

Study of Aggregate Site Rehabilitation in Ontario

1971 – 2009

Part 1



ONTARIO STONE, SAND
& GRAVEL ASSOCIATION

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Executive Summary

The availability of high-quality mineral resources close to demand centres in Ontario has helped to drive economic growth in the province for many years. Due to increasing land use conflicts, aggregate extraction has become controversial in recent years, partly because there has been very little information available about rehabilitated aggregate sites in the province. Consequently, neither praise nor criticism of site rehabilitation outcomes could be supported by accurate, objective data.

This study was undertaken by the Ontario Stone, Sand & Gravel Association (OSSGA) to address that shortcoming. The objectives of the study were to document and analyze field data, and develop informed conclusions and recommendations regarding the state of rehabilitation on former aggregate sites in Ontario.

Between June and September 2010, the study team completed field assessments and collected field data at 337 rehabilitated aggregate sites in select parts of southern and eastern Ontario for which licences had been surrendered and rehabilitation completed:

- 81 sites in the Greenbelt Plan Area
- 23 sites in the Lake Simcoe Protection Plan Area
- 101 sites outside the southern Ontario plan areas
- 82 sites in historical Metropolitan Toronto
- 50 sites in the City of Ottawa

Active aggregate sites were excluded from the study even if progressive rehabilitation was in place. Five types of data were collected for each rehabilitated site included in the study:

- percentage of tree coverage
- percentage of native vegetation
- current site use
- surrounding land uses
- municipal zoning

Between October 2010 and May 2011, the field data was compiled and analyzed to generate baseline data on the status of rehabilitation on surrendered sites. The data was also used to identify rehabilitation trends in Ontario. This information will enable those making future decisions about land use planning and successful site rehabilitation. It will be useful to evaluate plans for interim land uses, such as aggregate operations, within the context of achievable long-term rehabilitation outcomes.

The study team concluded its work in May 2011 by making 9 recommendations to the aggregate industry and its governing bodies:

- five recommendations for establishing a comprehensive objective database on aggregate site rehabilitation in Ontario; and
- four recommendations for monitoring ecological processes on rehabilitated aggregate sites in Ontario

1. Introduction

Ontario's high quality mineral aggregate resources are essential non renewable resources that have helped drive economic growth in the province. However, aggregate extraction is also a highly regulated activity that has experienced increasing land use conflict; as a result the establishment of new pits and quarries is often contested by local residents and environmental groups. Although aggregate extraction has changed significantly over the past 100 years, little information has been available on the current condition of former extraction sites. This study was undertaken by the Ontario Stone, Sand & Gravel Association (OSSGA) to address that shortcoming.

The study team compiled a list of formerly licensed extraction sites in the Greenbelt Plan Area, the Lake Simcoe Protection Plan Area, the Niagara Escarpment Plan Area, the Oak Ridges Moraine Conservation Plan Area, historical Metropolitan Toronto, and the City of Ottawa, and then visited each site to collect field data regarding current site conditions. The objectives of the study were to document and analyze the field data in order to develop informed conclusions and recommendations regarding the state of former aggregate sites in Ontario.

1.1 Mineral Aggregate Resources

The term "mineral aggregate resources" is defined by Ontario's Provincial Policy Statement (2005) to encompass a variety of naturally occurring material including gravel, sand, clay, earth, shale, stone, limestone, dolostone, sandstone, marble, granite, rock, and other natural materials prescribed by Ontario's *Aggregate Resources Act* as suitable for construction, industrial, manufacturing, and maintenance purposes. The term excludes metallic ores, asbestos, graphite, kyanite, mica, nepheline syenite, salt, talc, wollastonite, mine tailings, and other materials prescribed by Ontario's *Mining Act*.

Aggregates are used in the construction of houses, apartments, roadways, airports, dams, and institutional, commercial, and industrial buildings, thereby making a significant contribution to Ontario's infrastructure and economy. Although it is environmentally and economically preferable for the resource supply to be close to its market, extraction is shifted further from settlement areas as population grows and the demand for aggregate increases.

Ontarians all use aggregates in their everyday lives, yet the public perception of natural resource extraction tends to be negative. When one considers aggregate extraction *per se*, the inclination to think of landscape disturbances rather than the importance of aggregates in everyday life, the temporary nature of extraction processes, and the rehabilitation outcomes that can be achieved on former aggregate sites.

The rehabilitation of extraction sites usually includes grading slopes, using topsoil and subsoil, and planting vegetation on the site. Hence, once the extraction process is complete, the site may be transitioned back to a more productive or integrated land use than it originally provided.

1.2 Previous Research

Prior to the initiation of this study, there was very little information available on the final rehabilitation and subsequent use of aggregate sites in Ontario.

In the 1980's the Ministry of Natural Resources has completed considerable research into rehabilitation of aggregate sites, including: "Rehabilitation of Pits and Quarries for Forest Production (1988)", "Rehabilitation of Sand and Gravel Pits for Fruit Production in Ontario (1985)", "Agriculture and the Aggregate Industry: Rehabilitation of Extracted Sand and Gravel Lands to an Agricultural After-Use (1982)", "Rehabilitation of Pits and Quarries for Fish and Wildlife (1987)", and "Sand and Gravel Pit Rehabilitation in Northern Ontario – (1985)". In 1979 the Ministry of Natural Resources conducted a research study regarding the rehabilitation of 82 pits within historical Metropolitan Toronto (i.e., as defined prior to 1967, when the boundaries were expanded to their current limit), and published the results in *From Pits to Playgrounds* (see Appendix B, Figure 7: *Historical Metropolitan Toronto Pits to Playgrounds Sites*). This was the first study conducted in Ontario to demonstrate that aggregate properties are not routinely left as abandoned lands but are transformed and integrated into the landscape through rehabilitation. Also in 1979, the MNR completed "Trees and Shrubs for the Improvement and Rehabilitation of Pits and Quarries in Ontario"

In 1992, a study on aggregates in Ontario was published as *Aggregate Resources of Southern Ontario: A State of the Resource Study*. In 2007, the Ontario government announced that it would undertake a study to update available information on aggregates in the province, part of which would involve updating this 1992 publication.

In 2010, the Ministry of Natural Resources released a series of six papers comprising *The State of the Aggregate Resource in Ontario Study*, a report that addresses aggregates demand, availability, alternatives, recycling and reuse, supply, and rehabilitation in Ontario. *Paper 6: Rehabilitation* addressed provincial objectives within a scientific and political framework, assessing both progressive and final rehabilitation. The 50 most recently surrendered and completely rehabilitated sites were assessed to identify after-use trends in site rehabilitation. These recent examples were assumed to give the best indication of current rehabilitation trends. However, the research did not represent all rehabilitation outcomes across the entire province.

There are many outstanding rehabilitation achievements in Ontario. One of the earliest is located along the Niagara Escarpment. In 1929, rehabilitation began on the sunken rock garden that is renowned today as the Royal Botanical Gardens in Hamilton. It was the first aggregate property to be recognized for outstanding rehabilitation results, and was presented with the first Bronze Plaque Award from the Aggregate Producers Association of Ontario, predecessor to the OSSGA.

There are also many less well-known examples of successful aggregate site rehabilitation in Ontario, but the public is generally unaware of these and is inclined to believe that depleted aggregate sites are simply abandoned as "open scars" on the landscape.

As a result of this misconception, the OSSGA undertook this current study to determine the actual status of surrendered aggregate sites in Ontario in 2010-2011.

1.3 Objectives of Study

The objectives of the OSSGA study were to investigate, assess, and document the rehabilitation status of surrendered aggregate licensed sites in specific geographic areas of Ontario. This was achieved by completing the following tasks:

- identifying provincial standards, municipal zoning, and by-law designations for each site
- conducting individual field assessments to identify the current land use on each site
- assessing each site's current use within the context of surrounding land uses and current zoning for the site
- identifying original and current vegetation on each site to determine the ecological succession patterns for vegetative communities on the site
- creating baseline data on the status of rehabilitation efforts in Ontario
- identifying overall land use trends for rehabilitated aggregate sites in Ontario
- developing recommendations for the aggregate industry and governing bodies

1.4 Scope of Study

This study included only those former aggregate sites for which the rehabilitation was completed and where licences had been surrendered. Sites covered by active licences were excluded from the study even if progressive rehabilitation had occurred.

Aggregate licences surrendered under the *Pits and Quarries Control Act* (1971) or the *Aggregate Resources Act* (1990) were included within the scope of this study. This study also examined the unlicensed sites documented in *From Pits to Playgrounds* (1979).

This study did not compare the current land use with the rehabilitation plans prepared by aggregate producers during the surrendering process. Therefore, it did not determine whether the achieved rehabilitation matched what was proposed and approved under the *Pits and Quarries Control Act* or the *Aggregate Resources Act*.

1.5 Study Areas

The study areas were located in southern and eastern Ontario, and are identified throughout this report (see *Appendix A, Figure 1: General Study Area – Southern and Eastern Ontario*).

1.5.1 Southern Ontario Study Area

Four geographic areas of interest were identified within the southern Ontario Study Area:

- Greenbelt Plan Area (see Appendix B, Figure 9: Greenbelt Plan Area), including Niagara Escarpment Plan Area (see Appendix B, Figure 10: Niagara Escarpment Plan Area), Oak Ridges Moraine Plan Area (see Appendix B, Figure 11: Oak Ridges Moraine Conservation Plan Area), and Protected Countryside (including areas overlapping Lake Simcoe Protection Plan Area)
- Lake Simcoe Protection Plan Area (see Appendix B, Figure 12: Lake Simcoe Protection Plan Area)
- unlicensed sites within historical Metropolitan Toronto—i.e., “*pits to playgrounds*” sites (see *Appendix A, Figure 7: Historical Metropolitan Toronto Pits to Playgrounds Sites*)
- other sites outside the plan areas

1.5.2 Eastern Ontario Study Area

The **City of Ottawa** was the only geographic area of interest identified in the eastern Ontario Study Area.

1.6 Limitations of Study

Although several challenges were encountered during the study, the most significant constraint was the limited availability of data regarding surrendered licences.

The database currently used by the Ministry of Natural Resources (MNR)—the Aggregate Licensing and Permitting System (ALPS)—was created to record and store licence and permit data related to the *Aggregate Resources Act*. It should be noted that once the licence on the site is surrendered, these sites are no longer regulated by MNR under the ARA. Accordingly, ALPS was not designed to track post surrender data.

Unfortunately, data retention challenges have resulted in the loss of important data on surrendered licences. Problems with data retention include:

- incomplete records
- loss of some data
- incorrect or inaccessible site location information
- unknown rehabilitation information
- poor licence modification data

The available ALPS data was supplemented with valuable information provided by Ministry of Natural Resources Aggregate Inspectors in many regions. However, there is clearly a need for a standardized central database to retain this information (see *Section 7.1: Data Management Recommendations*). As an association, the collaboration of such outstanding information is regarded as a future goal.

In addition, some of the sites were inaccessible. This made it difficult to conduct field assessments, since most of the sites are now regarded as private property. Honouring landowners' decisions regarding access meant that the study team could not visit and quantify some of the sites identified for assessment.

Of the 428 surrendered licence sites originally identified for this study:

- 78 sites were removed from the study because Aggregate Inspectors indicated that the sites were still active
- 13 sites were removed from the study due to access issues imposed by the landowners
- 337 sites were retained in the study for further analysis

2. Legislation

Aggregate legislation was enacted in Ontario to address public, industry and provincial concerns regarding ongoing supply and demand issues, unregulated resource management activities, acceleration of rehabilitation and the desire to establish standards for the operation and rehabilitation of pits and quarries.

With the introduction of the *Pits and Quarries Control Act* in 1971, aggregates have been regulated by provincial and municipal legislation to ensure resource availability for future generations. The *Pits and Quarries Control Act* was designed to govern site rehabilitation and minimize the environmental impact of pit and quarry operations, while enabling Ontario to meet its own aggregate requirements.

The study team examined current legislation to better understand the legislative context under which extraction occurs.

2.1 Aggregate Resources Act

The *Aggregate Resources Act* was enacted in 1990 and replaced the *Pits and Quarries Control Act* of 1971 with comprehensive new standards for the licensing, operation, and progressive and final rehabilitation of pits and quarries. It is administered by the Ministry of Natural Resources and is the primary legislation governing aggregate extraction in the province.

The purposes of the *Aggregate Resources Act* are defined within Part 1, Section 2 of the Act:

- to provide for the management of the aggregate resources of Ontario
- to control and regulate aggregate operations on Crown and private lands
- to require the rehabilitation of land from which aggregate has been excavated
- to minimize adverse impact on the environment in respect of aggregate operations

The Act requires every licensee and/or permittee to perform both progressive and final rehabilitation on the site to the satisfaction of the Ministry of Natural Resources. This must be done in accordance with the Act, the regulators, the site plan, and the conditions of the licence or permit. If the Ministry is not satisfied that adequate rehabilitation has been performed on the site, MNR may issue a rehabilitation order under Section 48(2) of the Act to perform the progressive or final rehabilitation that is deemed necessary.

Current aggregate legislation also ensures that extraction is only a temporary land use, and that rehabilitation is undertaken to return each extracted site to its initial use or to uses compatible with surrounding land uses.

2.2 Greenbelt Plan

The *Greenbelt Act*, enacted in 2005, authorized the Government of Ontario to designate a Greenbelt Area and establish a Greenbelt Plan to protect a number of areas within that area, including the Niagara Escarpment Plan Area, the Oak Ridges Moraine Conservation Plan Area, and certain protected countryside lands as set out under the Greenbelt Plan.

The Greenbelt Plan increases the extent of agriculturally and environmentally protected land covered by the Niagara Escarpment Plan and the Oak Ridges Moraine Conservation Plan, creates protection linkages, and improves major surrounding watersheds. It also identifies where urbanization should not take place in order to protect the agricultural land base and the ecological features and functions of the landscape. In addition, the Greenbelt Plan supports tourism, sustainable rural economies, and a wide range of public recreational uses. Most notably for the purpose of this study, the Greenbelt Plan addresses and supports a number of natural resource features, including aggregates.

The sub-plans within the Greenbelt Plan designate various “area types,” each of which is subject to a specific level of protection.

2.2.1 Niagara Escarpment Plan

The Niagara Escarpment Plan, Canada’s first large-scale environmental land use plan, was adopted in 1985 and amended in 2005 and 2009. It is designed to secure the protection, conservation, and sustainable development of the Niagara Escarpment so that it will remain a natural environment in the future. The objectives of the plan are to:

- to protect ecological and historical areas
- to maintain and enhance the quality of natural streams and water supplies
- to provide adequate outdoor recreation opportunities
- to maintain and enhance the open landscape character of the Niagara Escarpment
- to ensure that all new development is compatible with the purpose of the plan
- to provide adequate public access to the Escarpment
- to support municipalities within the plan area in exercising the planning functions conferred on them by the *Planning Act*

Seven **area types** are designated within the Niagara Escarpment Plan:

- Escarpment Natural Areas (ecologically important for native flora and fauna)
- Escarpment Protection Areas
- Escarpment Rural Areas
- Minor Urban Centres
- Urban Areas
- Escarpment Recreation Areas
- Mineral Resource Extraction Areas

The Escarpment is a significant extraction area for the aggregate industry. New licensed pits and quarries are permitted in Escarpment Rural Areas for extraction amounts less than 20,000 tonnes annually.

The primary rehabilitation objective in the Niagara Escarpment Plan is to minimize the impact of new mineral extraction operations and related activities on the Escarpment. Rehabilitation must therefore include the following:

- Excess topsoil and overburden must be retained and stabilized for future rehabilitation.
- The slope grade of excavated pit walls must be 3:1 or less except in regions where topsoil and fill materials are scarce, in which case finished slopes may be no steeper than 20:1.
- Exposed sections of pit or quarry faces may be left unrehabilitated for aesthetic or educational purposes provided that this has been specified in the approved after-use plan.
- Vegetation—including seeding, crops, trees, and/or shrubs—is to be planted as soon as possible after grading is completed.

Wherever possible, rehabilitation must be progressive as extraction takes place.

2.2.2 Oak Ridges Moraine Conservation Plan

The Oak Ridges Moraine Conservation Plan was implemented by regulation in 2002 under the provisions of the *Oak Ridges Moraine Conservation Act* (2001). This ecologically-based plan protects key hydrological and ecological features and functions, and provides direction for land and resource management within the Oak Ridges Moraine.

Four **area types** are designated within the Oak Ridges Moraine Conservation Plan:

- Natural Core Areas: areas with large concentrations of natural features crucial to the entirety of the Moraine and designated for the highest level of protection and land use restrictions
- Natural Linkage Areas: natural and open space areas that provide ecological linkages to natural features
- Countryside Areas: rural and agricultural areas that serve as transition buffers to natural, linkage, and settlement areas; the latter include rural settlement areas and the Palgrave Estates residential community
- Settlement Areas: areas characterized by urban growth and development

Only very restricted new resource management, recreational, transportation, infrastructure, and utility uses are permitted in Natural Core Areas, Natural Linkage Areas, and Countryside Areas.

In addition, in parts of these areas known as Landform Conservation Areas—that is, areas with significant landscape character—stringent review and strict approval standards must be met in order to ensure that the Moraine and its landscape are protected from approved uses.

In Natural Core Areas, new aggregate operations are not permitted.

In Natural Linkage and Countryside Areas, a new aggregate operation or wayside pit is subject to stringent regulation and review, including requirements where the applicant must demonstrate that:

- the quality and quantity of surface and groundwater will be maintained or improved, and restored
- rehabilitation will take place on as much of the site as possible
- where key heritage natural features and/or Areas of Scientific Interest exist on the site or on adjacent lands, their health, diversity, size, and connectivity will be maintained

In applications for aggregate operations in Natural Linkage Areas, applicants must demonstrate that:

- operations will comply with the three conditions listed above
- no extraction will occur within 1.5 metres of the water table
- extraction will be completed as quickly as possible
- rehabilitation will take place in stages as quickly as possible
- the entire site will be rehabilitated

In Natural Linkage Areas, the licensee for an aggregate operation or wayside pit must maintain connectivity by establishing a linkage area that may contain rehabilitated land as well as undisturbed land. This area must be at least 1.25 kilometres wide and must lie outside of the active or unrehabilitated areas. In addition, it must connect with part of the Natural Linkage Area outside the operation site.

In Landform Conservation Areas, licences are not issued until the applicant demonstrates that the extracted area will be entirely rehabilitated to maintain a particular landform character that blends in with the surrounding landscape. Applicants must also ensure that the long-term ecological integrity of the area will be maintained or restored, and improved to the best possible extent.

2.2.3 Protected Countryside

The Greenbelt Plan identifies Protected Countryside lands to improve the reach of agriculturally and environmentally protected areas currently covered by the Niagara Escarpment Plan and the Oak Ridges Moraine Conservation Plan, and to enhance linkages between the areas covered by these plans and the bodies of water surrounding them.

Three **area types** are designated within the Protected Countryside:

- Protected Countryside: specialty crop and prime agricultural areas
- Natural System Areas: Natural Heritage System and Water Resource System areas, and areas with key natural heritage features and key hydrologic features (Natural Heritage System is not itself a designation with a list of permitted uses)
- Settlement Areas: areas containing towns, villages, and/or hamlets

In the Protected Countryside, activities related to the use of non-renewable resources are allowed, but are subject to all applicable legislation, regulations, and municipal official plan policies and by-laws.

In Natural System Areas, aggregate operations and wayside pits and quarries are subject to the following constraints:

1. New mineral aggregate operations, wayside pits and quarries, and ancillary or accessory uses are not permitted in these key natural heritage and key hydrologic areas:
 - significant wetlands
 - significant habitat of endangered or threatened species
 - significant woodlands unless occupied by young plantation or early successional habitat
2. Applications for a new mineral aggregate operation or new wayside pits and quarries will be approved in other key natural heritage or key hydrologic areas or vegetation protection zones only if the applicant can demonstrate:
 - how the Water Resource System will be protected or enhanced
 - that the provisions in Section 4.3.2.5 (c) and (d) and Section 4.3.2.6 (c) in the Greenbelt Plan have been addressed and will be met
3. Applicants for a new mineral aggregate operation or the expansion of an existing mineral aggregate operation must demonstrate:
 - how the connectivity between key natural heritage features and key hydrologic features will be maintained before, during, and after the extraction of aggregates
 - how the operator will immediately replace any habitat that could be lost from the site with equivalent habitat on another area of the site or on adjacent areas
 - how the Water Resource System will be protected or enhanced

Within the Protected Countryside, the Ministry of Natural Resources administers the following policies under the *Aggregate Resources Act* (1990) for all mineral aggregate operations, including wayside pits and quarries:

- Rehabilitated area must be maximized and disturbed area minimized during the entire lifecycle of the operation.
- Progressive and final rehabilitation efforts must contribute to the goals of the Greenbelt Plan.
- The Ministry must establish the 'maximum disturbed area' to be allowed for each operation, and rehabilitation must be required for any disturbed area exceeding that maximum.
- An application for a mineral aggregate operation or wayside pits and quarries may be approved only if the applicant demonstrates that the quantity and quality of groundwater and surface water will be maintained in accordance with provincial standards established under the *Aggregate Resources Act*.

Rehabilitation taking place on any mineral aggregate operation site in the Protected Countryside must comply with the following requirements:

- In areas with a high concentration of aggregate operations, the aggregate industry will work with the Ministry of Natural Resources to consider the development and implementation of comprehensive rehabilitation plans.
- The disturbed area of a site will be rehabilitated to a state equal to or greater than its original ecological value.
- For the entire site, long-term ecological integrity will be maintained or restored, and improved to the extent possible.
- If there are key natural heritage features or key hydrologic features on the site, or if these features existed on the site at the time of application:
 - the health, diversity, and size of these key features will be maintained or restored, and improved to the extent possible to promote a net gain of ecological health
 - any permitted extraction of mineral aggregates that occurs in a key feature will be completed and the area rehabilitated as early as possible in the life of the operation
- Aquatic areas remaining after extraction are to be rehabilitated to a state of aquatic enhancement that is representative of the natural ecosystem in that particular area, and the combined terrestrial and aquatic rehabilitation must meet the intent of Section 4.3.2.5 (c) in the Greenbelt Plan.
- Outside the Natural Heritage System, final rehabilitation will appropriately reflect the long-term land use in the general area, taking into account applicable policies of the Greenbelt Plan and existing provincial and municipal policies.

Final rehabilitation in the Natural Heritage System must meet these additional requirements:

- Where underwater extraction has not taken place, an amount of land equal to that under natural vegetated cover prior to extraction, and no less than 35% of each licence, is to be rehabilitated to forest cover that is representative of the natural ecosystem in that particular area or ecodistrict.
- Where underwater extraction has taken place, no less than 35% of the non-aquatic lands of each licence is to be rehabilitated to forest cover that is representative of the natural ecosystem in that particular area or ecodistrict.
- Rehabilitation must be implemented so that the connectivity of the key natural heritage features and key hydrologic features on the site with those on surrounding lands is maintained or restored, and improved to the extent possible.

Operators of mineral aggregate sites are strongly encouraged to consider and provide public access to former aggregate sites once final rehabilitation has been completed.

2.3 Lake Simcoe Protection Plan

The Lake Simcoe Protection Plan was adopted in 2008 as part of the Government of Ontario's strategy for protecting and restoring the ecological health of the Lake Simcoe Watershed. It focuses on the issues most critical to the health of Lake Simcoe, including:

- restoring the health of aquatic life in the Lake Simcoe Watershed
- improving water quality and maintaining water quantity
- protecting and rehabilitating important areas, such as shorelines and natural heritage, in order to improve the health of the ecosystem
- addressing the impact of invasive species, climate change, and recreational activities

A new aggregate operation, wayside pit, or quarry may be authorized in a key natural heritage feature, a key hydrologic feature, or its related vegetation protection zone only if the applicant can demonstrate that:

- the health, diversity, and size of the key natural heritage features will be maintained or restored, and improved to the extent possible to promote a net gain of ecological health
- any permitted extraction of mineral aggregates that occurs in a feature will be completed and the area rehabilitated as early as possible in the lifecycle of the operation

Applicants for a new aggregate operation must demonstrate how connectivity between both key natural heritage features and hydrologic features will be maintained before, during, and after extraction takes place, and show that any habitat lost during extraction or operation can be replaced or restored with equivalent habitat in another area of the site or within adjacent property.

3. Study Methodology

The study of aggregate site rehabilitation in Ontario involved preliminary assessments, prior to field evaluations.

3.1 Preliminary Assessments

The study team initially compiled a list of surrendered licensed sites based on information provided by MHBC Planning Limited, a contracted associate to OSSGA. They identified 428 surrendered licences within the study area, generally from government records, and categorized these sites in terms of upper- and lower-tier municipalities.

Ministry of Natural Resources' Aggregate Inspectors then examined satellite imagery to determine which of the 428 sites were active or had amalgamated licences and removed 78 sites from the list.

A database was then created for the surrendered licence information, which included, but was not limited to:

- site ID number
- licensee name
- surrender date
- annual tonnage limit
- licensed area
- excavation type (pit or quarry)
- township
- upper- or lower-tier municipality
- concession location

This database was the study team's primary tool for summarizing and organizing the information obtained throughout the study. Surrendered licence numbers were organized in terms of protection plan area, upper- and lower-tier municipality, and township fabric. Individual folders were created to store the data on each licence, and these were organized in the same terms as the database itself.

Aerial imagery was used to create maps showing each surrendered licence boundary within the identified land parcel. Land Information Ontario, the province-wide database for geographic information sharing, was used to determine 100 site boundaries. Meanwhile, Golder Associates Limited was contracted to digitize the remaining site boundaries and create an interactive geographic information system (GIS) for the entire study area. Layered information for each site of interest was included in the GIS database.

Maps of the overall study area and of individual licence boundaries maps were used to plan site visits and conduct preliminary aerial assessments. The latter focused on areas of possible disturbance or discontinuity within the landscape if the precise location was unknown.

To understand the southern Ontario study sites within the context of protection legislation, the study team reviewed the legislation itself and the Greenbelt Plan "area types" designated for the Niagara Escarpment, the Oak Ridges Moraine, and the Protected Countryside (including areas overlapping the Lake Simcoe Protection Plan).

3.1.1 Surrounding Land Use Categories

Prior to conducting field assessments, the study team determined the surrounding land uses for each site of interest using the following categories:

- **Aggregate Extraction:** land area licensed under the *Aggregate Resources Act* for the excavation of crushed stone, sand, and/or gravel.
- **Agriculture:** land area used to produce food and goods through farming practices (e.g., pasture, field crop, livestock, orchard, vineyard).
- **Commercial:** area used for the buying and selling of goods and/or services by commercial businesses.
- **Conservation Area:** land area with protection status that ensures the preservation of natural features, cultural heritage, or biota; may be nature reserve, parkland, or other area maintained by Ontario Conservation Authorities or provincial or territorial government.
- **Industrial:** land area used for the manufacturing and production of goods.
- **Institutional:** land area used by an establishment, association, or foundation that is funded and united for a specific purpose.
- **Recreational:** land area used for active and passive recreational purposes.
- **Residential:** land area primarily used for housing, typically zoned residential, and with existing residences on the property.
- **Rural:** large, isolated land area of open country with low population density.
- **Other:** land area that does not fit into the categories listed above.

3.1.2 Zoning Categories

Prior to conducting field assessments, the study team also identified relevant municipal zoning by-laws and official plan designations by examining publicly available online data and visiting some municipal offices. Classifications for similar uses were grouped as indicated below, and the zoning for each site was defined using the following categories:

- | • Zoning Category | Classifications |
|-----------------------------|--|
| • Aggregate: | area zoned for current or future aggregate use and classified as Extraction, Mineral Extraction, Aggregate Resource, Industrial Extractive, Quarry, and/or Rural Resource. |
| • Agriculture: | area zoned for farming purposes and classified as Agriculture. |
| • Commercial: | area zoned for commercial use and classified as Commercial, Highway Commercial, and/or Shopping Centre. |
| • Environmental Protection: | area zoned to protect locally important ecological features and classified as Environmental Protection. |
| • Industrial: | area zoned for industrial use and classified as Industrial and/or Restricted Industrial. |
| • Parks and Open Space: | area zoned for recreational park use and classified as Open Space, Special Recreation, Park, and/or Natural Environment. |
| • Protected: | area zoned as “protection area” in the provincial growth plan, reflecting provincial policy regarding lands considered protected by the province in municipal by-law, and classified as Oak Ridges Moraine, Conservation, Niagara Escarpment Plan, and/or Greenbelt. |
| • Residential: | area zoned for all levels of residential density <u>except</u> Rural Residential areas and classified as Residential, typically areas in which residential lots are already established. |
| • Rural: | area zoned for various uses but classified as Rural Countryside, Rural Residential, Rural Commercial, Rural General Industrial, Rural Heavy Industrial, and/or Rural Cluster, and intended to distinguish rural from urban land use patterns. |
| • Other: | area zoned for varied and infrequent land uses and classified as Institutional, Development Reserve, Future Development, Flood Plain, Community Facility, Waste Disposal, Hazard, Mixed Use, Reinvestment Area, Zoning under Review, Mixed Employment, Vehicle Service, and/or Zoological. |

3.2 Field Assessments

3.2.1 Field Visits

Between June 1, 2010, and September 14, 2010, field assessment visits were made, or attempted, at 350 surrendered licence sites by either Michael Scott or Heather McKay. During the process, 13 sites were removed from the study because of landowner (accessibility) issues, and field assessments were completed on 337 sites.

Field assessment sheets (see *Appendix D: Field Documentation Sheet*) were completed for each site, identifying:

- name of field assessor
- date of site visit
- licence number
- licensee name
- lot and concession
- township
- additional identifier (GPS coordinates)
- pit or quarry (type of site)
- surrounding land uses
- percentage of tree coverage
- native or non-native (vegetative cover)
- zoning
- official and other plans
- site sketch
- current land uses
- comments




For each surrendered licence site, a handheld Garmin Colorado 300 GPS unit was used to precisely define the location (*additional identifier*), and observations about the use of the surrounding lands (*Surrounding Land Uses*) were recorded to describe the general landscape and assist in determining the appropriateness of the rehabilitated site's current use.




Estimates were made regarding the amount of tree coverage (*% tree coverage*), and whether native or non-native vegetation dominated the site (*native or non-native*). A field drawing (*sketch*) further defined the location, in case future visits are required. Several photographs were taken of each site to visually document the land use at the time of the field assessment.





Data was recorded on the current land use (*current land use – %*) using the categories specified on the following pages (see *Section 3.2.2: Current Land Use Categories*). For some sites, multiple current uses were observed and recorded.





3.2.2 Current Land Use Categories




The current land use categories and sub-classifications used for the sites visited during this study are outlined below.



Current Land Use Category	Sub-Classification	Key	Photo Example
Natural Category for vegetated, terrestrial ecosystem maintained by environmental disturbances, not by human influence.	Cultural Thicket	Land dominated by shrub species (more than 25%) and having less than 25% tree coverage.	
	Woodland	Land with tree coverage in amounts typically between 35% and 60%.	
	Other	Meadow, grassland, prairie, or mature forest.	

Current Land Use Category	Sub-Classification	Key	Photo Example
Open Space Category for vegetated, terrestrial ecosystem with predominantly low-lying vegetation and less than 5% tree coverage, maintained through anthropogenic disturbances.	Natural	Ditch or unmaintained lawn.	
	Maintained	Manicured lawn and/or maintained garden.	
	Other	Exposed sand, stone, gravel, pavement stone, or roadway.	

Current Land Use Category	Sub-Classification	Key	Photo Example
Water Category for land that is either permanently flooded or periodically and seasonally inundated with water.	Storm Water Management	Pond designed to capture water run-off in developed areas where flooding can occur because of impermeable substrates.	
	Pond	Body of isolated standing water, typically smaller than a lake, in which water accumulates from rain and snow melt or is naturally spring-fed, and where wetland and aquatic plant species are present.	
	Restored Watercourse	Stream or river connected to neighbouring waterways that were altered by human influence and restored through site restoration.	
	Other	Lake, wetland, marsh, swamp, or bog.	

Current Land Use Category	Sub-Classification	Key	Photo Example
Agriculture Category for land used to produce food and goods through farming practices.	Vineyard	Land used for grapevine cultivation.	
	Livestock	Land used for animal cultivation.	
	Orchard	Land used for fruit crop cultivation.	
	Pasture	Land dedicated to growing low-lying vegetation for grazing animals.	
	Field Crop	Large field area dedicated to cultivation of vegetation for human consumption (e.g., vegetables) or agricultural purposes (e.g., hay or grain).	
	Other	Land or water body used for aquaculture—i.e., farming of aquatic species, usually fish.	

Current Land Use Category	Sub-Classification	Key	Photo Example
Recreational Category for land used for purposes or activities that provide enjoyment to people when they are not working.	Private	Recreational area located on personally-owned land.	
	Golf Course	Public or privately-owned golf course.	
	Conservation Area	Land that has protected status to ensure the preservation of natural features, cultural heritage, or biota; may be nature reserve, parkland, or other area maintained by Ontario Conservation Authorities.	
	Public Park, Sports Field, or Playground	Municipally-owned recreational area.	
	Other	Land used for a sportsplex, swimming pool, indoor skating rink, national or international sports facility, or physical fitness centre.	

Current Land Use Category	Sub-Classification	Key	Photo Example
Commercial Category for land used for the buying and selling of goods and/or services by commercial businesses.	Professional or Financial Services	Land on which professional or financial services are sold.	
	Restaurants	Land on which prepared food, beverages, and dining services are sold.	
	Grocery/ Retail	Land on which food and other general goods are sold.	
	Hotel	Land on which temporary accommodation and related services are sold.	

Current Land Use Category	Sub-Classification	Key	Photo Example
Industrial Category for land used for the manufacturing and production of goods.	Office	Land on which business, clerical, and/or professional duties are carried out.	
	General Industrial	Land with a variety of uses ranging from light manufacturing to heavy manufacturing plants.	
	Waste Disposal Site	Land used for a waste disposal site, landfill, recycling centre, compost facility, or similar activity.	
Institutional Category for land used by an establishment, association, or foundation that is funded and united for a specific purpose.	School	Land used for a public or private educational facility.	
	Government Office	Federal, provincial, or municipal properties and buildings used to provide public services.	
	Other	Land used for hospitals or non-governmental offices.	

Current Land Use Category	Sub-Classification	Key	Photo Example
Residential Category for land that is typically zoned residential, is primarily used for housing, and has existing residences or established residential lots.	Apartment	Land used for a suite of rooms occupied by more than one household, typically a multi-storey building.	
	Single-Detached	Land used for a single-family dwelling or detached home or for a free-standing residential building on a property that is divided into defined lots.	
	Semi-Detached	Land used for a pair of houses built side-by-side and attached on one side.	
	Townhouses	Land used for terraced, rowed, or linked houses.	
	Rural	Land in a low-density area that is zoned "rural" and typically has a single-detached home on several acres of agricultural, open space, or wooded land.	
	Other	Land used for a seniors' residence.	

4. Study Results

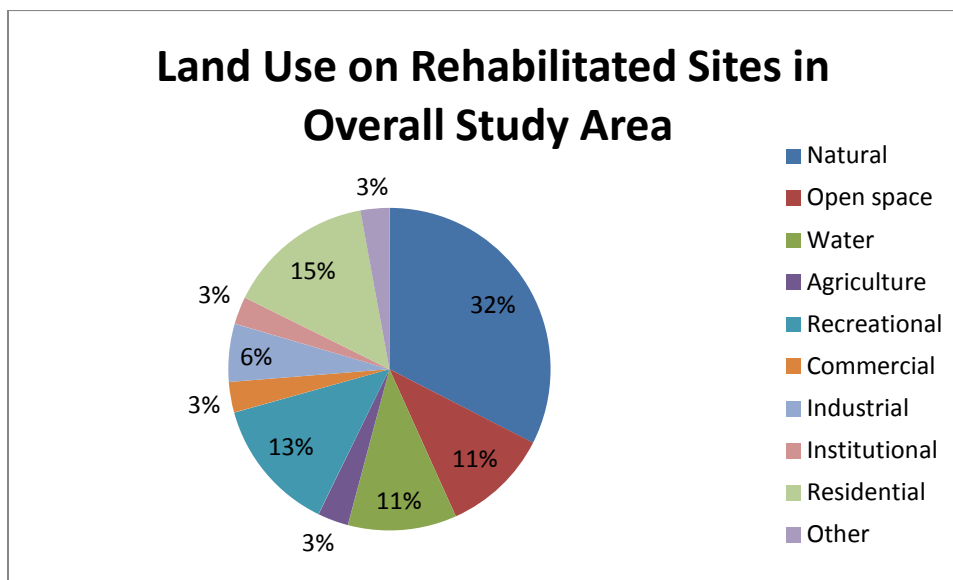
The study team examined 337 rehabilitated surrendered licence sites located throughout the southern and eastern Ontario study areas. Of these 311 are former pits and 16 are former quarry operations (information about the type of former aggregate operation was unavailable for 8 surrendered licences).

In the **Southern Ontario Study Area**, 287 sites were assessed. The results are documented in *Section 4.1: Southern Ontario Study Area*:

- 81 sites within Greenbelt Plan Area
- 23 sites within Lake Simcoe Protection Plan Area (excluding areas overlapping Greenbelt Plan Area)
- 82 sites in historical Metropolitan Toronto (*pits to playgrounds* sites)
- 101 sites outside plan areas (see Appendix A, Figure 2: Southern Ontario with Rehabilitated Sites)

In the **Eastern Ontario Study Area**, 50 sites in the City of Ottawa were assessed (see *Appendix A, Figure 2: Southern Ontario with Rehabilitated Sites*) and are documented in *Section 4.2: Eastern Ontario Study Area (City of Ottawa)*.

The predominant **current land uses** of the total 337 rehabilitated sites in the study area are Natural (32%), Residential (15%), Recreational (13%), Water (11%), and Open Space (11%), with some occurrences of Industrial, Agriculture, Commercial, Institutional, and Other land uses.



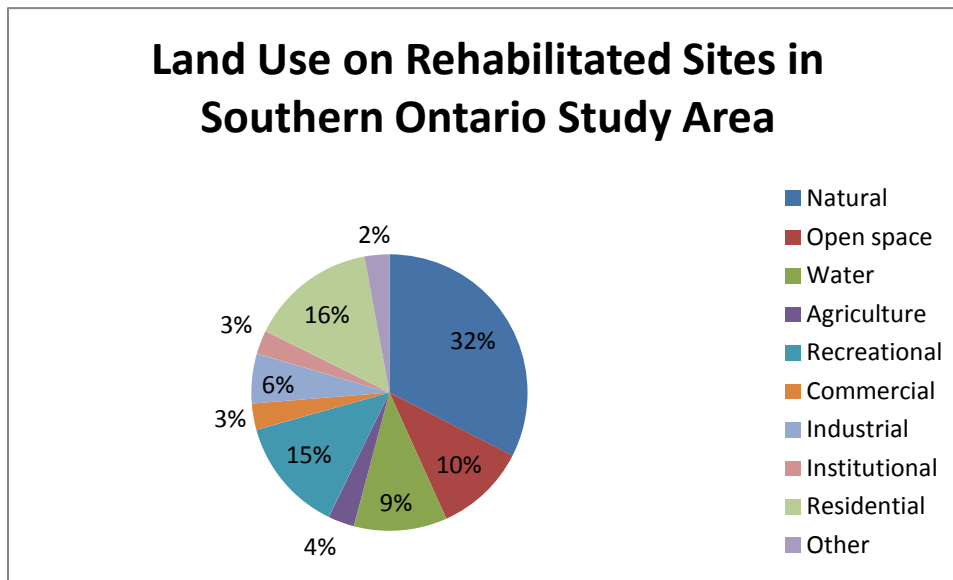
It was discovered that there is approximately 17% **tree coverage** on the sites across the entire study area and an estimated 66% of the plant life is **native vegetation to Ontario**.

For most sites, at least one **surrounding land use** is Rural (62%), Residential (50%), Agriculture (26%), and/or Aggregate (18%). Surrounding lands often have multiple uses.

The primary **zoning categories** are Rural (26%), Residential (25%), Agriculture (24%), Parks and Open Space (24%), and/or Aggregate (22%). Multiple zonings are in place for some sites.

4.1 Southern Ontario Study Area

The predominant **current land uses** of the 287 rehabilitated sites in the Southern Ontario Study Area are Natural (32%), Residential (16%), Recreational (15%), and Open Space (10%).



For most sites, at least one **surrounding land use** is Rural (55%), Residential (51%), Agriculture (24%), and/or Aggregate (15%).

The primary **zoning categories** are Residential (29%), Agriculture (25%), Parks and Open Space (25%), Rural (17%), and/or Aggregate (16%).

The results for the Southern Ontario Study Area is documented on the following pages:

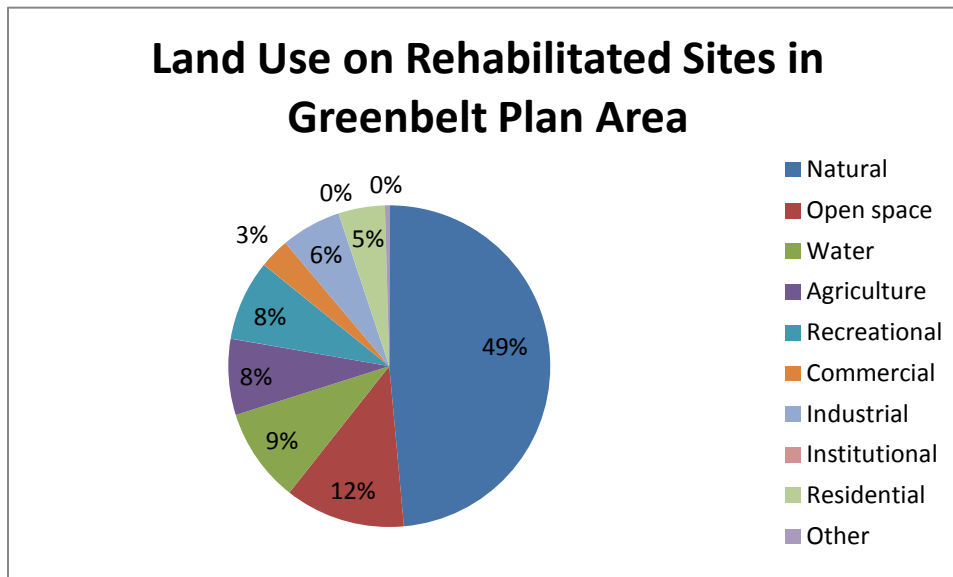
- Greenbelt Plan Area (Page 29-32)
- Lake Simcoe Protection Plan Area (excluding areas overlapping the Greenbelt Plan Area) (Page 33)
- Historical Metropolitan Toronto (*pits to playgrounds* sites) (Page 34)
- sites outside the southern Ontario plan areas (Page 35-36)

4.1.1 Greenbelt Plan Area

The 81 rehabilitated sites within the Greenbelt Plan Area are within three sub-plan areas:

- Niagara Escarpment Plan Area 26 sites
- Oak Ridges Moraine Conservation Plan Area 21 sites
- Protected Countryside 34 sites

The most common **current land uses** on the 81 sites in the Greenbelt Plan Area are Natural (49%), Open Space (12%), and Water (9%), followed by Recreation, Agriculture, Industrial, Residential, Commercial, and Other. No Institutional use was observed on the sites.



Approximately 20% **tree coverage** exists on the visited sites across the Greenbelt Plan Area with an estimated 80% of the plant life being native to Ontario.

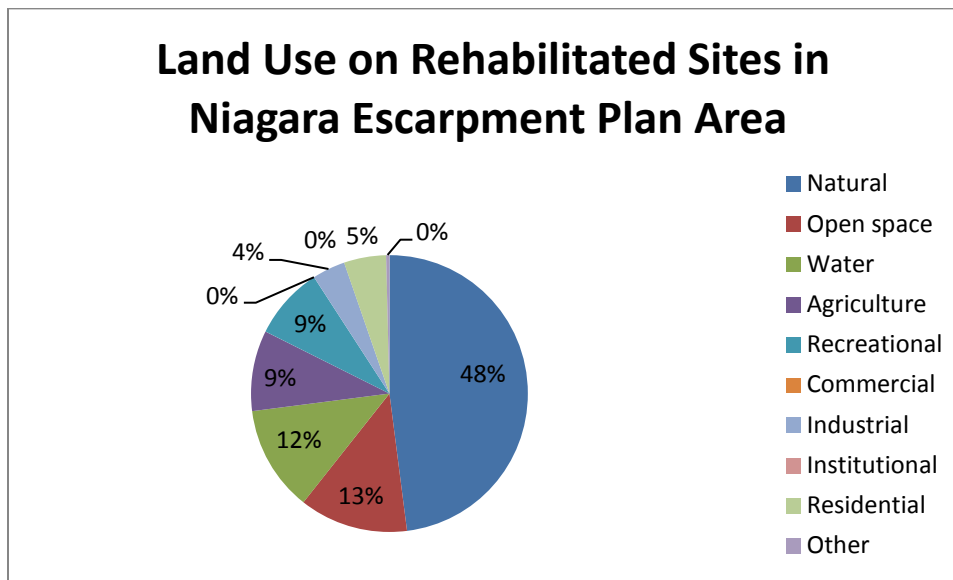
For most sites, at least one **surrounding land use** is Rural (88%), Agriculture (35%), Residential (30%), and/or Aggregate (28%).

The primary **zoning categories** are Protected (36%), Agriculture (27%), Aggregate (20%), Rural (19%), and/or Environmental Protection (12%).

4.1.1.1 Niagara Escarpment Plan Area

Of the 81 sites in the Greenbelt Plan Area, 26 were identified within the Niagara Escarpment Plan Area.

Predominant **current land uses** of the 26 sites are Natural (48%), Open Space (13%), Water (12%), and Agriculture (9%), followed by smaller amounts of Recreational, Residential, Industrial, and Other. No Commercial or Institutional use was observed on the sites.



For most sites, at least one **surrounding land use** is Rural (80%), Agriculture (38%), Residential (31%), and/or Aggregate (23%).

The primary **zoning categories** are Protected (85%), Aggregate (12%), Agriculture (4%), Parks and Open Space (4%), and/or Residential (4%). No sites are zoned Commercial, Industrial, or Environmental Protection.

The 26 sites fall within five Niagara Escarpment Plan **area types**:

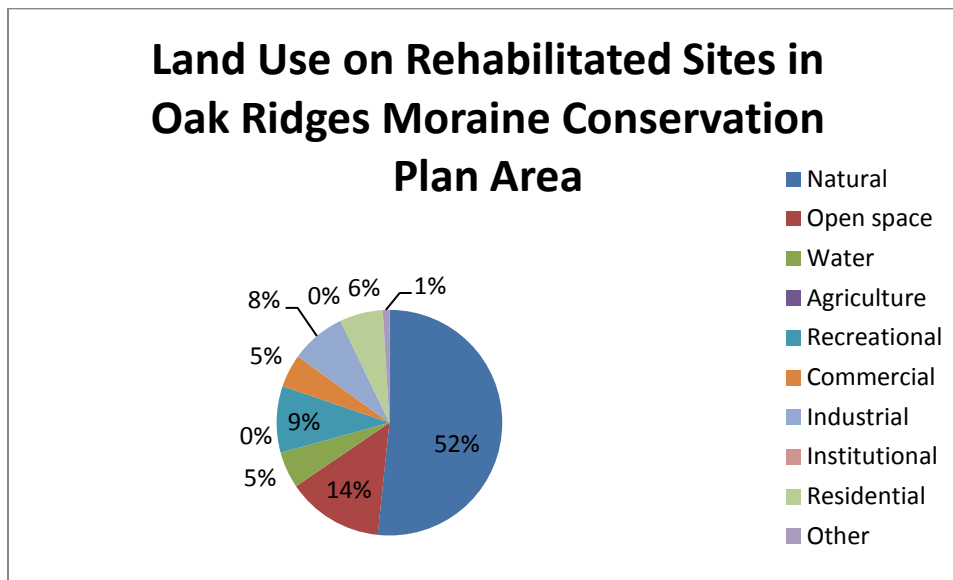
- Escarpment Protection Areas 46%
- Mineral Resource Extraction Areas 31%
- Escarpment Rural Areas 15%
- Escarpment Natural Areas 4%
- Escarpment Recreation Areas 4%

No site is within an Urban Area.

4.1.1.2 Oak Ridges Moraine Conservation Plan Area

Of the 81 sites in the Greenbelt Plan Area, 21 are within the Oak Ridges Moraine Conservation Plan Area.

The predominant **current land uses** on the 21 sites are Natural (52%), Open Space (14%), and Recreational (9%), followed by smaller amounts of Industrial, Residential, Water, Commercial, and Other. No Agriculture or Institutional use was observed on these sites.



For most sites, at least one **surrounding land use** is Rural (90%), Aggregate (38%), Residential (33%), Agriculture (14%), Commercial (14%), and/or Industrial (14%).

The primary **zoning categories** are Rural (33%), Protected (33%), Aggregate (24%), Parks and Open Space (14%), Agriculture (10%), Environmental Protection (10%), and/or Residential (10%).

The 21 sites fall within three Oak Ridges Moraine Conservation Plan **area types**:

- Countryside Areas 62%
- Natural Linkage Areas 29%
- Natural Core Areas 9%

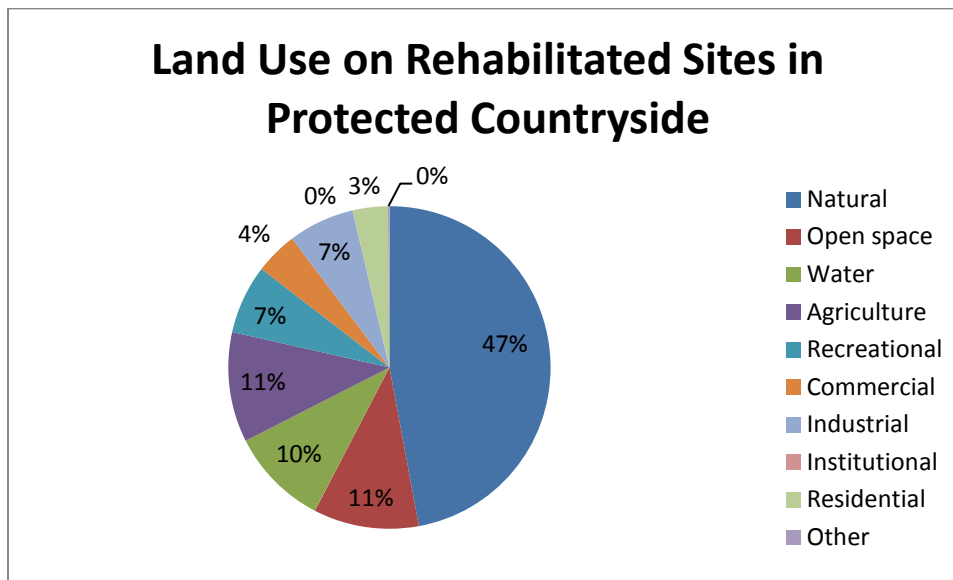
No site is within a Settlement Area.

The Countryside, Natural Linkage, and Natural Core sites account for 16%, 7%, and 2%, respectively, of the Greenbelt Plan Area sites and 4%, 2%, and 1% of the sites in the overall study area.

4.1.1.3 Protected Countryside

Of the 81 sites in the Greenbelt Plan Area, 34 (42%) are within the Protected Countryside, including sites overlapping the Lake Simcoe Protection Plan Area.

The predominant **current land uses** on the 34 sites are Natural (47%), Open Space (11%), Agriculture (11%), and Water (10%), followed by smaller amounts of Recreational, Industrial, Commercial, Residential, and Other. No Institutional use was observed on the sites.



There is approximately 19% **tree coverage** on the sites across the Protected Countryside.

For most sites, at least one **surrounding land use** is Rural (91%), Agriculture (44%), Aggregate (26%), Residential (26%), and/or Conservation Area or Provincial Park (18%).

The primary **zoning categories** are Agriculture (56%), Aggregate (23%), Environmental Protection (23%), Rural (23%), and/or Residential (9%).

The 34 sites fall within two Protected Countryside **area types**:

- Natural System Areas 79%
- Protected Countryside 26%

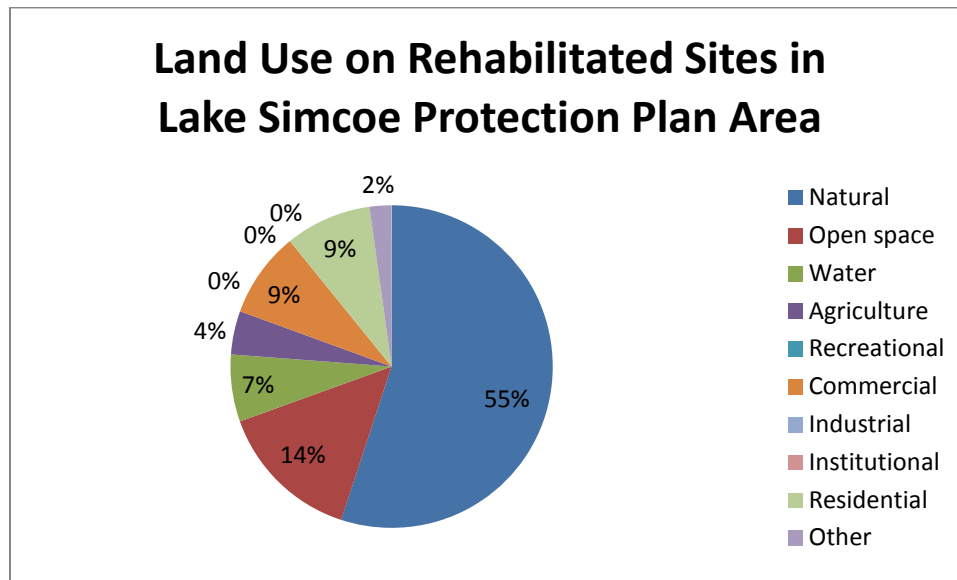
Two sites are within both area types, while no site is within a Settlement Area.

The Natural System and Protected Countryside sites account for 33% and 11%, respectively, of the Greenbelt Plan Area sites, and 8% and 3% of the sites in the overall study area.

4.1.2 Lake Simcoe Protection Plan Area

There are 23 rehabilitated sites within the Lake Simcoe Protection Plan Area, excluding sites overlapping the Greenbelt Plan Area.

The predominant **current land uses** on the 23 sites are Natural (55%) and Open Space (14%), followed by smaller amounts of Residential, Commercial, Water, Agriculture, and Other. No Recreational, Industrial, or Institutional use was observed on the sites.



There is approximately 19% **tree coverage** on the sites across the Lake Simcoe Protection Plan Area and approximately 45% of the plant life is **native Ontario vegetation**.

For most sites, at least one **surrounding land use** is Rural (83%), Agriculture (61%), Residential (35%), and/or Commercial (13%). No surrounding land has Aggregate, Industrial, Institutional, Conservation Area or Provincial Park, or Recreational use.

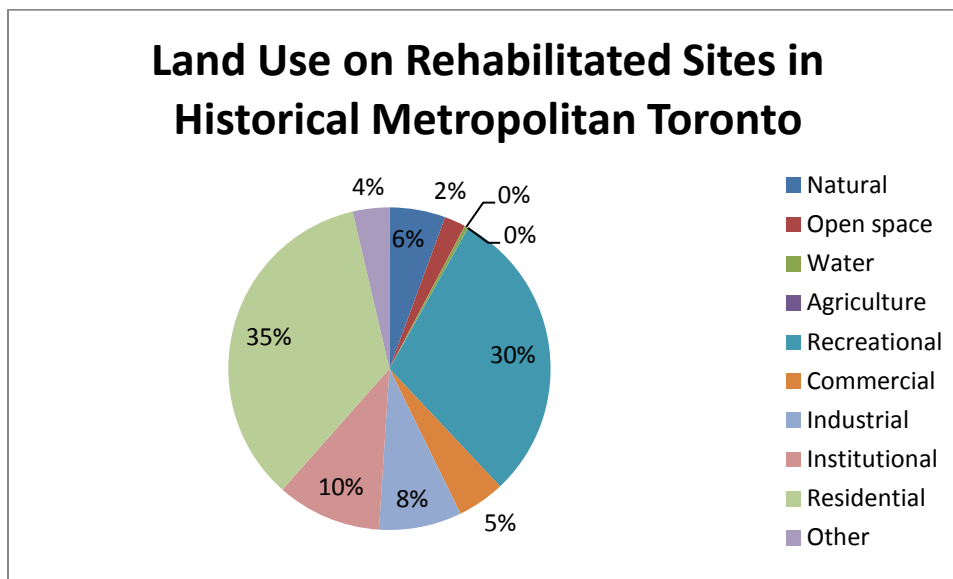
The primary **zoning categories** are Aggregate (57%), Environmental Protection (52%), Agriculture (43%), Rural (35%), Industrial (17%), Parks and Open Space (17%), Residential (17%), Commercial (9%), and/or Other (4%), the latter for a portion of one site used for a community facility. No site has Protected zoning.

4.1.3 Historical Metropolitan Toronto (*Pits to Playgrounds Sites*)

The term “historical Metropolitan Toronto” refers to the metropolitan Toronto area from 1953 to 1967, at which time the boundaries were expanded to their current limit (see also *Appendix E: Glossary*).

There are 82 rehabilitated sites within historical Metropolitan Toronto. On the basis of the Ministry of Natural Resources publication entitled *From Pits to Playgrounds*, these sites are sometimes known as “pits to playgrounds” sites.

The predominant **current land uses** on the 82 sites are Residential (35%), Recreational (30%), and Institutional (10%), followed by smaller amounts of Industrial, Commercial, Natural, Other, Open Space, and Water. No Agriculture use was observed on the sites.



There is approximately 16% **tree coverage** on the sites across historical Metropolitan Toronto and approximately 40% of the plant life is **native vegetation to Ontario**.

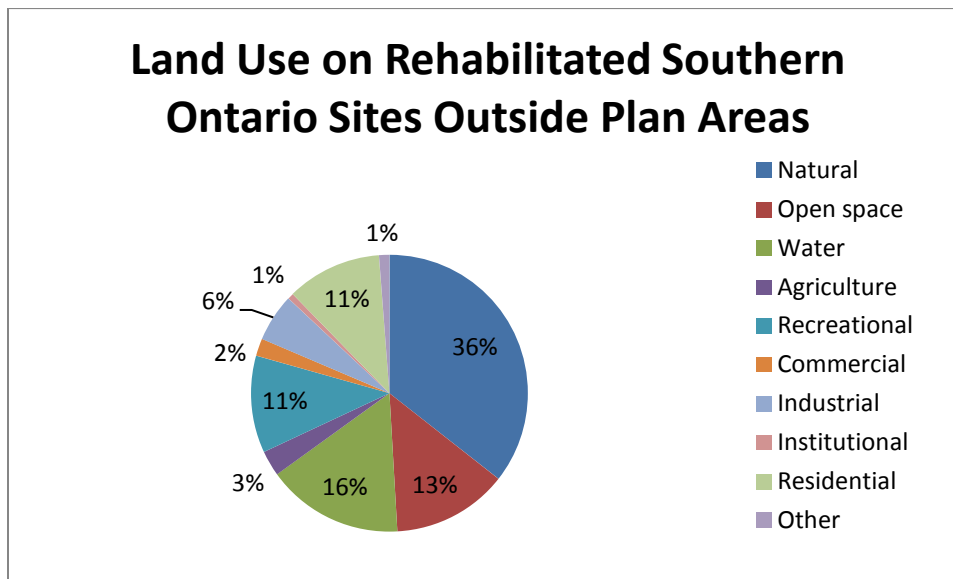
For most sites, at least one **surrounding land use** is Residential (78%), Commercial (22%), Industrial (19%), and/or Institutional (10%), followed by smaller amounts of Conservation Area or Provincial Park, Recreation, Agriculture, and/or Rural use. No surrounding land has Aggregate use.

The primary **zoning categories** are Residential (63%), Parks and Open Space (46%), Other (19%), Industrial (11%), Commercial (5%), and/or Protected (1%). “Other” includes zoning for institutional, employment, and mixed uses. No site has Aggregate, Agriculture, Environmental Protection, or Rural zoning.

4.1.4 Southern Ontario Sites Outside Plan Areas

There are 101 rehabilitated sites outside protection plan areas in the Southern Ontario Study Area.

The predominant **current land uses** on the 101 sites are Natural (36%), Water (16%), Open Space (13%), Recreational (11%), and Residential (11%), followed by smaller amounts of Industrial, Agriculture, Commercial, Institutional, and Other.



There is approximately 17% **tree coverage** on the sites outside plan areas in southern Ontario and approximately 84% of the plant life is **native vegetation to Ontario**.

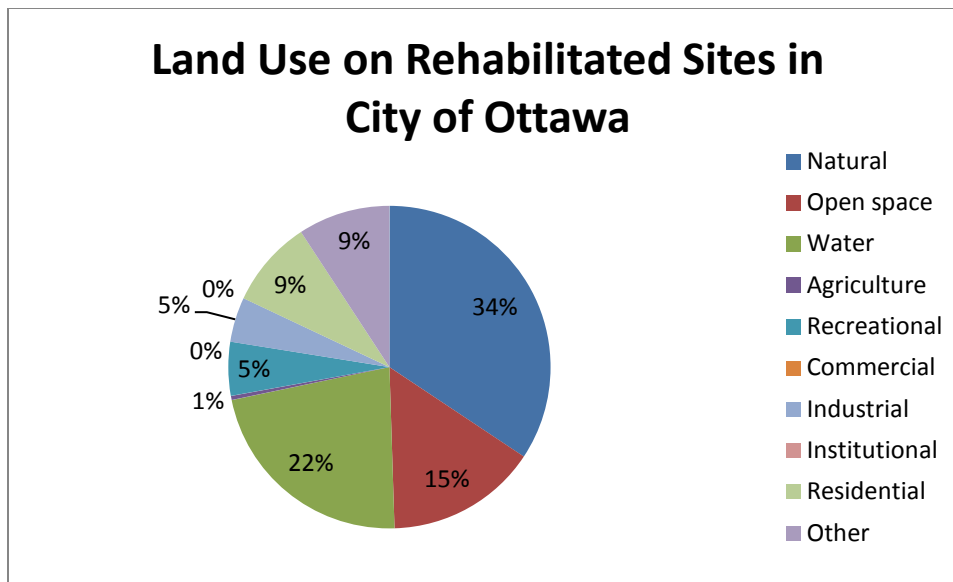
For most sites, at least one **surrounding land use** is Rural (67%), Residential (48%), Agriculture (27%), Aggregate (21%), and/or Commercial (10%).

The primary **zoning categories** are Agriculture (39%), Rural (26%), Other (25%), Parks and Open Space (24%), Environmental Protection (21%), Residential (21%), and/or Aggregate (18%). “Other” includes zoning for recreation, hazard, institutional, employment, and development land. No site is zoned Industrial.

4.2 Eastern Ontario Study Area (City of Ottawa)

There are 50 rehabilitated sites within the City of Ottawa, which is the only municipality within the Eastern Ontario study area.

The predominant **current land uses** on the 50 sites are Natural (34%), Water (22%), and Open Space (15%), followed by smaller amounts of Residential, Other, Recreational, Industrial, and Agriculture. No Commercial or Institutional use was observed on any rehabilitated site.



There is approximately 14% **tree coverage** on the sites in the City of Ottawa and approximately 82% of the plant life is **native vegetation to Ontario**.

For most sites, at least one **surrounding land use** is Rural (98%), Residential (44%), Agriculture (36%), and/or Aggregate (30%). No surrounding land has Institutional, Recreational, or Conservation Area or Provincial Park use.

The primary **zoning categories** are Rural (76%), Aggregate (52%), Agriculture (20%), Industrial (18%), and/or Parks and Open Space (18%). No site is zoned Protected or Residential.

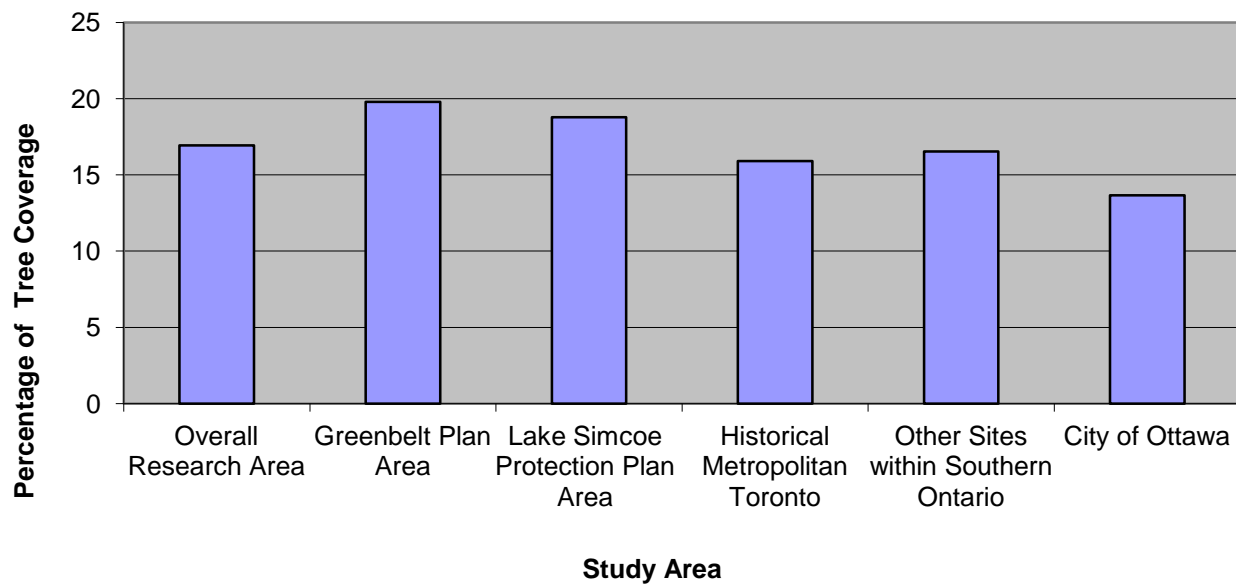
5. Analysis of Results

The field assessments for this study were undertaken between June and September 2010. Results were compiled and analyzed, and this report prepared, between October 2010 and May 2011.

5.1 Overall Study Area

5.1.1 Tree Coverage

Estimated Percentage of Tree Coverage



Estimated tree coverage on the sites in the total study area is distributed as follows:

- Greenbelt Plan Area 20%
- Lake Simcoe Protection Plan Area ¹ 19%
- Southern Ontario Sites Outside Plan Areas 17%
- Historical Metropolitan Toronto ² 16%
- City of Ottawa ³ 14%

The percentage of the **tree coverage** in the overall study area, and approximately 66% of the plant life is **native vegetation to Ontario**.

Metropolitan Toronto, has approximately 16% tree coverage, but only 40% of the plant life is native vegetation to Ontario. Tree coverage is similar to that in the eastern Ontario and Greenbelt study areas because of the current recreational and residential uses on the sites. Planting on municipally owned parklands and private residential properties has produced a healthy amount of tree coverage, but much of the vegetation is not native to Ontario. Since rehabilitation of the Toronto sites occurred before current rehabilitation standards were in place, it is likely that the higher native vegetation levels observed in the other study areas will become more prevalent, particularly because rehabilitation techniques are continually improving.

¹ These sites exclude those that overlap the Greenbelt Plan Area.

² These are “pits to playgrounds” sites.

³ These sites may have the least tree coverage because they have significant amounts of water and open space.

5.1.2 Current and Surrounding Land Use

The most prevalent **current land use** on sites in the overall study area is Natural (32%). This is defined for the purposes of this study as a “vegetated, terrestrial ecosystem maintained by environmental disturbances, not by human influence” (see *Section 3.2.2: Current Land Use Categories*). This indicates that many former aggregate sites have naturalized in such a way that they now conform with the surrounding natural environment. These naturalized sites tend to be undisturbed woodlands, cultural thickets, grasslands, meadows, and mature forests. They have the highest tree coverage (19%) among the studied sites, and 86% of the naturalized sites have at least one Rural surrounding land use.

The second most common current land use in the overall study area is Residential (14%), and 75% of these sites have at least one Residential surrounding land use.

The most common **surrounding land uses** differ significantly in the two study areas:

Eastern Ontario Study Area Surrounding Land Use

Rural	98%
Residential	44%
Agriculture	36%
Aggregate	30%

Southern Ontario Study Area Surrounding Land Use

Rural	55%
Residential	51%
Agriculture	24%
Aggregate	15%

It appears that population growth has had more influence on the southern than the eastern sites since Rural surrounding land use is more common in the Eastern Ontario Study Area and Residential surrounding land use is more common in the Southern Ontario Study Area. This is further suggested by the fact that Agriculture and Aggregate are more common surrounding uses in the eastern than in the southern study area.

5.1.3 Zoning

The zoning of former aggregate sites in the overall study area tends to reflect the rural environment. The most common municipal **zoning categories** associated with the Natural sites are Rural (37%), Aggregate (31%), and/or Agriculture (30%). Only 31% of these sites have either Environmental Protection or Protection zoning, and only 8% have Commercial or Industrial zoning.

Rural zoning is in place for 26% of the sites but 65% of these have multiple zoning categories. The primary land uses for the Rural sites are Natural (46%), Open Space (14%), and/or Water (12%), and for most of them, the surrounding land use is Rural (95%), and/or Residential (42%).

5.2 Southern Ontario Study Area

5.2.1 Greenbelt Plan Area

5.2.1.1 Tree Coverage

Tree coverage on former aggregate sites in the Greenbelt Plan Area is approximately 20%, making it the area with the most tree coverage in the entire study area. Average tree coverage on naturalized sites in this area is 24%.

5.2.1.2 Current Land Use

The most common current land use on sites in this area is Natural (49%).

5.2.1.3 Zoning

The most common zoning categories for sites in this area are Protected (36%) and Agriculture (27%). Current land use on 45% of the sites is Natural, with only 3% of the sites currently used for Agriculture.

Among the naturalized sites, the most common zoning categories are Natural (48%), Protected (42%), Agriculture (22%), and/or Aggregate (22%), and for most of these sites, at least one surrounding land use is Rural (95%).

5.2.2 Niagara Escarpment Plan Area

The rehabilitated sites within the Niagara Escarpment Plan Area fall within five **area types**:

- Escarpment Protection Areas 46%
- Mineral Resource Extraction Areas 31%
- Escarpment Rural Areas 15%
- Escarpment Natural Areas 4%
- Escarpment Recreation Areas 4%

The sites have become an integral part of the working ecosystem. The fact that 46% of them are designated as Escarpment Protection indicates that these former extraction sites have become important parts of the Niagara Escarpment Plan. Although only 4% of the rehabilitated sites are designated as Escarpment Natural, this nevertheless demonstrates that former aggregate sites can become high-level natural sites after they are rehabilitated.

5.2.2.1 Tree Coverage

Tree coverage on sites in this area is 22%. This is higher than the average for the overall study area (17%), suggesting not only that tree coverage has been an important aspect of site rehabilitation in this area but also that re-planting and plant regeneration are actively occurring on the sites.

5.2.2.2 Current Land Use

The most common current land uses on sites in this area are Natural (48%), Open Space (13%), Water (12%), and Agriculture (8%). These numbers suggest that the sites have reverted to uses that are compatible with the natural heritage of the area.

The surrounding land uses for sites in this area are predominantly Rural (81%) and/or Agriculture (38%), indicating that the rehabilitated sites are still rural in nature and tend not to be adjacent to residential areas.

5.2.2.3 Zoning

Most former aggregate sites within this area have Protection zoning (81%) and fall under the jurisdiction of the Niagara Escarpment Plan.

5.2.3 Oak Ridges Moraine Conservation Plan Area

The rehabilitated aggregate sites (21 sites) within the Oak Ridges Moraine Conservation Plan Area fall within three **area types**:

- Countryside Areas (13 sites) 62%
- Natural Linkage Areas (6 sites) 29%
- Natural Core Areas (2 sites) 9%

According to the Oak Ridges Moraine Conservation Plan:

- **Natural Linkage Areas** protect critical natural and open space linkages between the Natural Core Areas and along rivers and streams.
- **Natural Core Areas** protect those lands with the greatest concentrations of key natural heritage features that are critical to maintaining the integrity of the Moraine as a whole.

The fact that 38% of the rehabilitated sites are within the Natural Linkage and Natural Core Areas indicates that they have become important environmental components of the Oak Ridges Moraine. It also ensures that aggregate rehabilitation is working well, and that the sites have adapted to their surroundings.

5.2.3.1 Tree Coverage

Average tree coverage on former aggregate sites in this area is 18%.

5.2.3.2 Current Land Use

The most common current land use in this area is Natural (52%), and half of the naturalized sites are within Natural Linkage Areas (37.5%) and Natural Core Areas (12.5%). For most naturalized sites, the surrounding land use is Rural (100%), Aggregate (31%), Residential (25%), and/or Industrial (19%), and the primary zoning categories are Protected (37%), Rural (31%), and/or Aggregate (31%).

5.2.3.3 Zoning

Most of the sites have Protection (33%) and/or Rural (33%) zoning. The current land uses on the protected sites are Natural (42%), Industrial (24%), and Open Space (20%), and the surrounding land uses are Rural (86%), Agriculture (29%), Residential (29%), and/or Industrial (29%). Most protected sites are in Natural Linkage (57%) and Natural Core Areas (14%). On sites for which one zoning category is Rural (33%), the primary current land use is Natural (58%) and the primary surrounding land uses are Residential (43%) and/or Aggregate (43%). Most sites are in Countryside Areas (71%).

One site is located within a Natural Core Area with Protection zoning and has been returned to natural and water uses, demonstrating the potential to rehabilitate an extraction site into one that complies with the highest level of protection available under current legislation. In contrast, two sites with both Protection and Aggregate zoning have natural and industrial current land uses and rural and industrial surrounding land uses, despite being within Natural Linkage Areas. In these cases, some of the current use and municipal zoning does not comply with provincial protection standards.

5.2.4 Protected Countryside

The rehabilitated aggregate sites within the Protected Countryside (including areas overlapping the Lake Simcoe Protection Plan Area) fall within two **area types**:

- Natural System Areas: 76% (Natural Heritage System)
- Protected Countryside: 24%

According to the Greenbelt Plan:

The Natural Heritage System includes areas of the Protected Countryside with the highest concentration of the most sensitive and/or significant natural features and functions. These areas need to be managed as a connected and integrated natural heritage system, given the functional inter-relationships between them and the fact that this system builds upon the natural systems contained in the Niagara Escarpment Plan and the Oak Ridges Moraine Conservation Plan.

The Protected Countryside sites assessed in this study are in rural areas that the Greenbelt Plan defines as “areas that support, and provide the primary locations for, a range of recreational, tourism, institutional, and resource-based commercial and industrial uses” (Greenbelt Act, 2005).

The fact that so many former aggregate sites are now designated as part of the Natural Heritage System suggests that the sites are making an important contribution to the ecological well-being of the Greenbelt system, and that site rehabilitation in this area has largely been ecologically successful.

5.2.4.1 Tree Coverage

Average tree coverage on former aggregate sites in this area is 19%.

5.2.4.2 Current Land Use

The primary current land uses on these sites are Natural (47%), Open Space (11%), and Agriculture (11%), and the primary surrounding land uses are Rural (91%), and/or Agriculture (44%). These uses indicate that most of the sites have naturalized successfully within their rural context in keeping with the goals of the Greenbelt Plan.

5.2.4.3 Zoning

The primary zoning categories for these sites are Agriculture (56%), Environmental Protection (23%), Rural (23%), and/or Aggregate (23%). These too are consistent with the rural character of the area.

5.2.5 Lake Simcoe Protection Plan Area

5.2.5.1 Tree Coverage

At 19%, average tree coverage on former aggregate sites in the Lake Simcoe Protection Plan Area is the second highest in the overall study area, exceeded only by the Greenbelt Plan Area at 20%.

5.2.5.2 Current Land Use

The most common current land use is Natural (55%).

For rehabilitated sites with Aggregate zoning, the most common current land use is Natural (58%), and the primary surrounding land uses are Rural (92%), and/or Agriculture (69%).

5.2.5.3 Zoning

All rehabilitated sites in this area have multiple zoning categories. The most common are Aggregate (57%) and/or Environmental Protection (52%). Of the sites with Environmental Protection zoning, the most common current land use is Natural (54%), and the most common surrounding land use is Rural (92%).

Among sites for which the most common land use is Natural (55%), the primary zoning categories are Aggregate (60%), Environmental Protection (55%), Agriculture (50%), and/or Rural (30%), and the most common surrounding land uses are Rural (85%), Agriculture (60%), and/or Residential (40%).

5.2.6 Historical Metropolitan Toronto

Many of historical Metropolitan Toronto's recreational needs are being met by parks established on rehabilitated aggregate sites and many of these sites also make a significant contribution to the green space in Ontario's largest city centre.

5.2.6.1 Tree Coverage

At 16%, average tree coverage on sites in this area is the second lowest in the overall study area. However, for sites for which at least one zoning category is Parks and Open Space, the average tree coverage is 22%.

5.2.6.2 Current Land Use

Former aggregate sites in this area—which has the largest population and highest population density in Ontario—have the largest representation of Residential (35%) and Recreational (30%) current land uses in the overall study area. The primary surrounding land use is Residential (78%).

- For sites with Residential current land use, the most common zoning categories are Residential (93%) and/or Parks and Open Space (45%).
- For sites with Recreational current land use, the most common zoning categories are Parks and Open Space (85%) and/or Residential (65%).

5.2.6.3 Zoning

The primary zoning categories for these sites are Residential (63%) and/or Parks and Open Space (46%).

- For sites with Residential zoning, the current land use is primarily Residential (52%).
- For sites with Parks and Open Space zoning, the current land uses are primarily Recreational (58%) and/or Residential (25%), and the surrounding land use is primarily Residential (76%).

5.2.7 Southern Ontario Sites Outside Plan Areas

Although these former aggregate sites are outside protection plan areas, they are largely naturalized sites where rehabilitation has returned them to uses similar to those that preceded extraction.

5.2.7.1 Tree Coverage

At 17%, average tree coverage on these sites is consistent with that for sites across the entire study area, which is also 17%.

5.2.7.2 Current Land Use

The primary current land uses on these sites are Natural (36%), Water (16%), Open Space (13%), Recreational (11%), and Residential (11%), reflecting the fact that the primary surrounding land uses are Rural (67%), and/or Residential (48%).

5.2.7.3 Zoning

The primary zoning categories for these sites are Agriculture (39%), Rural (26%), Other (25%), Parks and Open Space (24%), Environmental Protection (21%), and/or Residential (21%). This is consistent with the fact that the primary surrounding land uses are Rural (67%), and/or Residential (48%).

5.3 Eastern Ontario Study Area (City of Ottawa)

The Eastern Ontario Study Area includes only the City of Ottawa.

5.3.1 Tree Coverage

At 14%, average tree coverage on former aggregate sites in the City of Ottawa is the lowest for the entire study area. However, the current land use on many of the sites is Water (22%), and some of the terrestrial sites may have higher-than-average tree densities.

5.3.2 Current Land Use

The primary current land use on sites in the Eastern Ontario Study Area is Natural (34%), compared to the Southern Ontario Study Area (32%).

The fact that the second most common current use is Water (22%) differentiates the eastern from the southern study area, and suggests that “below water table” extraction is more common in the eastern area, since such extraction sites are more likely to be rehabilitated as ponds.

The primary surrounding land uses for these sites are Rural (98%), and/or Residential (44%). Also similarly, the primary surrounding land uses for sites in the Southern Ontario Study Area are Rural (55%), and/or Residential (51%).

This land use data suggests that rehabilitated sites can become a cohesive part of the rural landscape, and that aggregate extraction, agriculture, and residential activities can successfully occur in close proximity to one another in rural settings.

5.3.3 Zoning

The primary zoning category for these sites is Rural (76%), which is consistent with the fact that most of the current surrounding land use is Rural (98%). Although the second most common surrounding land use is Residential (44%), this simply indicates that residences have been built in what is largely a rural setting.

6. Conclusion

This study addressed the lack of data regarding rehabilitated aggregate sites through the collection, recording, and analyzing objective field data on 337 former sites in southern and eastern Ontario for which rehabilitation completed and licences had been surrendered. It also provides an opportunity for readers to perceive aggregate operations in terms of long-term rehabilitation outcomes, particularly with respect to land use policy and planning, and the ecology of site rehabilitation.

6.1 Land Use Policy and Planning

Aggregate extraction is a common land use in Ontario, the study data shows that former aggregate sites can be successfully integrated into their surrounding environments after extraction operations are completed. The data also demonstrated that rehabilitated sites tend to be compatible with surrounding land uses, and that aggregate extraction is a temporary land use. In protected areas, the study data clearly showed that rehabilitated aggregate sites have reverted back to appropriate land uses.

This information should be used to guide land use policy and planning documents for aggregate extraction sites. Although “slope and seed” is the rehabilitation approach traditionally used by aggregate producers, the study team found that innovative approaches by individuals and planning staff can result in superior rehabilitation outcomes. In Brampton, for example, a series of former aggregate sites on the Brampton Esker were converted into an award-winning system of city-operated parks, an outcome that can be attributed to the City of Brampton’s unique vision and its innovative approach to long-term planning.

In the three decades between the publication of *From Pits to Playgrounds* and the commencement of this study, approximately 30% of the land formerly used for aggregate sites within historical Metropolitan Toronto had changed use, with most of the change involving current residential use. There are also former extraction sites now being used for municipal waste water facilities, licensed aquaculture ponds, and recreation areas. These current uses significantly exceed the traditional “slope and seed” objective, and show that a rehabilitated aggregate site can become an important part of the community fabric.

6.2 Ecology of Site Rehabilitation

The study data indicated that many former aggregate extraction sites have natural current land uses but that the ecology of site rehabilitation is poorly documented.

On many sites, re-vegetation is sparse or dominated by species that are not native to the area. There is excellent potential for most sites to be transformed for beneficial and integrated uses, including desirable green spaces within urban settings, restored ecosystems, and productive agricultural fields, to name only a few options. However, the prevalent basic rehabilitation practice will continue unless all stakeholders understand that specific types of rehabilitation can succeed.

This study and similar investigations can contribute to the emerging science of site rehabilitation. If industry and municipal stakeholders focus on continual learning and adaptive management strategies, site rehabilitation techniques can be strengthened to improve site integration with the surrounding environment.

When comparing the results documented in *From Pits to Playgrounds* to those found in the current study, it was reassuring to learn that native seed sources are used far more frequently for site rehabilitation than they were decades ago. However, using native seed sources is only one technique that contributes to the overall success of current rehabilitation efforts. Many success stories that remain untold could reveal the strengths and weaknesses of past and present approaches to site rehabilitation.

Two former aggregate sites within the Niagara Escarpment Plan Area have been returned to the Escarpment Natural designation, the highest level of protection. These examples counter the belief that aggregate properties remain “scars on the landscape” and demonstrates that the land can be restored in a way that maintains ecological integrity in even the most ecologically sensitive areas.

Since it is imperative to understand the ecology of aggregate site rehabilitation, the study team has made four ecological recommendations in *Section 7.2: Ecological Recommendations*.

7. Recommendations

Based upon the key findings of this study, the study team has made several recommendations regarding information management and ecological issues.

7.1 Data Management Recommendations

1. **Use Baseline Data:** It is recommended that the data collected during this study be used as baseline data for further research into aggregate site rehabilitation in Ontario. It is important to centralize the database and data sets for rehabilitated sites and gather the data in a collaborative manner. It is important to bring different partners together in a data-sharing agreement.

It was also very challenging to obtain data from various sources and combine it into a single database. It is recommended that one agency be responsible for creating and managing the central database.

2. **Improved Data Collection Standards:** Have standards for data collection of all future surrendered licences in order to maintain proper data retention. For example: lot, concession, municipality, licence reference number, copy of the site plans, licensed area, rehabilitation photos, etc.
3. **Refine Rehabilitation Best Practices:** The study team discovered that many organizations and individuals have valuable knowledge and data that are generally not available. It is recommended to work in collaboration and perform research involving industry, government, non-governmental organizations, conservation authorities, and universities to refine best practices for aggregate site rehabilitation.
4. **Continue Research:** In this study, rehabilitated sites were assessed only within specific areas. It is recommended that all rehabilitated sites in Ontario be studied over time, and that the data be added to the centralized database. This will maintain key data on the state of rehabilitated aggregate sites in the province and improve our overall knowledge of rehabilitation patterns in Ontario.
5. **Monitor Land Use:** It is recommended that an ongoing program be implemented for monitoring post-extraction land uses and recording the data in the central database. This will involve measuring changes in post-extraction land use over a defined period of time and analyzing the rehabilitation patterns that emerge. This information will increase our understanding of how the use of former aggregate sites evolves, and will support better land use policy and planning.

7.2 Ecological Recommendations

1. **Develop Best Practices for Primary Succession:** Succession is the primary natural process through which ecosystems develop. Management practices, such as soil placement or plantings, can be used to enhance this process. However, rehabilitation must be designed and implemented with proper techniques or site degradation may result. Ecosystem and land use objectives should be established from the surrounding landscape before rehabilitation is initiated. Opportunities to shape the physical landscape should be included in this process.
2. **Use Native Seed Sources:** Native plant species and seed mixtures should be selected for the specific environments in which rehabilitation is occurring. Species not suited to promoting succession in the area will more easily fail or create unwanted outcomes. Non-native and potentially noxious or invasive species should be avoided.
3. **Research Site-Specific Ecology:** Research is required to determine and compare the success rates of rehabilitation techniques. Within a given physical setting, ecologically based rehabilitation objectives and designs should be developed and recorded along with the baseline conditions against which success will be measured. Monitoring or future studies should be scoped to measure progress from a baseline. To that end, we recommend that baseline conditions be assessed as benchmarks on a representative set of sites in specific physiographic settings.
4. **Measure Ecological Success:** Progress toward achievement of ecological rehabilitation objectives should be measured (against baseline conditions) with economical and practical indicators. Depending on the site, these may include plant cover, species richness, wildlife use, etc. At the same time, more research is needed to develop better indicators that can be linked to rehabilitation design.

Appendix A: Study Areas

Figure 1: General Study Area – Southern and Eastern Ontario

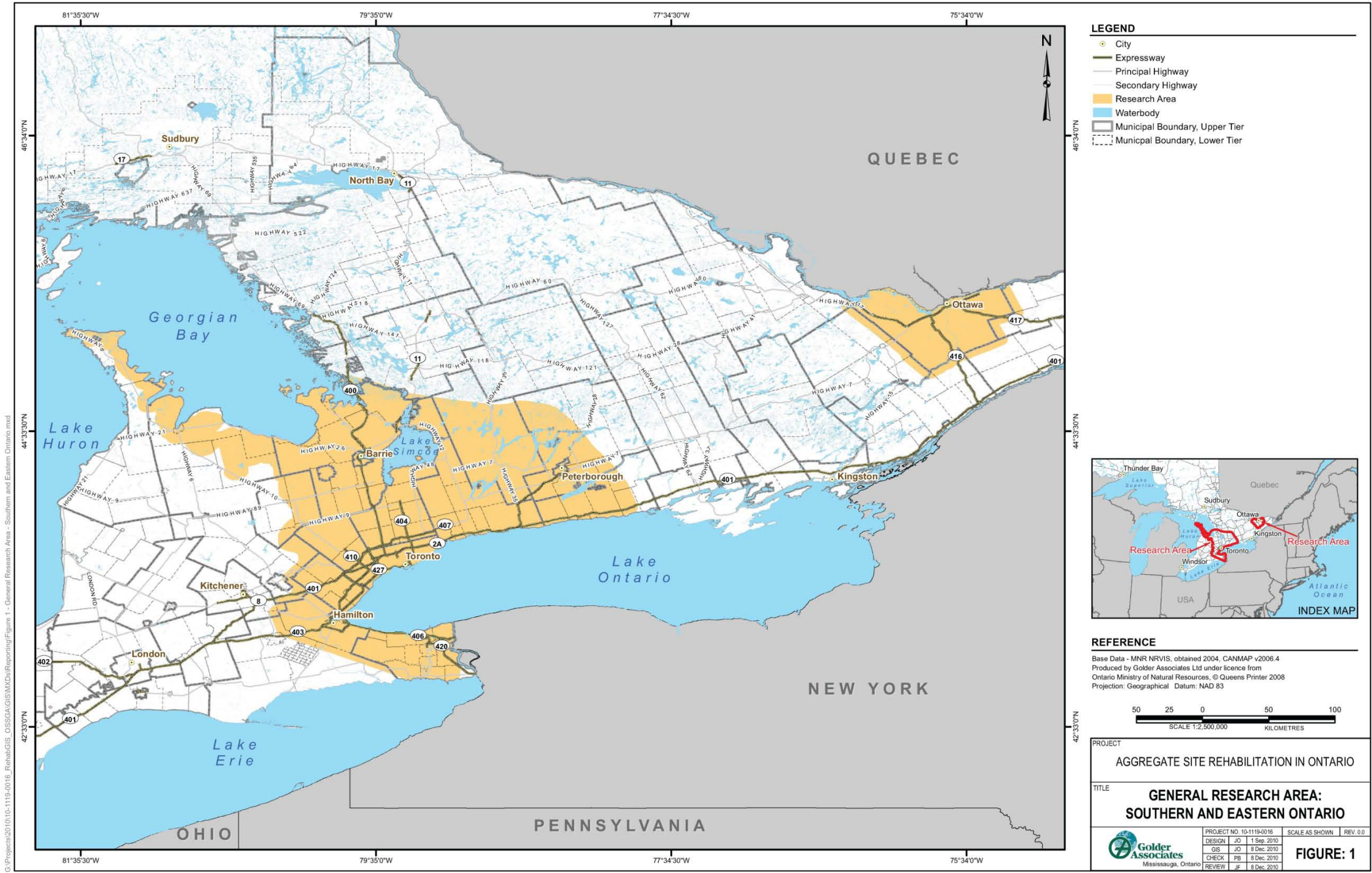


Figure 2: Southern Ontario with Rehabilitated Sites

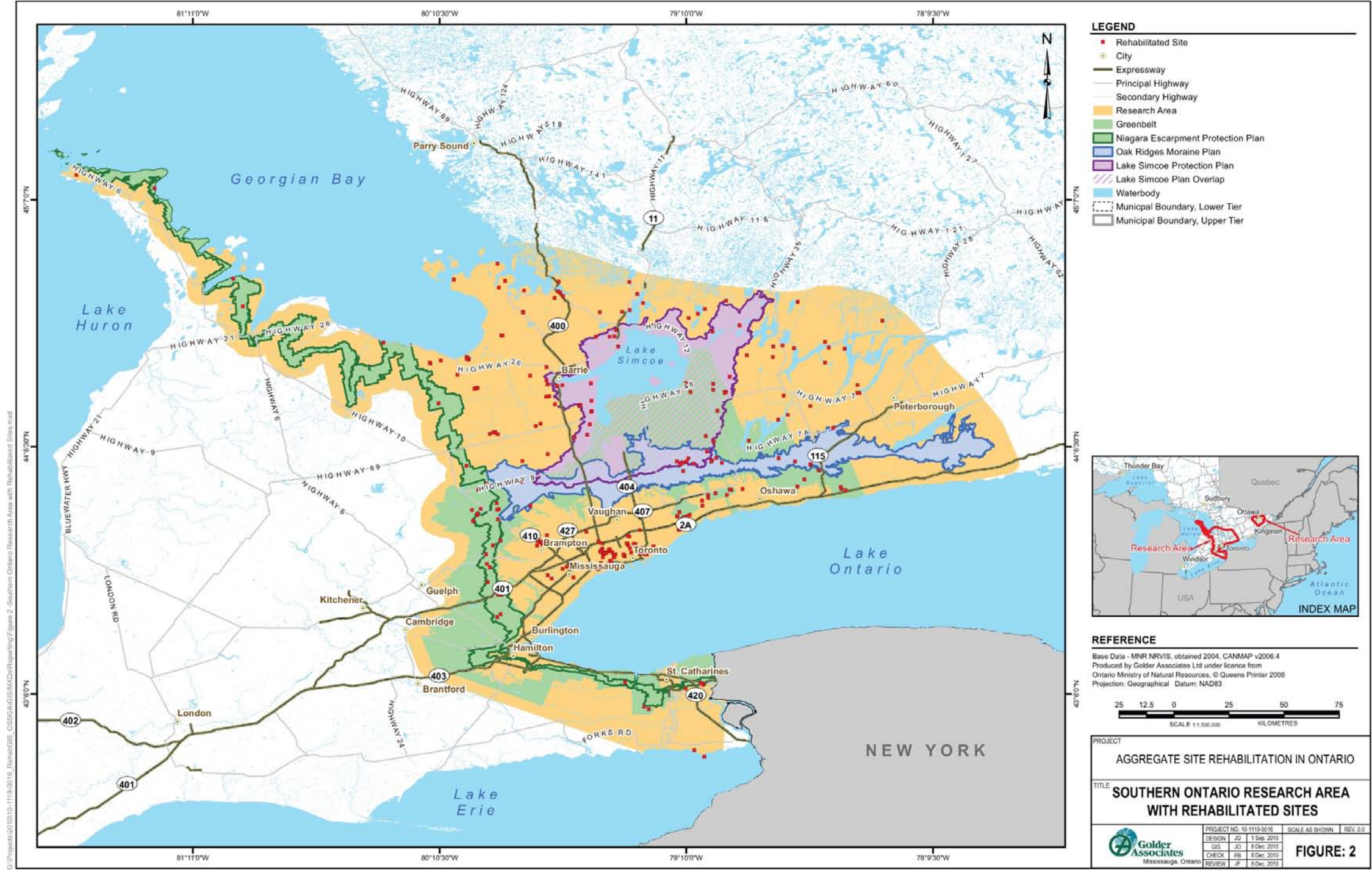


Figure 3: Southern Study Area – Greenbelt Plan

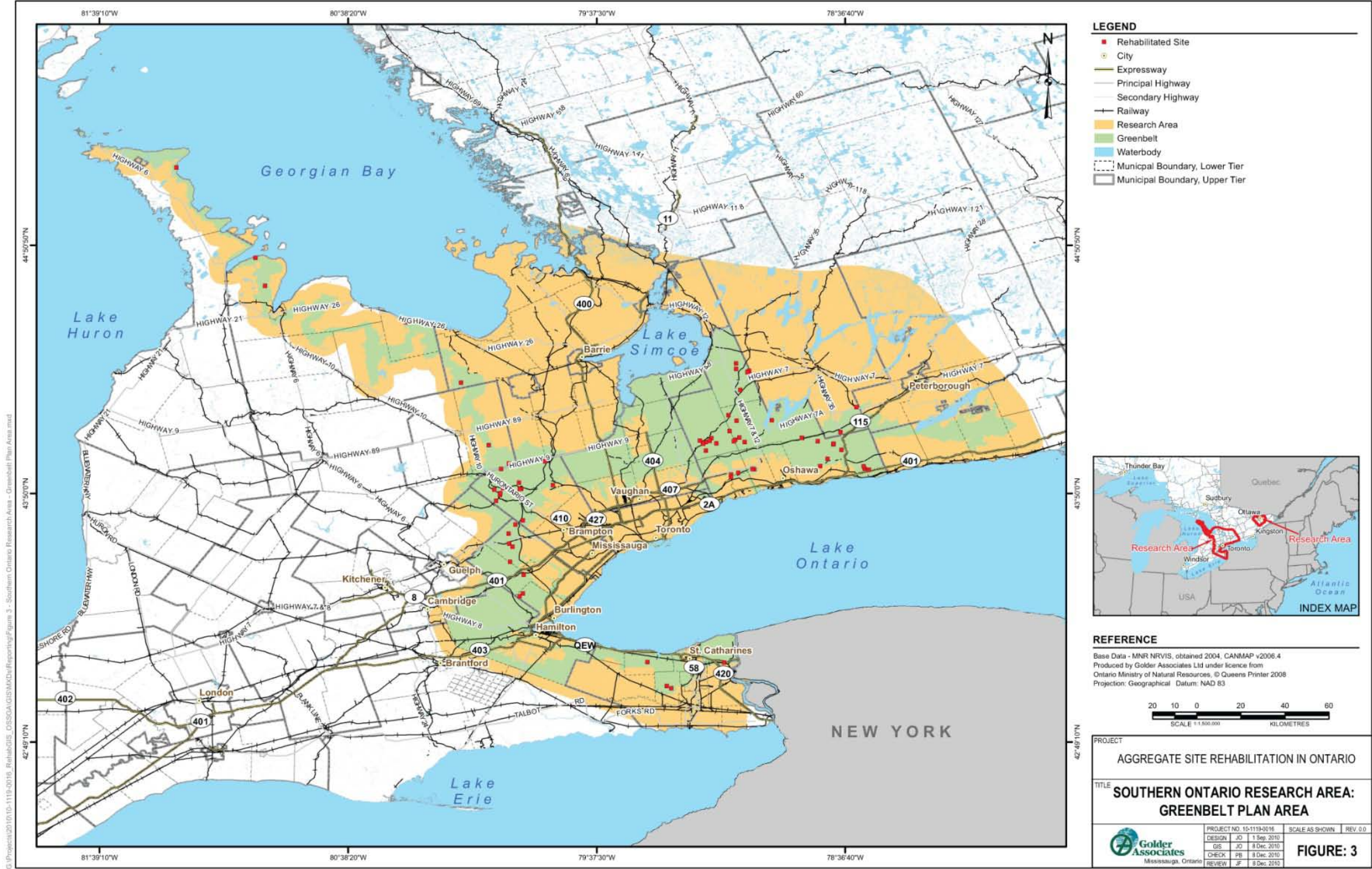


Figure 4: Southern Ontario Study Area – Niagara Escarpment Plan

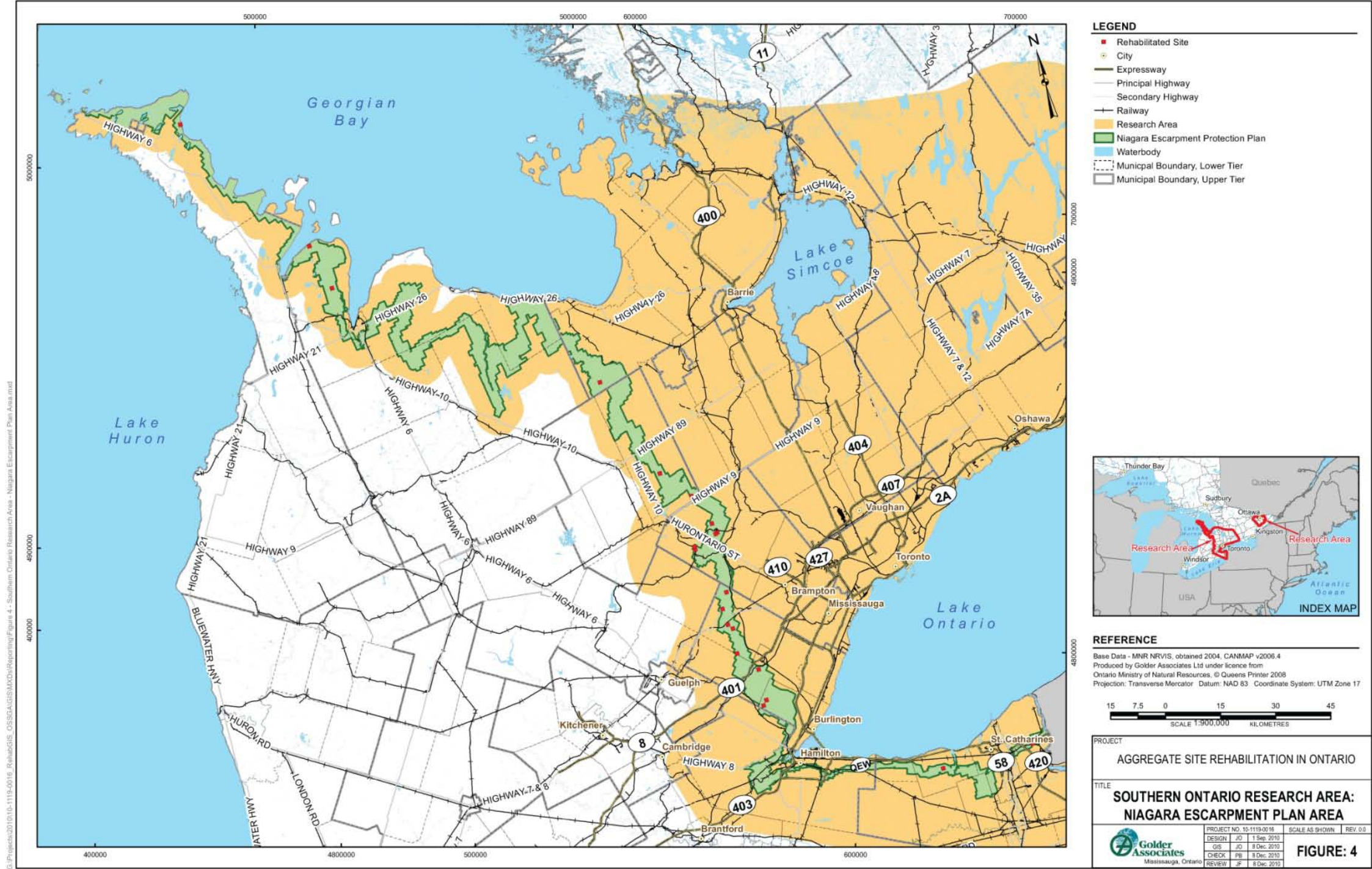


Figure 5: Southern Ontario Study Area – Oak Ridges Moraine Conservation Plan

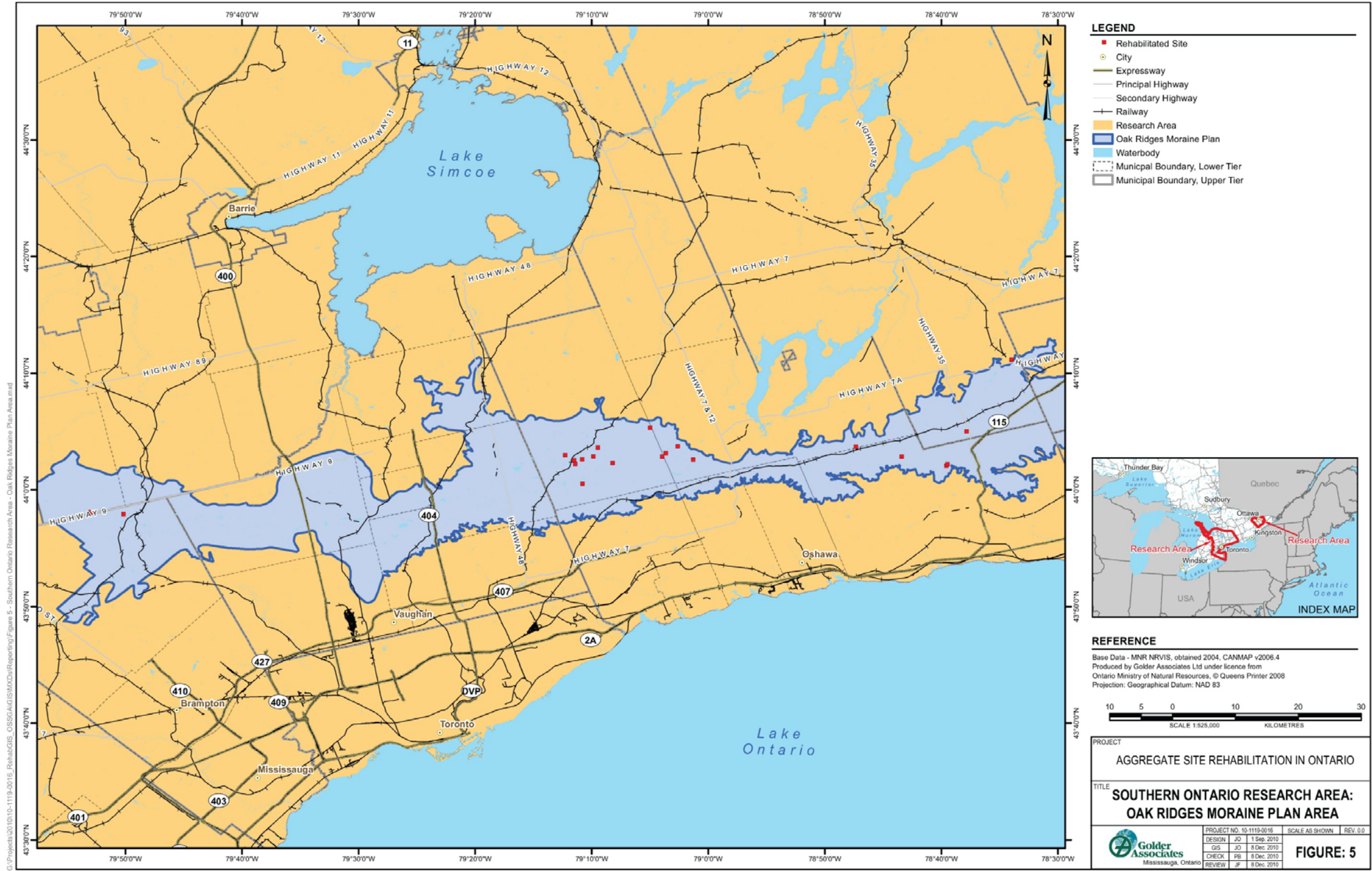


Figure 6: Southern Ontario Study Area – Lake Simcoe Protection Plan

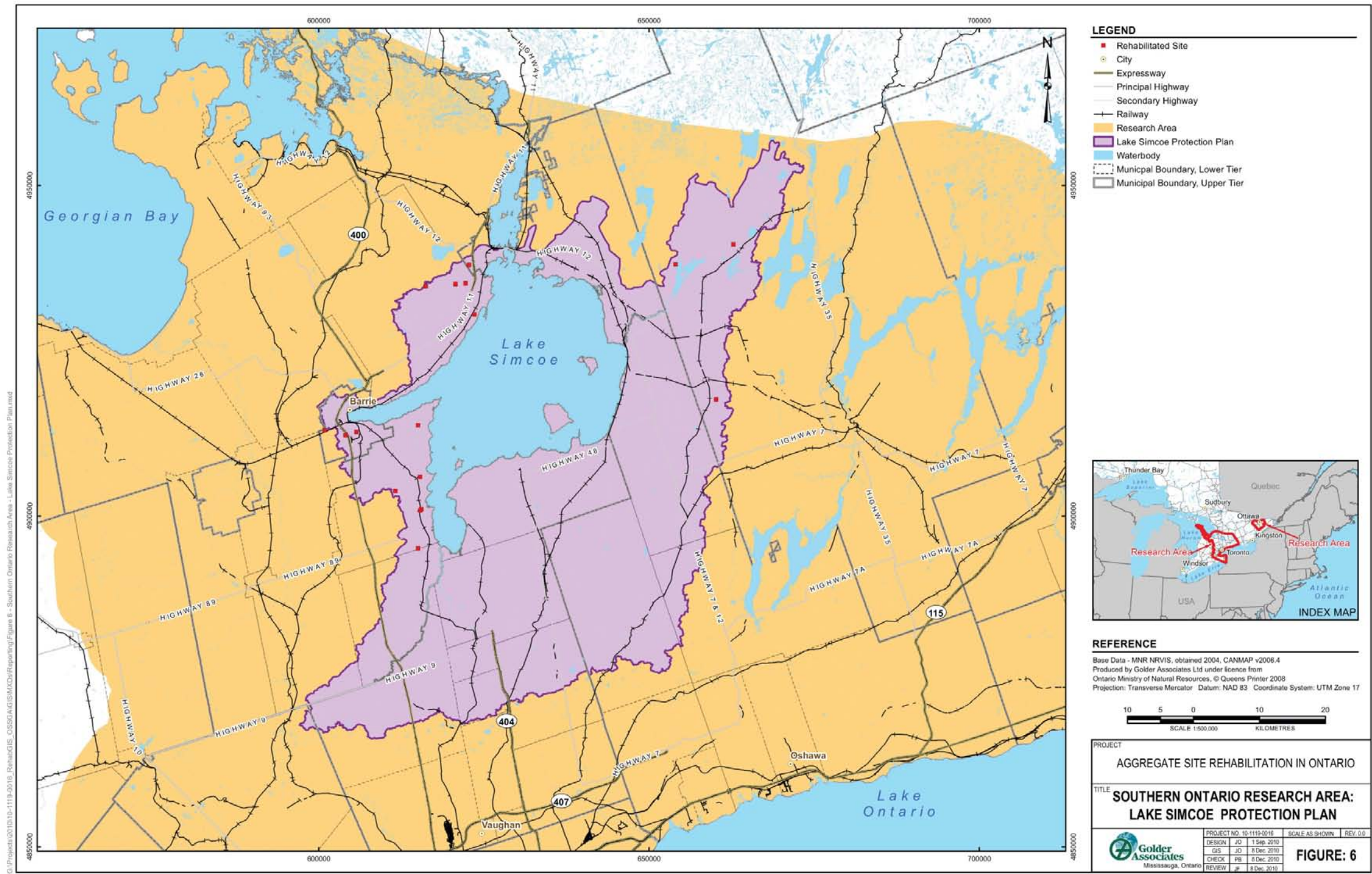


Figure 7: Southern Ontario Study Area – Historical Metropolitan Toronto Pits to Playgrounds Sites

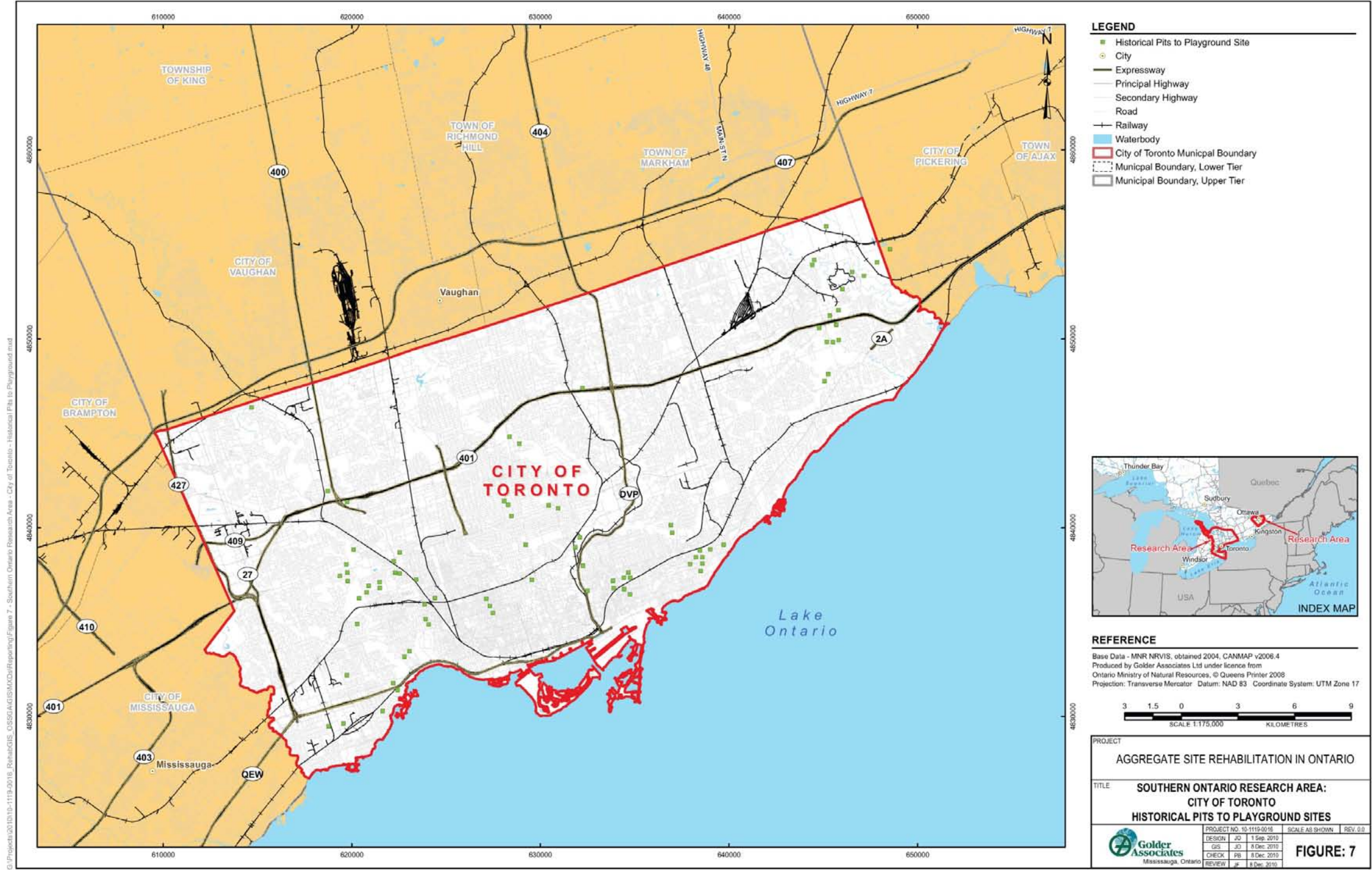
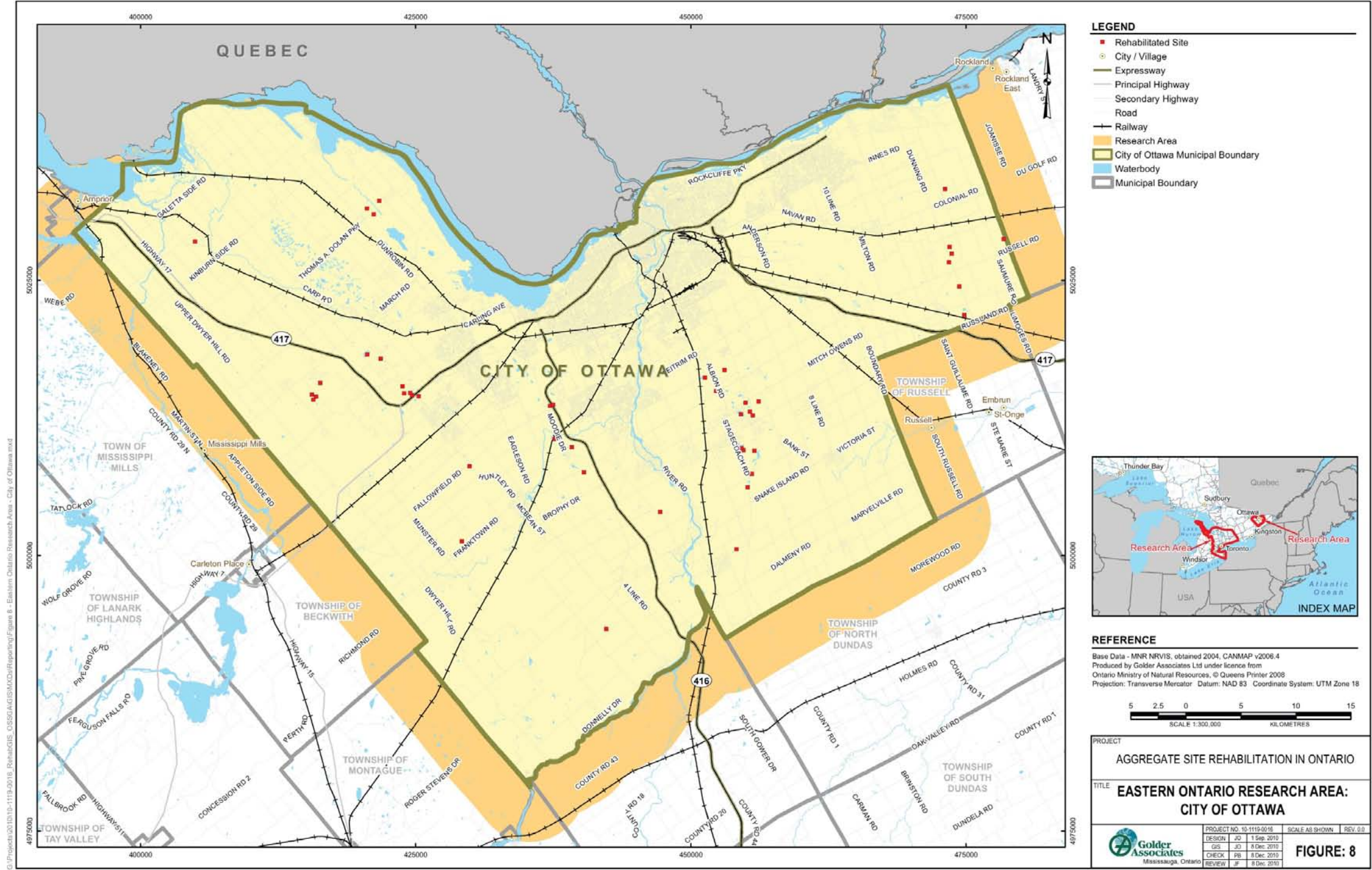


Figure 8: Eastern Ontario Study Area – City of Ottawa



Appendix B: Plan Area Maps

Figure 9: Greenbelt Plan Area

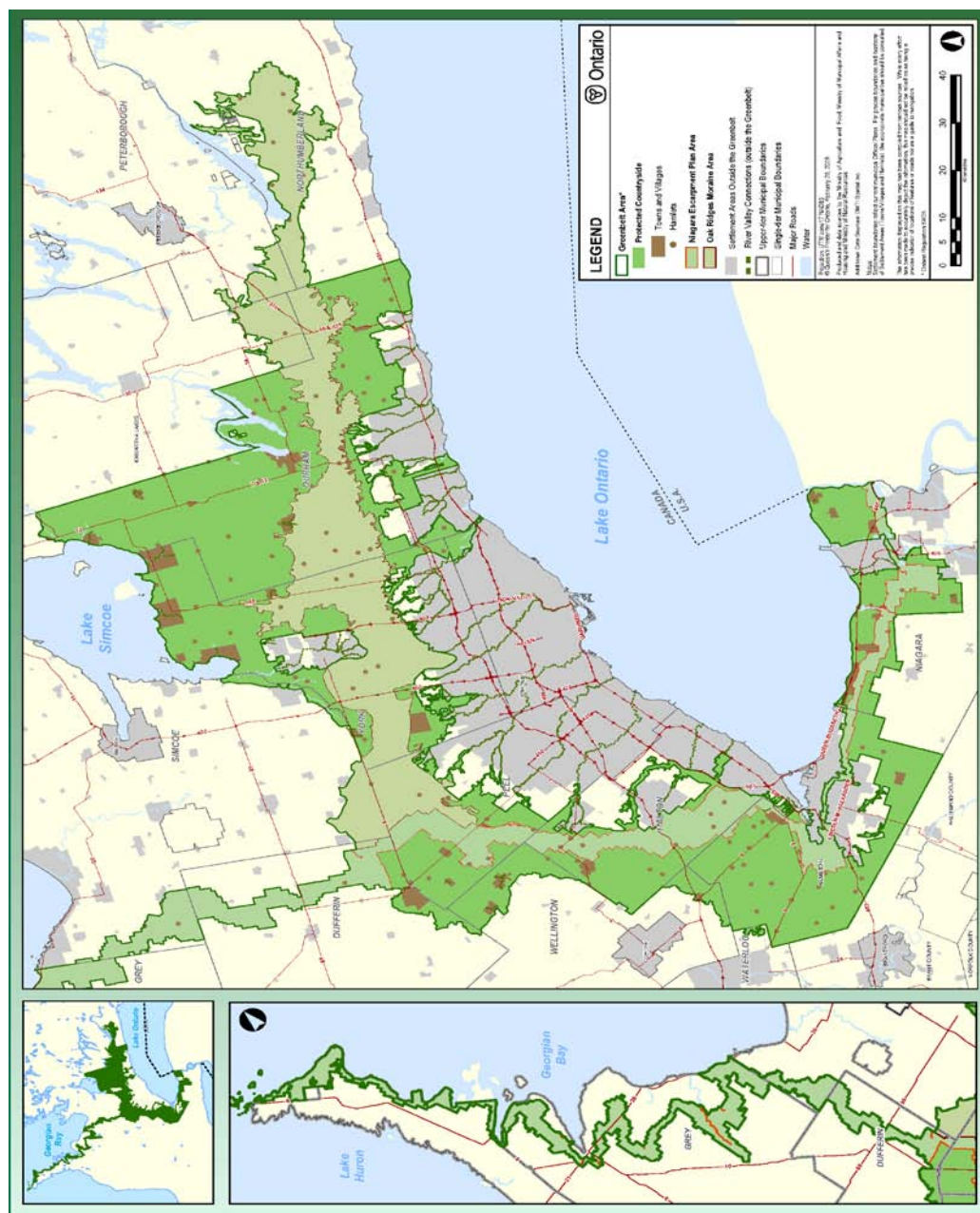
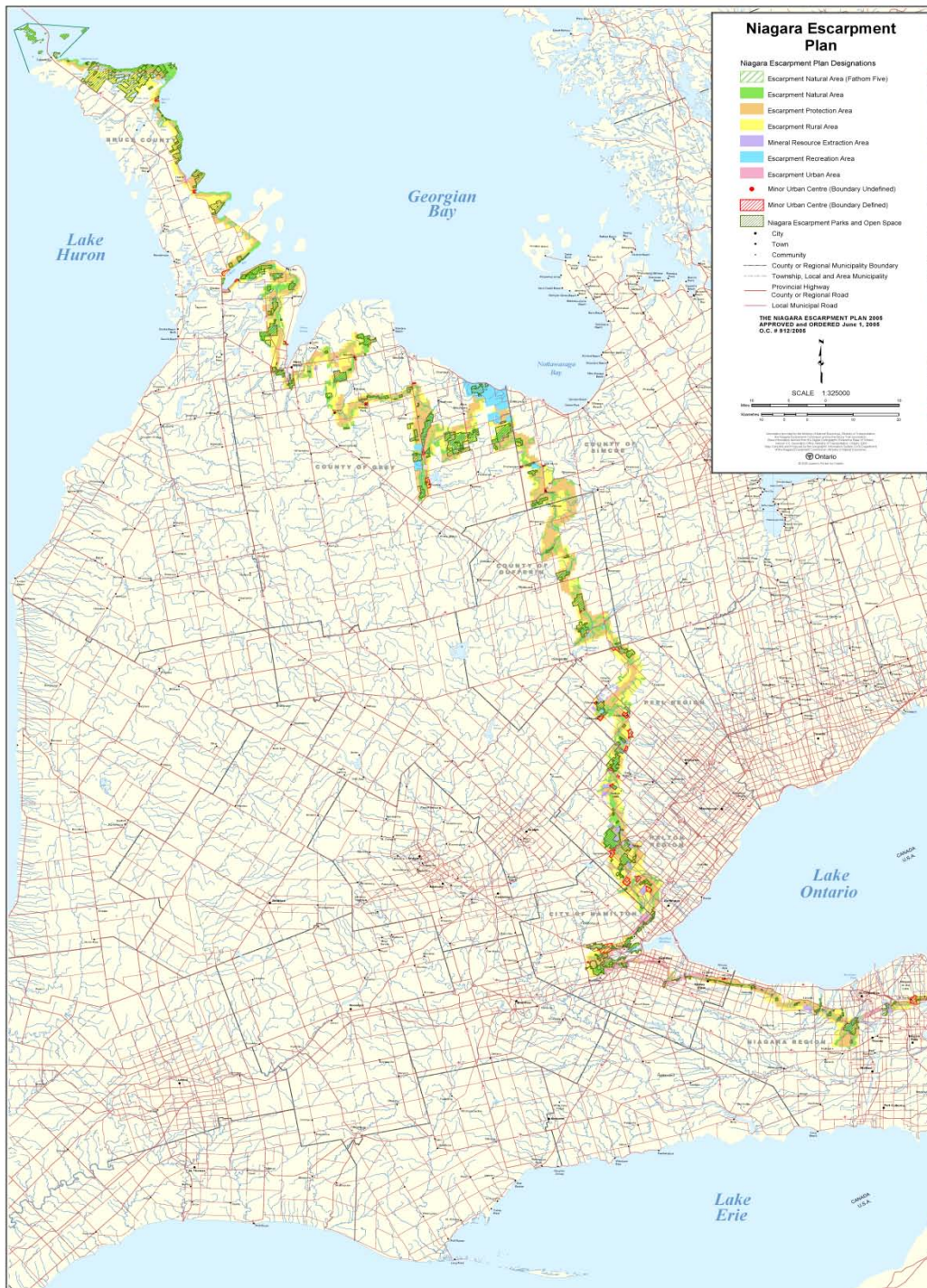
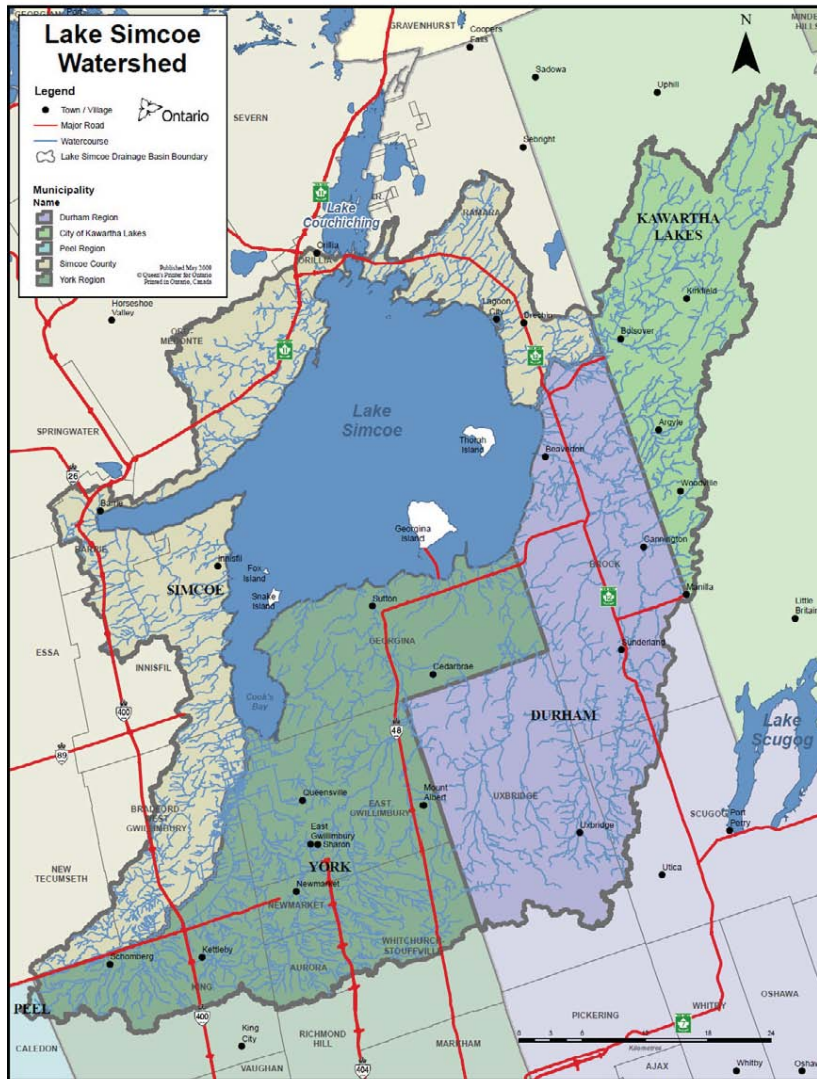


Figure 10: Niagara Escarpment Plan Area



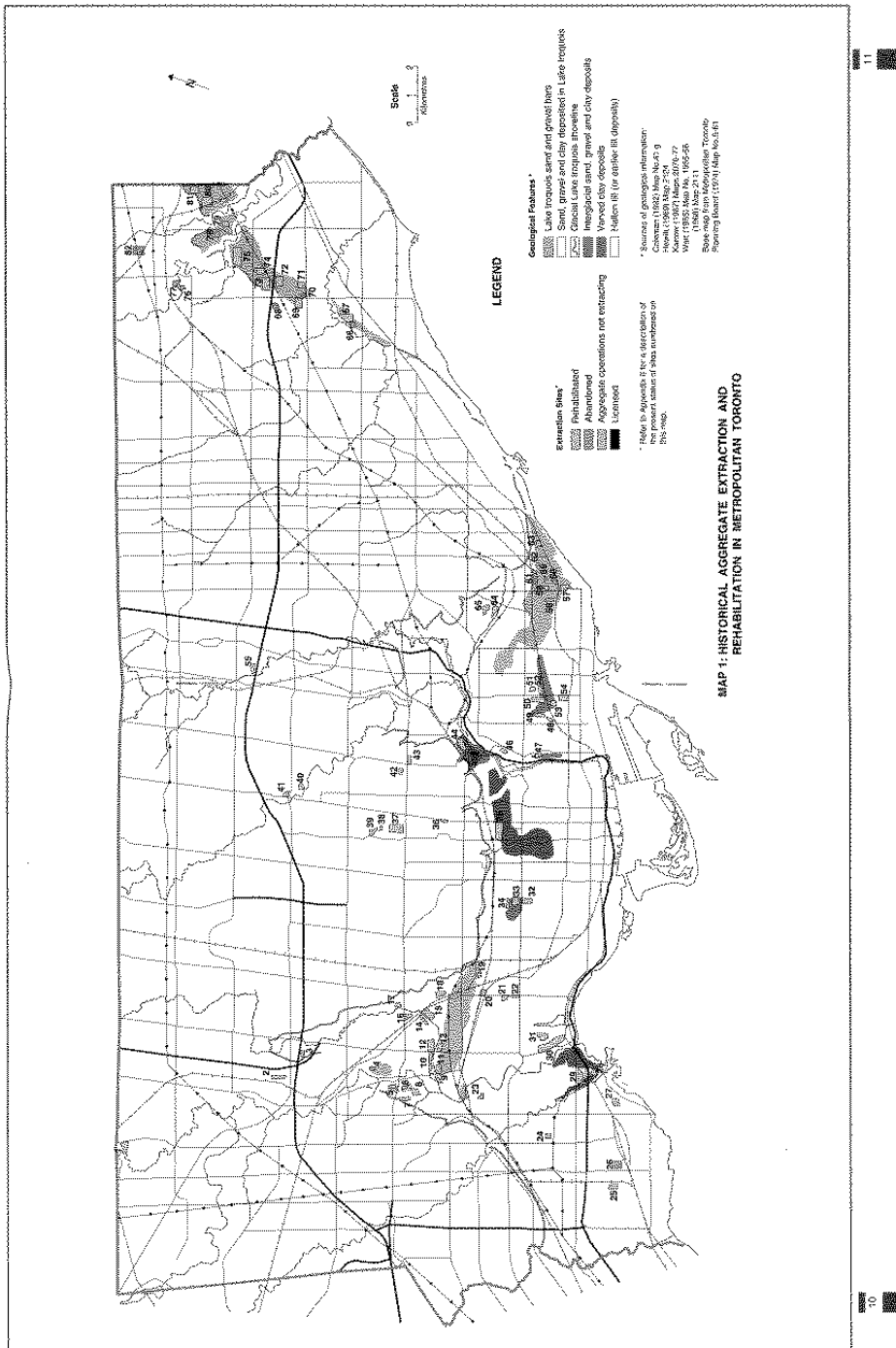
[illegible]

Figure 12: Lake Simcoe Protection Plan Area



Appendix C: Historical Metropolitan Toronto

Figure 13: Historical Metropolitan Toronto (1967)



Appendix D: Field Documentation Sheet

Name: _____

Date: _____

Greenbelt Rehabilitation Study

License # _____	Index _____
Licensee _____	
Lot _____	Concession _____
Geographic Township _____	
Additional Identifier _____	
Pit <input type="checkbox"/> Quarry <input type="checkbox"/>	

Surrounding Land Use	
-----------------------------	--

ELC _____	Native <input type="checkbox"/>
% Tree Coverage _____	Non-Native <input type="checkbox"/>
# Photos Taken _____	

Zoning _____
Official Plan _____
Other Plan _____

Sketch

These field sheets were also used for the Eastern Ontario study area

Current Land Use	
Natural % _____	Cultural Thicket <input type="checkbox"/> Woodland <input type="checkbox"/> Other _____
Open Space % _____	Natural <input type="checkbox"/> Maintained <input type="checkbox"/> Other _____
Water Bodies % _____	Stormwater Management <input type="checkbox"/> Pond <input type="checkbox"/> Restored Watercourse <input type="checkbox"/> Other _____
Agricultural % _____	Vineyard <input type="checkbox"/> Orchard <input type="checkbox"/> Field Crop <input type="checkbox"/> Live stock <input type="checkbox"/> Pasture <input type="checkbox"/> Other _____
Recreational % _____	Private <input type="checkbox"/> Conservation Area <input type="checkbox"/> Golf Course <input type="checkbox"/> Public Park / Sports Field / Playground <input type="checkbox"/> Other _____
Commercial % _____	Professional/Financial Services <input type="checkbox"/> Grocery / Retail <input type="checkbox"/> Restaurants <input type="checkbox"/> Hotel <input type="checkbox"/> Other _____
Industrial % _____	Office <input type="checkbox"/> General Industrial <input type="checkbox"/> Waste Disposal Site <input type="checkbox"/> Other _____
Institutional % _____	School <input type="checkbox"/> Government Office <input type="checkbox"/> Other _____
Residential % _____	Single-Detached <input type="checkbox"/> Semi-Detached <input type="checkbox"/> Townhouses <input type="checkbox"/> Apartment <input type="checkbox"/> Rural <input type="checkbox"/> Other _____
Other % _____	

[illegible]

Appendix E: Glossary

aggregate	naturally occurring material prescribed under Ontario's <i>Aggregate Resources Act</i> , including gravel, sand, clay, earth, shale, stone, limestone, dolostone, sandstone, marble, granite, rock other than metallic ores, or other prescribed material.
area of natural and scientific interest	means an area that has been: (a) identified as having earth science values related to protection, scientific study or education, and (b) further identified by the Ministry of Natural Resources using evaluation procedures established by that Ministry, as amended from time to time;
Ecological Land Classification System	Ontario Ministry of Natural Resources system for defining ecological units on the basis of bedrock, climate, physiography, and corresponding vegetation.
Greenbelt Plan	protection plan identifying where urbanization should not occur in order to provide permanent protection to the agricultural land base and ecological features and functions within the Greenbelt Plan Area.
Greenbelt Plan Area	area governed by the Greenbelt Plan and defined by Ontario Regulation 59/05 to include lands within the Niagara Escarpment Plan Area, the Oak Ridges Moraine Conservation Plan Area, the Parkway Belt West Plan Area, and lands designated as Protected Countryside by the Greenbelt Plan.
historical Metropolitan Toronto	metropolitan area created by the Ontario government in 1953 to include the City of Toronto, Etobicoke, Scarborough, North York, York, and the smaller communities of Leaside, East York, Forest Hill, Mimico, New Toronto, Long Branch, Swansea, and Weston; the term "historical" refers to the period from 1953 to 1967, at which time the boundaries of Metropolitan Toronto were expanded to their current limit.
Lake Simcoe Protection Plan	protection plan allowing research and monitoring policies applicable to areas outside the Lake Simcoe Watershed for the purpose of determining whether

	activities in those areas directly or indirectly affect the ecological health of the watershed area.
Lake Simcoe Watershed	area including Lake Simcoe and the Ontario lands from which water drains into Lake Simcoe.
licence	licence issued under the <i>Aggregate Resources Act</i> for the operation of a pit or quarry.
licence, active	licence status indicating the site is legally active, but does not necessarily mean that aggregate extraction operations are taking place.
licence, amalgamated	licence status indicating the merger of two or more active licensed areas.
licence, surrendered	licence status indicating that all licence fees, rehabilitation security payments, and special payments (if applicable) have been paid, and that rehabilitation has been performed and completed in accordance with the <i>Aggregate Resources Act</i> and Regulations, the site plan, if any, and the conditions of the licence.
licensee	a person or corporate entity to which a licence has been issued under the <i>Aggregate Resources Act</i> for the operation of a pit or quarry.
Ministry of Natural Resources	provincial government ministry responsible for the stewardship of Ontario's provincial parks, forests, fisheries, wildlife, mineral aggregates, and Crown lands and waters—which make up 87% of the province's area—and for sustainably managing the province's natural resources and ensuring that they remain abundant and available for the benefit of future generations.
Niagara Escarpment	area extending 725 kilometres from Queenston on the Niagara River to the islands off Tobermory on the Bruce Peninsula, and including a variety of topographic features and land uses.
Niagara Escarpment Plan	protection plan providing for the maintenance of the Niagara Escarpment and the land in its vicinity as a substantially continuous natural environment, and designed to ensure that only development compatible with that natural environment occurs in the area.

non-renewable resources	non-agricultural natural resources of which there is only a finite supply, including mineral aggregates.
Oak Ridges Moraine	geological landform extending 160 kilometres from the Trent River in the east to the Niagara Escarpment in the west.
Oak Ridges Moraine Conservation Plan	ecologically-based protection plan established to provide land use and resource management direction for the 190,000 hectares of land and water within the Oak Ridges Moraine.
pit	land or land under water from which <i>unconsolidated</i> aggregate is being or has been excavated, and that has not yet been rehabilitated; does not include land or land under water that has been excavated for a building or structure on the excavation site or in relation to which an order has been made under Section 1(3) of the <i>Aggregate Resources Act</i> .
quarry	land or land under water from which <i>consolidated</i> aggregate is being or has been excavated, and that has not yet been rehabilitated; does not include land or land under water that has been excavated for a building or structure on the excavation site or in relation to which an order has been made under Section 1(3) of the <i>Aggregate Resources Act</i> .
rehabilitation	treatment of land from which aggregate has been excavated so that the use or condition of the land is restored to its former use or condition, or so that the use or condition of the land is changed to another use or condition that is compatible with surrounding land uses.
site	land or land under water to which an aggregate application, permit, or licence applies.
zoning by-law	a by-law passed under Section 34 or Section 38 of Ontario's <i>Planning Act</i> , or under any predecessor legislation, and including an order made under Section 47(1)(a) of the <i>Planning Act</i> or predecessor legislation and zoning control made effective by a development permit issued under the <i>Niagara Escarpment Planning and Development Act</i> .

Appendix F: References and Acknowledgements

References

- Aggregate Resources. (1990). Act, R.S.O. 1990, Chapter A.8. Website last accessed September 15, 2010. <http://www.e-laws.gov.on.ca/index.html>
- Bauer, Anthony M., A Guide to Site Development and Rehabilitation of Pits and Quarries, Ministry of Natural Resources, 1970
- Brodtkom, F. (2000). Good Environmental Practice in the European Extractive Industry: A Reference Guide. A Study for Cembureau, Cerame-Unie, EULA, Eurogypsum, Euro-ROC, IMA-Europe, UEPG. Website last accessed August 4, 2010 http://www.ima-eu.org/good_practise.html
- Coates, W.E. and Scott, O.R., A Study of Pit and Quarry Rehabilitation in Southern Ontario, Ministry of Natural Resources, 1979.
- Hilditch, Tom. W., Sinclair, George A. and Hughes, Christopher P., Rehabilitation of Pits and Quarries for Forest Production, Ministry of Natural Resources, 1988.
- Lowe, S.B., Trees and Shrubs for the Improvement and Rehabilitation of Pits and Quarries in Ontario, Ministry of Natural Resources, 1979
- Mackintosh, E.E. and Hoffman, M.K., Rehabilitation of Sand and Gravel Pits for Fruit Production in Ontario, Ministry of Natural Resources, 1985
- Mackintosh, E.E. and Mozuraitis, E.J., Agriculture and the Aggregate Industry: Rehabilitation of Extracted Sand and Gravel Lands to an Agricultural After-Use, Ministry of Natural Resources, 1982.
- Michalski, Mihael F. P., Gregory, Daniel R. and Usher, Anthony J., Rehabilitation of Pits and Quarries for Fish and Wildlife, Ministry of Natural Resources, 1987
- Miller, R. J. and Mackintosh, E.E., Sand and Gravel Pit Rehabilitation in Northern Ontario, Ministry of Natural Resources, 1985
- Ontario Ministry of Municipal Affairs and Housing, 2005. *Greenbelt Plan*.
- Ontario Ministry of Municipal Affairs and Housing, 2002. *Oak Ridges Moraine Conservation Plan*.
- Ontario Ministry of Natural Resources, 1990. *Aggregate Resources Act*.
- Ontario Ministry of Natural Resources, 2005. *Niagara Escarpment Plan*.
- Planning Act. (1990) R.S.O. 1990, c.13. Website last accessed November 4, 2009. <http://www.e-laws.gov.on.ca/index.html>

Planning & Engineering Initiatives Ltd., 1992. *Aggregate Resources of Southern Ontario: A State of the Resource Study*.

Rehoukova K. and Prach K. (2008). Spontaneous Vegetation Succession in Gravel–Sand Pits: A Potential for Restoration. *Restoration Ecology*, 16, 305-312.

Richardson, P. and Larson, D. (2009). Diversity and Resistance to Simulated Climate Change. The Ontario Aggregate Resources Corporation

The Ontario Aggregate Resources Corporation. Pit and Quarry Rehabilitation: The State of the Art in Ontario. Website last accessed November 4, 2009.

http://www.toarc.com/publications_rehabilitation.asp

Trimble, K. and M. Seibert. (2002). An evolution of reclamation approaches through the life of a southern Ontario gravel pit. Paper presented at the 2002 National Meeting of the American Society for Surface Mining and Reclamation. Lexington, Kentucky. June 9-13th.

Yundt, S.E. and Augaitus, D.B., From Pits to Playgrounds: Aggregate Extraction and Pit Rehabilitation in Toronto – A Historical Review, Ministry of Natural Resources, 1979, (Revised 1992)

Yundt, S.E. and Lowe S.B. (2002). Quarry rehabilitation: Cliffs, landforms, and ecology. Proceedings of the 26th Annual British Columbia Mine Reclamation Symposium, Dawson Creek, British Columbia.

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