# A Natural Heritage System for the St. Clair River Watershed

**FINAL DRAFT**

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## 1.0 INTRODUCTION

Recent advances in conservation biology have emphasized the need to take a holistic, landscape approach to the conservation of natural resources and maintenance of biological diversity (biodiversity). This follows from the recognition that connections among the environments biotic and abiotic elements extend beyond the limits of discrete remnant natural features (woodlots, wetlands, *etc.*) and reach across landscapes. Within the St. Clair River Remedial Action Plan (RAP) Area of Concern (AOC), the maintenance/restoration of wildlife habitat and riparian buffers in the upper watershed is inextricably linked to water quality and wildlife populations in the St. Clair River itself. Recognition of this provides the impetus to undertake a landscape level analysis of natural features and develop a conservation plan that can guide protection, rehabilitation and restoration initiatives in the future. This type of conservation plan is referred to in this report as a Natural Heritage System (NHS).

The NHS map (figures 2a and 2b) provided with this report should be used to guide the various implementing agencies, the RAP Implementation Committee (RIC), Ontario Ministry of Natural Resources (OMNR), Ontario Ministry of Environment and Energy (MOEE), Michigan Department of Natural Resources (MDNR), County of Lambton, St. Clair County, individual Townships, and assorted agencies and stewardship groups in making land use decisions. Each implementing agency needs to execute the NHS within the context of their own mandate. The framework serves as a focal point whereby, if all factions contribute, a cohesive, ecologically-based natural areas protection system will result. This should increase the quality and quantity of fish and wildlife habitat throughout the watershed. NHS implementation will contribute to the eventual delisting of the St. Clair AOC through the improvement of impairments such as water quality and wetland, riparian and upland habitats.

### 1.1 Purpose of Study

The purpose of this study is:

> *to develop a framework for a Natural Heritage System which works towards meeting the targets and thresholds, originally established by the Draft Framework (see section 4.1 for Draft Framework discussion, as refined by the RAP Implementation Committee (RIC) and Binational Public Advisory Council (BPAC) for the St. Clair River study area*

The study, as defined, has the following three objectives:

- to incorporate the existing natural areas - upland, riparian and wetland (some of which may have special designation/protection based on their natural values) in the formation of a Natural Heritage System;

- to identify additional areas for restoration or rehabilitation to enhance the Natural Heritage System; and

- to establish a framework from which a Natural Heritage System landscape can be developed which will provide the best opportunity to ensure long term biodiversity and habitat

conservation, by connecting natural areas representing the complete range of natural features/values inherent to the region.

## 1.2 Study Area Defined

The Stage II Recommended Plan for the St. Clair River RAP identifies the need to broaden the scope of the RAP to encompass the immediate drainage basin of the St. Clair River, in order to more comprehensively address the environmental problems defined in the Stage I RAP. The inclusion of the St. Clair River watershed is considered essential for the RAP, as activities anywhere within the drainage basin can lead to downstream impacts (MOEE and MDNR 1995).

The *Study Area* defined for the present habitat review and NHS framework development includes St. Clair County in Michigan and has been expanded to include the North Sydenham River, Bear Creek and Black Creek subwatersheds in Ontario (figure 1). The extent of the study area, as defined in this report, covers an area of approximately 378,035 ha (181,460 ha in Ontario and 196,575 ha in Michigan).

## 1.3 Natural Heritage Systems - Criteria and Principles

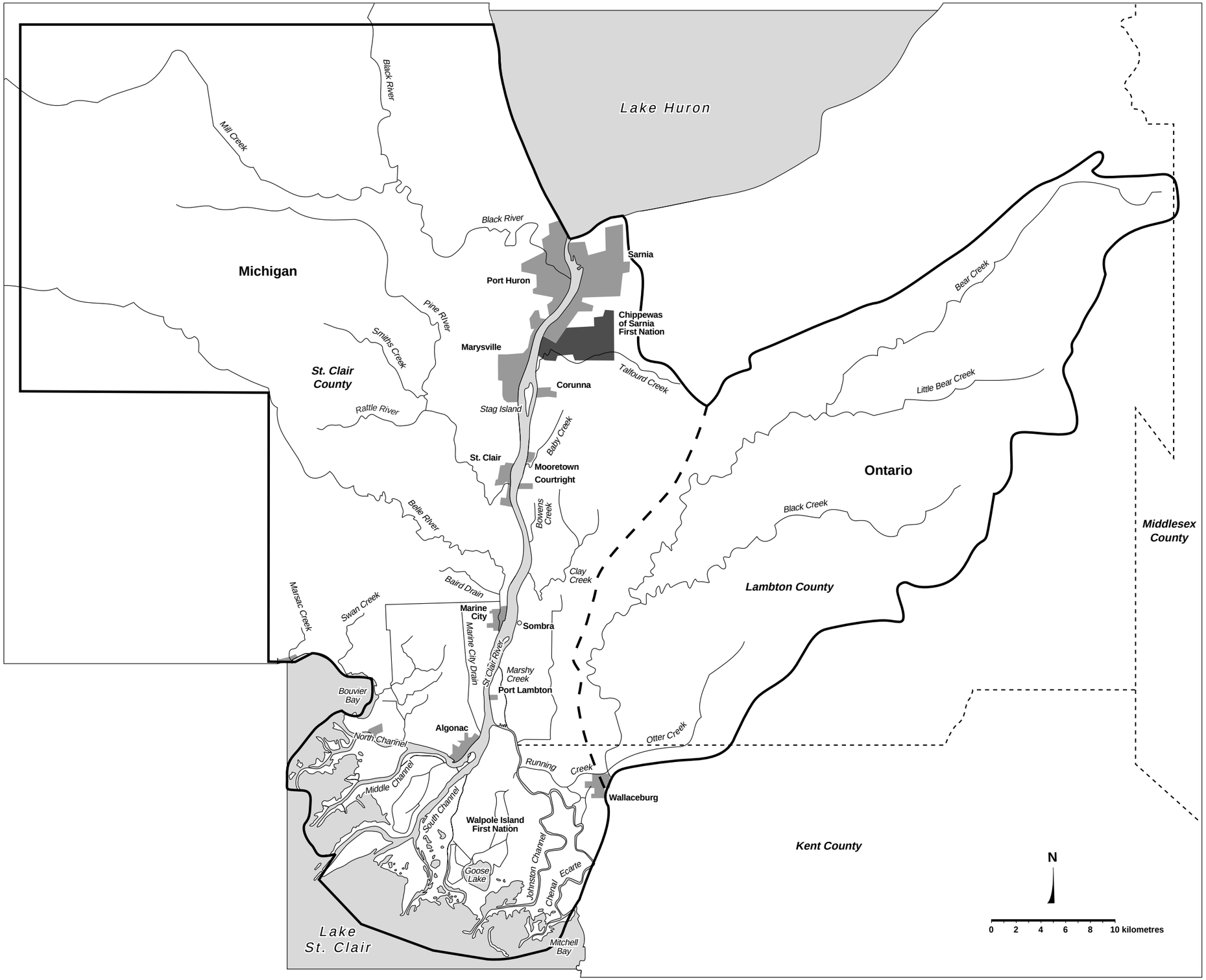
### *1.3.1 Rationale for a Natural Heritage System*

In recent years the concepts of "Greenlands", "Natural Heritage Areas" and "Natural Environment Systems" have made important contributions to the planning process in Ontario. Riley and Mohr (1994) explain the ecological principals underlying these concepts and provide a useful template for their implementation in southern Ontario. Areas protected using these concepts are delineated on the basis of ecosystem process (function), ecosystem linkages, and structure (species and community composition). This has to be undertaken within the context imposed by past land use and existing conditions. Although interest in the environment and the protection of ecological systems has been espoused for over two decades, it is only within the past two to five years that the non-built environment has received full recognition as an integral part of our living space in southern Ontario.

It is critical that the natural ecological functions performed by remnant natural systems be maintained and enhanced. These functions not only regulate the fundamental conditions for our survival (*e.g.*, maintenance of atmospheric gases; oxygen, carbon dioxide and nitrogen, in the correct proportions), but also supply the necessary components for growing food, ameliorating the climate, preventing soil erosion, controlling sedimentation, providing wildlife habitat, maintaining migration and nursery habitats, recharging water catchment and ground water reservoirs, *etc.* de Groot (1992, table 4, page 27) lists 37 functions that the environment performs, all of which contribute to human well-being and quality of life.

**Figure 1**

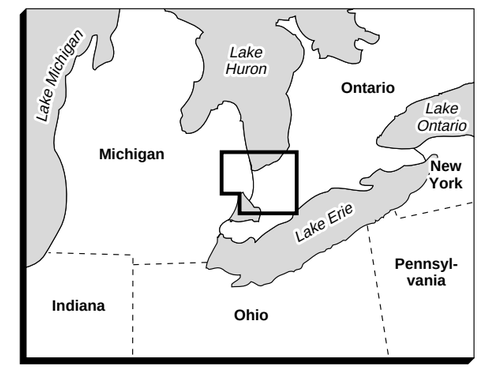
## *St. Clair River Watershed Natural Heritage System Study Area*




### Legend

- Natural Heritage System Study Area
- Subwatershed Boundary
- County Boundary

### Study Area Location



Beyond the importance of protecting the ecosystem for environmental reasons, the natural environment is an important part of our cultural heritage. We can gain a sense of belonging, of having roots, through the appreciation of the landscapes inhabited and shaped by the First Nations people of North America who lived in southern Ontario for thousands years prior to the arrival of European settlers. These are the landscapes of seemingly endless forests, savanna and prairie which are referred to in the early survey reports of the first European settlers.

Over the last ten years our understanding of the impacts that degrade urban natural areas, and the extent to which they can or cannot be mitigated, has greatly increased. New areas of research such as "biological conservation" and "restoration ecology" have emerged and are continually providing new insights into the importance of protecting remnant ecosystems, and how protection can be achieved while allowing for long-term ecosystem management. It is these advancements that have, in part, precipitated the greater awareness of environmental degradation and the desire to protect remnant natural environments.

### *1.3.2 Conservation Biology and the Protection of Natural Areas*

<u>The role of core protected areas</u>

The fragmentation of previously large, contiguous, undeveloped blocks of habitat has created many isolated, remnant natural areas in southern Ontario. This can best be seen where forests, wetlands and prairie remnants become “islands of green” surrounded by human agricultural or urban development.

The deleterious effects of habitat fragmentation on plants and animals are in some cases obvious and easily explained. For example, some animals such as wolf, bear, and fisher regularly travel over large distances to forage, breed or to seasonally migrate. The home range for animals such as these is often much larger than the size of the remaining natural areas in a fragmented landscape. The result of fragmentation is that even though the remaining natural areas may be of high quality and therefore constitute suitable habitat for wide ranging species, these species are not present due to the fact that they will not travel through the intervening “developed” (urban or agricultural) landscape to reach isolated habitat patches.

In other cases, the effects of habitat fragmentation may not be as obvious. For example, within small, isolated natural areas the number of individuals of each species will be limited by the availability of resources. When breeding is limited to a small, isolated population, inbreeding occurs and this may result in reduced vitality, potentially leading to local extinction. For the long term maintenance of viable populations it is therefore important to determine the minimum viable population size (MVP) and the corresponding habitat area required to accommodate MVP. Studies suggest that for some animal species MVP ranges from between 500 to 10,000 individuals (Soulé 1987).

Another concern of habitat fragmentation is the impact of the local extinction of a species in a habitat patch due to unforseen, random natural events. Local extinction events of a population are a natural, relatively common occurrence in long-term ecological time-frames. For instance, a particularly hard winter, a 100 year storm event or the introduction of a predator or disease could eliminate a species

in a small isolated patch. In a landscape that is connected, the patch would be recolonized in time by individuals which survived in nearby areas. In a fragmented landscape, however, recolonization is unlikely to occur owing to the difficulties of crossing inhospitable, developed landscapes. Over time this can result in an ongoing reduction of the biodiversity of the remnant patches, and therefore, over the landscape.

The retention of very large natural core areas (>1000 ha) remains the best method to preserve plants and animals. However, in southern Ontario there are very few undeveloped areas large enough to adequately protect a representative range of flora and fauna and maintain the ecological function of natural environments. The natural landscape is fragmented and the long term survival of plants and animals which move through the landscape is becoming increasingly dependent on the establishment of natural corridors that link smaller natural areas. For this reason research in conservation biology is concentrating on regional approaches to biodiversity conservation through the establishment of integrated core and corridor protection areas, such as those developed in Natural Heritage Systems.

From the outset, however, it is worth noting that fragmented landscapes characterized by intense urban and agricultural development cannot be expected to support a complete assemblage of indigenous flora and fauna even with substantial corridor linkages. This is due to the fact that human habitation results in significant impacts that cannot, in every instance, be mitigated through the creation of landscape corridors.

The role of corridors and linkages

In an undisturbed natural environment plants and animals move within the landscape in both random and select patterns. Movement patterns vary greatly, both between species and within species, depending on the reason for the movement. Some categories of animal movement patterns are as follows:

- **foraging behaviour** may be local for small mammals (measured in tens of metres) or very wide ranging for large predators (measured in tens or hundreds of kilometres);
- **seasonal movements** in response to changing weather is often a part of the survival strategy for animals. Some animals seek out specific, local overwintering sites while others, such as birds, make long distance migrations;
- **breeding behaviour** often involves movement as animals search for a mate or to locate specific rearing or nesting habitat; and
- **dispersal** is generally a random event in time, distance and direction, often involving the longest distance animals move. Progeny usually must disperse from parental territory in animal and plant species which live longer than one year in order to ensure resource sharing. Animals with large home ranges (large mammals, birds) force progeny to disperse over longer distances in search of new habitats. As a movement pattern, dispersal is also important to the long term survival of species due to its role in contributing to evolution through cross-breeding and through re-colonization following natural disasters or long term climate change.

As natural environments become increasingly developed by human activity, the normal movement patterns of organisms are disrupted. Unfortunately, it is difficult to assess the impact of disrupted

movement patterns on the health and survivorship of plants and animals inhabiting a region. Given the fundamental biological roles of the movement listed above, it must be assumed that the ability of organisms to maintain natural movement patterns is crucial to their survival. Consequently, designing Natural Heritage Systems for species preservation must give due consideration to accommodating movement patterns if long term protection is to be achieved.

Knowing about the movement patterns of the individual species which inhabit an area will yield important information which will guide the design of a core and corridor protection system. The more biological data which is used in selecting the location, size, vegetation types, *etc.* of habitat corridors, then greater is the likelihood that organisms will use these areas as functional links connecting core protected areas.

### 1.4 Habitat Targets and Thresholds - A *Draft Framework*

The need for a ecosystem-based approach, like a Natural Heritage System, for guiding the rehabilitation of habitats within AOC watersheds is provided in "*A Draft Framework for Guiding Habitat Rehabilitation in Great Lakes Areas of Concern*" (Environment Canada *et al.* 1996), hereafter referred to as the *Draft Framework*. Although this document does not specifically address the development of an NHS, it draws on the same basic tenets and can be used to identify targets for habitat conservation in an NHS.

The *Draft Framework*, produced by Environment Canada-Canadian Wildlife Service (CWS), Ontario Ministry of Natural Resources (OMNR) and the Ontario Ministry of Environment and Energy (MOEE), provides targets and thresholds for several parameters in three habitats: wetland, riparian and upland. The authors note in the report that the targets, *"... are to be considered minimum requirements"* (page 1). Additional comments indicate that, "*In many cases, there may be circumstances that preclude reaching 100% of the target ...*" and that, "*Thresholds are designed to guide RAP teams and PACs* [Public Advisory Councils] *who may feel the AOC can be de-listed even though it does not meet the targets.*" (page 1).

There are three associated issues addressed in the *Draft Framework* that deserve reiteration here:

1) "*... the protection of existing habitat must remain the most important planning activity in an AOC.*" This is a fundamental tenet of an NHS developed in the highly fragmented landscape of southern Ontario. There are so few remaining native woodlands, wetlands and significant habitats - and those that do remain are all disturbed to varying degrees - that their retention as the core areas on which to build an NHS must be accepted;

2) The management of habitats for fish and wildlife must go beyond the AOC boundaries. This is consistent with the NHS approach, which recognizes that boundaries must be ecologically determined; and

3) Representivity must be considered in the identification of components (natural features and areas for rehabilitation) within the NHS. Representivity refers to a consideration of the range and proportion of habitat types or ecosystems that formed the original (pre-European settlement)

landscape. Thus, meeting the target for all upland forests with maple/beech communities, when the original forests were composed of maple, beech, pine, hickory, oak, elm, hemlock, and basswood in various mixtures, does not satisfy the representation requirement. Similar examples can be provided for wetlands, grasslands and aquatic habitats. Representivity is critical if biodiversity issues are to be successfully addressed owing to the need for a diverse array of indigenous communities.

The *Draft Framework* presents a series of suggested habitat criteria, in the form of targets and corresponding thresholds, which would provide a greater degree of native biodiversity within the natural environment. The targets represent minimum goals for upland, riparian and wetland habitats that can be achieved through protection, restoration or rehabilitation. The threshold values suggest what level of viability and/or protection to the environment a habitat may provide at reduced target figures (Tables 1 to 3).

Table 1. *Draft Framework* targets and thresholds: upland forest habitats.*

| Parameter | Target | Threshold and Level of Protection Provided | |
|---|---|---|---|
| percent forest cover in watershed | >30% | 20-30%<br>15-20%<br>10-15%<br><10% | 90% of bird species<br>80% of bird species<br>60-70% of bird species<br>50-60% of bird species, but only approximately 20% of forest interior species |
| size of largest forest patch | 100 ha minimum | none provided | |
| % of watershed that is interior forest >100 m from edge | >10% | 5-10%<br>2-5%<br><2% | 80-90% of interior bird species<br>60-80% of interior bird species, but restricted distribution<br>maximum 50% of interior bird species, 1 or 2 locations |
| % of watershed that is interior forest >200 m from edge | >5% | 3-5%<br>1-3%<br><1% | 70-80% of bird species<br>40-70% of bird species, restricted distribution<br>fewer interior species |

* Source: Environment Canada *et al.* (draft) 1997

Table 2. *Draft Framework* targets and thresholds: riparian habitats.*

| Parameter | Target | Threshold and Level of Protection Provided | |
|---|---|---|---|
| % natural vegetation along streams | 75% natural vegetation | 50-75% | may maintain stream function |
| | | 25-50% | some nutrient enrichment, algae and erosion problems |
| | | <25% | degraded stream |
| | 75% buffers >30 m | 3-15 m buffer | corridor for common species, removes some nutrients, removes some sediments some temperature moderation |
| | | 3 m buffer | corridor for abundant species, removes some nutrients in 1st order streams limited temperature moderation |
| % baseflow | >25% | none provided | |
| total suspended solid | <25 mg/l | none provided | |
| stream sinuosity | meander every 5-7 channel widths | none provided | |

* Source: Environment Canada *et al.* (draft) 1997.

Table 3. *Draft Framework* targets and thresholds: wetland habitat.*

| Parameters | Targets | Thresholds and Level of Protection Provided | |
|---|---|---|---|
| % wetlands in study area | 10% or restore to original | none provided | |
| % wetlands in sub-watershed | 6% of each sub-watershed | none provided | |
| amount of natural vegetation adjacent to wetlands | 240 m | 120-240 m | provides habitat but moderate predation, removal of sediment & nutrients |
| | | 50-120 m | high predation rate, low rate of sediment & nutrient removal |
| | | 30-50 m | some wildlife habitat, high predation rate, removal of some sediments & nutrients |
| | | <30 m | poor habitat, high predation rate, limited removal of sediments & nutrients |

* Source: Environment Canada *et al.* (draft) 1997

### *1.4.1 Limitations to the Draft Framework*

The three habitat types used in the *Draft Framework* do not include meadows, prairie or early successional habitats which may be, or may have been, present in southern Ontario. There is a need, therefore, to examine historic patterns of vegetation in order to achieve a degree of representation for the complete range of habitats present within a given region. Limiting targets to upland forests, riparian habitats and wetlands will overlook other natural areas that contribute to a healthy, functional watershed.

The *Draft Framework* does not assess the quality of habitats used to meet targets. Degraded ecosystems such as forests which have been grazed or logged, or wetlands and riparian vegetation

invaded by exotic species, *etc*. will not make the same contribution to the health of a watershed as non-degraded ecosystems. A knowledge of the quality of habitats is essential to provide direction for future management activities including identifying restoration areas, improved forest management practices, and the adoption of best management practices in agriculture.

In Table 2, the target of 75% of buffers being >30 m (percent natural vegetation along streams) has no corresponding thresholds for 15 m to 30 m, to be consistent with threshold information shown for other targets. The riparian habitat target of >25% (percent baseflow) may not be a viable riparian habitat parameter within areas comprised of a clay or silty-clay soil material with relatively flat lying topography. Clay soils typically have very slow infiltration rates to ground water and result in high run-off volumes during storm events, resulting in low or inconsistent baseflow contributions from ground water. Consequently, stream flow can fluctuate from zero to flood over a very short period of time. As a result, base flow measurements are nearly impossible for the majority of streams within the study area.

### *1.4.2 Stakeholder Discussions*

A workshop was held in Sarnia, Ontario with attendees, many from RIC and BPAC, including representatives from MOEE, OMNR, Department of the Environment Canada (DOE), Walpole Island First Nation, St. Clair County, Michigan, USEPA, associated NGOs from Canada and the U.S. and members from the consultant team (Geomatics International Inc.).

Through discussions it was established at the outset, that the product of this study was not a final NHS for immediate implementation. Rather, the purpose of this study is to explore how the NHS approach could be used to assist in the de-listing of AOC impairment criteria by providing overall improvement of water quality and fish and wildlife habitat throughout the adjacent watershed. The intent of the study, therefore, is to provide a framework for the NHS, including a preliminary map indicating potential areas for protection and restoration.

Discussions were held as to the validity or perceived feasibility of the targets as presented within the *Draft Framework*. The Workshop discussions provided direction as to which thresholds should be adopted as targets when developing the NHS within the St. Clair River study area. It was determined that the lower end of each threshold's upper category (as shown in Tables 1,2 and 3) was to be used as a target during the development and implementation of the St. Clair River study area NHS. These adopted targets are listed below in Table 4.

Table 4. Targets derived from *Draft Framework*: as refined for the St. Clair River NHS.

| Parameters | Targets | Threshold benefit |
|---|---|---|
| **Upland Forest** | | |
| percent forest cover | 20 % | 90% of birds |
| size of largest forest patch | 100 ha | none provided |
| percent forest interior (>100 m) | 5 % | 80-90% of interior species |
| percent forest interior (>200 m) | 3 % | 70-80% of bird species |
| **Riparian** | | |
| percent natural vegetation along streams | 50 % | may maintain stream function |
| % baseflow | >25% | none provided |
| total suspended solid | <25 mg/l | none provided |
| stream sinuosity | meander every 5-7 channel widths | none provided |
| **Wetlands** | | |
| percent wetlands in study area | 10 % | none provided |
| percent wetland in sub-watersheds | 6 % | none provided |
| width of buffer of natural vegetation adjacent to wetlands | 120 m | provides habitat but moderate predation; removal of sediment & nutrients |

## 1.5 Lambton County NHS - A Review

During the initial stages of this project the County of Lambton, (which covers much of the Ontario portion of the study area), undertook the conceptualization and framework development for the Lambton County NHS for inclusion in their ongoing Official Plan review. The draft Lambton County NHS provides a basis, within one portion of the study area, on which to build the required NHS framework.

A portion of the study area is included in the draft NHS map produced by Lambton County (Lambton County 1997). The Lambton County mapping identifies anchors, primary corridors and linkages to form their NHS. Six *anchors* have been defined, representing large significant natural areas within the county. Corridors have been identified largely along watercourses and the shorelines of Lake Huron and the St. Clair River. However, in some cases corridors follow upland woodlots, landforms or man-made formations. In most instances, the corridors provide good connections between the natural areas of Lambton County. Three linkages were proposed to further enhance the Lambton County NHS by providing connections between the following watersheds; Sydenham River to the Ausauble Gorge; Clay Creek to the North Sydenham River; and Black Creek to the South Sydenham River. The proposed width of corridors or linkages is not discussed in the Official Plan or in the

Natural Heritage Issue Paper (Lambton County 1996). Not included in the Lambton County NHS, but, identified in the Natural Heritage Issue Paper (Lambton County 1996), and referred to in the draft Official Plan, are secondary corridors which generally follow back-lot woodlots in rural areas.

Rather than developing a system completely separate from the initial concepts adopted by Lambton County, it was determined that the basic mapped features should be incorporated into the St. Clair River study area NHS. This includes anchors, primary corridors, linkages and secondary corridors identified by Lambton County. This study therefore, supports and compliments the NHS developed by Lambton County.

In order to implement the St. Clair watershed NHS, it will be necessary to clarify the relationship between the Lambton County NHS and the framework presented in this study. It is suggested that the Lambton County NHS be viewed as a component or subset of the St. Clair Watershed NHS. Implementation of the Lambton County NHS will contribute to attaining the preliminary goals and objectives provided in this report.

## 1.6 Preliminary Goals and Objectives for a Natural Heritage System

Goals and objectives of a Natural Heritage System need to be developed and adopted by all the agencies and organizations that will be responsible for implementing and maintaining the NHS. For this reason, only a preliminary set of goals and objectives are presented here. It is intended that these contribute to the establishment of an NHS within the study area. These preliminary goals and objectives intended to build on and not replace the goals and policies provided in the NHS established by Lambton County.

Preliminary NHS Goal:

Develop a landscape-level network of linked core areas for the conservation of biological diversity, natural processes, and viable populations of indigenous species and ecosystems, with the aim of contributing to the delisting targets in the St.Clair AOC.

Preliminary NHS Objectives:

1) Identify and delineate core areas that represent the full range of biological and physical features in the study area;

2) Identify opportunities for “green” linkages to connect core areas;

3) Incorporate sufficient core area and linkages to meet targets established by the BPAC;

4) Produce a map of the Natural Heritage System showing all core areas and linkages;

5) Establish a mechanism to periodically review new data and information and identify opportunities for improving the NHS.

6) Develop a strategy for the implementation of a Natural Heritage System;

7) Integrate the Natural Heritage System into local land use plans, including Official Plans at the County level;

8) Develop a public awareness strategy to educate the public and garner support for implementation;

9) Identify opportunities and establish programmes to assist landowners in participating in the NHS through stewardship programmes, tax relief, conservation agreements, land donation, restoration incentives, etc.;

10) Review agricultural policies (especially with respect to drainage schemes) that negatively impact on the Natural Heritage System and seek cooperation of the Ministry of Agriculture and Food to refine local policies if and where appropriate;

11) Establish a monitoring protocol to periodically evaluate the Natural Heritage System and determine if it is being maintained, improved, or if incremental losses of habitat are occurring.

## 2.0 METHODOLOGY

### 2.1 Available Digital Data and Sources

One of the requirements for the development of the NHS framework is the identification and utilization of existing datasets, with a primary emphasis on digital data. Table 5 summarizes the datasets provided to the study team for inclusion in the NHS development.

Information regarding the quality of natural areas in the study area is either unavailable or sparse. Although it is recognized that this information is important for the development of the NHS, the compilation of habitat quality indicators would be a relatively large task and is beyond the scope of the present project. This lack of data on natural areas quality will have a significant impact on the assessment of riparian areas and wetlands, as the percent natural vegetation along streams or in wetland buffers is restricted to forest cover. Some of the information which should be sought in the development of a more detailed database would include a knowledge of habitat quality including: forests, wetlands, meadows, prairie and early successional vegetation some of which can constitute important natural riparian vegetation or buffers adjacent to wetlands.

Table 5. Digital datasets used in the development of the NHS.

| | |
|---|---|
| **Ontario Study Area** | |
| base layer | OMNR supplied OBM digital mapping<br>- 1:10,000 scale<br>- covers include transport, drainage, vegetation, cultural, township boundaries |
| woodlots | OMNR digital forest cover mapping<br>- derived from LANDSAT satellite imagery (93/94), 25 m nominal resolution<br>- no speciation or typing |
| wetlands | OMNR digital wetland mapping<br>- 1:10,000 scale based on OBM<br>- no indication of wetland classification (national, provincial or local significance) or typing |
| ESA | Lambton County Preliminary Environmentally Sensitive Areas Study (1980)<br>- original mapping 1:50,000 scale based on NTS<br>- 23 ESA boundaries digitally captured |
| ANSI | Life Science Areas of Natural and Scientific Interest Site Districts 7-1 and 7-2 (OMNR)<br>- hard copy 1:250,000 scale mapping compared to digital ESA mapping |
| rehab sites | Survey of Candidate Sites on the St. Clair and Detroit Rivers for Potential Habitat Rehabilitation/Enhancement<br>- 28 point locations for St. Clair River digitally captured |
| soils | OMAFRA digital soils for Lambton (1957) and Kent County (1989)<br>- 1:50,000 scale digital mapping (updated) for Kent County<br>- 1:63,360 scale original mapping provided in digital for Lambton County (no update) |
| historical land use | Historical Land Use Mapping<br>- provided by M.Cadman (CWS) with permission from MCCR<br>- 1:50,000 scale county based mapping for Kent and Lambton counties<br>- hard copy mapping converted to digital |
| **Michigan Study Area** | |
| base layer | U.S. Army Corps of Engineers supplied MIRIS digital mapping<br>- 1:24,000 scale<br>- cover includes transport, drainage, cultural |
| land use | St. Clair County Planning Commission<br>- classified LANDSAT satellite image, 25 m nominal resolution<br>- covers include woodlots, wetlands, urban, agricultural, industrial, recreational |
| pre-settlement vegetation | MIRIS digital mapping theme supplied by MIRIS<br>- county based mapping (1:24,000)<br>- indicates historical vegetation cover and land use |
| natural features inventory | Nature Conservancy through MIRIS supplied digital point data<br>- indicates locations of endangered and threatened habitats |

Data were also unavailable for calculating percent baseflow of streams and rivers. As much of the study area is comprised of clay and silty-clay soils, with high rates of runoff, baseflow may not be

an important riparian habitat target (see discussion in section 1.4.1). Total suspended solids and stream sinuosity were also not evaluated in this study as sufficient data were unavailable to perform the necessary analyses.

## 2.2 Project Process

The design and development of this Natural Heritage System followed the steps outlined below.

1) Collect all existing information on natural features and land uses in the study area, preferably in digital format.

2) Review the *Draft Framework* to determine the applicability of targets within the St. Clair River study area.

3) Present the existing conditions and the comparison with the *Draft Framework* to RIC, BPAC and other stakeholders with the intent of:
   - introducing the concept of NHS and its relationship to the St. Clair River RAP;
   - discussing overall direction of the NHS;
   - displaying the results of the preliminary data collection and analysis; and
   - discussing the targets and thresholds of the Draft Framework with the intent of modifying or refining the targets for application in the St. Clair River study area.

4) Using the existing data, apply the refined targets, as endorsed by RIC and BPAC, to the St. Clair River study area and determine which criteria have been fulfilled and what targets have been realized.

5) Using guidance and input from the stakeholder workshop, identify locations within the study area as natural areas (uplands, riparian and wetlands) and potential rehabilitation/restoration areas that would contribute significantly toward meeting the selected targets.

6) Provide recommendations for further development and refinement of the NHS.

## 2.3 Analytical Methods

Available digital and report based information was reviewed for the St. Clair River study area and analyses were undertaken based on existing conditions within the watershed with respect to the refined targets. It should be noted that the natural areas (forests, riparian corridors, wetlands) used in the following calculations do not for the most part have any formal designation (*i.e.*, Conservation Area, Environmentally Significant/Sensitive Areas (ESA), Area of Natural and Scientific Interest (ANSI), nature reserves, park, *etc.)* which would ensure their long term protection. This study did not attempt to assemble and assess information which may have been available to determine the *quality* of the natural areas identified.

All analyses were undertaken within the ARC/INFO geographic information system (GIS). All digital data were converted to standard ARC/INFO coverages, using North American Datum 1927 (NAD27) in a Universal Transverse Mercator (UTM) projection. Information from classified satellite imagery, originally in raster format, was converted to vector format to be incorporated into the database. Area analyses were performed within the GIS environment to provide quantitative values for the assessment of targets.

Within the development of the NHS and target analyses, the term buffer is used both in an ecological context and in an analytical sense. A buffer from an ecological or biophysical perspective indicates a physical zone or region that will lessen the impact of a feature or event on another. As an example, a 30 m vegetated buffer along a watercourse will decrease the flow rates of surface runoff and trap sediment and excess nutrients that may otherwise be carried into the stream. In this way the vegetated strip "buffers" the watercourse. From a GIS or analytical perspective a buffer is a line or polygon placed around a feature to delineate a region that is equidistant from that feature. A 30 m buffer along a watercourse would produce for a polygon 30 m wide, parallelling the original feature, regardless of landuse or vegetated state. The reason for this differentiation is because the type or quality of vegetation in a buffer may not be known within the existing digital database. Therefore, using digital spatial technologies (GIS), a 30 m buffer may be applied to a feature (*i.e.*, analytical buffer) with the intention that the buffer may presently or in the future be restored to natural vegetation (*i.e.*, ecological buffer).

Interior forest conditions were determined by using GIS software to apply to all woodlots, interior buffers of 100 m and 200 m from the forest edge. Since edge effects are generally considered to extend 100-200 m (or more) into a woodlot, application of these buffers provides some indication of the area of interior forest. Interior forest is critical to ecosystem health and the long term survival of species demanding interior forest conditions. The proportion of woodlots with interior forest conditions is also an indicator of the amount of fragmentation of the remaining forests within the landscape. For example, a high percent forest cover when combined with a low proportion of interior forests indicates the forest cover is comprised of many small woodlots, lacking significant interior forest habitat conditions.

Vegetated stream length was calculated based on those areas where forest cover intersected with drainage cover. The two datasets (forest cover and drainage cover) were digitally produced separately, therefore, the tolerances or digital capture methods may not have been exactly the same. As a result, a woodlot that lies along a stream course may have a slight "gap" between the forest edge and the stream in the combined digital layer. To compensate for this "gap", a 5 m analytical buffer was applied to the drainage cover to allow complete intersection with the digital information of woodlots.

The presence of woodlots along stream courses was the only consistent analytical measure possible for the vegetated watercourse target using the current digital database. Land use mapping from classified satellite imagery is available for both St. Clair County, Michigan and the Ontario portions of the study area, however, the nominal 25 m resolution from the LANDSAT imagery is insufficient to provide meaningful data for the detection of a 30 m riparian buffer. In addition, the distinction between row crops, pasture, old field and meadow is not readily apparent on a satellite image. Without extensive ground truthing, the distinction cannot be made between old field or meadow,

and row cropping or pasture. Variations in resolution, time of year and moisture conditions provide for variations in final classified images. The questionable distinctions between field crops, pasture, old field and meadow may provide for erroneous estimates of total vegetated stream lengths (either high or low). Limiting the analysis to forest cover has therefore produced a conservative estimate of vegetated stream lengths.

### 2.4 Data Comparisons - Michigan vs. Ontario

One of the most noticeable difference between the Ontario and Michigan data is the scale variability in the various digital layers. The base data (Ontario Basic Mapping - OBM) for Ontario consists of 1:10,000 scale, ARC/INFO GIS files, while the Michigan Resource Information System (MIRIS) base data for Michigan, at 1:24,000, was provided as MicroStation .DGN format files. These two scales, although not completely compatible, provide for a reasonably close comparison in detail. Both provide drainage, transportation routes, urban areas and major cultural features. The drainage coverages are slightly different, in that the OBM coverage makes some attempt to distinguish agricultural drains, while the MIRIS data distinguishes major and minor waterways. Agricultural drains may not exist at the same density within St. Clair County and therefore, may not have been a determining factor in classification. The two datasets have been standardized to have a “drainage” cover representing all drainage features within the study area.

Land cover mapping, specifically woodlots and wetlands, provides for significant differences in the data as used for the development of the NHS framework. The OMNR digital data, for both wetlands and woodlots, were produced at 1:10,000 scale, compatible with digital OBMs. These data were derived through a combination of existing mapping and aerial photo interpretation, current to 1993. In Michigan, wetland and woodlot data were acquired from the digital St. Clair County dataset; these data were derived from the interpretation and classification of satellite (LANDSAT) imagery, geographically referenced to the 1:24,000 MIRIS base data. Although referenced to 1:24,000 scale mapping, the nominal 25 m resolution of the LANDSAT imagery provides for an optimal scale of approximately 1:50,000. Given the scale and resolution differences between the two woodlot datasets, the accuracies of the MIRIS dataset do not appear to be as fine as those of the OBM.

The wetland files provided by the OMNR consist of polygons with no classifications or attribute data associated with them. Subsequently, hard copy information was obtained from the *St. Clair/Sydenham Regional Habitat Plan, Biological #2: Significant Wetlands, Areas of Natural and Scientific Interest and Environmentally Sensitive Areas* (reference to be provided in final) to delineate wetlands by name and provincial classification. No wetland classifications or delineations were provided for the Michigan data.

Natural features mapping within Ontario is represented by the ESA, ANSI and Conservation Area programs as operated by individual municipalities and the provincial government. These programs distinguish areas with significant natural features that should be preserved within the natural environment. Digital mapping of comparable features within St. Clair County were not found. The MIRIS data catalogue includes a Natural Features Inventory dataset which provides point locations for endangered, threatened or otherwise significant plant and animal species, natural plant communities and other natural features, with each point referenced to data in associated attribute

files. As these data depict points of breeding, nesting or habitat it was not deemed appropriate to include here. The points may or may not fall within existing natural areas in Michigan; the provision of such data may encourage the “curious” to seek out the habitats leading to potential disturbance or damage. Reference should, however, be made to these features during the implementation phases of the NHS.

Soils data were not directly used in the development of the NHS for the St. Clair River study area. Data from Ontario Ministry of Agriculture Food and Rural Affairs (OMAFRA 1957 and 1989) is inconsistent in that the Kent County soils (reference to be provided in final) mapping was updated in the late 1980's early 1990's, subdividing many of the clay and loam units as originally mapped in the mid 1950's. The Lambton County soils maps (reference to be provided in final) have, however, not been updated so the unit distinctions have not been refined making the comparison between the two counties very difficult. Soils data are available for St. Clair County, Michigan, from the MIRIS data catalogue. These data have not been integrated into the current database as they have not been completely edited or rectified; processes that are currently underway by MDNR.

An historical land cover dataset (Native Landscape) is available from the MIRIS data catalogue as well as a survey of prairie vegetation (Comer *et al*. 1995). These digital data have been prepared based on US Public Land Survey information compiled between 1816 and 1856, and include information on vegetation, open lands, natural disturbances and cultural features. Similar mapping of historic vegetation is available for southern Ontario through the Ministry of Citizenship, Culture and Recreation (Findlay 1978) and selected references such as Bakowsky (1993) and RLSN (undated). These data have been summarized and mapped for this study (figures 3a and 3b) and should be fully reviewed during NHS implementation to determine viable historical targets for both wetlands and natural land cover (forests, prairie, savannah). A discussion of the value and application of these historical data is provided in section 4.0.

## 3.0 ANALYSES OF CURRENT CONDITIONS AND TARGETS

Below is a discussion of the existing forest, wetland and riparian land cover based on the available information in the digital datasets described above. The existing conditions are compared with the desired target conditions presented in Table 4 above. Habitats which fall short of the targets will be used to help direct development of NHS strategies aimed at meeting the desired target conditions of forest, wetland and riparian land cover.

### 3.1 Upland Forest Habitats

The analyses indicated that a total of 49,720 ha of forest cover exists within the study area. This accounts for 13.2% of the total study area, a value which is below the target of >20%. Based on the thresholds outlined within the *Draft Framework* (Table 1), the current forest cover would support only 60% to 70% of the bird species indigenous to the area. The largest single forest patch is 3,039 ha in size and an additional 54 woodlots are >100 ha in size. The target for size of largest forest patch is therefore exceeded by the existing conditions (Table 6).

The analysis of the available digital data indicated that 1,741 patches of forest have interior forest as defined by a 100 m forest edge. These patches cover 9,980 ha, consisting 2.6% of the study area within the study area, a value below the 5% defined for forest interior >100 m from edge (Table 6). Based on the threshold values from the *Draft Framework* (Table 1), a value of 2.6% for interior forest cover (>100 m of edge) provides habitat for 60% to 80% of the forest interior bird species with restricted distribution.

A more rigorous standard for forest interior conditions is defined by a 200 m forest edge. Within the study area interior forests (>200 m edge) are found in 334 forest patches, covering 2,437 ha or 0.7% of the study area. This value is also below the target of 3% (Table 6). Threshold indicators from the *Draft Framework* (Table 1) suggest 0.7% interior forest cover (>200 m of edge) provides habitat for fewer than 40% of forest interior bird species.

Table 6. Targets and existing conditions for upland forests in the St. Clair NHS study area.

| Parameter | Target | Ontario | Michigan | Study Area Condition |
|---|---|---|---|---|
| forest cover | >20%<br>>36,292 ha | 11.2%<br>20,400 ha | 14.9%<br>29,320 ha | **13.2% forest covered**<br>(4239 forest patches - 49,720 ha) |
| size of largest forest patch | 100 ha minimum | 1,300 ha | 3,039 ha | **largest patch 3,039 ha**<br>total of 55 patches >100 ha |
| % of interior forest >100 m from edge | >5%<br>>9,073 ha | 2.0%<br>3,680 ha | 3.2%<br>6,300 ha | **2.6% interior forest**<br>(1,741 forest patches - 9,980 ha) |
| % of interior forest >200 m from edge | >3%<br>>5,444 ha | 0.4%<br>800 ha | 0.8%<br>1,637 ha | **0.7% interior forest**<br>(334 forest patches - 2,437 ha) |

## 3.2 Riparian Habitats

The existing natural vegetation along streams accounts for approximately 7.6% (1,209,412 m) of the total length of watercourses (15,906,320 m) within the study area (Table 7). According to the threshold outlined within the *Draft Framework* (Table 2), this degree of riparian vegetation cover will result in a degraded stream course. As indicated previously (pages 15 and 16), this number is an underestimate owing to the inability to detect 30 m buffers along watercourses using LANDSAT imagery. Additionally, estimated total stream lengths include all agricultural drains, as the database does not make sufficient distinction between a natural stream and an agricultural drain; this contributes to an underestimation of vegetated stream length.

Table 7. Targets and existing conditions for riparian habitat in the St. Clair NHS study area.

| Parameter | Target | Ontario | Michigan | Study Area Condition |
|---|---|---|---|---|
| % natural vegetation along streams* | 50% natural vegetation cover | 13.4%<br>467,400 m | 6.0%<br>742,012 m | **7.6%**<br>1,209,412 m |
| | 75% buffers >30 m | (buffer widths not available with existing data set) | | |
| % baseflow | >25% | parameter not analyzed | | |
| total suspended solid | <25 mg/l | parameter not analyzed | | |

| | | |
|---|---|---|
| stream sinuosity | meander every 5-7 channel widths | parameter not analyzed |

* the length of streams running through forested areas was used as a surrogate for natural vegetation, other data for natural vegetation along streams were not available digitally. The value reported is therefore conservative, and may increase with additional field data. See section 2.3 Analytical Methods.

### 3.3 Wetlands

The existing percentage of wetland present in the study area is 2.7%, a value which is well below the target of 10% for this parameter (Table 8). Thresholds are not supplied for this parameter as each region is unique. Thresholds would be area-specific and must be developed based on existing conditions and historical habitats. The existing database is in need of refinement to obtain a more accurate estimate of the proportion of the study area covered by wetlands. For example, historical wetland data available in the *St. Clair River AOC Stage 2 Recommended Plan* (MOEE and MDNR 1995, page 18) shows wetlands which were present after 1984, but, which are now mapped as woodlots in the digital database. Some swamps (treed wetlands) may therefore have been included in the forest landcover, where rightly they should be included in the wetland cover. More detailed field studies are also required to verify the existence of treed swamps. Many former swamps may now resemble upland forests if their hydrological regimes have been significantly altered either through development or through agricultural activities (*e.g.*, installation of drains). Calculations for sub-watersheds were not completed as it was felt that insufficient data exist to warrant such analyses.

Vegetation adjacent to wetlands (*i.e.*, ecological buffer) could not be assessed with the present digital data set. Vegetated buffers are beneficial and necessary for the protection of abiotic and biotic features of wetlands, however, each wetland or wetland complex is unique and requires individual assessment. Maintenance of the historic hydrologic balance is one of the most essential parameters for a healthy wetland. In many cases adjacent land use must look beyond a 120 m buffer in order to ensure the maintenance of a natural hydrologic balance. Recent data show that even disturbances 1 to 2 km distant can negatively impact wetland biodiversity (Findlay and Houlahan 1997).

Table 8. Targets and existing conditions for wetland habitat in the St. Clair NHS study area.

| Parameters | Targets | Ontario | Michigan | Study Area Conditions |
|---|---|---|---|---|
| % wetlands in study area | 10% or restore to original | 3.4%<br>6,311.0 ha | 2.0%<br>3,910.9 ha | **2.7%**<br>10,221.0 ha |
| % wetlands in sub-watershed | 6% of each sub-watershed | not calculated on sub-watershed basis | | |
| amount of natural vegetation adjacent to wetlands | 120 m | not analyzed due to lack of data | | |

## 4.0 DEVELOPMENT OF THE ST. CLAIR RIVER NHS FRAMEWORK

A preliminary NHS map (figures 2a and 2b) has been produced for the St. Clair River study area in support of the framework development and based on currently available information. As directed by

RIC and BPAC, the preliminary NHS framework has been designed based on achieving the targets shown in Table 4.

The existing conditions (section 3.0) indicate a shortfall for all refined targets with the exception of *largest forest patch* (target greater than 100 ha). As a result, the initial NHS should not only support the concepts of no-*net*-loss, but, should also include the concept of no loss of existing conditions. This involves the inclusion of **ALL** existing forests, riparian corridors and wetlands identified on the draft NHS map. This not only includes natural areas which are identified as ANSIs (Klinkenberg 1984, Lindsay 1984), ESAs (University of Waterloo 1980), classified wetlands and the known locations of rare species, but should also incorporate all existing forests and wetlands without any special designation. The present task therefore in the further development of the NHS, is to examine opportunities for enhancing (enlarging) the existing natural areas and to look for additional areas, including areas for restoration, in order to meet the targets identified in Table 4.

### 4.1 Enhanced Forest Cover

Total forest cover and forest interior, defined both 100 m and 200 m edges, are below the adopted targets of 20%, 5%, and 3% respectively (Table 6). An initiative suggested at the NHS workshop, which is supported by the data on existing conditions, was the restoration of gaps within forested areas and smoothing of forest edges to increase the area of both forest interior and total forest cover. Theoretically, to provide 100 m of forest interior habitat with an edge (buffer) of 200 m, it is necessary to have a woodlot which is 500 m in width. To provide 100 m of forest interior habitat with a smaller 100 m edge (buffer), a total width of 300 m is required. Therefore, those woodlots that were close to or at the 500 m minimum width were examined for restoration opportunities. Restoration to achieve interior woodlots with 200 m edge would contribute to the enhancement of all forest cover tracts. Enhancement opportunities for these woodlots identified 2,515.3 ha (Table 9) of gaps and/or rough forest edges for restoration to effectively create interior forest conditions with minimum impact on other land uses (see figures 2a and 2b).

With the addition of 2,515.3 ha of land (largely agricultural) for forest restoration, the proportion of forest interior defined by a 200 m edge (buffer) doubled from 0.7% to 1.3%, while overall forest cover changed very little, 13.2% to 13.8% (Table 7). This figures are still below the desired targets, thus there is a need to identify additional areas for forest restoration.

### 4.2 Increased Vegetated Stream Courses

The total length of vegetated stream courses, currently at 7.6% for the study area, is well below the target value of 50%. This study identified an additional 565,637 m of streams (Table 9) for restoration/ rehabilitation. Streams selected for the restoration of a 30 m vegetation buffer included: all streams flowing directly into the St. Clair River as the improvement of these streams will have the most immediate impact on improved habitat and water quality in the St. Clair River, and major natural channels which provide linkage between large forest blocks. The latter streams would contribute to the long term objectives of the NHS which include corridors to facilitate movement for genetic enrichment and adaptation of plants and animals in the region. The buffer has been applied

as an analytical buffer due to the present lack of detailed vegetation information available in the digital database. Nonetheless, the 30 m buffer width was chosen based on studies which show that a 30 m vegetation buffer removes the majority of sediment and nutrient inputs from surrounding lands (Barling and Moore 1994, Klein 1990, Clinnick 1985, Lynch *et al.* 1985, Government of Canada 1984, Erman and Mahoney 1983 and Young *et al.* 1980). It should be noted, however, that streams with a 30 m swath of vegetation running along each bank may not constitute suitable habitat to provide a linkage function allowing plants and animals to migrate between larger connected natural areas. With these additional restoration/rehabilitation areas the percentage of vegetated stream courses rose to 11.2%, a value still well below the 50% target (Table 9). This number may also rise with the availability of more detailed land use mapping along the stream courses.

Table 9. Targets, existing conditions and draft NHS values in the St. Clair River study area.

| Parameters | Targets | Existing in Ontario | Existing in Michigan | Existing in Study Area | Restoration Ontario | Restoration Michigan | Total NHS Study Area |
|---|---|---|---|---|---|---|---|
| **Uplands** | | | | | | | |
| forest cover | 20% | 11.2%<br>20,400 | 14.9%<br>29,320 ha | 13.2%<br>49,720 ha | 9.1 %<br>1,854.0 ha | %<br>661.3 ha | 13.8%<br>68,921.3 |
| forest interior (>100 m) | 5% | 2.0%<br>3,680 ha | 3.2%<br>6,300.6 ha | 2.6%<br>9,980 ha | 1.5%<br>2,762.9 ha | 0.6%<br>1,097.7 ha | 3.7%<br>13,840.6 |
| size of largest forest patch | 100 ha minimum | 1,300 ha | 3,339 ha | 56 patches > 100 ha | not required | not required | 56 patches > 100 ha |
| forest interior (>200 m) | 3% | 0.4%<br>799.9 ha | 0.8%<br>1,657.3 ha | 0.7%<br>2.437 ha | 1.0%<br>1,851.0 ha | 0.4%<br>770.6 ha | 1.3%<br>5,058.6 |
| **Riparian** | | | | | | | |
| natural vegetation along streams | 50% | 13.4%<br>467,400 m | 6.0%<br>742,012 m | 7.6 %<br>1,209,412 | 2.0%<br>326,061 m | 1.5 %<br>239,576 m | 11.2%<br>1,775,049 m |
| % baseflow | >25% | parameter not analyzed | | | parameter not analyzed | | |
| total suspended solid | <25 mg/l | parameter not analyzed | | | parameter not analyzed | | |
| stream sinuosity | meander every 5-7 channel widths | parameter not analyzed | | | parameter not analyzed | | |
| **Wetlands** | | | | | | | |
| wetlands in study area | 10% | 3.4%<br>6,311.0 ha | 2.0%<br>3,910.9 ha | 2.7%<br>10,221.0 ha | not attempted - need to determine restoration based on historical data | | 2.7%<br>10,221.0 ha |
| % wetlands in sub-watershed | 6% of each sub-watershed | not calculated on sub-watershed basis | | | not calculated on sub-watershed basis | | |
| amount of natural vegetation adjacent to wetlands | 120 m | not analyzed due to lack of data | | | not analyzed due to lack of data | | |

## 4.3 The Contribution of Wetlands

With all known wetlands incorporated in the NHS the existing condition of 2.7% is well below the target of 10% (Table 8). At this time no specific recommendations have been made to increase the total amount of wetland found within the study area. This study has, however, indicated there is need to improve the database by ensuring that all wetlands are included, such as swamps, thickets and other unidentified wetlands. These data are necessary to provide a more realistic value of the percentage of wetland within the study area. St. Clair County has indicated that restoration efforts within the county are oriented towards the re-establishment or re-introduction of wetlands, as opposed to the rehabilitation of woodlots. Ongoing wetland restoration should continue and in particular should be undertaken in areas where historical records show wetlands are the natural vegetation cover of an area.

Based on the historic vegetation mapping (MIRIS, MCCR), approximately 27% of the study area's natural land cover may have been wetlands (including open and forested wetland). These wetlands primarily were composed of marshes along the St. Clair River and on the St. Clair River delta and inland swamps, particularly on the clay plains in Ontario east of the St. Clair River. Attempts to restore wetlands will be difficult as a result changes to local and regional hydrology through intentional drainage (including pumping of canals to lower water tables) and the conversion of wetlands to profitable agricultural lands. A study should be undertaken to identify areas which previously were wetland and which are now marginal or abandoned agricultural land. Wetland restoration may be possible if agricultural drainage canals could be blocked, allowing flooding and a return to more natural hydrological conditions.

## 4.4 Future Development of the NHS

The proposed NHS enhancements outlined in sections 4.1, 4.2 and 4.3 build on the existing natural areas of the St. Clair study area. In order to fully develop a functional NHS, and to move further towards the desired targets presented in Table 4, additional work is required. The purpose of the following sections is to provide a work plan that identifies opportunities and priorities for the next steps to be taken in the development of the NHS for the St. Clair study area.

### *4.4.1 Gap Analysis*

Gap analysis is becoming a standard tool for determining ecological representation within protected areas or as a general indicator of ecological health and biodiversity. An analysis of historical and present vegetation types/communities within the study area should be undertaken to identify if any "gaps" community representation. Further, by comparing the historical vegetation mapping and the proposed NHS mapping any gaps in protected or captured biodiversity can be determined for the proposed NHS. Vegetation types which are poorly represented can then be identified as a priority when considering areas to be added to the NHS. Historic vegetation mapping will provide a guide as to what areas may be suitable for the restoration of under-represented vegetation types.

### *4.4.2 Functional Linkages*

The design of corridors or linkages in the NHS must be based on the requirements of the plants and animals which inhabit the region and will benefit from functional movement corridors. By examining the movement patterns, distances and habitat preferences of selected plants and animals predictions can be made regarding the minimum requirements of a functional linkage. The NHS can then focus on those areas which best meet the minimum requirements and enhance the linkage corridors as required.

### *4.4.3 Restoration*

It is likely the gap analysis will identify prairie and wetland vegetation types as under represented in the NHS. In regard to prairies, the St. Clair study area is fortunate to have many examples of remnant prairie still in existence (Comer *et al.* 1995, Bakowsky 1993, RLSN undated, Findlay 1978) and many groups active in prairie restoration within the area (*e.g.*, the Rural Lambton Stewardship Network, OMNR and City of Windsor). By carefully examining what prairie areas have been included in the NHS, and what additional prairie areas are present or suitable for restoration, a meaningful representation of this vegetation/habitat type may be achieved.

The representation or restoration of wetland will likely prove more difficult. Although historic mapping (figures 3a and 3b) may show the location of wetlands, changes to the hydrology of the region, through the creation of artificial drainage ditches and tile beds along with the conversion of wetlands to lands used for intensive agriculture, will make restoration a difficult task. There may be opportunities, to partially re-create the appropriate hydrologic conditions through the draining, removal or damming of unused ditches in marginal agricultural lands.

Opportunities for increased forest cover have already been identified as secondary corridors in the Lambton County Official Plan (1997), further applying the method of enlarging woodlots described in section 4.1 would result in increased numbers of forest patches with interior conditions.

### *4.4.4 Improved Vegetation Mapping*

Detailed mapping of the vegetation types present in the study area is still best accomplished using aerial photographs and extensive ground truthing. Although there are new generation satellites currently providing data at much enhanced resolution (less than 5 m), the digital data remains sparse and expensive. Detailed mapping is necessary for all phases of NHS development, gap analysis, creating linkages and undertaking restoration. More detailed mapping may in fact show the proposed NHS is closer to desired targets if additional woodlands are differentiated as swamp and if stream courses and wetlands are shown to have existing buffers. In other cases, more detailed mapping may indicate that natural areas are degraded by cattle grazing, logging, recreational use, *etc.* and are in need of greater protection through the NHS.

### *4.4.5 Stewardship*

Private landowners have a significant role to play in environmental protection. As the majority of the NHS is based on private lands, the continuation of a comprehensive stewardship program (with financial incentives) will be an essential component of the implementation of the NHS. In a recent survey of landowner's perception of natural heritage carried out in Lambton and Kent counties,

Ontario, it is clear that landowners have very definite opinions regarding the protection of natural areas and that in most cases they support the NHS concept and would be willing to become involved in landscape rehabilitation.

*4.4.6 Best Management Practices (BMP)*

OMAFRA, in conjunction with the CWS and the OMNR, have developed a comprehensive set of Best Management Practices (BMPs) for agriculture and a program for each farm to develop and initiate an environmental farm plan. Given that a large proportion of the St. Clair study area is in agricultural land uses, the institution of the following BMPs would make a substantial contribution to upland, riparian and wetland targets of the proposed NHS:

- maintain the habitat present on farms;
- adopt cropland conservation techniques;
- select and use pesticides and herbicides with care using integrated pest management;
- encourage conversion to organic farming;
- establish, protect and enhance windbreaks, shelter belts, and fence-rows for optimum crop protection and habitat conservation by maintaining a minimum width of three trees with a continuous canopy of mixtures of native species of trees;
- establish, protect and enhance vegetated buffers along drainage features, wetlands and woodlands;
- restrict livestock movement within natural areas, drainage channels and hedgerows;
- where possible establish hedgerow or woodland connections between natural areas;
- remove invasive and non-native plants (*e.g.* European buckthorn) from hedgerows and woodlands; and
- promote BMPs through education and information such as signage that explains the linkage between conservation and sustainable agriculture ( *e.g.*, windbreaks prevent soil erosion, the creation of habitat within fields increases the presence of pollinators for crops and insectivorous birds to reduce crop pests).

## 5.0 RECOMMENDATIONS

The design, development and implementation of the Natural Heritage System should be based on a 100 year plus planning horizon. The NHS framework presented here is a first draft which has established baseline conditions, provided preliminary goals and objectives, set future targets and presented an outline for further input and refinement.

Issues raised in the report, such as the need for additional information and the development of strategies to address the shortfall in the targets, require action to build upon and improve the NHS. The refinement and implementation of the NHS should continue to use ecological criteria and tenets that contribute to the goals and objectives.

Several of the preliminary objectives provided in section 1.6 have been partially or fully addressed in this study. However, for the NHS to progress, it will be necessary to undertake some additional studies, dovetail some on-going and parallel programs, and intensify efforts at implementing the NHS as it now stands. The following recommendations are offered to contribute to this process.

1) Formally adopt the refined targets, developed with the input of the BPAC, and use then to guide the development of the St. Clair Watershed NHS.

2) In discussions with Lambton County, clarify the relationship between the St.Clair Watershed NHS and the Lambton County NHS with respect to goals, objectives and implementation.

3) Establish a steering committee, composed of stakeholders from across the region (*e.g.*, planners from area municipalities and major urban areas, agricultural associations, OMAF, OMNR, BPAC and/or RIC, *etc.*), to provide an inter-disciplinary and inter-jurisdictional forum to discuss needs and options for the implementation of the NHS in the coming years. Implementation will necessarily be accomplished at the local jurisdictional level, however, agreement among jurisdictions on an NHS (local, provincial, state and across national boundaries) will provide greater justification, for and impetus to, further development of the NHS.

4) Review existing conditions and targets to examine trends and achievements for implementing the NHS.

5) Continue the development of the St. Clair Watershed NHS by following the guidance provided in section 4.0 of the report including:

   i) identify additional areas for forest restoration;
   ii) restore 30 m vegetated buffer to identified watercourses and identify additional watercourses for buffer establishment;
   iii) verify the identification of wetland areas and refine the estimation of existing conditions provided in Table 9;
   iv) undertake a study to identify areas for wetland restoration;
   v) undertake a gap analysis to guide the selection of habitats for restoration;
   vi) enhance linkage corridors;
   vii) identify areas for restoring prairie, wetlands and forest;
   viii) refine mapping of existing vegetation;
   ix) continue the establishment of stewardship agreements; and
   x) institute BMPs where possible.

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# APPENDIX A:

# Glossary of Acronyms

## GLOSSARY OF ACRONYMS

| | |
|---|---|
| *ANSI* | - Area of Natural and Scientific Interest |
| *AOC* | - Area of Concern |
| *BMP* | - Best Management Practices |
| *BPAC* | - Binational Public Advisory Council |
| *CWS* | - Canadian Wildlife Service |
| *DOE* | - Department of Environment, Canada |
| *ESA* | - Environmentally Significant/Sensitive Area |
| *GIS* | - Geographic Information System |
| MCCR | - Ontario Ministry of Citizenship, Culture and Recreation |
| *MDNR* | - Michigan Department of Natural Resources |
| *MIRIS* | - Michigan Resource Information System |
| *MOEE* | - Ontario Ministry of Environment and Energy |
| *NAD27* | - North American Datum (1927) - geographical positioning datum |
| *NGO* | - Non-government Organization |
| *NHS* | - Natural Heritage System |
| *OBM* | - Ontario Basic Mapping |
| *OMAFRA* | - Ontario Ministry of Agriculture, Food and Rural Affairs |
| *OMNR* | - Ontario Ministry of Natural Resources |
| *PAC* | - Public Advisory Council |
| *RAP* | - Remedial Action Plan |
| *RIC* | - RAP Implementation Committee |
| *RSLN* | - Rural Lambton Stewardship Network |
| *USEPA* | - U.S. Environmental Protection Agency |
| *UTM* | - Universal Transverse Mercator - map projection and coordinate system |

# APPENDIX B:

# Discussion of Targets and Thresholds

**DISCUSSION OF TARGETS AND THRESHOLDS**
(from workshop held at Derby Lane VIP Centre, Sarnia, Ontario, April 29th, 1997)

**Attendees**

Mirek Sharp - Geomatics International, Burlington, Ontario
Robert Delorme - Geomatics International, Burlington, Ontario
Daryl Cowell - Geomatics International, Burlington, Ontario
Gary Johnson - MOEE, Sarnia, Ontario
Michelle Nicolson - EcoServices, London, Ontario
Paulette Duhaime - BPAC
Patrick Donnelly - Lambton County, Ontario
Frank Schoonover - BPAC
Dan Mazur - USEPA, Chicago, IL
Thomas Matheson - USEPA, Chicago, IL
Roy Schrameck - MDEQ, Livonia, MI
John Haggeman - Environment Canada, Pain Court, Ontario
Darrel Randell - Rural Lambton Stewardship Network, Chatham, Ontario
Michael Williams - Walpole Island First Nation, Ontario
Fred Johnson - OMNR, Chatham, Ontario
Ken Smy - BPAC
Don Hector - OMNR, Chatham, Ontario
Janet Planck - Environment Canada, Burlington, Ontario
Mandy Dunlop - Wildlife Habitat Council, Detroit, Michigan
John Young - Wildlife Habitat Council, Detroit, Michigan

**Introduction**
Gary Johnson (OMOEE) introduced all present and outlined the purpose of the workshop both for the Natural Heritage Study and St. Clair RAP Delisting Targets.

The current project with the Ministry of Environment and Energy includes the preliminary identification of high priority natural areas and areas for restoration. This will be based on a Natural Heritage Systems (NHS) approach. It has been agreed that it is beyond the scope of this study to undertake a full NHS, and that there is no field component to the study, however, existing data on remnant natural areas will be assembled and, together with existing classified land use maps and forest cover mapping, used to develop a first approximation of a Natural Heritage System. Existing data will include reports on natural features (Environmentally Sensitive Areas studies, MNR's priority sites for restoration report, etc.), Forest Cover Mapping, digitized wetland maps (to be supplied by the MNR).

The focus of the exercise is to identify areas suitable for restoration or enhancement that will assist in meeting de-listing targets identified in the Stage 2 Recommended Plan.

**Purpose of Workshop**

The draft Natural Heritage Areas and potential linkages will be presented at the workshop. It is emphasized that this work is preliminary and is intended as a starting point for further studies. We will also present the list of sources used to derive the map. The purpose of the workshop is to review and discuss the preliminary NHS and to identify additional sources of information that can be used to refine it. In addition, it will be important to discuss the extent to which the suggested areas for restoration and rehabilitation might be used to satisfy de-listing guidelines for Impaired Beneficial Uses. An assessment of current delisting guidelines, successes, barriers to success and appropriate opportunities/suggestions for appropriately modifying habitat delisting targets will be discussed.

**Discussion of Targets and Thresholds from Workshop**

Mirek Sharp (Geomatics International) introduced/reviewed the concept of a Natural Heritage System (NHS) and proceeded to outline the work being undertaken by Geomatics International.

Robert Delorme (Geomatics International) reviewed the digital data that had been received to date from the various agencies and government ministries and what datasets were still outstanding or being sought. A list of acquired and required data sets is appended.

M. Sharp outlined the concept of targets for the watershed based NHS as developed in the *Draft Framework for Guiding Habitat Rehabilitation in Great Lakes Areas of Concern* (Environment Canada, OMNR and OMOEE, 1996). Targets, thresholds and existing conditions were outlined for the three habitats identified in the Draft Framework: upland forests, riparian, and wetland habitats. Discussions followed regarding appropriate thresholds for the various habitats.

Existing conditions were presented based on information gathered to date. Upland forests represent the most complete dataset with indications of 13.2% (49,720 ha) present woodlot coverage within the study area.

All attendees agreed that the target of 30% presented for upland forest was not reasonable. Concerns were raised that setting high targets/thresholds may send a negative message to the stakeholders within the study area. For example, stakeholders may perceive that 30% of their land would need to be converted from profit making farming activities to “idle” woodlots or wetland habitats. It was suggested that a coverage of 15% for upland forest would be more reasonable.

The “No Net Loss” concept was brought forward as a starting point to preserve natural areas (forest, riparian areas, wetlands) which presently exist. Discussions which focused on this concept agreed that simply preserving remaining habitat did not go far enough and that there is a need to rehabilitate and restore portions of the environment which have been degraded.

The concept of forest interior and what this means to the overall forest ecosystem and the habitats within forests, was discussed. It was recognized that an increase of 1% to interior forest cover within the study area may be more beneficial than a 5% increase in total forest cover. For instance, the addition or rehabilitation of a small woodlot adjacent to an existing larger woodlot may increase local diversity and the health of existing populations, to a greater extent than creating a somewhat larger, isolated woodlot. These concepts need to be explored and developed as part of the on-going

NHS process over time. This emphasizes the need for the development of an NHS to best identify present and future natural heritage resources.

The appropriate time frame for examining the NHS concept was re-emphasized based on historic and future scenarios of environmental change. Specifically it was reiterated that the development of a functional NHS is not a short term project, but rather one that can require decades to establish. Fifty to one hundred year time spans were discussed as potential time frames for implementation and completion of an NHS. It was pointed out that the NHS should serve as a vision for long term environmental planning and be implemented as opportunities arise.

At the workshop the following question was presented, *"Do we want to be conservative and limit ourselves in the future, or do we adopt a higher threshold now to allow for potential habitat increases in the future?"* The example of the Chicago Prairie Restoration Project was explained as follows: approximately 17 years ago a design to rehabilitate and preserve prairie habitats on the outskirts of the City of Chicago was developed. At the time it was thought to be overly ambitious and not realistic. Today this project has met or exceeded many of the original proposed goals.

It was proposed that future rehabilitation should not be constrained by what we perceive as unreasonable goals today. It was therefore agreed that goals should be set high so as not to limit future endeavours and initiatives. The understanding is that targets outlined in the *Draft Framework* may not be met in the short term but should be viewed as long term goals.

Suggestions were made that a review of the potential to reach each goal should be undertaken in the future to develop on-going strategies. In addition, historical land uses should be identified and built into the NHS to determine if the suggested targets are reasonable from a historic point of view.

One of the parameters for riparian habitats is the percent of natural vegetation along first to third order streams. It was suggested that within the St. Clair study area 50% natural cover should be the target within a given stream buffer. A 15 m buffer width was suggested.

Discussions were held as to the validity of some of the parameters and targets for these habitats. It was suggested that percent baseflow, total suspended solids and stream sinuosity, although important factors, should not be considered as parameters on their own within the riparian habitat evaluation. These factors are difficult if not impossible to asses within the study area without extensive research and/or field work.

Some suggestions were made as to how to include these factors in the evaluation using qualitative as opposed to quantitative measures. Total suspended solids within a watercourse should decrease if re-vegetation of a stream course occurs. The natural vegetation acts as a buffer trapping sediments, providing stability to the banks, thus decreasing the amount of sediments entering a watercourse.

If forest/vegetation cover and wetlands are increased within the study area, increased baseflow sound result. As it stands, determining baseflow within a predominantly clay-textured watershed would require extensive field work. Baseflow will vary from 0 to 100% depending on the time of year and precipitation events. Runoff in this area is extreme and infiltration of the surface material is limited. Within the context of an NHS, urban planning issues should be addressed to augment baseflow

conditions. Minimizing hard and impenetrable surfaces and using storm water retention ponds are two methods to increase or sustain baseflow conditions within an urban setting.

Sinuosity can be increased through the blockage of old agricultural drains that are no longer in use. This, along with re-vegetation of stream courses could increase fisheries habitats.

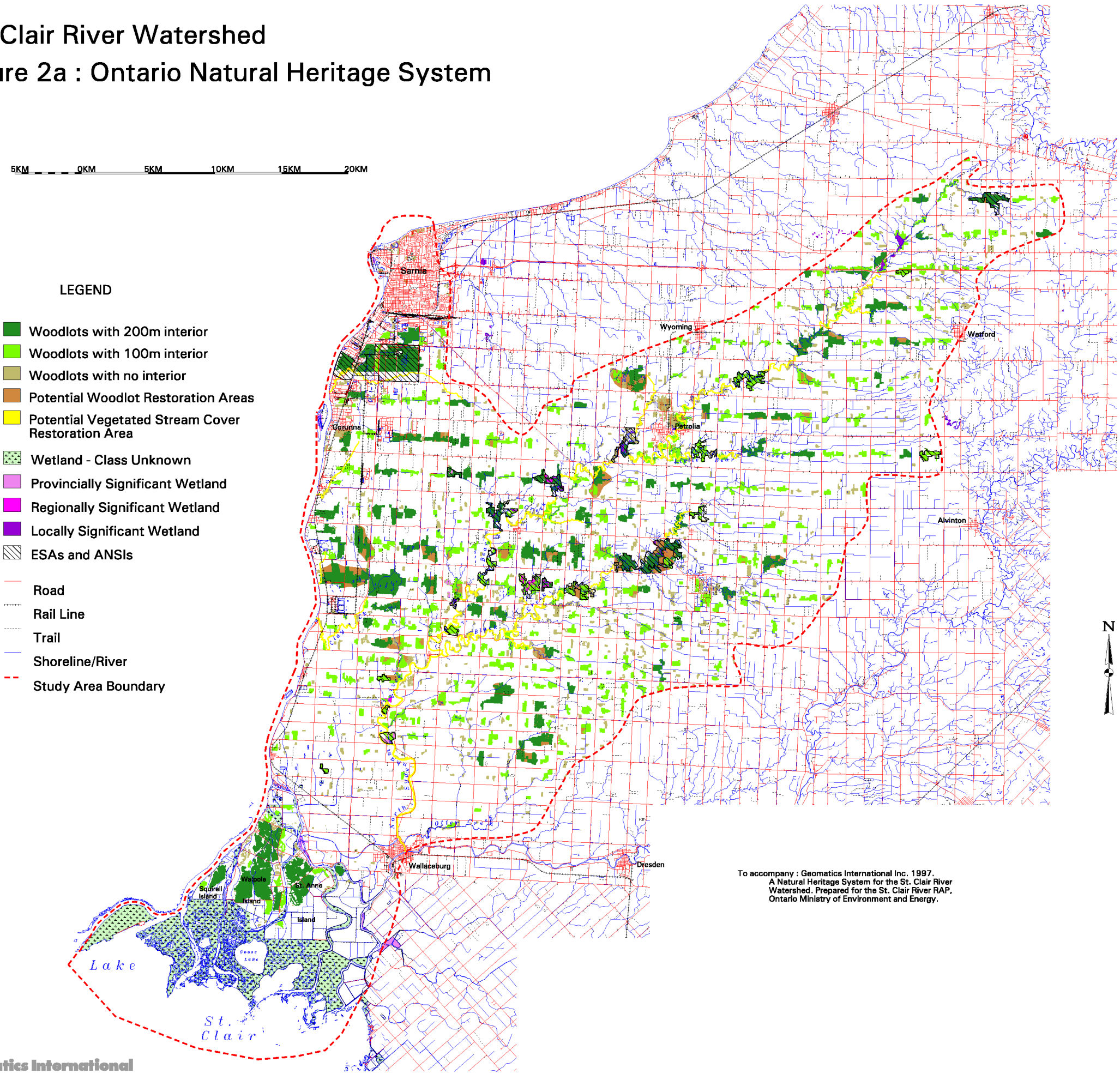
Wetland habitat thresholds are not provided for percent wetland within the study area, with the exception of amount of vegetation adjacent to wetlands (buffer). The upper limit of these thresholds is 240 m. Discussions were held as to where this figure came from. It was suggested that Nancy Patterson (CWS) should be approached to determine what ecological factors and literature were considered in the adoption of the 240 m buffer.

It was resolved that the lower end of each threshold's upper category was to be suggested as a goal or target for habitat conditions within a completed NHS.

| | | |
|---|---|---|
| upland forest | percent forest cover | 20% |
| | percent of forest interior > 100 m from edge | 5% |
| | percent of forest interior > 200 m from edge | 3% |
| riparian | percent natural vegetation along streams | 50% |
| wetlands | percent wetlands in study area | 10% (target) |
| | amount of vegetation adjacent to wetlands | 120 m |

# St. Clair River Watershed

## Figure 2a : Ontario Natural Heritage System



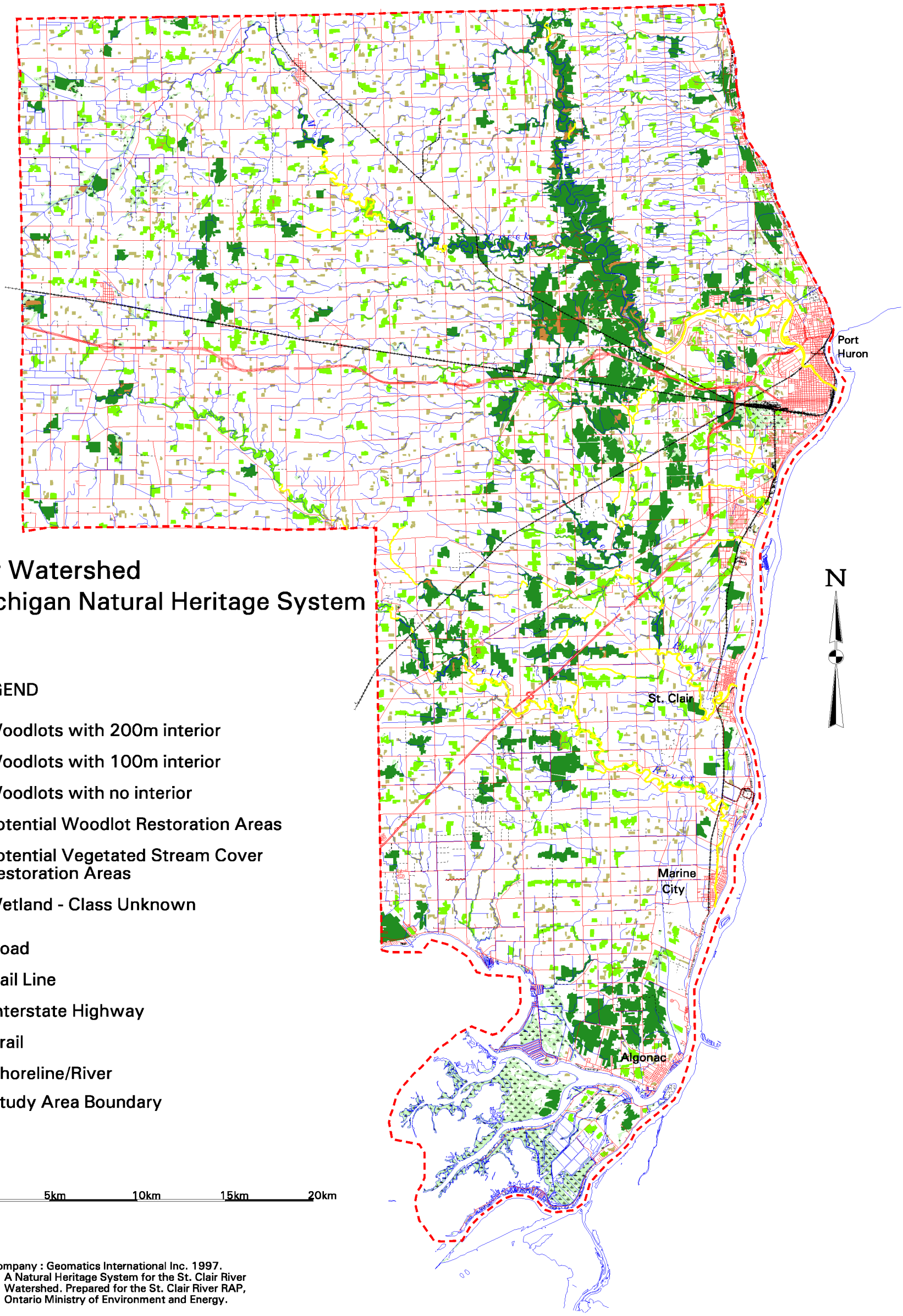

To accompany : Geomatics International Inc. 1997.
A Natural Heritage System for the St. Clair River Watershed. Prepared for the St. Clair River RAP, Ontario Ministry of Environment and Energy.

Geomatics International

Date : November 1997

Base Information : OMNR, 1 : 10 000 scale OBM
Projection : Universal Transverse Mercator
Zone 17, NAD27

# St. Clair River Watershed
## Figure 2b : Michigan Natural Heritage System




LEGEND

- Woodlots with 200m interior
- Woodlots with 100m interior
- Woodlots with no interior
- Potential Woodlot Restoration Areas
- Potential Vegetated Stream Cover Restoration Areas
- Wetland - Class Unknown
- Road
- Rail Line
- Interstate Highway
- Trail
- Shoreline/River
- Study Area Boundary

5km 0km 5km 10km 15km 20km

To accompany : Geomatics International Inc. 1997.
A Natural Heritage System for the St. Clair River Watershed. Prepared for the St. Clair River RAP, Ontario Ministry of Environment and Energy.

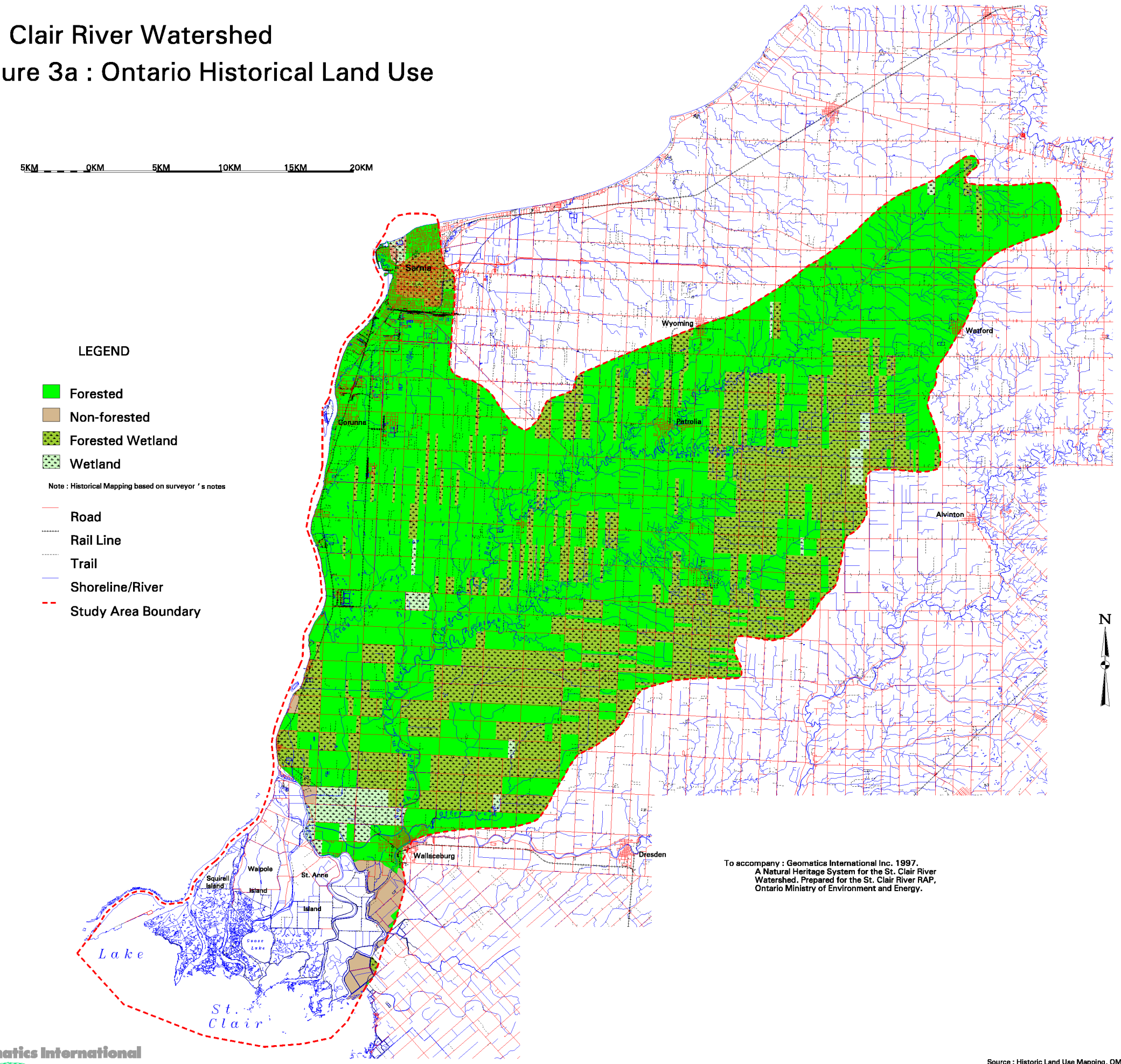
Geomatics International

Date : November 1997

Base Information : MIRIS, 1 : 24 000 Base Mapping
Projection : Universal Transverse Mercator
Zone 17, NAD27

# St. Clair River Watershed

## Figure 3a : Ontario Historical Land Use



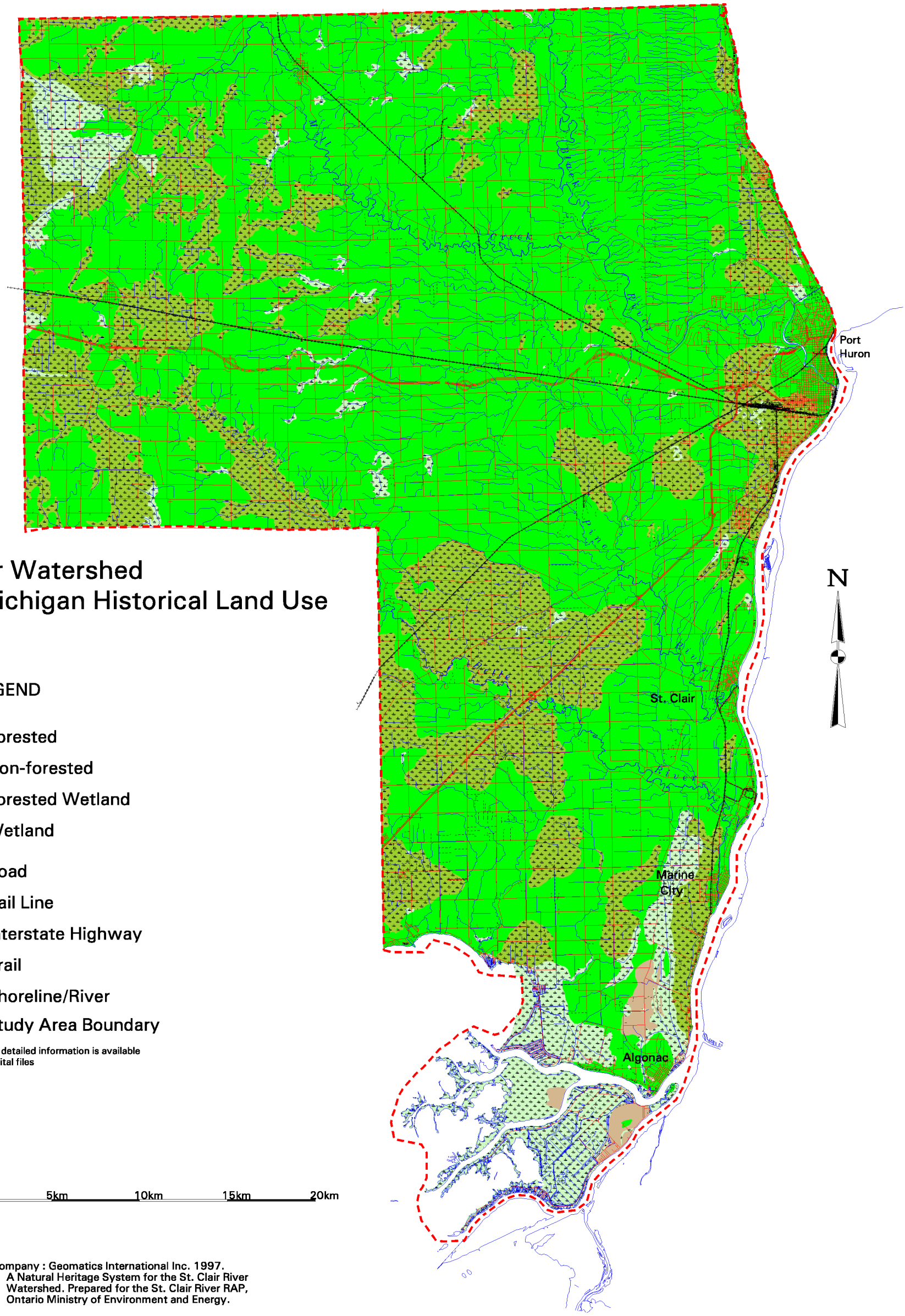

To accompany : Geomatics International Inc. 1997.
A Natural Heritage System for the St. Clair River Watershed. Prepared for the St. Clair River RAP, Ontario Ministry of Environment and Energy.

Geomatics International

Source : Historic Land Use Mapping, OMCCR
Base Information : OMNR, 1 : 10 000 scale OBM
Projection : Universal Transverse Mercator
Zone 17, NAD27

Date : November 1997

# St. Clair River Watershed
# Figure 3b : Michigan Historical Land Use




LEGEND

- Forested
- Non-forested
- Forested Wetland
- Wetland
- Road
- Rail Line
- Interstate Highway
- Trail
- Shoreline/River
- Study Area Boundary

Note : More detailed information is available in digital files

5km 0km 5km 10km 15km 20km

To accompany : Geomatics International Inc. 1997. A Natural Heritage System for the St. Clair River Watershed. Prepared for the St. Clair River RAP, Ontario Ministry of Environment and Energy.

Geomatics International

Date : November 1997

Source : MIRIS, 1 : 24 000, Presettlement Land Use - Native Use
Base Information : MIRIS, 1 : 24 000 Base Mapping
Projection : Universal Transverse Mercator
Zone 17, NAD27