

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APPENDIX A: Natural Heritage Feature in the Lake Simcoe Watershed

Table 1: Lake Simcoe subwatersheds with Areas of Natural and Scientific Interest (ANSIs)

SUBWATERSHED	HECTARES	PERCENTAGE OF SUBWATERSHED	PERCENTAGE OF WATERSHED
Barrie Creeks	1.4	0.04%	<0.01%
Beaver River	2,496.1	7.63%	0.86%
Black River	3,110.3	8.29%	1.08%
Durham Forest and Sur	83.6	0.00%	0.03%
East Holland	2,055.7	8.32%	0.71%
Hawkestone Creek	76.2	1.59%	0.03%
Innisfil Creeks	197.1	1.84%	0.07%
Lake Simcoe	337.9	0.47%	0.12%
Oro Creeks North	103.5	1.38%	0.04%
Pefferlaw Brook	3,244.9	11.39%	1.12%
Ramara Creeks	255.8	1.86%	0.09%
Talbot River	768.6	10.96%	0.27%
Thorah Island	163.9	37.29%	0.06%
Upper Talbot River	159.9	0.57%	0.06%
Uxbridge Brook	154.7	0.96%	0.05%
West Holland	3,717.4	10.56%	1.29%
Whites Creek	497.4	4.72%	0.17%

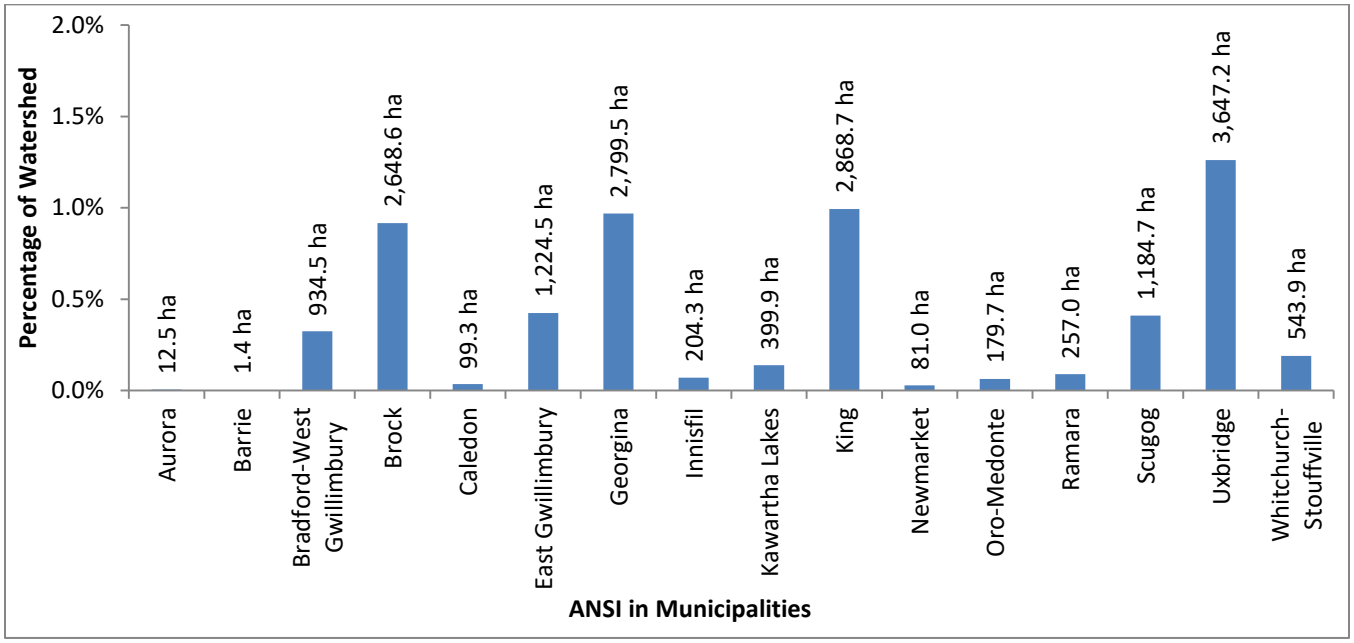


Figure 0.1: Lake Simcoe municipalities with Areas of Natural and Scientific Interest (ANSIs)

Table 2: Lake Simcoe subwatersheds with watercourse and fish habitat

SUBWATERSHED	HECTARES	PERCENTAGE OF SUBWATERSHED	PERCENTAGE OF WATERSHED
Barrie Creeks	296.2	7.89%	0.10%
Beaver River	4,818.0	14.72%	1.67%
Black River	4,173.4	11.12%	1.44%
East Holland	3,314.9	13.41%	1.15%
Georgina Creeks	354.2	7.18%	0.12%
Georgina Island	16.8	1.30%	0.01%
Hawkestone Creek	1,071.8	22.40%	0.37%
Hewitts Creek	191.3	10.92%	0.07%
Innisfil Creeks	1,174.2	10.96%	0.41%
Lovers Creek	768.1	12.81%	0.27%
Maskinonge River	678.5	10.69%	0.23%
Oro Creeks North	867.0	11.52%	0.30%
Oro Creeks South	779.6	13.58%	0.27%
Pefferlaw Brook	2,495.3	8.76%	0.86%
Ramara Creeks	1,732.2	12.61%	0.60%
Talbot River	1,474.3	21.02%	0.51%
Upper Talbot River	4,126.9	14.59%	1.43%
Uxbridge Brook	2,520.4	15.62%	0.87%
West Holland	6,043.0	17.17%	2.09%
Whites Creek	1,518.8	14.41%	0.53%

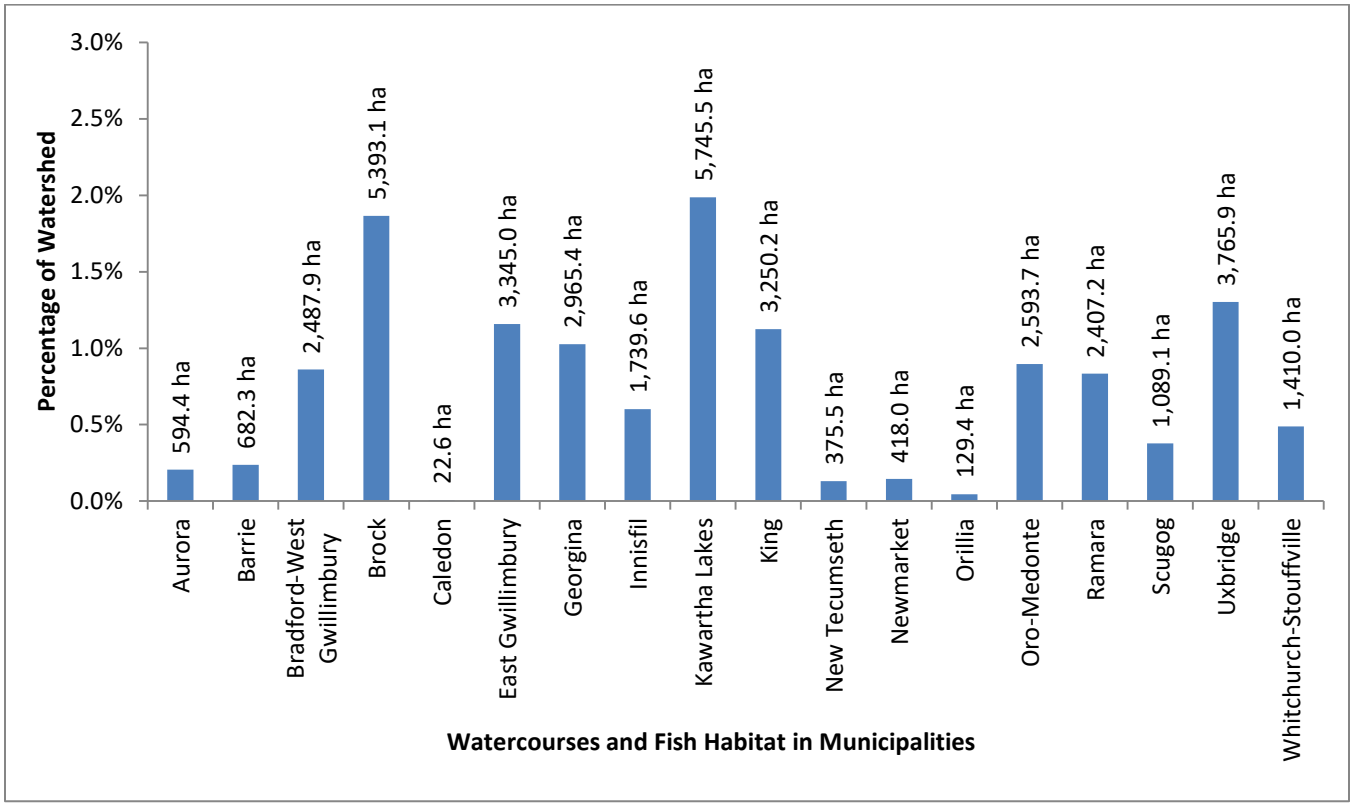


Figure 0.2: Lake Simcoe municipalities with watercourse and fish habitat

Table 3: Lake Simcoe subwatersheds with Natural Areas Abutting Lake Simcoe (NAALS)

SUBWATERSHED	HECTARES	PERCENTAGE OF SUBWATERSHED	PERCENTAGE OF WATERSHED
Barrie Creeks	22.6	0.60%	0.01%
East Holland	1,426.4	5.77%	0.49%
Goffatt Island	2.6	56.44%	<0.01%
Grape Island	4.0	38.36%	<0.01%
Hawkestone Creek	323.5	6.76%	0.11%
Hewitts Creek	59.2	3.38%	0.02%
Innisfil Creeks	876.0	8.18%	0.30%
Lake Simcoe	0.6	<0.01%	<0.01%
Lovers Creek	24.2	0.40%	0.01%
Oro Creeks North	578.6	7.69%	0.20%
Oro Creeks South	351.8	6.13%	0.12%
Ramara Creeks	1,300.9	9.47%	0.45%
Strawberry Island	7.8	76.88%	<0.01%
Talbot River	47.6	0.68%	0.02%
Thorah Island	371.0	84.41%	0.13%
West Holland	1,625.1	4.62%	0.56%
Whites Creek	5.1	0.05%	<0.01%

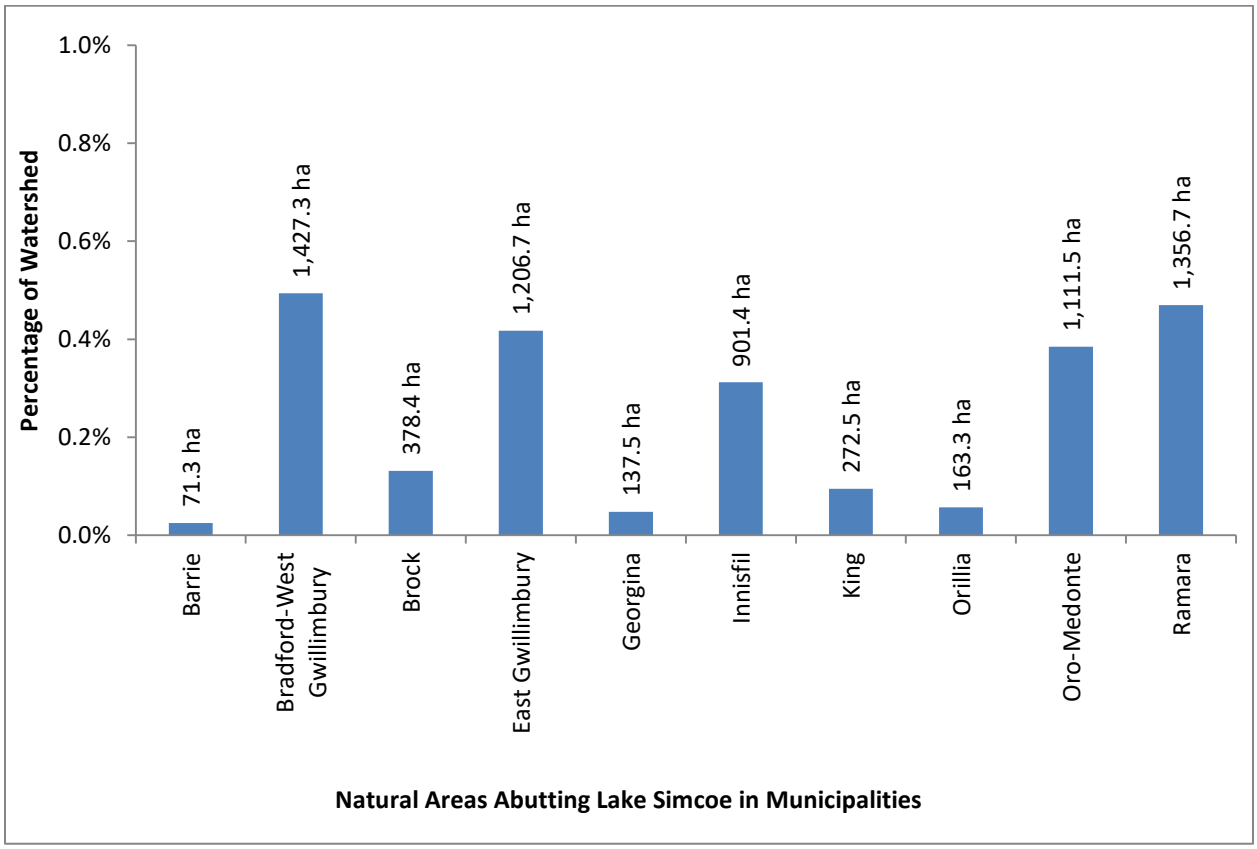


Figure 0.3: Lake Simcoe municipalities with Natural Areas Abutting Lake Simcoe (NAALS)

Table 4: Lake Simcoe subwatersheds with shoreline

SUBWATERSHED	HECTARES	PERCENTAGE OF SUBWATERSHED	PERCENTAGE OF WATERSHED
Barrie Creeks	31.7	0.85%	0.01%
Beaver River	0.6	0.00%	<0.01%
Black River	45.4	0.12%	0.02%
Durham Forest and Surrounding Area	0.0	0.00%	<0.01%
East Holland	37.0	0.15%	0.01%
Fox Island	5.4	26.55%	<0.01%
Georgina Creeks	62.8	1.27%	0.02%
Georgina Island	47.6	3.68%	0.02%
Goffatt Island	2.9	63.10%	<0.01%
Grape Island	5.1	48.48%	<0.01%
Hawkestone Creek	13.9	0.29%	<0.01%
Hewitts Creek	0.4	0.02%	<0.01%
Innisfil Creeks	127.2	1.19%	0.04%
Lake Simcoe	<0.1	0.00%	<0.01%
Lovers Creek	7.4	0.12%	<0.01%
Maskinonge River	3.5	0.06%	<0.01%
Oro Creeks North	69.7	0.93%	0.02%
Oro Creeks South	55.2	0.96%	0.02%
Pefferlaw Brook	40.0	0.14%	0.01%
Ramara Creeks	128.9	0.94%	0.04%
Snake Island	17.0	12.52%	0.01%
Strawberry Island	3.5	34.03%	<0.01%
Talbot River	3.4	0.05%	<0.01%
Thorah Island	32.2	7.34%	0.01%
West Holland	3.7	0.01%	<0.01%
Whites Creek	16.1	0.15%	0.01%

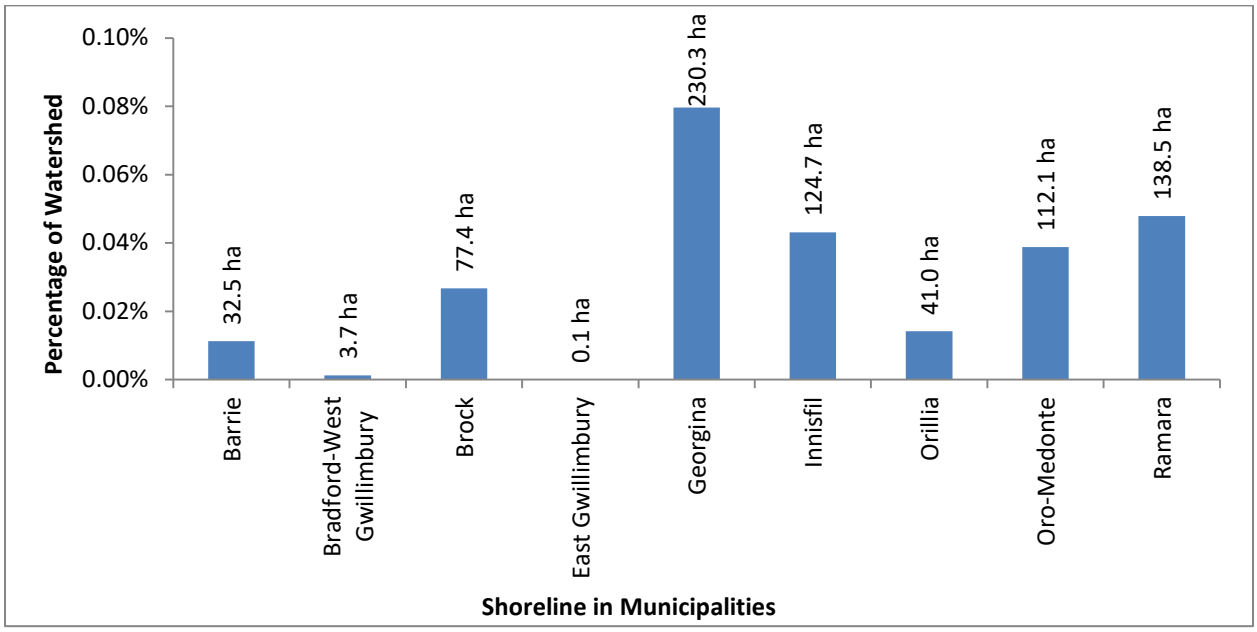


Figure 0.4: Lake Simcoe municipalities with shoreline

Table 5: Lake Simcoe subwatersheds with valleyland

SUBWATERSHED	HECTARES	PERCENTAGE OF SUBWATERSHED	PERCENTAGE OF WATERSHED
Barrie Creeks	78.0	2.08%	0.03%
Beaver River	495.1	1.51%	0.17%
Black River	1,092.2	2.91%	0.38%
East Holland	1,552.6	6.28%	0.54%
Georgina Creeks	4.6	0.09%	<0.01%
Hawkestone Creek	72.2	1.51%	0.02%
Hewitts Creek	20.5	1.17%	0.01%
Innisfil Creeks	132.4	1.24%	0.05%
Lovers Creek	304.8	5.08%	0.11%
Maskinonge River	9.3	0.15%	<0.01%
Oro Creeks North	263.6	3.50%	0.09%
Oro Creeks South	31.1	0.54%	0.01%
Pefferlaw Brook	856.5	3.01%	0.30%
Ramara Creeks	57.7	0.42%	0.02%
Talbot River	48.5	0.69%	0.02%
Upper Talbot River	816.3	2.89%	0.28%
Uxbridge Brook	792.3	4.91%	0.27%
West Holland	2,268.5	6.45%	0.78%
Whites Creek	22.1	0.21%	0.01%

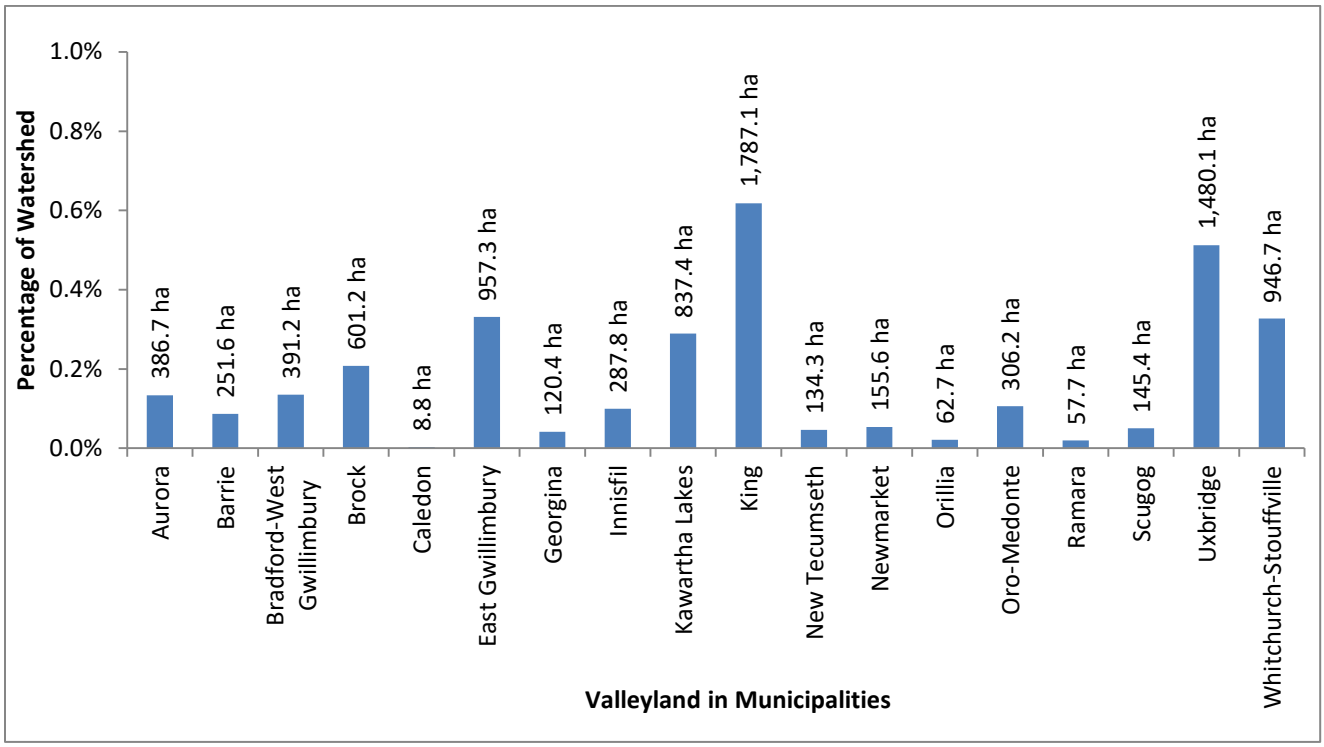


Figure 0.5: Lake Simcoe municipalities with valleyland

Table 6: Lake Simcoe subwatersheds with wetland

SUBWATERSHED	HECTARES	PERCENTAGE OF SUBWATERSHED	PERCENTAGE OF WATERSHED
Barrie Creeks	76.4	2.03%	0.03%
Beaver River	6,235.5	19.05%	2.16%
Black River	9,154.5	24.39%	3.17%
East Holland	2,686.9	10.87%	0.93%
Fox Island	0.1	0.58%	<0.01%
Georgina Creeks	771.3	15.64%	0.27%
Georgina Island	753.6	58.36%	0.26%
Hawkestone Creek	976.4	20.41%	0.34%
Hewitts Creek	122.5	6.99%	0.04%
Innisfil Creeks	1,149.5	10.73%	0.40%
Lovers Creek	883.8	14.74%	0.31%
Maskinonge River	579.6	9.13%	0.20%
Oro Creeks North	953.2	12.66%	0.33%
Oro Creeks South	523.7	9.13%	0.18%
Pefferlaw Brook	5,435.9	19.08%	1.88%
Ramara Creeks	3,263.9	23.77%	1.13%
Snake Island	34.6	25.52%	0.01%
Talbot River	1,178.0	16.80%	0.41%
Thorah Island	177.5	40.39%	0.06%
Upper Talbot River	7,620.3	26.95%	2.64%
Uxbridge Brook	2,096.3	12.99%	0.73%
West Holland	3,753.9	10.67%	1.30%
Whites Creek	2,403.1	22.80%	0.83%

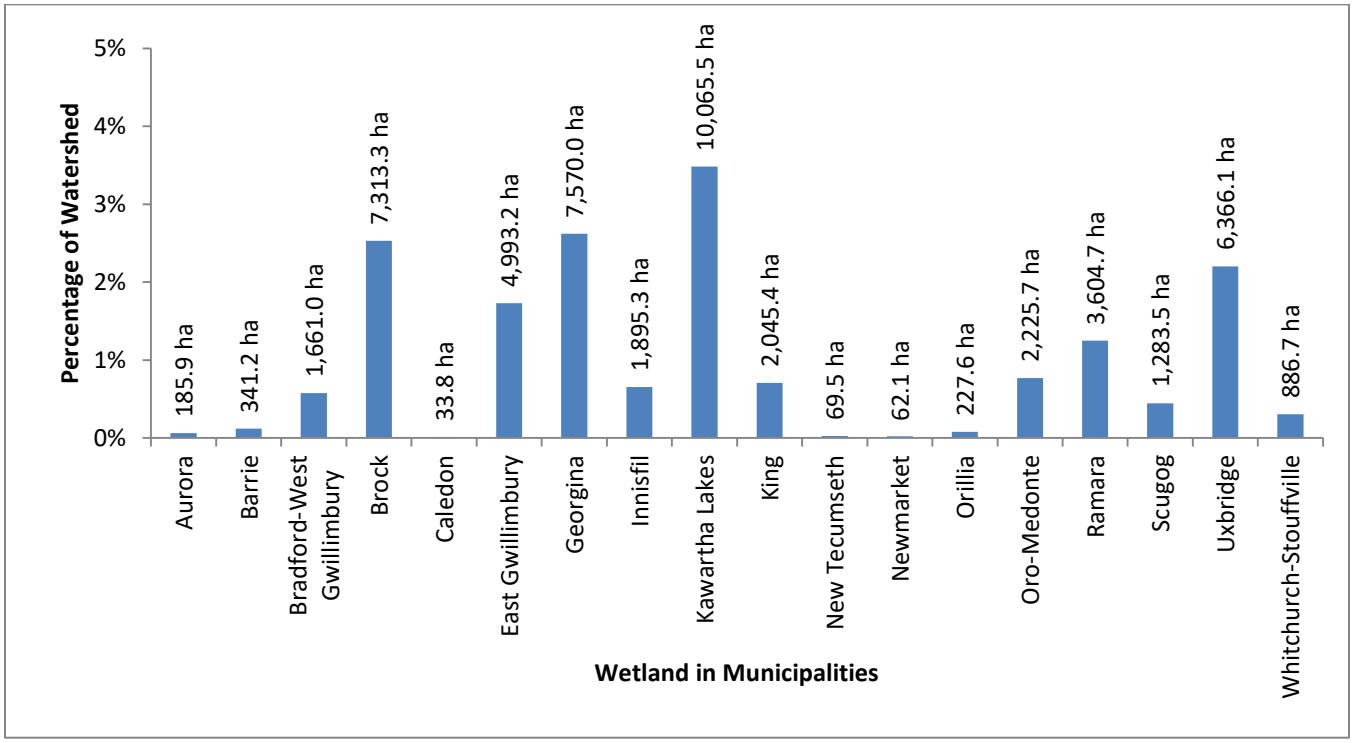


Figure 0.6: Lake Simcoe municipalities with wetland

Table 7: Lake Simcoe subwatersheds with woodland

SUBWATERSHED	HECTARES	PERCENTAGE OF SUBWATERSHED	PERCENTAGE OF WATERSHED
Barrie Creeks	508.3	13.54%	0.18%
Beaver River	8,291.6	25.34%	2.87%
Black River	16,228.0	43.23%	5.62%
Durham Forest and Surrounding Area	299.5	94.95%	0.10%
East Holland	5,629.0	22.78%	1.95%
Fox Island	12.9	63.31%	<0.01%
Georgina Creeks	1,879.5	38.10%	0.65%
Georgina Island	1,083.4	83.91%	0.37%
Goffatt Island	2.6	55.87%	<0.01%
Grape Island	3.7	35.29%	<0.01%
Hawkestone Creek	2,379.5	49.74%	0.82%
Hewitts Creek	264.3	15.09%	0.09%
Innisfil Creeks	3,025.6	28.24%	1.05%
Lovers Creek	1,683.8	28.09%	0.58%
Maskinonge River	985.2	15.52%	0.34%
Oro Creeks North	2,853.6	37.91%	0.99%
Oro Creeks South	2,361.9	41.16%	0.82%
Pefferlaw Brook	11,417.8	40.08%	3.95%
Ramara Creeks	4,752.4	34.61%	1.64%
Snake Island	96.7	71.35%	0.03%
Strawberry Island	7.5	73.54%	<0.01%
Talbot River	2,293.9	32.70%	0.79%
Thorah Island	366.4	83.36%	0.13%
Upper Talbot River	17,945.5	63.45%	6.21%
Uxbridge Brook	5,250.2	32.54%	1.82%
West Holland	7,816.8	22.21%	2.70%
Whites Creek	3,497.5	33.18%	1.21%

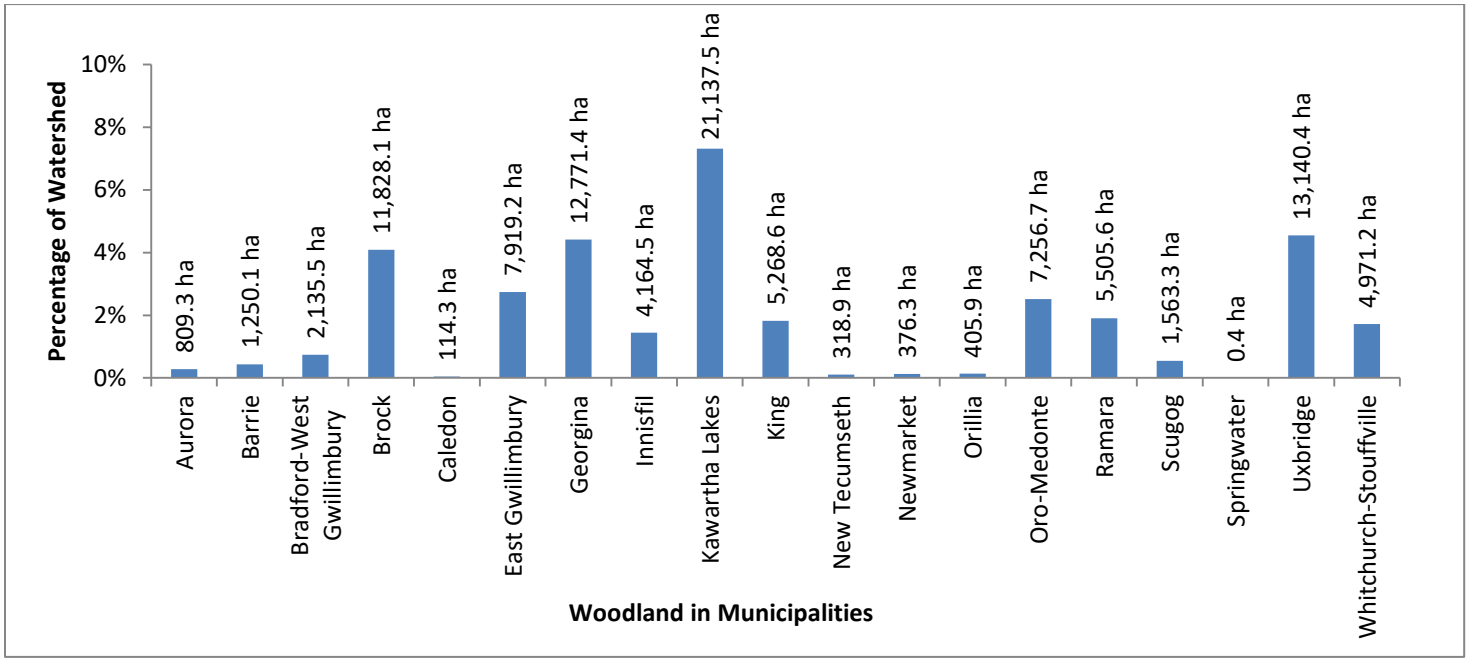
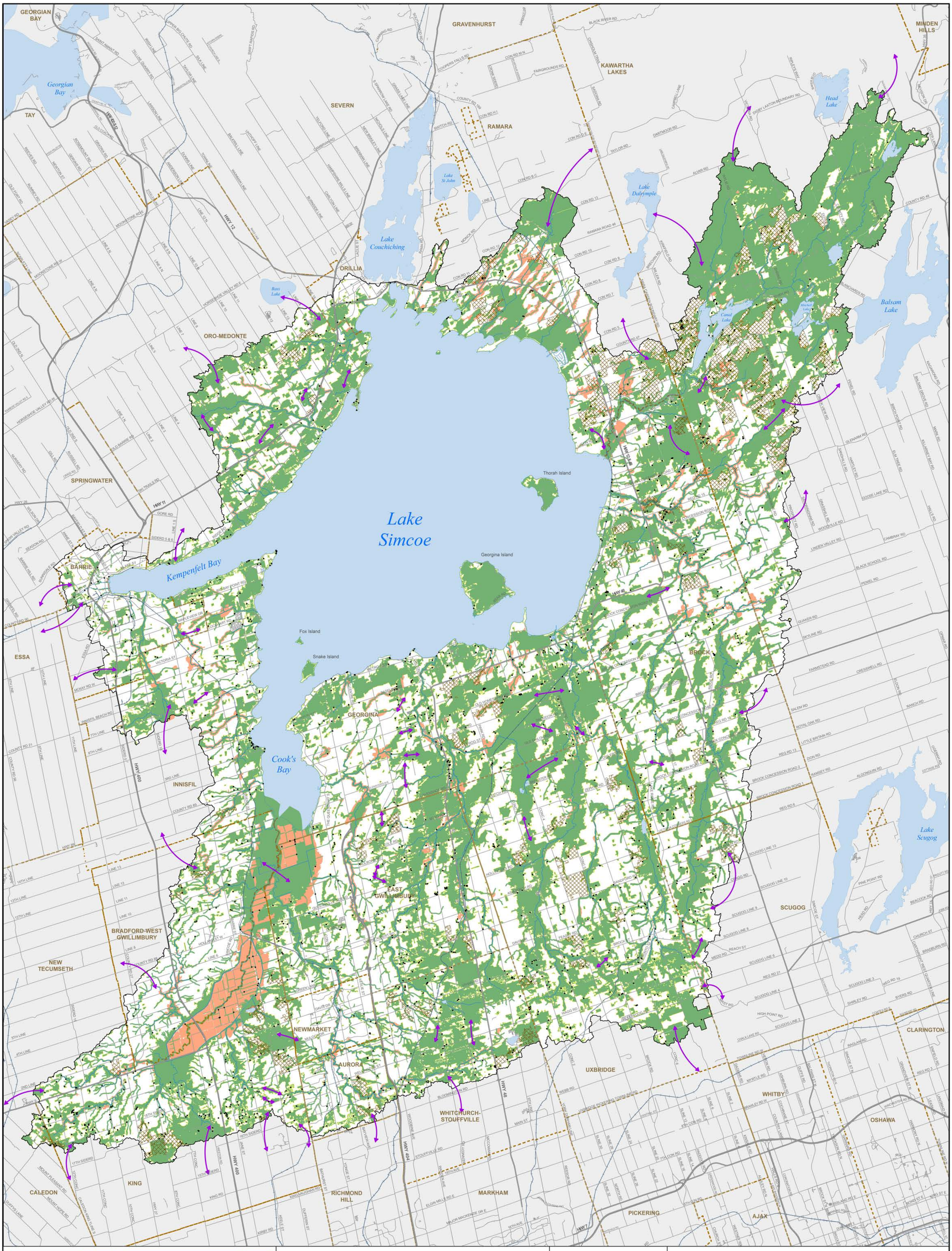


Figure 0.7: Lake Simcoe municipalities with woodland



LEGEND

- Local Linkages
- Regional Linkages
- Watercourse
- Rail
- Major Road
- Waterbody
- Lower Tier Municipality
- NHS CORE
- 30 Metre Buffer
- Targeted Areas for NHS Enhancement
- Grassland
- Lake Simcoe Watershed (Including Durham Forest and adjacent lands)

Figure 4.15

LSRCA Natural Heritage System

Lake Simcoe Region conservation authority

N W E S

0 5 10 15 20 25 Kilometres