Ontario

Ministry of Transportation

Highway 7 & 8 Transportation Corridor Planning and Class EA Study

From Greater Stratford to New Hamburg Area
MTO Group Work Project (G.W.P.) 13-00-00

Report F (Part 1): Working Paper - Environmental Conditions and Constraints

DRAFT

July 2007

This report is presented in draft format to obtain information and comments from stakeholders. Your input is requested by October 30, 2007 so the report can be finalized.

www.7and8corridorstudy.ca

TSH engineers architects planners

Ce document hautement spécialisé n'est disponible qu'en anglais en vertue du règlement 411/97, qui en exempte l'application de la Loi sur les services en français. Pour de l'aide en français, veuillez communiquer avec le ministère des Transports, Bureau des services en français au : 905-704-2045 ou 905-704-2046.

Table of Contents

Exhibits

Note: Some environmental exhibits (as marked *) are also available on the enclosed CD for improved viewing.

Appendices

1.0 INTRODUCTION

1.1 Introduction to the Highway 7 & 8 Transportation Corridor Study

The Ministry of Transportation (MTO) is undertaking a Highway 7 & 8 Transportation Corridor Planning and Class Environmental Assessment (Class EA) Study, from the Greater Stratford to New Hamburg area. The study will:

- develop a plan that addresses:
  - capacity, operation and safety needs along the 2-lane section of Highway 7&8 between Stratford and New Hamburg and through the urban centers (Stratford, Shakespeare and New Hamburg) along the two lane sections of Highway 7 & 8 for the movement of people and goods; and
  - linkage needs between the analysis area for broader transportation connections to other regions in the province.
- prepare a preliminary design for the provincial roadway components of that plan; and
- be documented in a Transportation Environmental Study Report for public review at study completion.

This study will also:

- build on the findings of previous MTO Highway 7 & 8 studies including:
  - Study Design – Greater Stratford to New Hamburg Area, December 2005
  - Natural Environmental Existing Conditions Report, February 2006
  - Business Impact Assessment – Existing Conditions, November 17, 2004
  - Preliminary Environmental Review of Contaminated Property and Waste Management, Secondary Source Groundwater Investigation, March 10, 2006
  - Stage 1 Archaeological Resource Assessment, October 2004
  - Description of Man-Made Heritage in the Environment, Preliminary Report, July 1981
- address the policies and growth forecasts of the final Growth Plan for the Greater Golden Horseshoe, released by the province on June 16, 2006; and
- be carried out as a Group 'A' project, in accordance with the Class Environmental Assessment for Provincial Transportation Facilities.

Access to the above documents can be obtained through the project website at www.7and8corridorstudy.ca.

A major component of the study is an outreach and consultation program structured around six key points of decision-making, each of which will be supported by:

- the release of a newsletter;
- the release of draft reports for review and comment;
- a round of Public Information Centres (PICs);
- posting of information on the study web site; and

- newspaper notices.

At the completion of the study, the filing of a Transportation Environmental Study Report (TESR) will be announced through newspaper notices. Decisions on funding and timing of detail design and construction are based upon environmental clearance of the TESR, since it authorizes the type of transportation facility and its location.

For orientation and reference, a map of the Analysis Area is provided in Exhibit 1.1 below. The analysis area is larger than the study area recommended in the Study Design Report (December 2005) because it includes a broader area in which a preliminary study area will be confirmed as part of this study.

Exhibit 1.1
Highway 7 & 8 Transportation Corridor Planning and Class EA Study
Map of Analysis Area

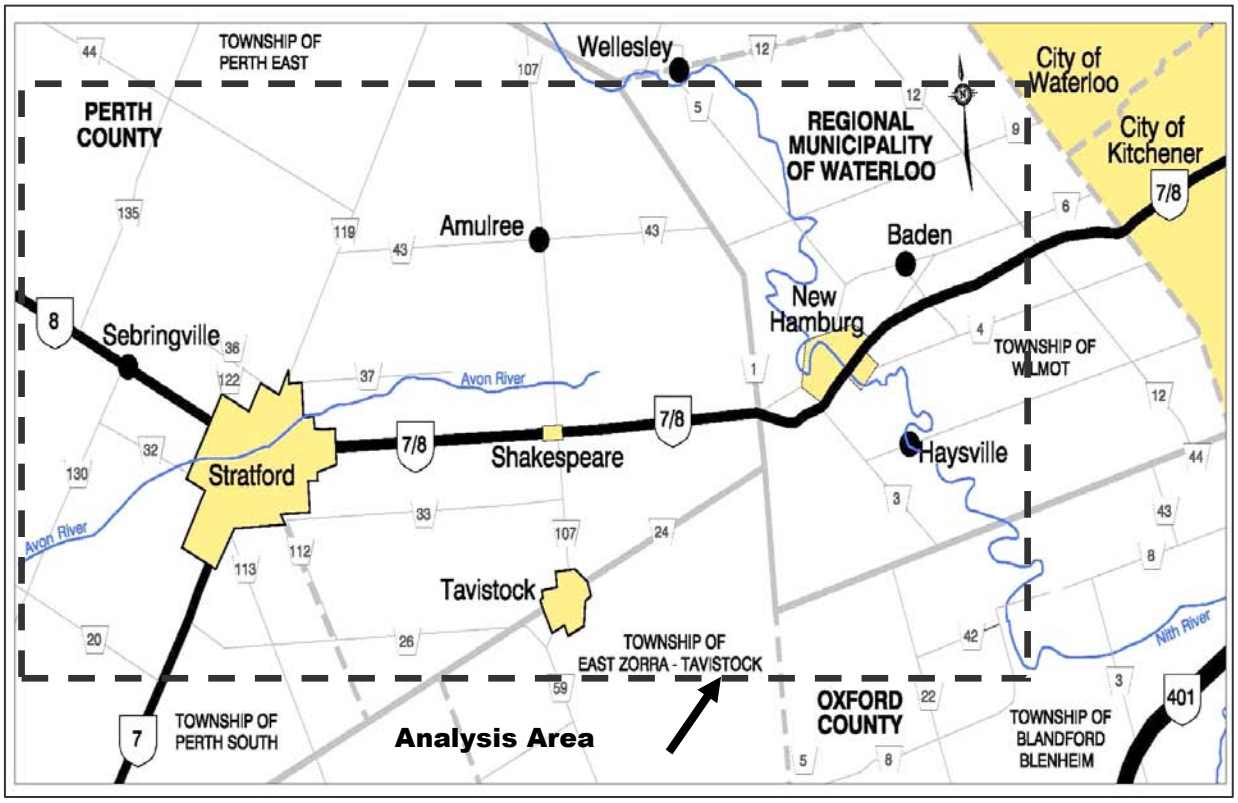


Exhibit 1.2 below provides a summary of study objectives from Report A of this study ("Study Plan for Technical Work, Outreach and Consultation").

Exhibit 1.2 Highway 7 & 8 Transportation Corridor Planning and Class EA Study Summary of Study Objectives
1. To identify and assess the factors that are driving 'Area Transportation System' needs
2. To apply those driving factors in developing a Transportation Development Strategy to address long-term multi-year needs for the movement of people and goods
3. To undertake the planning and preliminary design of the provincial roadway components (provincial highways and provincial transitways) of those strategies
4. To conduct the planning and preliminary design of provincial roadways with an inherent approach of avoiding or minimizing overall environmental impacts
5. To identify highway access management measures for growth management and highway protection
6. To engage public and stakeholders early in the study process and continue to engage them throughout the study process

Exhibit 1.3 below provides a preliminary statement of transportation problems and opportunities from Report A of the study.

Exhibit 1.3 Highway 7 & 8 Transportation Corridor Planning and Class EA Study Preliminary Statement of Transportation Problems and Opportunities
1. There are transportation capacity concerns for the movement of both people and goods along the 2-lane section of Highway 7&8 between Stratford and the New Hamburg area and on Highway 7&8 through the urban centres (Stratford, Shakespeare and New Hamburg).
2. Provincial/inter-regional traffic through the urban centres (Stratford and Shakespeare) along Highway 7 & 8 interferes with their "downtown/historic crossroads" function.
3. The connection of the analysis area to transportation corridors serving to other regions in the province may be inadequate for long-term transportation and economic development needs.
4. Geometric and traffic safety characteristics on Highway 7 & 8 must be addressed with respect to long-term traffic needs.
5. There is currently no comprehensive highway access management plan for Highway 7 & 8 from Greater Stratford to New Hamburg to protect highway needs and to address the GGH policy of discouraging inappropriate highway-related growth.

Exhibit 1.3
Highway 7 & 8 Transportation Corridor Planning and Class EA Study
Preliminary Statement of Transportation Problems and Opportunities

6. The GGH Growth Plan policy of co-ordinating transportation system planning and land use planning must be addressed.

1.2 Purpose, Relevance and Position of Report F Part 1 within Study Process

The main purpose of Report F is to document the existing environmental conditions and constraints. The environmental investigations that take place during the study will identify significant and sensitive features of the natural, socio-economic and cultural environments, so they can be avoided or so impacts can be minimized to these areas during the generation and evaluation of planning alternatives during the study. The content of Report F provides the Project Team with the information they need to satisfy Study Objective #4 listed in Exhibit 1.2.

Report F is managed in two parts as follows:

Part 1 (Summer 2007):

- Establishes an environmental overview within the analysis area based on secondary source information (existing/secondary source information – mapping / constraint mapping, data, reports), supplemented by preliminary field reconnaissance; and
- Provides an overview/background level of detail that supports the selection of 'Area Transportation System' alternatives, and the development and selection of preliminary planning alternatives.

Part 2 (Fall 2008):

- Identifies the environmental conditions and constraints within the detailed planning analysis area, referred to as the preliminary study area, (as identified through field investigations to augment secondary source information); and
- Provides a higher level of detail that supports the environmental impact assessment which is a component of generating provincial roadway detailed planning alternatives and preliminary design alternatives.

The second part of the report addresses the same environmental factor-specific areas but at differing levels of detail.

It is important to note that Report F presents information on existing environmental conditions and constraints. Potential environmental impacts and mitigation will be described in subsequent reports (i.e., Reports E, G, etc.) that include a description of the evaluation of alternatives during the study process. Commitments to future environmental work, mitigation and/or compensation will be documented in the TESR (Report K).

The study is following the federal and provincial EA processes as described in Appendix A.

A detailed outline of the study process is provided in Report A: Study Plan for Technical Work, Outreach and consultation, and an overview is provided in Appendix B of this report.

As can be seen in Exhibit 1.4 below, Report F Part 1 is the third of 11 reports to be prepared for this study and the second report of Phase 2, Area Transportation System Planning.

Exhibit 1.4
Highway 7 & 8 Transportation Corridor Planning and Class EA Study
Summary of Reports

STUDY PHASE 1: STUDY PLAN
• Report "A" Study Plan For Technical Work, Outreach And Consultation
STUDY PHASE 2: AREA TRANSPORTATION SYSTEM PLANNING
• Report "B": Working Paper – Overview of Transportation, Land Use and Economic Conditions Within the Analysis Area
• ***Report "F" 1st Part: Working Paper - Environmental Conditions And Constraints***
• Report "C": Working Paper – 'Area Transportation System' Problems and Opportunities
• Report "D": Working Paper – Area Transportation System Alternatives
STUDY PHASE 3: PRELIMINARY PLANNING
• Report "E": Milestone Report – Highway 7 & 8 Transportation Corridor Needs Assessment
STUDY PHASE 4: DETAILED PLANNING FOR PROVINCIAL ROADWAYS
• Report "F" 2nd Part: Working Paper - Environmental Conditions And Constraints
• Report "G": Working Paper – Generation of Detailed Planning Alternatives for Provincial Roadway
• Report "H": Milestone Report – Selection of Detailed Planning Alternatives for Provincial Roadway
STUDY PHASE 5: PRELIMINARY DESIGN FOR PROVINCIAL ROADWAYS
• Report "I": Working Paper - Generation of Preliminary Design Alternatives for Provincial Roadways
• Report "J": Milestone Report - Selection of Preliminary Design Alternatives for Provincial Roadway
STUDY PHASE 6: TRANSPORTATION ENVIRONMENTAL STUDY REPORT
• Report "K": Transportation Environmental Study Report

Part 1 of Report F is designed to provide a comprehensive secondary source overview of existing environmental conditions and constraints. For highlights of the report, readers are referred to the following sections of the report:

Exhibit 3.1 – Aquatic Resources
Exhibit 3.2 – Significant Natural Heritage Designations
Exhibit 3.4 – Physiography
Exhibit 3.5 – Surficial Geology
Exhibit 3.6 – Geological Cross-section
Exhibit 3.7 – Geological Cross-section
Exhibit 4.2 – Municipal Land Use
Exhibit 4.3 – Community Facilities
Exhibit 4.5 – Agricultural Soils
Exhibit 4.6 – Potential Contaminant Areas/Locations
Exhibit 5.2 – Registered Archaeological Sites
Section 3.6 – Summary of Significant/Sensitive Natural Environmental Conditions
Section 4.8 – Summary of Significant/Sensitive Socio-Economic Environmental Conditions
Section 5.3 – Summary of Significant/Sensitive Cultural Environmental Conditions
Exhibit 6.1 – Summary of Significant Environmental Features in Analysis Area

Consultation and the engagement of public and stakeholders early in the study process is relevant to the content of Report F because environmental conditions and constraints require local knowledge and information. Environmental investigations rely heavily on information obtained through shared government data bases, approving agencies and ministries, local municipalities, First Nations and the general public. Contact with agencies, ministries and municipalities were initiated early in the study, in order to obtain the secondary source information required to prepare Report F (Part 1) in time for the first Public Information Centre (PIC). Consultation in advance of the PIC has also included meetings with the Municipal Advisory Group (MAG), Regulatory Agency Group (RAG) and presentations to municipal Councils, to explain the study process and to confirm that this report will be available at the first PIC.

The early and continuous engagement of stakeholders during the study is important to the Project Team's understanding of local knowledge and the significant and sensitive features of the natural, socio-economic and cultural environments in the analysis area.

1.3 Environmental Factors, Sub-Factors and Criteria

The factors and sub-factors to be considered in the generation, assessment and evaluation of alternatives are presented in Report A of this study. For convenience, the environmental factors , sub-factors and criteria are provided in Exhibit 1.5 below.

Exhibit 1.5
Highway 7 & 8 Transportation Corridor Planning and Class EA Study
Preliminary Identification of Environmental Factors, Sub-Factors and Criteria
To Be Considered in the Generation, Assessment and Evaluation Of Alternatives

Factors / Sub-factors	Criteria
1. Natural Environmental Factors	
1.1 Fisheries and Aquatic	1.1.1 Fish Habitat

Exhibit 1.5
Highway 7 & 8 Transportation Corridor Planning and Class EA Study
Preliminary Identification of Environmental Factors, Sub-Factors and Criteria To Be Considered in the Generation, Assessment and Evaluation Of Alternatives

Factors / Sub-factors	Criteria
	1.1.2 Fish Community
1.2 Terrestrial Ecosystems	1.2.1 Wildlife
	1.2.2 Wetlands
	1.2.3 Forests
	1.2.4 Vegetation
	1.2.5 Designated/Special Areas (such as ESAs, ESPAs, ANSIs)
1.3 Groundwater	1.3.1 Areas of Groundwater Recharge and Discharge
	1.3.2 Groundwater Source Areas and Wellhead Protection Areas
	1.3.3 Large Volume Wells
	1.3.4 Private Wells
	1.3.5 Groundwater-Dependent Commercial Enterprises
	1.3.6 Groundwater-Sensitive Ecosystems
1.4 Surface Water	1.4.1 Watershed / Subwatershed Drainage Features/Patterns
	1.4.2 Surface Water in Watercourses and Wetlands
1.5 Air Quality	1.5.1 Local and Regional Air Quality
	1.5.2 Sensitive Receptors to Air Pollutants and Greenhouse Gases
2. Land Use / Socio-Economic Environmental Factors	
2.1 Land Use Planning Policies, Goals, Objectives	2.1.1 First Nation Land Claims
	2.1.2 Provincial / Federal Land Use Planning Policies/Goals/Objectives
	2.1.3 Municipal (local and regional) Land Use Planning Policies / Goals / Objectives
	2.1.4 Development Objectives of Private Property Owners
2.2 Land Use – Community	2.2.1 Indian Reserves
	2.2.2 First Nation Sacred Grounds
	2.2.3 Urban and Rural Residential
	2.2.4 Commercial/Industrial
	2.2.5 Tourist Areas and Attractions
	2.2.6 Community Facilities / Institutions
2.3 Noise Sensitive Areas (NSA's)	2.3.1 Transportation Noise
	2.3.2 Construction Noise
2.4 Land Use - Resources	2.4.1 First Nation Treaty Rights or Use of Land and Resources for Traditional Purposes
	2.4.2 Agriculture
	2.4.3 Parks and Recreational Areas
	2.4.4 Aggregates, Mineral Resources

Exhibit 1.5 Highway 7 & 8 Transportation Corridor Planning and Class EA Study Preliminary Identification of Environmental Factors, Sub-Factors and Criteria To Be Considered in the Generation, Assessment and Evaluation Of Alternatives	
Factors / Sub-factors	**Criteria**
2.5 Major Utility Transmission Corridors	
2.6 Contaminated Property and Waste Management	
2.7 Landscape	2.7.1 Scenic composition
	2.7.2 Sensitive Viewer Groups
	2.7.3 Scenic value of Views/Vistas From the Transportation Facility
	2.7.4 Specimen Trees
3. Cultural Environmental Factors	
3.1 Cultural Heritage – Built Heritage and Cultural Landscapes	3.1.1 Buildings or "Standing" Sites of Architectural or Heritage Significance or Ontario Heritage Foundation Easement Properties
	3.1.2 Heritage Bridges
	3.1.3 Areas of Historic 19th Century Settlement
	3.1.4 Cultural Heritage Landscapes
	3.1.5 First Nations Burial Sites
	3.1.6 Cemeteries
3.2 Cultural Heritage – Archaeology	3.2.1 Pre-Historic and Historic First Nations' Archaeological Sites
	3.2.2 Historic Euro-Canadian Archaeological Sites

Most of these environmental factors, sub-factors and criteria are discussed in the following sections of this report.

1.4 Environmental Work Plan

The environmental work plan will be carried out in accordance with the:

- Class EA for Provincial Transportation Facilities;
- MTO Environmental Reference for Highway Design; and
- MTO Environmental Standards and Practices documents.

For access to the above documents, please refer to the study web site.

These documents have been prepared for MTO undertakings and transportation projects of this type, to ensure that all ministry studies satisfy the requirements of federal and provincial EA principles and guidelines.

The environmental work plan includes further environmental investigations, including secondary source reviews and field investigations, after a study area is confirmed. The work plan will also be based on filling any data gaps that are identified in Phase 1 of the project.

As the study progresses and the range of alternatives become more focused, more detailed environmental investigations will be undertaken. The level of detail and scale of mapping will increase, as the Project Team begins to focus in on specific areas or corridors within the analysis area.

A full complement of environmental specialists are working on the study to investigate factor-specific area(s).

2.0 PROVINCIAL POLICY STATEMENT

The Provincial Policy Statement (PPS) is issued under the authority of Section 3 of the Planning Act. It provides direction on matters of provincial interest related to land use planning and development, and promotes the provincial "policy-led" planning system. The new Provincial Policy Statement came into effect on March 1, 2005. This coincides with the effective date of Section 2 of the Strong Communities (Planning Amendment) Act, 2004, which requires that planning decisions on applications that are subject to the new PPS "shall be consistent with" the new policies.

The Provincial Policy Statement recognizes the complex inter-relationships among economic, environmental and social factors in planning and embodies good planning principles. It includes enhanced policies on key issues that affect our communities, such as: the efficient use and management of land and infrastructure; protection of the environment and resources; and ensuring appropriate opportunities for employment and residential development, including support for a mix of uses. The new policies fulfill the government's commitment to provide strong, clear policy direction on land-use planning to promote strong communities, a clean and healthy environment, and a strong economy.

The PPS focuses growth within settlement areas away from significant or sensitive resources and areas that may pose a risk to public health and safety. Furthermore, it recognizes that the wise management of development may involve directing, promoting or sustaining growth. It states that land use must be carefully managed to accommodate appropriate development to meet the full range of current and future needs, while achieving efficient development patterns.

The PPS states that the Province's natural heritage resources, water, agricultural lands, mineral resources and cultural heritage and archaeological resources provide important environmental, economic and social benefits. The wise use and management of these resources over the long-term is a key provincial interest. Through the PPS, the Province wants to ensure that its resources are managed in a sustainable way to protect essential ecological processes and public health and safety, minimizing environmental and social impacts, to meet its long-term needs.

It is important to note that Section 1.6.6.4 of the Provincial Policy statement specifies the following:

"When planning for corridors and rights-of-way for significant transportation and infrastructure facilities, consideration will be given to significant natural heritage, water, agricultural, mineral, cultural heritage and archaeological resources."

The Provincial Policy Statement includes two sections that relate directly to environmental conditions and constraints. They are summarized below.

2.1 Wise Use and Management of Resources

The PPS states that "Ontario's long-term prosperity, environmental health and social well-being depend on protecting natural heritage, water, agricultural, mineral and cultural heritage and archaeological resources for their economic, environmental and social benefits". The policy statement identifies six broad categories for protection as summarized below:

Natural Heritage
This section includes statements about the protection of:

- natural features and areas for the long term;
- the long-term ecological function and biodiversity of natural heritage systems;
- significant habitat of endangered species and threatened species;
- significant wetlands, woodlands and valleylands as well as significant wildlife habitat and areas of natural and scientific interest;
- fish habitat;
- natural heritage features; and
- agricultural uses.

Water
This section includes statements about the protection of:

- quality and quantity of water; and
- sensitive surface and ground water features.

Agriculture
This section includes statements about the long-term protection of prime agricultural areas and specialty crop areas. It also describes permitted uses that are compatible with agricultural operations, guidelines on types, sizes and intensities of agricultural land uses and new land uses in agricultural areas. Sub-sections include:

- permitted uses
- lot creation and lot adjustments
- removal of land from prime agricultural areas

Mineral Petroleum
This section identifies a need to protect minerals and petroleum resources for long-term use. Sub-sections describe:

- protection of long-term resource supply
- rehabilitation
- extraction in prime agricultural areas

Mineral Aggregate Resource
This section states that mineral aggregate resources shall be protected for long-term use. Guidelines are listed for:

- protection of long-term resource supply;
- rehabilitation;
- extraction in prime agricultural areas; and

- wayside pits and quarries, portable asphalt plants and portable concrete plants.

Cultural Heritage and Archaeology
This section includes guidelines for the conservation of:

- significant built heritage resources and cultural heritage landscapes;
- potential and significant archaeological resources;
- lands adjacent to protected heritage property.

The protection of natural heritage, water, agriculture, minerals and petroleum, mineral aggregate resources, cultural heritage and archaeology is included in the Highway 7 & 8 Transportation Corridor Planning and Class EA Study, through the inclusion of relevant environmental factors and criteria to be used in assessing planning alternatives during the study. A description of existing features is provided in subsequent sections of this report.

2.2 Protecting Public Health and Safety

The PPS states that "Ontario's long-term prosperity, environmental health and social well-being depend on reducing the potential for public cost or risk to Ontario's residents from natural or human-made hazards. Development shall be directed away from areas of natural or human-made hazards where there is an unacceptable risk to public health or safety or of property damage".

Natural hazards include hazardous lands adjacent to shorelines or watercourses, beach areas and floodways, Special Policy Areas as approved by the Ministers of Municipal Affairs and Housing and Natural Resources, institutional uses including hospitals, nursing homes, day cares and schools, essential emergency services or hazardous substances.

Human-made hazards include lands affected by mine hazards (i.e., oil, gas and salt hazards) and contaminated sites.

The protection of public health and safety as described in the PPS will be accomplished through the application of relevant environmental factors and criteria in the evaluation of planning alternatives during the Highway 7 & 8 Transportation Corridor Planning and Class EA Study. Information on natural and human-made hazards is being collected as described in subsequent sections of this report.

3.0 NATURAL ENVIRONMENT

3.1 Fisheries and Aquatic Ecosystems

3.1.1 Methodology

A desktop review was completed for the analysis area using 2006 topographic maps. Existing fisheries and aquatic information was obtained from the Ontario Ministry of Natural Resources (MNR), Grand River Conservation Authority (GRCA), and Upper Thames River Conservation Authority (UTRCA). Due to the large analysis area, site-specific fish community and habitat data are not presented in this report. These data will be presented when the analysis area has been refined and more detailed information is required.

In order to characterize the aquatic recourses in the analysis area, the following documentation was reviewed:

- The Upper Thames River Watershed Report Cards (UTRCA 2001);
- The Thames River Watershed Synthesis Report (UTRCA 2005);
- Aquatic Species at Risk in the Thames River Watershed, Ontario (DFO/UTRCA 2004);
- Grand River Fisheries Management Plan (MNR/GRCA 1998);
- Exceptional Waters: State of the Resource Report (GRCA 2005);
- Water Quality in The Grand River: A Summary of Current Conditions (2000-2004) and Long Term Trends (GRCA 2006); and
- Grand River Fisheries Update (GRCA 2006).

3.1.2 Existing Conditions

The analysis area is divided by two watersheds: the Grand River Watershed and the Thames River Watershed. Watercourses on the west side of the analysis area flow southwest to the Thames River while watercourses on the east side of the analysis area flow southeast toward the Grand River. Watercourses within the analysis area are shown on Exhibit 3.1.

The fish community in the analysis area can be described according to thermal preference of the fish community found within a waterbody. Thermal designations for the watercourses within the analysis area are provided on Exhibit 3.1. The three major community types are defined below (Wright and Imhof 2001):

Coldwater: Fish community comprised primarily of fish species intolerant of water temperatures that exceed 22 ºC in the summer and are usually found only in groundwater rich areas.

Coolwater/Transitional water: Fish communities comprised of species that can tolerate more variable water temperatures and conditions. This will include species that are cool water tolerant

and some species of salmonids that can tolerate maximum summer water temperatures up to 24 ºC for brief periods of time. These communities are often found where occasional groundwater discharges occur.

Warmwater: Fish communities comprised of species that are highly tolerant of wide temperature and flow fluctuations and can withstand water temperatures in excess of 26 ºC for prolonged periods of time.

Both the Grand River Watershed and the Thames River Watershed contain both high quality cold water and warm water fish habitat. Exhibit 3.1 shows the thermal classification of fish habitat within the analysis area based on the Ministry of Natural Resource's Natural Resources and Values Information System (NRVIS) layer (2002).

Fish habitat and fish community are addressed in the following sections.

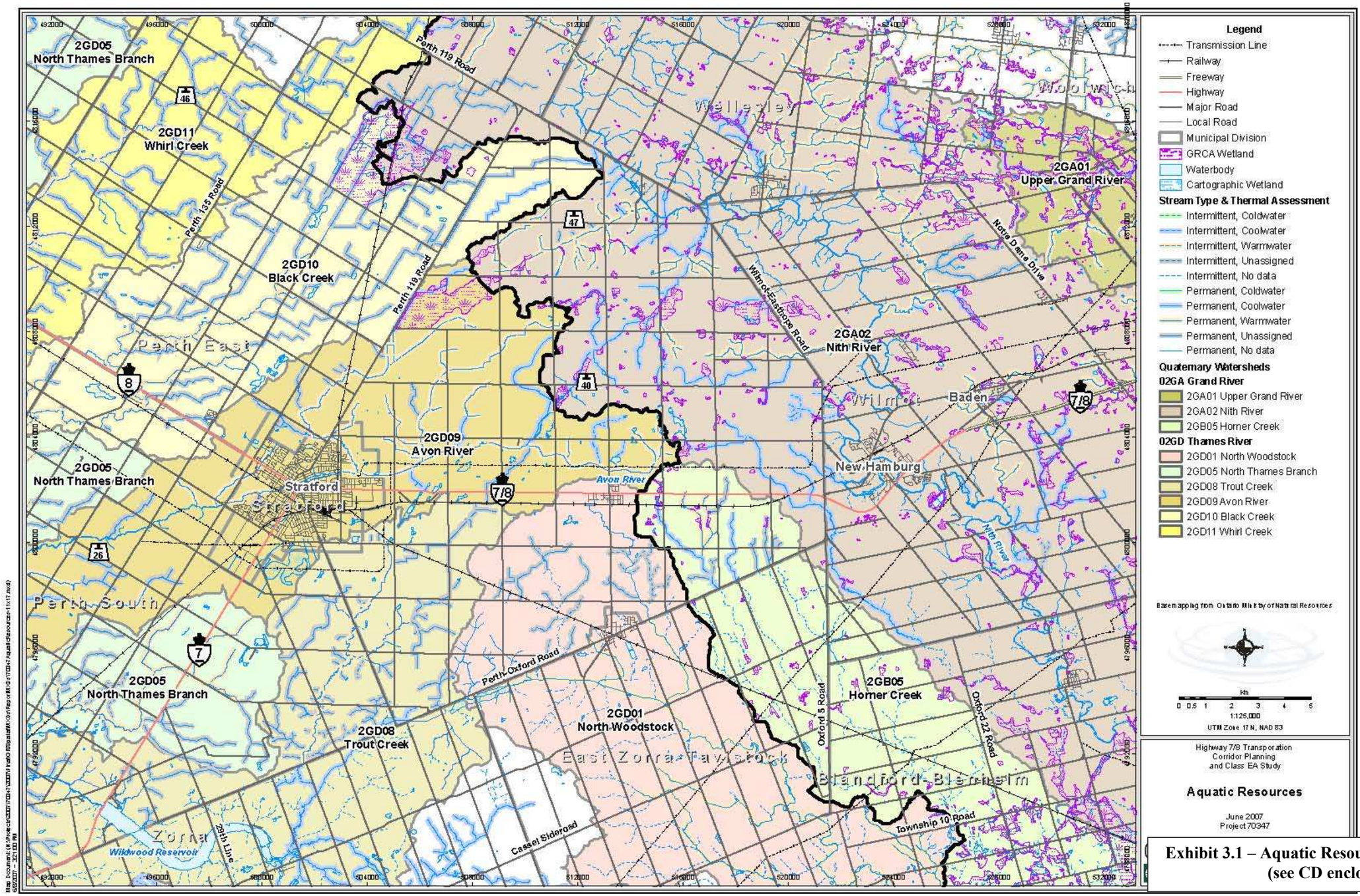


Exhibit 3.1 – Aquatic Resources (see CD enclosed)

3.1.3 Grand River Watershed

The analysis area covers three subwatersheds within the Grand River watershed: Nith River (2GA02), Horner Creek (2GB05) and the Upper Grand (2GA01).

The Grand River is the largest inland river system in southern Ontario and the largest tributary flowing into Lake Erie on the Canadian side. The Grand River is approximately 300 km long. It flows from the headwaters near Dundalk to Port Maitland, where it empties into Lake Erie. The Grand River watershed is about 6,800 km^2. Three major tributaries flow into the Grand River. These are: Speed/Eramosa, Conestogo and Nith Rivers.

The Grand River has been designated a Heritage River by the Canadian Heritage Rivers System (CHRS). The Grand River is an extremely valuable resource with over 82 species of fish in the watershed. This number is more than 50% of all the fish species found in Canada. The Grand River is a high quality fishery supporting significant populations of sport fish such as northern pike (*Esox lucius*), smallmouth bass (*Micropterus dolomieu*), and walleye (*Sander vitreus*). The river also supports a seasonal run of migratory rainbow trout (*Oncorhynchus mykiss*) from Lake Erie upstream to the Caledonia dam, well downstream of the analysis area.

Many of the Grand River tributaries contain high quality, self-sustaining coldwater salmonid populations. Brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*) are found in various tributaries throughout the analysis area. The cold-water tributaries that support the native brook trout are fed primarily from groundwater discharge areas, both as diffuse seepages and by point source springs (MNR/GRCA 1998).

Seven fish species and seven mussel species that are designated Species-at-Risk have been identified within the Grand River subwatersheds that are within the analysis area for this project. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the Species at Risk Act (SARA) lists the following fish species:

- Black Redhorse (*Moxostoma duquesnei*) - Threatened
- Silver Shiner (*Notropis photogenis*) - Special Concern
- Bigmouth Buffalo (*Ictiobus cyprinellus)* - Special Concern
- Redside Dace (*Clinostomous elonatus*) - Special Concern
- American Eel (*Anguilla rostrata)* - Special Concern
- Grass Pickerel (*Esox americanus vermiculatus)* - Special Concern
- River Redhorse (*Moxostoma carinatum)* - Special Concern

The listed mussel species are:

- Wavy-rayed Lampmussel (*Lampsilis fasciola*) - Endangered
- Rainbow Mussel (*Villosa iris*) - Endangered
- Round Pigtoe (*Pleurobema sintoxia)* - Endangered
- Kidneyshell (*Ptychobranchus fasciolaris)* - Endangered
- Round Hickorynut (*Obovaria subrotunda)* - Endangered
- Snuffbox (*Epioblasma triquetra)* - Endangered

Mapleleaf Mussel (*Quadrula quadrula*) - Threatened

Nith River

The Nith River enters the Grand River at the town of Paris and forms the western boundary of the Grand River watershed. The Nith River and its main tributaries, Wilmot and Silver Creek, are predominantly warmwater fisheries that support resident warmwater sport fish and migratory rainbow trout. However, within the analysis area the Nith River, Wilmot and Silver Creek are designated as cool water fisheries. This designation is supported by the gravelly deposits and sandy tills within the analysis area that would provide groundwater discharge. The New Hamburg Dam, located in the town of New Hamburg, is a stable warmwater fishery and has a fishway for fish migration.

Horner Creek

Horner Creek flows into Whitemans Creek, north of Princeton, and Whitemans Creek enters the Grand River between Paris and Brantford. Only Horner Creek is located within the analysis area. Presently, the upper watershed is heavily drained for agricultural purposes. Horner Creek is designated a cool water fishery and is well known as a high quality trout stream. There are also some warmwater headwater streams within the Horner Creek watershed.

Upper Grand River

The analysis area includes a very small portion of the middle reach of the Upper Grand subwatershed in the northeast corner. The middle reach within the analysis area is designated as a warmwater fishery.

3.1.4 Thames River Watershed

The Thames River is the second largest watershed in southern Ontario and one of Canada's most southern watercourses. It is approximately 273 km long and drains approximately 5,285 km^2.

The post-glacial landscape, the dynamic physical features, fluctuating water levels, pools and riffles, high nutrient levels, the presence of both coldwater and warmwater streams contribute to the river's biological diversity (Cudmore *et al*., 2004). The Thames River has been designated a Heritage River by CHRS. The Thames River and its many tributaries are rich in aquatic life, with approximately 90 species of fish and 30 species of freshwater mussels. This assemblage constitutes 58% of all the fish species found in Canada.

The Thames River is divided into three major branches: North, Middle, and South. Subwatersheds of the North and South branches in the Upper Thames watershed are located within the analysis area. The South branch arises to the west of Tavistock, continues through Woodstock and then converges with the North Thames branch in London at the Forks of the Thames. The North branch originates north of Mitchell, in London at the Fork of the Thames. The Middle branch arises southwest of Tavistock and joins the South branch near Thamesford.

Above the Forks of the Thames (North, South and Middle branches) the river is called the Upper Thames. The river below the Fork of the Thames is known as the Lower Thames. The river flows in a southwesterly direction to Lake St. Clair, which drains into Lake Erie.

To date, 72 of the 90 fish species recorded in the Thames River have been recorded in the Upper Thames watershed. Seven fish species and six mussel species that are designated Species-at-Risk are found in the Upper Thames subwatersheds that are within analysis area. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the Species at Risk Act (SARA) lists the following fish species:

- Black Redhorse (*Moxostoma duquesnei*) - Threatened
- Silver Shiner (*Notropis photogenis*) - Special Concern
- Redside Dace (*Clinostomous elonatus*) - Special Concern
- Bigmouth Buffalo (*Ictiobus cyprinellus)* - Special Concern
- Northern Brook Lamprey (*Ichthyomyzon fossor)* - Special Concern
- Pugnose Minnow (*Opsopoedus emiliae)* - Special Concern
- Spotted Sucker (*Minytrema melanops)* - Special Concern

The listed mussel species are:

- Wavy-rayed Lampmussel (*Lampsilis fasciola*) - Endangered
- Rayed Bean Mussel (*Villosa fabalis*) - Endangered
- Rainbow Mussel (*Villosa iris*) - Endangered
- Round Pigtoe (*Pleurobema sintoxia)* - Endangered
- Mudpuppy or Salamander Mussel (*Simpsonais ambigua)* - Endangered
- Mapleleaf Mussel (*Quadrula quadrula*) - Threatened

Four subwatersheds within the North Branch (2GD05) are located within the analysis area. These are: Avon River (2GD09), Trout Creek (2GD08), Black Creek (2GD10), and Whirl Creek (2GD11).The North Woodstock (2GB01) subwatershed in the South Branch of the Upper Thames watershed is also located within the analysis area.

3.1.4.1 North Branch

The North Branch of the Thames River is comprised of a variety of coolwater and warmwater streams. The North Branch watershed occupies two small portions of the southwest corner of the analysis area. Four main tributaries of the North Branch watershed are within the analysis area: Avon River, Trout Creek, Black Creek, and Whirl Creek.

The Avon River traverses the town of Stratford and vast agricultural land before entering the North Branch near St. Marys, outside the analysis area. The main channel of the Avon is designated a warmwater fishery. However, there are smaller headwater streams that are coolwater fisheries. Coldwater streams have also been identified in the Avon River watershed. There have been 34 species of fish recorded in the Avon watershed including smallmouth bass (*Micropterus dolomieu*) and largemouth bass (*Micropterus salmoides*).

Trout Creek is predominantly a warmwater system. Stream conditions are variable with some healthy coldwater streams that are known to support brook trout populations, along with degraded channelized watercourses upstream of Wildwood Reservoir (Maaskant, 2001).

Black Creek originates in the Ellice Swamp, north of Stratford, and extends through the town of Sebringville before flowing into the North Branch of the Thames River. Black Creek is a warmwater fishery with known smallmouth bass (*Micropterus dolomieu*) and rock bass (*Ambloplites rupestris*) populations. Much of the subwatershed's headwater area is comprised of degraded channelized watercourses.

The analysis area includes only a small portion of the Whirl Creek subwatershed in the northwest corner. Current information on fish habitat and community is not available for this subwatershed.

3.1.4.2 South Branch

The North Woodstock subwatershed is the only portion of the South Branch of the Thames River located within the analysis area. Coldwater streams are present in this subwatershed, some of which serve as nursery areas for game fish. Within the analysis area the main channel of the South Branch is designated a warmwater fishery, while the smaller headwater streams are coolwater fisheries.

3.2 Terrestrial Ecosystems

Methodology
As part of the literature review and desktop analysis, the following existing documentation was reviewed:

- Natural Resource Values Information System (OMNR 2006a), including digital layers delineating environmentally designated features (i.e., Provincially Significant Weltands, Locally Significant Wetlands, Areas of Natural and Scientific Interest), general locations of Species at Risk (i.e., element occurrences for species designated Endangered, Threatened, or Special Concern by the Committee on the Status of Endangered Wildlife in Canada; COSEWIC) and provincially rare species (i.e., element occurrences for species designated S1[1], S2 or S3 by the Ministry of Natural Resources; OMNR) and OMNR identified Wooded Areas; and,
- Natural Heritage Information Centre Database (OMNR 2006b), including Natural Area Reports (including the following area types: Wetland, Earth Science ANSI, Life Science ANSI, and International Biological Program site).

Correspondence was initiated with the OMNR (Mike Stone *pers. comm.* 2007) Grand River Conservation Authority (GRCA; David Cunningham *pers. comm.* 2007) and Upper Thames

[1] *S ranks are assigned by the OMNR to indicate status in Ontario. The "S" denotes "State" as the system was adopted from the United States. The designations are: S1 – extremely rare in Ontario; S2 – very rare; S3 – rare to uncommon; S4 – common and S5 – very common.*

River Conservation Authority (UTRCA; Tracy Annett *pers. comm.* 2007) in letter requests for the following natural heritage data:

- Rare species data, including those with national status (endangered, threatened and special concern species designated by COSEWIC) and provincial status (Srank and MNR rank);
- Other (non-rare) species data including flora and fauna records;
- Natural Area designations, i.e., Crown Game Reserves, Migratory Bird Sanctuaries, National Wildlife Areas, Deer Wintering Areas, Heronries, etc.;
- Ecological Land Classification mapping;
- Wetland mapping;
- Floodplain mapping;
- Other pertinent natural heritage data not identified in the data requests.

Locations of existing features are illustrated on Exhibit 3.2 and discussed in greater detail in the following section.

3.2.1 Wildlife

The Natural Heritage Reference Manual (MNR 1999) guides identification of Significant Wildlife Habitat as defined by Section 2.1 of the Provincial Policy Statement. At present, a request for information has been submitted to MNR and is pending. As data becomes available, it will be added to later versions of this report.

3.2.2 Wetlands

The Highway 7 & 8 analysis area contains a total of 31 wetlands evaluated under the Ontario Wetland Evaluation System (OWES), including eight Provincially Significant Wetlands (PSW) and 23 Locally Significant Wetlands (LSW) as illustrated on Exhibit 3.2. Evaluated wetlands are summarized in the following sections based on information from the NHIC database.

Provincially Significant Wetlands

Provincially Significant designation is assigned to wetlands and/or complexes of wetlands evaluated under Ontario Wetland Evaluation System to represent the high level of wetland function and perceived value relative to other wetland systems throughout Ontario. PSW designations are authorized by the applicable Ontario Ministry of Natural Resources district office, and are protected under the Provincial Policy Statement. The following sections provided summaries of the eight PSWs identified for the Highway 7 & 8 analysis area.

3.2.2.1 Central Whitemans/Horner Creek Complex PSW

The Central Whitemands/Horner Creek Complex is a diverse wetland made up of four wetland types (1% bog, 1% fen, 90% swamp and 8% marsh) occurring in eight individual wetlands. Wetland cover is proximately treed deciduous, with Silver Maple (*Acer saccharinum*), Ash (*Fraxinus sp.*), Yellow Birch (*Betula alleghaniensis*), Red Maple (*Acer rubrum*) and Poplar (*Populus sp.*) common throughout. Marsh communities are variable in cover, ranging from Cattails (*Typha sp.*), broad- and narrow-leaved emergents, and forb dominated systems. Notably, communities with thick organic substrates support Tamarack (*Larix laricina*) and Black Spruce (*Picea mariana*).

The wetlands are primarily palustrine in type, with small quantities of riverine and lacustrine also occurring; lacustrine types are associated with noted kettle lakes and bogs. Substrates are generally equivalent parts mineral (clay, loam and silt) and organic types (MacMillan et al., 1987).

3.2.2.2 Ellice Swamp PSW

Ellice Swamp is a large PSW made up of one wetland type (100% swamp) in 13 individual wetlands. The wetland is 100% palustrine with 100% organic substrates. Dominant vegetation forms include deciduous trees, tall shrubs, low shrubs and narrow-leaved, broad leaved and robust emergents. Swamp communities are dominated by *Spiraea sp.*, willow species (*Salix sp.*),

dogwood species (*Curnus sp*.), soft maple (*Acer sp*.), poplar (*Populus sp.),* duckweed (*Lemna sp.*), and a variety of grasses, sedges and mosses.

3.2.2.3 Gads Hill South PSW

This PSW is made up of ten individual wetlands, composed of two wetland types (95% swamp and 5% marsh). Gads Hill South complex is approximately 88% palustrine and 12% riverine. Bernard *et al.* (1994) report 37% clay/loam and 63% humic/mesic substrates. Swamp communities are dominated by Green Ash (*Fraxinus pennsylvanica)*, poplar (*Populus sp.)*, Silver Maple (*Acer saccharinum*), White Elm (*Ulmus americana)*, Nannyberry (*Viburnum lentago)*, Virginia Creeper (*Parthenocissus quinquefolia)*, Jewelweed (*Impatiens sp.*), Buckthorn (*Rhamnus cathartica*), willow species (*Salix sp.*), Yellow Birch (*Betula alleghaniensis*), Eastern White Cedar (*Thuja occidentalis)*, White Birch (*Betula pendula*), Sensitive Fern (*Onoclea sensibilis)*, Joe Pye-weed (*Eupatorium maculatum*), Skunk Cabbage (*Symplocarpus foetidus*), and Horsetail (*Equisetum arvense*). Marsh communities are dominated by dogwood (*Cornus sp*.), willow species (*Salix sp*.), JoePye-weed (*Eupatorium maculatum*), *Spiraea sp*., cattail (*Typha sp*.), goldenrod (*Solidago sp.*) and narrow leaved emergents such as grasses and sedges.

3.2.2.4 Haysville Wetland Complex PSW

Drabick *et al.* (2003) report that the PSW is comprised of 17 individual wetlands, which are composed of two wetland types (93% swamp and 7% marsh). Of the 17 wetlands, four are isolated, three are palustrine and ten are riverine (Drabick *et al.* 2003). Dominant vegetation forms include deciduous trees, tall shrubs, low shrubs, narrow-leaved emergents, submergents and herbs.

3.2.2.5 Little Lakes Swamp Complex PSW

This PSW is made up of seven individual wetlands, composed of two wetland types (85% swamp and 15% marsh). The Little Lakes Swamp complex is approximately 29% palustrine and 71% riverine. Moore and Robinson (1995) report 21% clay/loam and 79% humic/mesic substrates. Swamp communities are dominated by Green Ash (*Fraxinus pennsylvanica)*, Silver Maple (*Acer saccharinum*), White Elm (*Ulmus americana*), Black Willow (*Salix nigra*), Trembling Aspen (*Populus tremuloides*), Yellow Birch (*Betula alleghaniensis*), hemlock (*Tsuga sp.)*, Eastern White Cedar (*Thuja occidentalis*), Largetooth Aspen (*Populus grandidentata*), poplar (*Populus sp.)*, Balsam Poplar (*Populus balsamifera*), Red-osier Dogwood (*Cornus stolonifera*), Silky Dogwood (*Cornus amomum*), willow species (*Salix sp.*), Highbush Cranberry (*Viburnum trilobum*), Skunk Cabbage (*Symplocarpus foetidus*), Sensitive Fern (*Onoclea sensibilis)*, Virginia Creeper (*Parthenocissus quinquefolia)*, jewelweed (*Impatiens sp.*), Stinging Nettle (*Urtica dioica*) and Deadly Nightshade (*Atropa belladonna)*. Marsh communities support Reed Canary Grass (*Phalaris arundinacea*), Swamp Milkweed (*Asclepias incarnata)*, cattails (*Typha sp.*), jewelweed (*Impatiens sp.*), Horsetail (*Equisetum arvense*), dogwood (*Cornus sp.*), willow species (*Salix sp.*), and a variety of free-floating plants and submergent plants.

3.2.2.6 New Hamburg Oxbow Wetland Complex PSW

New Hamburg Oxbow Wetland Complex is made up of four individual wetlands, composed of two wetland types (62% swamp and 38% marsh). Wetlands are 96% palustrine and 4% isolated with substrates containing 87% clay/loam and 13% humic/mesic. The dominant vegetation forms include deciduous trees, free-floating plants, robust emergents and narrow leaved emergents.

3.2.2.7 Phillipsburg Swamp PSW

This PSW is made up of eight individual wetlands (six isolated and two palustrine) composed of two wetland types (99% swamp and 1% marsh). Drabick *et al.* (2003) report 10% clay/loam and 90% humic/mesic substrate. Swamp communities are dominated by Silver Maple (*Acer saccharinum*), Yellow Birch (*Betula alleghaniensis*), Green Ash (*Fraxinus pennsylvanica)*, hemlock (*Tsuga sp.)*, White Oak (*Quercus alba*), White Pine (*Pinus strobes*), Eastern White Cedar (*Thuja occidentalis*), Canada Yew (*Taxus canadensis*), Wood Fern (*Dryopteris sp.*), jewelweed (*Impatiens sp.*), False Nettle (*Boehmeria cylindrical*), Sensitive Fern (*Onoclea sensibilis)*, Poison Ivy (*Toxicodendron radicans*) and dogwood (*Cornus sp.*). Marsh communities are dominated by Green Ash (*Fraxinus pennsylvanica)*, willow species (*Salix sp.*), Marsh Milkweed (*Asclepias incarnate*), Soft Rush (*Juncus effuses*), cattail (*Typha sp.*), duckweed (*Lemna sp.*) and pondweed (*Potamogeton sp.*).

3.2.2.8 Spongy Lake PSW

Spongy Lake wetland is a PSW composed of two individual isolated wetlands, composed of four wetland types (2% bog, 17% fen, 42% swamp and 38% marsh) that are 100% isolated. Swamp communities are dominated by Yellow Birch (*Betula alleghaniensis*), Silver Maple (*Acer saccharinum*), White Birch (*Betula pendula*), White Pine (*Pinus strobes*), ash (*Fraxinus sp.)*, Tamarack (*Larix laricina*), Eastern White Cedar (*Thuja occidentalis)*, dogwood (*Cornus sp.*), and a variety of sedges, grasses and herbs. Marsh communities are dominated by narrow-leaved emergents including sedges, grasses, cattail (*Typha sp.*), and mosses. Narrow-leaved and robust emergents dominate fen communities. Bogs are dominated by Tamarack (*Larix laricina*), Leatherleaf (*Chamaedaphne calyculata*), blueberry (*Vaccinium sp.*), herbs and moss. Open water communities contain mixed submergents and include unvegetated portions in depths greater than 2m deep.

Locally Significant Wetlands

Locally Significant Wetlands are wetland units and/or complexes evaluated under the Ontario Wetland Evaluation System (OWES) that did not meet the requirements for a Provincially Significant designation. However, these wetlands provide unique or specialized function within the context of the local landscape, including maintenance of critical ecosystem function, moderation of storm flows and water quality, protection for rare species, as well a number of social benefits. Locally Significant Wetlands (LSW) are protected by various policies

administered by the local planning authorities, including Municipal Official Plans and the Conservation Authorities Act.

A review of the analysis area identified 23 individual LSWs as illustrated on Exhibit 3.2. Swamp and marsh wetland types are common throughout all LSWs. Fen and bog units rarely occur on this landscape and are more representative within PSW designations. Swamp units are dominated by deciduous cover including Silver Maple (*Acer saccharinum*), Ash (*Fraxinus sp*.), Poplar (*Populs sp*.), Black Willow (*Salix nigra*), Swamp White Oak (*Quercus bicolor*), represented in treed communities, and Red-Osier Dogwood (*Cornus stolonifera*), shrub Willows (*Salix sp*.), Alder (*Ulnus sp*.) and Buttonbush (*Cephalanthus occidentalis*) common in the understory and swamp thicket communities. Marsh communities vary in dominant species, with Cattails (Typha sp.), Sedge (*Carex sp.*) and other graminoids, and forb communities common throughout.

LSWs identified for the Highway 7 & 8 analysis area are listed as follows:

- Baden East Wetland Complex
- Baden Southwest Wetland Complex
- Berletts Corners North Wetland Complex
- Gads Hill Swamp North
- Haysville North Wetland Complex
- Josephsburg South Wetland Complex
- New Hamburg South Wetland Complex
- New Prussia Southeast Wetland Complex
- Nith River Wetland Complex II
- Phillipsburg Northeast Wetland Complex
- Plattsville North - Nith River Wetland Complex
- Sebringville Woods
- Shakespeare Hills/Avon Banks
- Silver Creek
- Silver Spring Creek - Hunsburger Creek Wetland Complex
- St. Agatha West Wetland Complex
- St. Agatha Wetland Complex
- Stratford Complex
- Upper Alder Creek Wetland Complex
- Waldau Wetland Complex
- Washington Creek
- Wilmot Creek Wetland
- Zorra Swamp

3.2.3 Forests

3.2.3.1 Interior Forest Habitat

Interior forest habitat is a sheltered environment away from the influence of forest edges and open habitats. The presence of forest interior is a sign of woodland health, and is directly related to the woodland's size and shape. Large woodlands with round or square outlines have the greatest amount of forest interior. Narrow, linear woodlands are less likely to support interior forest habitat.

Wildlife populations in southern Ontario are often healthier in regions with relatively more forest cover and where forest fragments are grouped closely together or connected by corridors of natural habitat. Experts believe that 25 to 30 per cent forest cover is required to support high flora and fauna richness attributes associated with historical forest cover (Landowner Resource Centre 2000).

Most authors recognize the interior forest habitat located more than 100 m away from the forest edge (Riley and Mohr, 1994). The 100 m rule has been adopted by most planning level studies however tolerance of edge disturbance should be considered on a species by species basis. The Wildlife Habitat Technical Guide (OMNR 2000) has adopted an "area-sensitive species" concept to treat species-specific tolerances to edge effects, and to use breeding bird observations as evidence of suitable habitat availability. Analysis area-sensitive bird data will be included in the assessment of site specific data and reported in Part 2 of Report F – after field work is carried out for a preliminary study area.

An estimate of interior forest habitat within the analysis area was identified by applying the 100 m rule to all woodland identified by the OMNR (2007a) as illustrated on Exhibit 3.2. A total of 7671.7 ha of forest was identified for the analysis, 1173.5 ha of which was identified as interior forest.

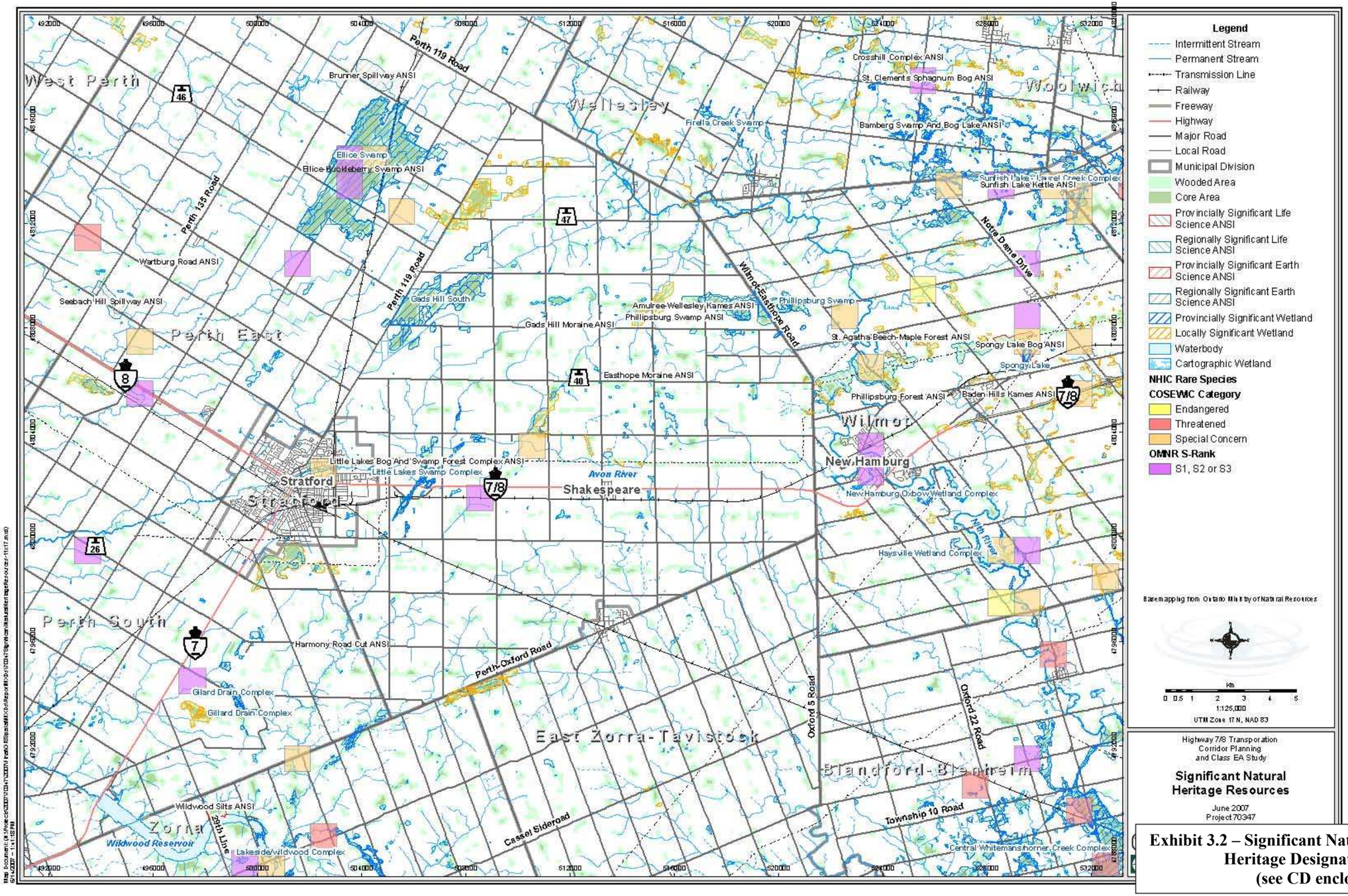


Exhibit 3.2 – Significant Natural Heritage Designations (see CD enclosed)

3.2.4 Rare Species

A review of the NHIC database identified a total of 26 significant plant and wildlife species in the Highway 7 & 8 corridor analysis area, including seven species of national concern (ranked special concern, threatened or endangered by COSEWIC) and 19 provincially significant species (according to S ranks and MNR status posted on the NHIC database). Exhibit 3.3 below provides a summary of significant species by organism type and mapped approximately on Exhibit 3.2 as element occurrences. A complete species list appears in Appendix C.

Exhibit 3.3 Summary of Significant Species

Organism Type	Nationally Significant Species (COSEWIC)		Provincially Significant (Srank/MNR rank)	
	No. of Species	No. of EO*	No. of Species	No. of EO*
Breeding Birds	**1**	**1**	**3**	**6**
Herptiles	**1**	**1**	**0**	**0**
Odonata	**0**	**0**	**1**	**1**
Vascular Plants	**3**	**4**	**12**	**12**
Fish	**1**	**1**	**3**	**6**
Molluscs	**1**	**1**	**0**	**0**
TOTAL	**7**	**8**	**19**	**25**

**EO – element occurrences*

3.2.5 Designated / Special Areas

The Highway 7& 8 analysis area contains five Life Science (LS) Areas of Natural and Scientific Interest (ANSI) and five Earth Science (ES) ANSIs. These are presented on Exhibit 3.2. All ANSIs are summarized in the following sections. Summaries are based on information obtained from the NHIC database. Complete ANSI reports are pending.

3.2.5.1 Little Lakes Bog and Swamp Forest ANSI-LS

Little Lakes Bog and Swamp Forest is a 135 ha mixture of swamp forest that is dissected by a hydro corridor, the Avon River flowing through the forest, and three kettle lakes. The ecosystem complex is made up of seven community types consisting of open water, floating sphagnum mat, cattail pockets, tamarack swamp, silver maple swamp, hemlock-cedar swamp and beech-maple forest. One of the lakes is divided in half by fill and one lake is separated from the other two by Highway 7 & 8 and a railroad corridor.

3.2.5.2 Phillipsburg Forest ANSI-LS

Phillipsburg Forest covers an area of approximately 310 ha consisting mainly of black maple-ash-hickory forest. The landform is a floodplain area on a kame moraine, spillway and undrumlinized till plain. The forest makes an upland progression to sugar maple-hemlock, beech-maple and oak forest. Some rare plant species are present in Phillipsburg Forest including Green Dragon (*Arisaema dracontium*), Shaggy False Gromwell (*Onosmodium hispidissimum*) and White Trout Lily (*Erythronium albidum*).

3.2.5.3 Phillipsburg Swamp ANSI-LS

Phillipsburg Swamp covers an area of approximately 310 ha comprised mostly of a mature silver maple swamp, which is divided into a section of spring swamp and a section of perennial swamp. The swamp is composed of beech-maple upland wood and hemlock-yellow birch communities. The area has been disturbed by logging and dumping, with most of the disturbance occurring in the eastern section.

3.2.5.4 Spongy Lake Bog ANSI-LS

Spongy Lake Bog is an 80 ha area bog located in a geologic kettle. Some examples of representative bog types within Spongy Lake Bog include tamarack fen, tamarack-black spruce bog, water willow shrub carr, white cedar swamp, and cedar-red maple swamp. A small portion of this area consists of upland maple-beech forest.

3.2.5.5 St. Agatha Beech-Maple Forest ANSI-LS

St. Agatha Beech-Maple Forest is a 95 ha length of maple-beech forest on undrumlinized till plain, which is divided by a hydro corridor. Narrow-leaved Spleenwort (*Asplenium pycnocarpon*) is a rare species that has been found on this site.

3.2.5.6 Baden Hills Kames ANSI-ES

Baden Hills Kames ANSI is located 1 km east of the village of Baden in Wilmot Township, Waterloo Country. It is a late Wisconsinan – Port Huron Stadial glacial deposit. These hill stand up as domes about 200 feet high and are composed of sand and gravel. Spongy Lake to the north is a kettle lake and serves as a typical complement to the Baden Hills.

3.2.5.7 Harmony Cut ANSI-ES

Harmony Cut ANSI covers an area of approximately 0.41 ha. This ANSI contains the Type Section of the Late Wisconsinan Port Bruce Stadial Stratford Till and Tavistock Till. Stratford Till is overlain by Tavistock Till at the ANSI. Stratford Till represents a weak Huron ice advance, while Tavistock Till is a strong ice advance from the northwest.

3.2.5.8 Seebach Hill Spillway ANSI-ES

The Seebach Hill Spillway is approximately 500 ha. The ANSI contains Late Wisconsinan, Port Bruce Stadial, Milverton Moraine (Wartburg Till), Elma Till, Stratford Till and a spillway.

3.2.5.9 Wartburg Road Cut ANSI-ES

The Wartburg Road Cut covers an area of approximately 0.41 ha. The ANSI contains the Late Wisconsinan, Port Bruce, Stadial and Wartburg Till. Wartburg Till appears to represent a

minor ice advance deposited by either the Georgian Bay and/or Huron ice lobe. The Wartburg Till forms the Milverton Moraine.

3.2.5.10 Easthope Moraine ANSI-ES

The Easthope Moraine ANSI report is not present on the NHIC database (2006). Additional information is being obtained from MNR.

3.2.6 International Biological Program Sites

Three sites within the study were inventoried as part of the International Biological Program (IBP) during the late 1960's and early 1970's. The studies were part of an international initiative developed by the International Council of Scientific Union and the International Union of Biological Sciences focusing on the productivity of biological resources, environmental change and human adaptability to environmental change. The three sites documented below corresponded with Wetland and/or ANSI designated areas discussed in greater detail in the preceding sections. IBP sites are noteworthy for a number of reasons including their relatively large areas of natural cover and biodiversity in the landscape, and their contributions to scientific study.

3.2.6.1 Ellice Huckleberry Marsh

The Ellice Huckleberry Marsh covers a total area of approximately 791.2 ha, which is dominated by 368 ha of wet mesic closed deciduous mature deciduous swamp. Wet mesic semi-open deciduous swamp forest comprises 174 ha of the total marsh followed by 162 ha of wet semi-open swamp peatland heath and 54.7 ha of wet semi-open mixed swamp scrubland.

3.2.6.2 Gads Hill Agreement Forest

The Gads Hill Agreement Forests is a mesic forest complex measuring approximately 280 ha in area and consisting of successional lowland deciduous and mixed forest and swamp. Landform character is generally flat in relief, described as a broad basin of modified moraine lake, with predominately poorly drained clay substrates and scattered organic deposits (Hay 1971). The forest includes areas of unusually mature trees, and is considered an important regional example of climax beech - maple forest.

3.2.6.3 Spongy Lake Bog and Sand Hills

The total area of the Spongy Lake Bog and Sand Hills area is 47.3 ha within a kame moraine complex. Within this complex is a kettle depression with a small shallow lake and flat peat basin with high sand hills on all sides of the small lake. Seven distinct communities are represented within the diverse complex including lowland coniferous, mixed and deciduous forests, thickets, marshes and aquatic communities. Disturbances are generally considered light to moderate and are mainly due to cutting and grazing. This ecosystem has been described as a good example of communities that are demonstrative of sub-boreal habitats, including tamarack fen, water willow carr, and white cedar swamp (Walsh 1970).

3.3 Geology and Hydrogeology

3.3.1 Methodology

Assessment of analysis area hydrogeological conditions was conducted by way of a desktop study. The desktop study included review of published information including:

- Ontario Geological Survey mapping (Karrow, 1987);
- Ministry of Environment water well records (MOE, 2006);
- Ontario Base Mapping (MNR, 2006); and
- Available wellhead protection information (Perth and Oxford Counties) and historical consulting reports.

A Geographic Information System (GIS) platform enabled spatial data sets to be overlaid so that relations among different variables could be detected and sensitive areas identified.

A conceptual understanding of the local hydrogeology was developed from historical reports including a Perth County Groundwater Study. This conceptualization was refined through analysis of water well records, delineated capture-zones, geological mapping and local drainage patterns. Exhibit 3.4 portrays the physiography including the major landforms and surface topography of the analysis area. Exhibit 3.5 shows the regional surficial geology, location of cross-sections, location of MOE water wells, high water use municipal wells and well head protection areas for some selected municipal supply wells. To assist in this analysis, two geological cross-sections as shown on Exhibits 3.6 and 3.7 were also prepared. The refined conceptual understanding of the local and regional hydrogeology was then used to highlight areas of sensitivity and/or significance to the proposed road-construction activities.

3.3.2 Physiography and Topography

The landforms within the area of investigation are shown on Exhibit 3.4 and are described in this section.

The landforms have been shaped by a cover of glacial deposits that overlay Devonian and Silurian age limestone bedrock. The glacial landforms were formed from clay drift, resulting in low slopes and subdued landforms. In addition, the ice commonly bordered shallow, temporary ponds, which modified the landforms through wave action and through filling depressions with lacustrine silt. Bedrock topography has had little influence on the surficial landforms.

Surficial topographic relief is minimal throughout the analysis area with the exception of moraine ridges cross-cutting various parts of the area. The topographic relief is largely the result of glacial depositions such as moraine, eskers and kames, and erosion (river valleys) during the Quaternary period.

Relief within the area ranges from approximately 427 m Above Sea Level (ASL) in the middle, north and northeast extents to 299 mASL in the southeastern reaches and along the river valley

(Exhibit 3.4). The higher elevations correspond to the moraine, kame and esker features. The area is drained by a number of major watercourses such as the Avon and Nith Rivers and numerous other permanent and intermittent creeks.

3.3.3 Geology

The distribution of subsurface materials influences the rate and direction of groundwater movement in the analysis area. Although the characteristics of the underlying bedrock are important in understanding regional-scale aquifers and groundwater protections, the shallow overburden sediments are most relevant to this study, given their thickness and the relatively shallow impacts associated with highway construction and improvements. Details of the subsurface geologic and hydrogeologic condition were evaluated through the development of two representative cross-sections using the MOE Well Record database across the analysis area. The locations of the cross-sections are presented in Exhibit 3.5. Exhibit 3.6 portrays an N-S cross-section along eastern reach and Exhibit 3.7 portrays a N-S cross-section along western reach. The cross-sections depict the extensive till units overlying bedrock throughout most of the analysis area. The following sections describe the geology of the area of investigation in terms of bedrock and surficial geology.

3.3.3.1 Bedrock Geology

Regionally, the bedrock is comprised of nearly flat-lying Paleozoic (Devonian and Silurian) limestones, dolostones and shales underlying the overburden sediments throughout the analysis area. Water well information data in the analysis area was used to interpret the position of the bedrock surface. Bedrock is encountered in most of the wells at a depth of about 50 - 80 m. Although nearly flat, there is a regional slope (<0.2%) of the bedrock surface to the south, dropping from 325 mASL to 295 mASL. No exposed bedrock was encountered across the analysis area.

3.3.3.2 Surficial Geology

Above the bedrock are unconsolidated Quaternary age soil/sediments of varying depths, deposited during a complex sequence of glacial advances and retreats that have occurred over the past million years. The most common materials resulting from these glaciations are till, surficial sand and gravel outwash, ice-contact deposits and glaciolacustrine sediments deposited within glacial lakes. The lateral distribution of surficial soils is shown on Exhibit 3.5. The distribution and thickness of overburden is shown in cross-section in Exhibits 3.6 and 3.7. The term "overburden" is used to group the unconsolidated soil deposits lying on the competent bedrock. Within most areas, the thickness of overburden materials is substantial and may be over 80 m thick.

Till is a low permeable unsorted mixture of clay, silt, sand, gravel and stones in varying proportions. It forms the major component of the overburden in the analysis area. The Gads Hill Moraine northeast of Stratford is capped by silty to sandy tills that form part of the regionally extensive Stratford till. The Stratford till is shown in light green on Exhibit 3.5. This till occurs at the surface over much of the western part of the analysis area. It underlies the younger till (silty

clay till) north of Shakespeare and east of the analysis area. The Easthope Kame Moraine north of Shakespeare is the topographic high point of the area and is also capped by the silt to clayey till. Sometimes sandy ice-contact deposits occur between the till sheets. The core sediment of the moraine is composed of sand and gravel materials. To the east of the end moraines, the till surface drops down to the Nith River, which lies in an area infilled with outwash sand and gravel. In places, till contains isolated lenses and thin layers of sand, silty sand and gravely sand which serve as a shallow overburden aquifer for local residential water supply.

The eskers and kames are illustrated on Exhibit 3.5 as ice-contact stratified and glaciofluvial deposits (orange and pale orange colour). Eskers are sand and gravel deposits that are formed from melt water channels within or below a glacier. Readily identifiable eskers trend northwest-southeast and are found along the Nith River basin. Kames are ice-contact deposits that are typically laid down at the front of melting glaciers. The most well developed kames within the analysis area are Easthope Kame Moraine located north of Shakespeare, west of Nith River and the second series is located in the northeastern most corner east of Baden.

Glaciolacustrine sediments are composed of laminated clay and silt and have been surficially deposited over silty and sandy till. These deposits are considered to be locally thin and discontinuous. On the surficial geological map, these deposits are light blue and are mainly found in the western part of the analysis area. Although thin and discontinuous, some pockets can reach up to 10 m in thickness.

Finally, long narrow stretches of modern alluvial and organic deposits are found along the surficial rivers/streams/creek, coloured brown on the Exhibit. These materials are relatively thin and overlay the till surface.

Of interest to this study, which will be dealing with the near surface overburden, is the presence of a desiccated soil layer at surface called the weathered zone. Typically in Ontario the upper 3 to 5 m of the overburden is subject to significant weathering mechanisms such as freeze-thaw cycles, thermal fluctuations, geochemical dissolution of some minerals by fresh rainwater, compaction and disruption and post glacial stress release. The net result is a slightly enhanced permeability created by more loose soils and preferential pathways such as fractures in more clayey soils.

3.3.4 Hydrogeology

Groundwater within the Highway 7 & 8 Transportation Corridor Planning analysis area supports vegetation, animals, and humans. People living in the rural areas obtain their drinking water from wells, and numerous industries rely on groundwater for commercial and industrial use. Aquifers supply farmers with water for irrigation and to develop their products for commercial distribution. Aquatic habitat, in both streams and wetlands, is dependent on specific groundwater conditions. Certain fish species require a specific thermal regime, which may be influenced by groundwater upwelling, and wetland vegetation can be highly sensitive to changes in groundwater quality.

The analysis area includes regionally important groundwater recharge areas as well as discharge areas commonly associated with wetlands and rivers and streams. Hydrogeologically sensitive areas are identified on the basis of surficial geology, groundwater recharge and discharge areas, and the locations of water wells.

3.3.4.1 Water Supply Aquifers

Due to the heterogeneity of overburden deposits, it is difficult to characterize a single regional overburden aquifer. However, multiple discontinuous aquifers of varying lateral extent exist throughout the analysis area. Unconfined systems, such as the surficial sand and gravel deposits to the northeast can provide sufficient yield for private as well as for municipal water supply wells. In contrast, confined or semi-confined systems within silty material can supply only enough for a single household. Within the analysis area, over 60% of drilled wells are completed in bedrock, indicating that the bedrock is an important regional aquifer. Within the bedrock, aquifers exist at specific depths where the rock is characterized by a well-developed network of fractures. Bedrock aquifers are generally of large lateral extent, and provide sufficient yield for the municipal water supply.

3.3.4.2 Recharge and Discharge Areas

Most of the Perth County, which covers a major part of the analysis area is considered a bedrock recharge area (Waterloo Hydrogeologic, 2003). However, regionally significant recharge occurs through the surficial sands and gravels deposits in the northwest reaches as well as in area of thin drift over bedrock. The Easthope and Gads-Hill Moraine are also recharge areas, although the low permeability capped soils limit the amount of recharge. Recharge also occurs in areas of lacustrine or outwash sands overlying the low permeability tills. Generally, the surficial sand accepts significant recharge and acts as a storage reservoir feeding the downward leakage through the silt and clay below. Where creeks cut into these sediments there is lateral flow and some local discharge occurs from these horizontally layered deposits.

Groundwater discharge areas are predominantly limited to wetlands and river and stream valleys. This is expected since in many of these areas groundwater is providing baseflow to these water bodies (Waterloo Hydrogeologic). Local variations to this pattern occur along the hummocky crest of the moraine, eskers and kame areas. Here, the presence of topographical depressions lined with low-permeability material creates the necessary conditions for perched water tables, which give rise to numerous wetlands, streams and isolated ponds. These features receive only limited ground water discharge on a seasonal basis.

3.3.4.3 Groundwater Flow

Groundwater flow directions are important with respect to the capture areas for municipal wells and for the supply to local wells, wetlands and streams. Similar to much of Ontario, most of this area is a recharge area, with a strong downward component of ground water flow to the bedrock aquifers below. Ground water flow in the bedrock is predominantly lateral towards regional discharge zones such as the Avon, Thames and Nith Rivers. Perth County Groundwater Management study (Waterloo Hydrogeologic, 2003), which covers part of the present

investigation area, identified regional groundwater flow in bedrock from northeast (415 mASL) to southwest (220 mASL). A bedrock groundwater divide occurs near the Easthope Moraine along a line running north of Shakespeare towards Gads Hill (Exhibit 3.4). This groundwater high separates flow in the bedrock towards the Nith River watershed in the east and Avon River watershed in the south.

Groundwater flow patterns are more complex in the overburden. The surficial till and fine-grained lacustrine sediments covering most of the analysis area inhibit rapid groundwater movement. Under this condition, in most areas groundwater flow will be downward through the low permeability sediments. The groundwater table typically is a subtle reflection of the topographic surface, providing some lateral hydraulic gradient. Where the water table lies in the upper more weathered zone (typically in the upper 3 to 5 m) of the soil, groundwater will flow slowly in a lateral direction. Groundwater flow rates are not great in this respect as these soils are usually of low permeability. Where more permeable sand lenses exist, they will conduct groundwater laterally, provided there is an outlet.[2] This also happens in the horizontally layered fine-grained glaciolacustrine deposits in the western part of the analysis area, as previously described.

3.3.4.4 Water Wells

Examination of the water well database reveals a total of 2,718 reliably located wells on record[3] within the analysis area (MOE, 2006). Of these, 1,090 are screened in the overburden, and 1,628 are screened in bedrock. Of these 1,090 overburden wells, 152 are dug wells, screened mainly within the shallow overburden units of till. Dug wells are typically of large diameter, drilled in low permeability soils, and rely on the well storage to provide enough water for single-family use.

Of the 1,628 bedrock wells, 1,408 are finished in the upper 30 m of the bedrock surface. This is because the upper bedrock layers have usually undergone the most physical weathering and exhibit significant vertical joints and fractures, often enhanced by millennia of dissolution. The remainder are found at greater depths. Exhibit 3.5 shows that most bedrock wells are in confined aquifers, protected by low permeability overburden aquitards. Where there is only thin drift such as in eskers, kames and moraine areas, the numbers of bedrock wells are lower as the bedrock aquifers respond as unconfined systems and are not as well protected.

A total of 42 municipal and three communal supply wells operate within or around the analysis area. Wells operate on a continuous or intermittent basis depending on seasonal demand. Of these wells, 19 are located in the eastern part near New Hamburg, Philipsburg, Baden, St. Agatha area, and 26 wells in the western part surrounding the Stratford area. All of the municipal wells throughout the Perth County pump water from the bedrock (Waterloo Hydrogeologic, 2003). Some municipal wells that are located in Kitchener-Waterloo in the northeast part (eskers and kame areas) are drilled in overburden. As shown in Exhibit 3.5, capture zones and wellhead

[2] *For example, a pumping well, or a watercourse.*

[3] *It is our experience that up to 30% more unreported wells may exist. However, given the large number of wells, we believe we have a representative coverage for the purposes of this study.*

protection areas (WHPAs)[4] have been mapped for some selected wells. Wells outside the analysis area have been included in this analysis because their WHPAs extend into the study domain.

3.4 Surface Water

The analysis area is divided by the Grand River Watershed and the Thames River Watershed. Watercourses on the west side of the analysis area flow southwest to the Thames River while watercourses on the east side of the analysis area flow southeast toward the Grand River.

3.4.1 Grand River Watershed

The Grand River is the largest inland river system in southern Ontario and the largest tributary flowing into Lake Erie on the Canadian side. The Grand River is approximately 300 km long. It flows from the headwaters near Dundalk to Port Maitland, where it empties into Lake Erie. The Grand River watershed is about 6,800 km^2. Three major tributaries flow into the Grand River. These are: Speed/Eramosa, Conestogo and Nith Rivers. The Grand River has been designated a Heritage River by the Canadian Heritage Rivers System (CHRS).

The analysis area encompasses three subwatersheds of the Grand River: Nith River (2GA02), Horner Creek (2GB05) and a small corner of the Upper Grand (2GA01). These subwatersheds are described below but more detail is provided in Section 3.1.3.

3.4.1.1 Nith River

The Nith River enters the Grand River at the town of Paris and forms the western boundary of the Grand River watershed. The Nith River flows primarily through lands that are under heavy agricultural use and are extensively drained. Some gravel deposits provide groundwater discharge but the system through the analysis area exhibits poor water quality and sedimentation. Its main two tributaries are Wilmot Creek and Silver Creek.

3.4.1.2 Horner Creek

Horner Creek flows into Whitemans Creek, north of Princeton. Whitemans Creek converges with the Grand River between Paris and Brantford, which is well beyond the analysis area. The upper watershed is heavily drained for agricultural purposes, however some localized deposits of sand and gravel are present that contribute small amounts to baseflow.

3.4.1.3 Upper Grand

The analysis area encompasses only a small portion of the middle reach of the Upper Grand Subwatershed in the northeast corner. This area is primarily a headwaters area and exhibits

[4] *These wellhead protection areas are based on those reported by each municipality and are usually of a preliminary nature as many of those studies are still in draft.*

groundwater discharge that generates substantial baseflow.

3.4.2 Thames River Watershed

The Thames River is the second largest watershed in southern Ontario and one of Canada's most southern watercourses. It is approximately 273 km long and drains approximately 5,285 km^2.

The Thames River is divided into three major branches: North, Middle, and South. Subwatersheds of the North and South branches in the Upper Thames watershed are located within analysis area. The South branch arises to the west of Tavistock, continues through Woodstock and then converges with the North Thames branch in London at the Forks of the Thames. The North branch originates north of Mitchell, in London at the Fork of the Thames. The Middle branch arises southwest of Tavistock and joins the South branch near Thamesford.

Above the Fork of the Thames (North, South and Middle branches) the river is called the Upper Thames. The river below the Fork of the Thames is known as the Lower Thames. The river flows in a southwesterly direction to Lake St. Clair, which drains into Lake Erie.

This system has been described in some detail in Section 3.1.4.

The Avon River, Trout Creek, Black Creek and Whirl Creek constitute the subwatersheds of the North Branch that flow through the analysis area. North Woodstock subwatershed is in the South Branch of the Upper Thames and drains the south portion of the analysis area.

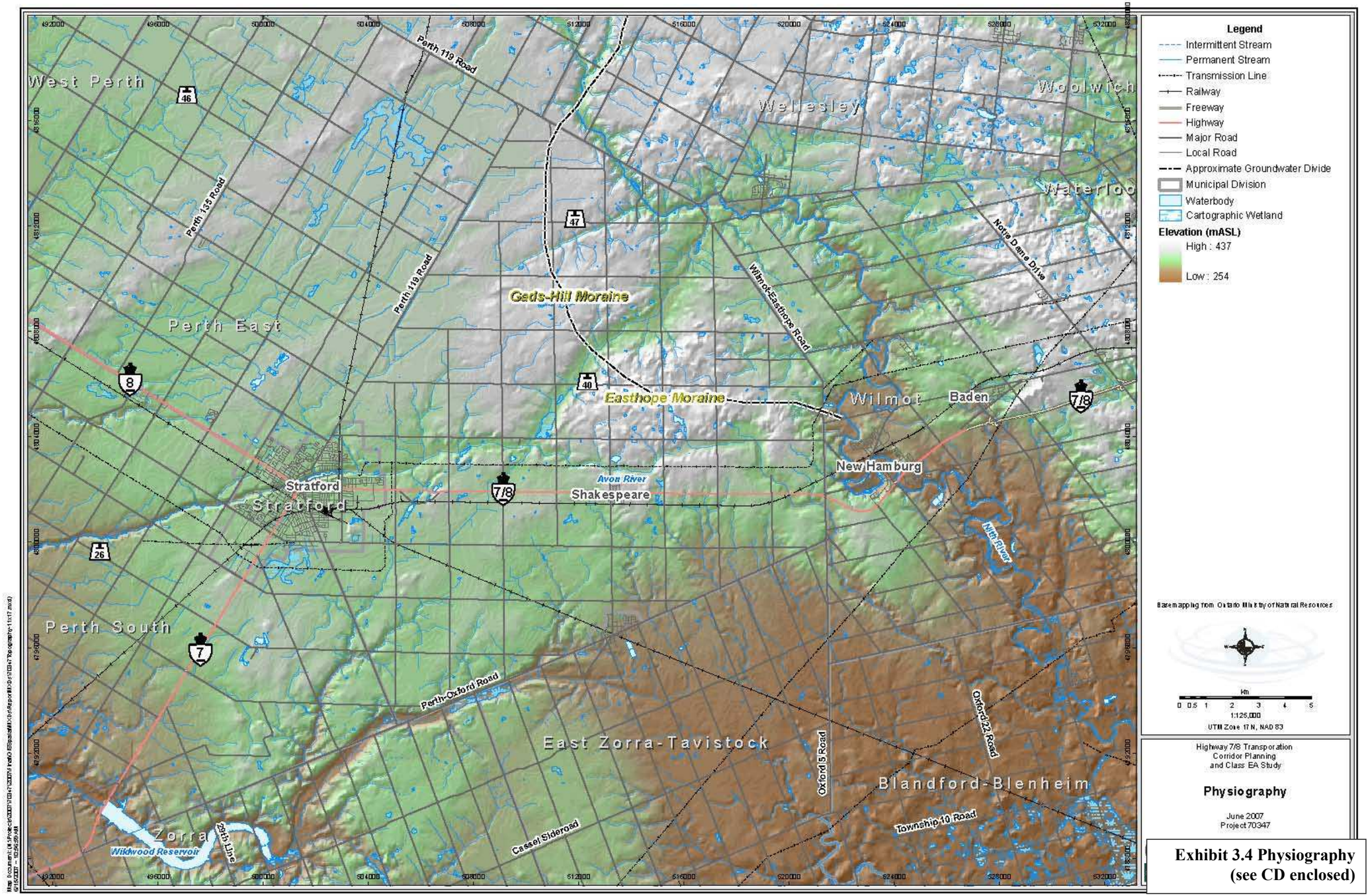


Exhibit 3.4 Physiography (see CD enclosed)

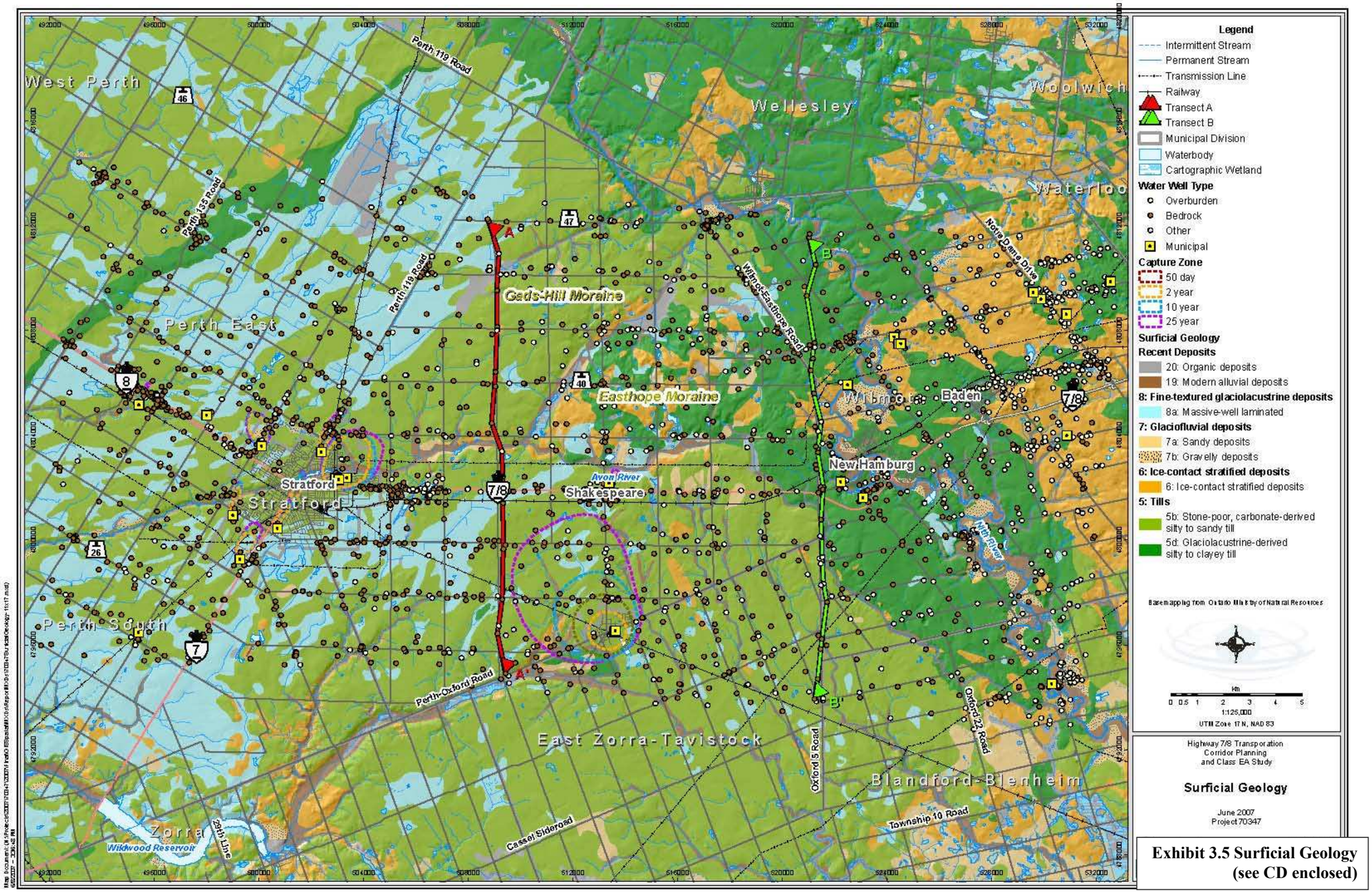


Exhibit 3.5 Surficial Geology (see CD enclosed)

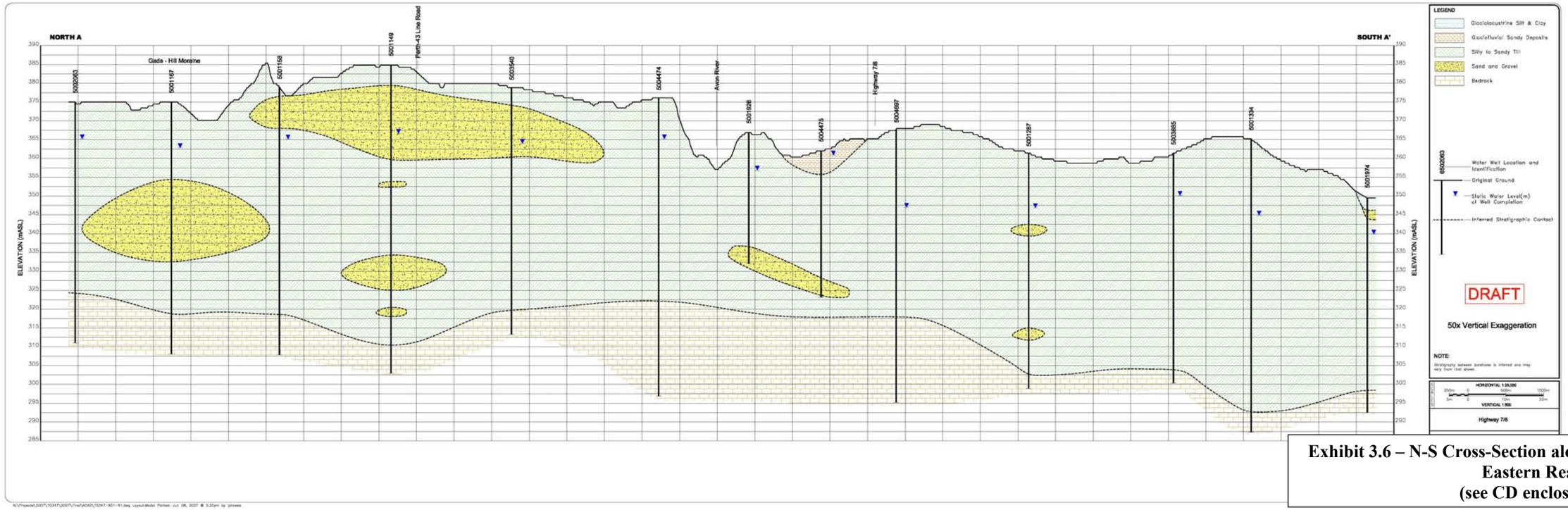


Exhibit 3.6 – N-S Cross-Section along Eastern Reach (see CD enclosed)

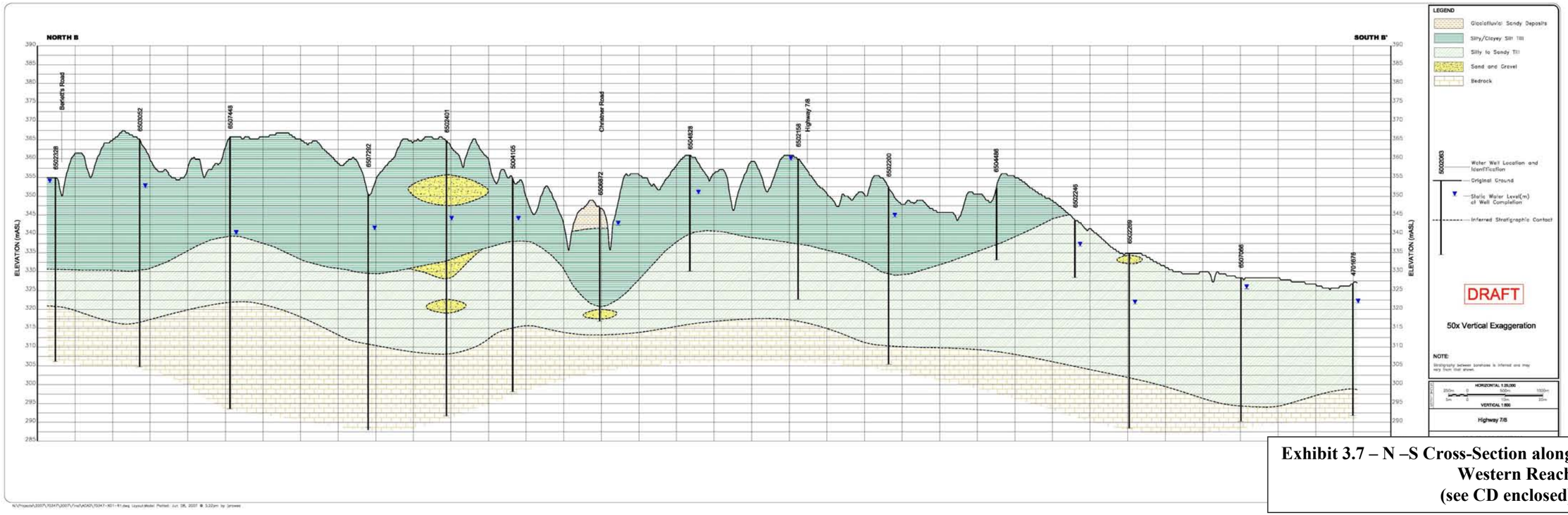
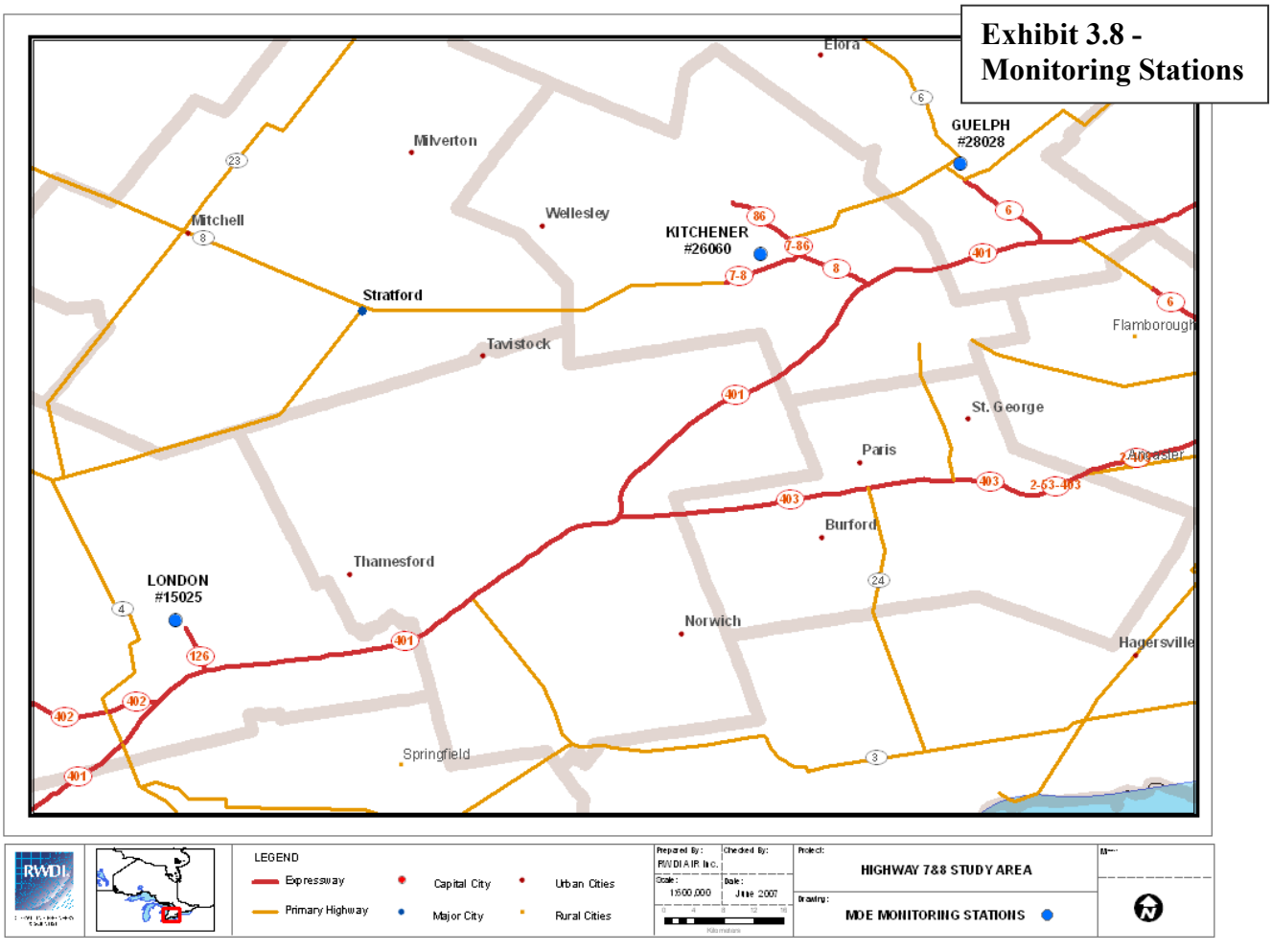


Exhibit 3.7 – N –S Cross-Section along Western Reach (see CD enclosed)

3.5 Air Quality

The current air quality in the Highway 7 & 8 Kitchener to Stratford analysis area can be generally characterized with air quality monitoring data from Ontario Ministry of Environment (MOE) and Environment Canada (EC) monitoring stations. The station closest to the Highway 7 & 8 analysis area is located in Kitchener (West Avenue/Homewood). Other applicable stations in the vicinity of the analysis area include Guelph (Exhibition Street/Clark Street) and London (900 Highbury Avenue) (Exhibit 3.8). The contaminants summarized from these stations include carbon monoxide (CO), nitrogen dioxide (NO2), primary fine particulate matter (PM2.5), benzene, and 1,3-Butadiene. Data for coarse particulate matter (PM10), formaldehyde, acetaldehyde and acrolein were not available. The contaminants shown were selected because they are directly associated with transportation emissions and are those that will be studied in the dispersion modelling at a later stage in the Environmental Assessment process.

Exhibit 3.8 - Monitoring Stations



Exhibits 3.9, 3.10, and 3.11 provide the mean, 90th percentile, and maximum values of measured concentrations from the monitoring stations listed above. The data are extracted from the MOE's "Air Quality in Ontario – 2005 Report" and represent conditions over the year 2005, the most recent data available from the MOE. The mean values are more representative of typical

conditions, 90th percentile values (value of concentration which is exceeded only 10% of the time) are more representative of credible worst-case conditions, and maximum values are more representative of rare peak events.

In the case of PM2.5, elevated levels are commonly related to regional photochemical processes. According to the MOE's "Air Quality in Ontario – 2005 Report" and previous studies done by Environment Canada (EC) and by RWDI, transboundary air pollution (mainly from United States) is one of the largest contributors to Ontario's smog events in the summer. Lake breeze convergence (from Lake Huron and Lake Erie) in the Kitchener to Stratford area can also increase PM2.5 levels under south-westerly wind conditions. Therefore, the data shown in Tables 1 and 2 are a combination of local and transboundary effects.

The mean and 90th percentile values in Exhibits 3.9 and 3.10 meet the provincial ambient air quality criteria (AAQC) (listed in Exhibit 3.12). As expected, the maximum values in Exhibit 3.11 for PM2.5 exceed the AAQC and the maximum values for the other contaminants meet the AAQC's.

Exhibit 3.10 includes a summary of the concentrations of the two measured transportation related air toxic chemical species benzene and 1,3-butadiene, which belong to the broader group called volatile organic compounds (VOCs). Since VOCs are difficult to measure, there are only a few monitoring stations in Ontario that regularly measure the ambient concentrations of these contaminants. The data for these compounds in Exhibit 3.10 are derived from the "National Air Pollution Surveillance (NAPS) Network Annual Data Summary for 2004" report. Acrolein and acetaldehyde are two other transportation related VOC compounds of interest but were not available in the analysis area.

Exhibit 3.9: Mean Value of Concentrations of Transportation Related Contaminants for 2005

Contaminant	Averaging Period	Units	MOE Station		
			Kitchener [1] (#26060)	London (#15025)	Guelph (#28028)
CO	1-hour	ppm	0.56	0.17	N/A
NO_2	1-hour	ppb	12.9	14.1	N/A
$PM_{2.5}$	1-hour	$\mu g/m^3$	9.5	11.9	8.8

Notes: [1] The Kitchener monitoring station stopped monitoring CO in Year 2004, therefore Year 2003 CO concentrations from Kitchener are presented in the table.
ppm, ppb, and ($\mu g/m^3$) stand for parts per million, parts per billion, and microgram per cubic metre, respectively.

Exhibit 3.10: 90th Percentile of Concentrations of Transportation Related Contaminants for 2005

Contaminant	Averaging Period	Units	MOE Station		
			Kitchener [1] (#26060)	London (#15025)	Guelph (#28028)
CO	1-hour	ppm	0.82	0.32	N/A
NO_2	1-hour	ppb	27	28	N/A
$PM_{2.5}$	1-hour	$\mu g/m^3$	24	24	22
Benzene	24-hour	($\mu g/m^3$)	1.4	1.5	N/A
1,3-Butadiene	24-hour	($\mu g/m^3$)	0.1	0.1	N/A

Notes: [1] The Kitchener monitoring station stopped monitoring CO in Year 2004, therefore Year 2003 CO concentrations from Kitchener are presented in the table.
ppm, ppb, and ($\mu g/m^3$) stand for parts per million, parts per billion, and microgram per cubic metre, respectively.

Exhibit 3.11: Maximum Value of Concentrations of Transportation Related Contaminants for 2005

Contaminant	Averaging Period	Units	MOE Station		
			Kitchener [1] (#26060)	London (#15025)	Guelph (#28028)
CO	1-hour	ppm	3.94	2.4	N/A
	8-hour	ppm	2.66	1.24	N/A
NO_2	1-hour	ppb	68	69	N/A
	24-hour	ppb	50	51	N/A
$PM_{2.5}$	1-hour	$\mu g/m^3$	73	71	66
	24-hour	$\mu g/m^3$	48	46	46

Notes: [1] The Kitchener monitoring station stopped monitoring CO in Year 2004, therefore Year 2003 CO concentrations from Kitchener are presented in the table.
ppm, ppb, and ($\mu g/m^3$) stand for parts per million, parts per billion, and microgram per cubic metre, respectively.

Exhibit 3.12: Provincial Ambient Air Quality Criteria (AAQC)

Contaminant	Averaging Period	Current AAQC
CO	1 hour 8 hour	30 ppm 13 ppm
NO_2	1 hour 24 hour	200 ppb 100 ppb
PM_{10}	24 hours	50 $\mu g/m^3$
$PM_{2.5}$ [1]	24 hours	30 $\mu g/m^3$
Benzene	N/A	N/A
1,3-Butadiene	N/A	N/A
Formaldehyde	24 hours	65 $\mu g/m^3$
Acetaldehyde	24 hours	500 $\mu g/m^3$
Acrolein	N/A	N/A

Source: Ontario Ministry of the Environment. Summary of O.Reg 419/05 Standards and Point of Impingement Guidelines & Ambient Air Quality Criteria (AAQCs). September 2001.
Canadian Council of Ministers of the Environment. Canada-Wide Standards of Particulate Matter and Ozone. Endorsed by CCME Council of Ministers, June 5-6, 2000, Quebec City.

Notes: [1] Canada Wide Standard for $PM_{2.5}$ established for the year 2010 based on the 98th percentile ambient measurement annually averaged over three consecutive years.
$\mu g/m^3$ for "microgram per cubic metre".
N/A stands for "not available".

3.6 Summary of Significance/Sensitivity of Natural Environmental Conditions

Both the Grand River and Thames River are significant resources in the analysis area with respect to the natural environment including aquatic and terrestrial ecosystems, groundwater and surface water. These systems provide enormous biological species diversity as well as providing drinking water, recreational activity and livelihood for the surrounding population.

The protection of water quality and quantity, flora and fauna communities, including Species-at-Risk is of primary importance to this study.

3.6.1 Aquatic Resources

Coldwater streams are considered the most sensitive aquatic resource in the analysis area. Coldwater streams provide habitat for fish species that are intolerant of disturbance such as habitat fragmentation, changes in water chemistry or changes in thermal regime. Coldwater fish species often have very specific habitat requirements including forested riparian cover, clean water quality, and baseflow sufficient to maintain flow rates and coldwater temperatures. The absence or impairment of any one of these conditions can undermine the viability of the fish populations. In particular, coldwater fish are dependant on groundwater upwellings or spring fed streams to aerate incubating eggs. Because of this need, important areas of groundwater discharge, including wetlands and headwaters streams that contribute to fish habitat, must be protected.

Warmwater streams are also sensitive but typically provide habitat for fish species that are more tolerant to environmental disturbance. Warmwater fish species, particularly in urbanized areas, can often withstand changes to habitat without any significant influence on the community.

Field investigations are required to confirm locations of some aquatic features as some of the map features are dated. Field investigations to record/assess fish habitat conditions in various portions of these watercourses will also be required as corridor alternatives are refined.

3.6.2 Terrestrial Resources

The following table provides a summary of the key terrestrial features and land designations identified for the analysis area.

Exhibit 3.13: Summary of Key Terrestrial Features and Land Designations

Feature and/or Land Designation	Applicable Policy Documents/Policy Implications
Provincially Significant Wetlands (PSW)	Protected under the Provincial Policy Statement (PPS).
Locally Significant Wetlands (LSW)	Protected under the Conservation Authorities Act. Municipal Official Plan policies may assess impacts of development and public infrastructure projects on LSW and unevaluated wetlands.
Areas of Natural and Scientific Interest (ANSI)	Protected under the PPS.
Interior Forest Habitat	High quality habitats with relatively minimal anthropogenic disturbance. Potential for high incident of rare or uncommon wildlife.
Species at Risk	Protected under the PPS, Species at Risk Act and the Endangered Species Act.

The proximity to infrastructure of any of these features/land designations may affect their function. For example, reductions in surface water or groundwater contribution to wetlands would compromise the biodiversity of both wildlife and vegetation. Fragmentation of interior forest habitat would compromise the ability of certain birds and wildlife species to carry out life processes. The removal of their habitat would lead to a reduction in abundance and biodiversity.

All of the features listed above have been identified within the analysis area. Most are protected under the PPS and other legislation. Others such as interior forest habitat will be examined during field investigations to determine size, species composition and other details that will contribute to the impact assessment.

3.6.3 Hydrogeology

Three hydrogeological indicators are used to determine which areas are most sensitive to the potential impacts of highway construction and operation:

1. Proximity to groundwater recharge areas;
2. Proximity to groundwater discharge areas; and
3. Proximity to water wells set in shallow, unconfined aquifers.

Recharge areas are the water source for the groundwater system. Therefore the proximity of infrastructure to such areas may affect water resources that are used by humans and/or support the natural environment. The proximity to a discharge area is also significant because these exhibit groundwater upwelling that supports aquatic habitat. Reductions in upwelling in groundwater-fed wetlands could reduce vegetation diversity by starving those species that require the most moisture. In extreme cases, disruption by human activities could cause wetlands to dry up unseasonably, and affect the hydroperiodicity of certain species. Given the reliance of so many animal species on wetland habitat, animals may be displaced or unable to survive. Similarly such disruption may redirect groundwater discharge, which could lead to flooding of low-lying areas. Reduced discharge into particularly sensitive reaches of streams could also impact fish habitat and spawning grounds.

The proximity of water wells set in shallow, unconfined aquifers are significant for two reasons. First the building of infrastructure may temporarily lower the water levels of nearby shallow wells. Nearby water wells set in the same shallow aquifer could be affected. Another long-term effect could be the permanent lowering of the water table caused by permeable bedding of buried services such as storm sewers. Second, these wells are sensitive to inadvertently introduced contaminants entering the groundwater system. Shallow, dug wells relying on tile joints to allow water entry are particularly susceptible to contamination due to the short travel distance necessary to reach the aquifer and the absence of any extensive aquitards to intercept the contaminants.

4.0 SOCIO-ECONOMIC ENVIRONMENT

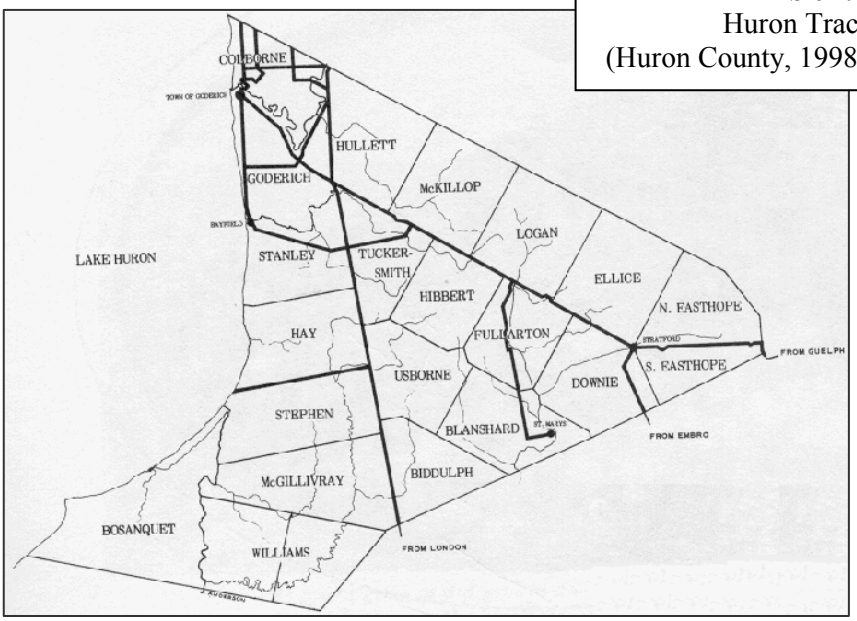
4.1 Land Use Policies, Goals, Objectives

4.1.1 First Nation Land Claims

There are no First Nation Reserves in the analysis area. The First Nations with settlements closest to the analysis area include the Chippewas of the Thames, Munsee-Delaware (near London) and the Mississaugas of the New Credit and Six Nations (near Brantford).

The analysis area is located within the Huron Tract which encompassed 1.1 million acres. The land was purchased in 1827 from the Chippewas of Chenail Ecarte, the Ausable River, and St. Clair for this tract as shown on Exhibit 4.1.[5]

Exhibit 4.1
Huron Tract
(Huron County, 1998)



The Department of Indian and Northern Affairs Canada has indicated that there are several land claims that may be relevant to the analysis area, namely:

- Stoney Point Indian Reserve (court file #T-702-85);
- Chippewas of Kettle and Stoney Point (court files #24085/96, #13182/92, #T-863-95 and #T-3077-94);
- Walpole Island First Nation (court file #00-CV-189329)

The protection of the natural environment (i.e., fisheries, wildlife etc.) is important to the continued and long-term use of the lands for traditional activities.

4.1.2 Provincial Land Use Planning/Goals/Objectives

4.1.2.1 Provincial Policy Statement (PPS 2005)

The Ontario Provincial Policy Statement establishes the provincial interest and direction in transportation systems and planning through the following policies:

[5] *Huron County (1998) http://www.huroncounty.ca/library/assess/preambl2.htm, http://www.chiefs-of-ontario.org/*

1.6.5.1 Transportation systems should be provided which are safe, energy efficient, facilitate the movement of people and goods, and are appropriate to address projected needs.

1.6.5.3 Connectivity within and among transportation systems and modes should be maintained and, where possible, improved including connections that cross jurisdictional boundaries.

1.6.6.4 When planning for corridors and rights-of-way for significant transportation and infrastructure facilities, consideration will be given to the significant resources in Section 2: Wise Use and Management of Resources.

1.7.1 Long-term economic prosperity should be supported by:
e) planning so that major facilities (such as airports, transportation/transit/rail infrastructure and corridors, intermodal facilities, sewage treatment facilities, waste management systems, oil and gas pipelines, industries and resource extraction activities) and sensitive land uses are appropriately designed, buffered and/or separated from each other to prevent adverse effects from odour, noise and other contaminants, and minimize risk to public health and safety;

The PPS also establishes the need to protect prime agricultural areas, and to avoid where possible encroachment of infrastructure, including transportation, in these areas:

2.3.4.1 Lot creation in prime agricultural areas is discouraged and may only be permitted for:
d) infrastructure, where the facility or corridor cannot be accommodated through the use of easements or rights-of-way.

Section 7.1 of the Ministry of Transportation *Environmental Protection Requirements For Transportation Planning And Highway Design, Construction, Operation And Maintenance* expands upon the previous policy:

> *Transportation planning and highway design, construction, operation and maintenance activities shall be done in a manner that avoids lot creation and lot adjustments on prime agricultural lands and prime agricultural areas where possible and practical. (Provincial Policy Statement, s.2.3.4.1) Where avoidance is not practical then highways may be located in Prime Agricultural Lands and Prime Agricultural Areas where it has been demonstrated through an environmental assessment that:*
> 1. *there is no reasonable alternative location which avoids prime agricultural lands and areas;*
> 2. *consideration has been given to lower priority agricultural lands (lower capability lands) within the prime agricultural lands and areas;*
> 3. *the detrimental impacts from the location, design, construction operation and maintenance of a new highway on surrounding agricultural communities, existing operations and lands are minimized to the extent feasible; and*

4. consideration has been given to Nutrient Management and Minimum Distance Separation requirements of affected farming operations (Nutrient Management Act, s. 6(2)).

4.1.2.2 Growth Plan for the Greater Golden Horseshoe (2006)

Part of the analysis area falls within the Greater Golden Horseshoe Plan Area. The following policies within the plan address transportation objectives:

3.2.2 Transportation – General
1. The transportation system within the GGH will be planned and managed to –
e) provide for the safety of system users.

3.2.4 Moving Goods
3. The planning and design of highway corridors, and the land use designations along these corridors, will support the policies of this Plan, in particular that development is directed to settlement areas, in accordance with policy 2.2.2.1(i).

While there are no Urban Growth Centres, as defined by the Growth Plan, within the Analysis area, the community of New Hamburg is depicted conceptually as a Built-Up Area. The proposed Highway 7 & 8 improvements will create better linkages between Urban Growth Areas such as Downtown Kitchener and Uptown Waterloo and communities to the west.

4.1.3 Municipal Land Use Planning Policies/Goals/Objectives

4.1.3.1 Methodology

The Approved Official Plans (with revisions as documented in the most recent office consolidations) were obtained from each of the municipalities which have portions of their respective jurisdictions within the analysis area, including:

- County of Perth;
- City of Stratford;
- Regional Municipality of Waterloo and Township of Wilmot; and
- County of Oxford.

The land uses as represented in these Official Plans were assembled for the analysis area and are provided in Exhibit 4.2. To provide greater clarity and consistency across the plans, some consolidation of land use designations have been made. Various industrial designations, for example, are represented in this exhibit as simply industrial. The complete land use detail of the plans has been assembled and is available as a database for future use in this study as required.

A preliminary inventory from secondary sources of institutional and community features, such as cemeteries, schools, churches and health care facilities, and recreational/community facilities, as well as the road network, rail and pipeline corridors are illustrated in Exhibit 4.3.

The following sections provide a description of existing and planned land uses within the analysis area, as defined by each of the relevant municipal jurisdictions.

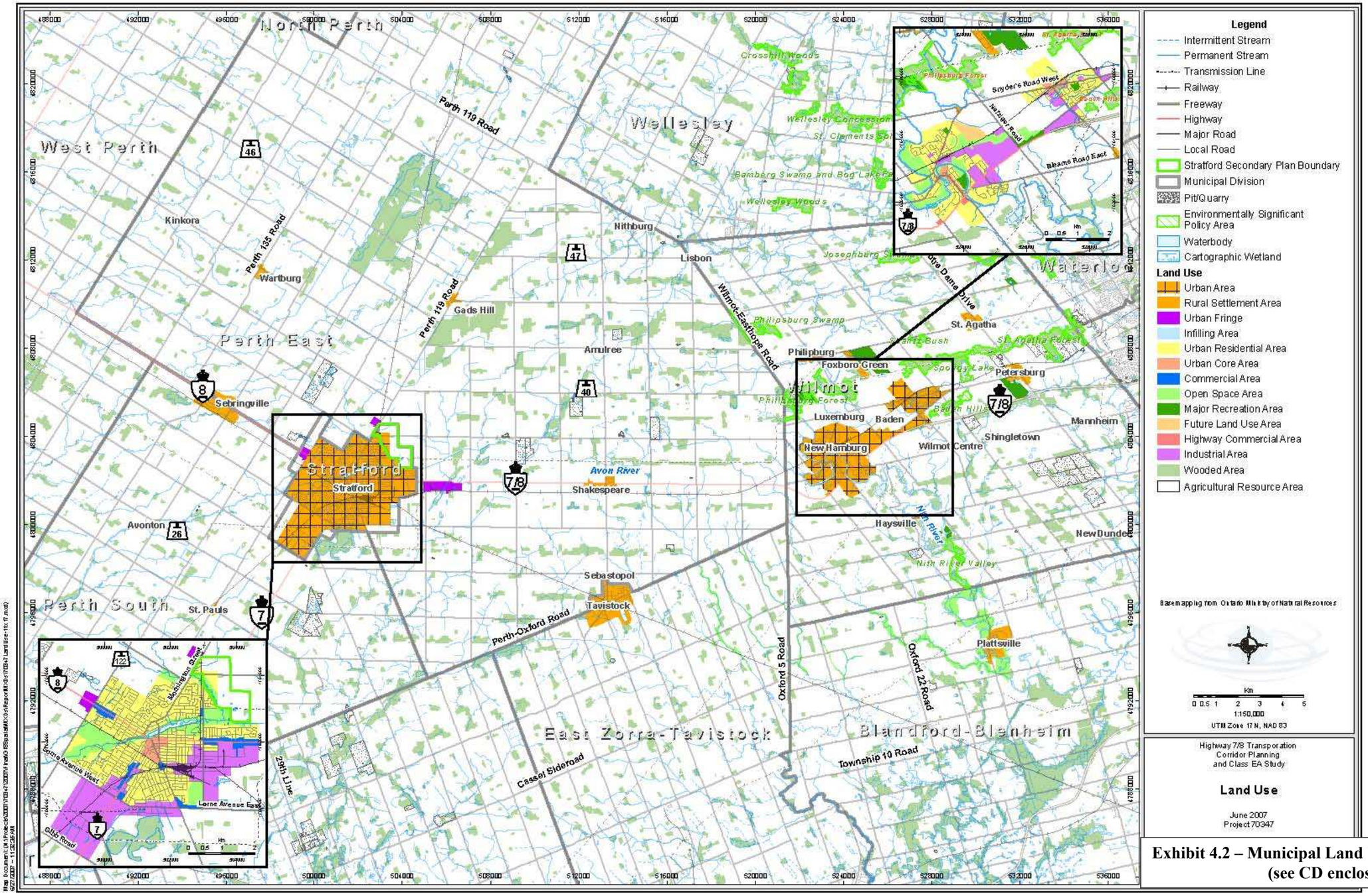


Exhibit 4.2 – Municipal Land Use (see CD enclosed)

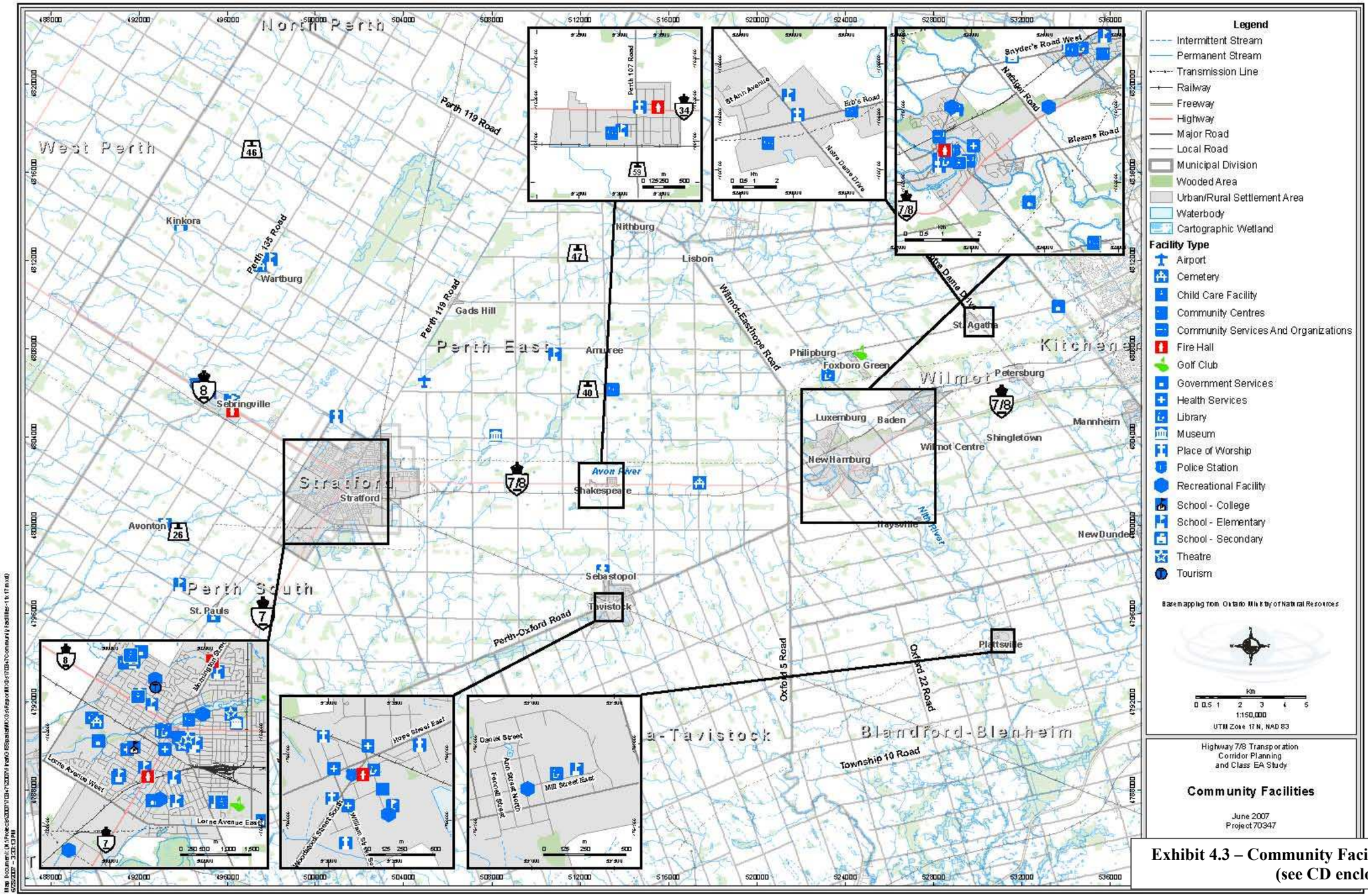


Exhibit 4.3 – Community Facilities (see CD enclosed)

4.1.3.2 County of Perth

The central and western parts of the analysis area are located in the County of Perth, specifically within the Townships of Perth East and Perth South. The County of Perth Official Plan (OP) was adopted by Council on December 11, 1997 and was approved by the Ministry of Municipal Affairs and Housing on June 12, 1998 and the Ontario Municipal Board on March 29, 1999.

There are a number of Settlement Areas, consisting of Villages and Hamlets, within the analysis area. Villages are settlement areas with a broad range of land uses and activities, including commercial uses, industrial operations, and institutional uses that serve the local community and surrounding rural areas. In comparison, hamlets are characterized as compact groupings of non-farm related development. While primary land uses in hamlets are single-detached residential uses, some hamlets provide very limited amounts of commercial, industrial, institutional, and recreational development.

Villages within Perth East include Shakespeare, located along Highway 7 & 8, Gads Hill, Sebringville, and Wartburg. Kinkora and Sebastopol are the only Hamlets in the Township of Perth East. The Hamlets of St. Pauls Station and Avonton are located within the Township of Perth South.

The City of Stratford is the only serviced urban area situated in the County of Perth. While the County of Perth OP does not apply to the City of Stratford, it does designate lands on the outskirts of Stratford as Urban Fringe and Infill Areas. The Urban Fringe applies to specific lands along public roadways that have existed for several decades as strip or ribbon development, including an area along Highway 7 & 8 to the east of Stratford. It is the intent of the OP to prevent the spread of non-farm related development beyond the limits of the Urban Fringe designation (see Exhibit 4.2).

Infill Areas are small concentrations of residential uses that have developed in agricultural areas of the County. The OP permits a limited amount of new residential development to occur within these lands provided that it minimizes the impact on surrounding agricultural lands and farming operations. There is one small area designated as Infill Area to the west of Stratford.

The remaining lands within the analysis area are designated as Agriculture.

4.1.3.3 City of Stratford

The City of Stratford is located in the western part of the analysis area. The City of Stratford Official Plan was adopted by Stratford Council on January 25, 1993 and approved with modifications by the Minister of Municipal Affairs and Housing on November 28, 1994. Highway 7 & 8 is the main thoroughfare for the City approaching from the east and is designated as an arterial road. Within the city limits, Highway 7 & 8 is known as Ontario Street. Land use designations adjacent to Ontario Street include commercial, industrial, and residential.

Ontario Street terminates within the Downtown Core designation, which is intended to maintain the downtown as the City's centre for retail and service trade and government services while increasing the diversity and number of residential opportunities. Areas to the west and north of the downtown core are predominantly residential. Crossing diagonally through the City is a Parks and Open Space system that includes the Avon River and Lake Victoria.

The City of Stratford Northeast Secondary Plan was prepared in April 2004 for the area to the east of Romeo Street and north of Devon Street. The predominant land use is low density residential, with a distribution of medium density uses adjacent to or with direct accessibility to arterial and collector roads.

4.1.3.4 Region of Waterloo

The eastern part of the analysis area falls within the Region of Waterloo. The Region of Waterloo OP was approved by the Ministry of Municipal Affairs and Housing on November 23, 1995 and further approved and amended on September 30, 2006. This part of the Region also falls entirely within the Township of Wilmot (refer to the following section).

Within the Regional OP, New Hamburg is designated as a Township Urban Area and a Community Core Area in the Regional Official Plan. Township Urban Areas are designated to provide employment opportunities and accommodate the majority of the population and household growth as forecasted for the Region. Similarly, Community Core Areas are intended to be the primary focus of area municipalities, including enhanced transportation facilities, and medium and high-density developments.

To the northeast of New Hamburg are lands designated Agricultural Resource Area / Future Township Urban Area, which are anticipated to accommodate growth beyond the year 2016. The Regional OP also identifies eight Rural Settlement Areas. The remainder of the analysis area within the Region of Waterloo is designated as Agricultural Resource Area.

4.1.3.5 Township of Wilmot

The Regional Municipality of Waterloo approved the Township of Wilmot Official Plan with modifications on July 7, 2004. New Hamburg is designated as an Urban Area in the Township of Wilmot OP, as is Baden. The lands abutting Highway 7 & 8 to the north between New Hamburg and Baden to the east are also designated as Urban Area. The OP directs future residential, industrial and commercial growth within the Township to the Baden and New Hamburg Urban Areas (see Exhibit 4.2).

Within the New Hamburg Urban Area, the majority of the land adjacent to Highway 7 & 8 is designated as Urban Residential and General Industrial, with pockets of Light Industrial, Highway Commercial, and Urban Core. Recent approval of residential development has added over 600 new units within the Urban Residential designation. As of November 2006, the City had received applications for two additional draft plans of subdivision totalling 186 units. The Township is currently constructing a new Multi-Use Recreational Facility on 65 acres of land at the east end of New Hamburg.

To the north of New Hamburg along the Nith River are lands designated Major Recreation, which permit conservation areas, major public parks, privately owned recreation areas, appropriate heritage features, fairgrounds, golf courses, camping facilities and recreational trailer parks. Lands adjacent to the New Hamburg Urban Area to the northeast are identified as Future Land Use Area on Map No. 5 of the OP. Section 2.3 of the OP explains that the Future Land Use Area is not to be considered as a land use designation on such lands, and that the land use designation for such properties in this Plan will remain Agricultural Resource Area.

The Baden Urban Area is located north of Highway 7 & 8. Abutting the highway are Major Recreation, General Industrial, and Urban Residential designations. The remainder of the Urban Area is comprised primarily of lands designated Urban Residential, along with Urban Core and Light Industrial. Recent approved developments in Baden will add over 1,000 new residential units to lands within the Urban Residential designation.

There are nine Rural Settlement Areas in the Township of Wilmot within the analysis area that provide for residential, associated commercial, institutional, recreational and open space land uses outside the Urban Areas. The Rural Settlement Areas are listed below:

- Lisbon
- St. Agatha
- Phillipburg
- Foxboro Green
- Petersburg
- Luxemburg
- Shingletown
- Wilmot Centre
- Haysville

The remainder of lands within the Township is designated as Agricultural Resource Areas, which permits farming, small-scale on-farm business activities, farm-related non-residential uses, mineral extraction and forestry as the primary activities.

4.1.3.6 County of Oxford

The County of Oxford comprises a small part of the analysis area to the southeast. The County's Official Plan was adopted by Council on December 13, 1995, and was approved by the Ministry of Municipal Affairs and Housing on August 20, 1996.

Two of Oxford's eight area municipalities fall within the analysis area: the Township of East Zorra-Tavistock, and the Township of Blandford-Blenheim (see Exhibit 4.2). Within the Township of East Zorra-Tavistock, Tavistock is designated as a Serviced Village. Serviced Villages permit a full range of land uses. Tavistock is predominantly designated Residential, with lands to the west and the south designated Industrial. At the centre of Tavistock is the Village Core designation, which represents areas that have historically functioned as a downtown

pedestrian shopping district and are intended to be the most intensive and dominant business area within the settlement.

All remaining areas in East Zorra-Tavistock are designated as Agricultural Reserve.

Within the Township of Blandford-Blenheim is Plattsville, a Serviced Village area at the southeastern edge of the analysis area. Like Tavistock, it is predominantly Residential and contains a Village Core. Much of the remaining lands are designated Open Space, although two small Industrial designations abut the Village Core. Similar to East Zorra-Tavistock, the remaining areas within Blandford-Blenheim are designated as Agricultural Reserve and Open Space. There are no areas designated for Future Urban Growth within the analysis area.

4.2 Land Use/Community

The focus of the land use investigation at this phase of the study was to assemble readily available secondary source land use information from the municipal jurisdictions within the study analysis area. This includes:

- Existing population within analysis area;
- Existing and planned land uses;
- Locations and characteristics of tourist related facilities / features;
- Location of municipal services, including water supply plants, water pollution control plants, and waste management facilities;
- Location of recreational and community features/resource use;
- Location of educational facilities;
- Location of health and safety facilities and services; and,
- Location of aggregate and mineral resources.

4.2.1 First Nation Reserves

There are no First Nation Reserves within the analysis area. However, the analysis area is located within the Huron Tract which encompasses 1.1 million acres, as described in Section 4.1.1 .

4.2.2 First Nation Sacred Grounds

Given the history of the area in relation to aboriginal land uses, there is some potential for First Nation sacred grounds within the analysis area. Additional information will be sought through consultation with First Nations during the study.

4.2.3 Urban and Rural Residential

Urban and rural residential areas within the analysis area have been described in Section 4.1.3. Population data from the 2006 census for municipalities that fall into the analysis area are presented in Exhibit 4.4:

Exhibit 4.4 Analysis Area Municipalities: 2006 Population	
Municipality	2006 Population (persons)
Perth County	
Township of Perth East	12,041
Township of Perth South	4,132
City of Stratford	30,461
Subtotal - Perth County	***46,634***
Region of Waterloo	
Township of Wilmot	***17,097***
Oxford County	
Township of East Zorra-Tavistock	7,350
Township of Blandford Blenheim	7,149
Subtotal - Oxford County	***14,499***
Total	**78,230**

Source: 2006 Community Profiles. Statistics Canada, 2007

4.2.4 Commercial/Industrial

Within the City of Stratford, commercial uses are located primarily along Ontario Street, with additional pockets along Downie Street, Lorne Avenue East, Erie Street north of Lorne Avenue West, and Highway 8. Industrial uses in Stratford are centered around Romeo Street South and Erie Street south of Lorne Avenue West. In the New Hamburg and Baden Urban Areas, industrial uses are located adjacent to Highway 7 & 8 and extend as far north as the railway tracks. Shakespeare also has a cluster of several businesses (mostly tourist-oriented) on the existing Highway 7 & 8.

There are no known commercial and industrial uses that are not agriculture-related outside of these areas. This information will be confirmed and updated during the Business Impact Assessment for the Highway 7 & 8 Transportation Corridor Planning and Class EA Study.

4.2.5 Tourist Areas and Attractions

4.2.5.1 County of Perth

Within the County of Perth, and the entire analysis area, the Stratford Festival is the premier destination for tourists. The Festival is North America's largest classical repertory theatre and attracts audiences of more than 600,000 each year from across Ontario and the bordering States.

It is reported that the Festival generates more than $170 million for the Stratford economy[6]. Plays are shown at four theatres in the City: Festival Theatre, Avon Theatre, Tom Patterson Theatre, and the Studio Theatre.

Other tourist attractions in Stratford include the City's extensive park lands along the Avon River, part of which plays host to Art in the Park, the Stratford-Perth Museum at 270 Water Street, and The Fairgrounds in Stratford, which hosts the Stratford Farmers Market every Saturday, along with a fall fair and a rodeo in September. The Stratford Summer Music Festival, located at numerous venues in the City, takes place over a four-week period in late summer. On the outskirts of Stratford is the Brocksden County School Museum at 2719 Perth Line 37 (see Exhibit 4.3).

Many visitors to the Stratford Festival travel through Shakespeare on their way to Stratford and visit the village's collection of antique stores and other gift shops. The Fryfogel Inn is also a tourist destination.

4.2.5.2 Region of Waterloo

There are several tourist attractions in this part of the Region. Castle Kilbride in Baden is a National Historic Site and the 19th century home of James Livingston, Canada's Flax Mill King. In New Hamburg, the Heritage Water Wheel on the Nith River is distinguished as the largest operating waterwheel in North America. New Hamburg is also known for its Fall Fair, which features a demo derby and a children's carnival.

4.2.5.3 County of Oxford

No tourist attractions in the County were identified within the analysis area.

4.2.6 Community Facilities/Institutions

4.2.6.1 County of Perth

There are four community centres in the analysis area:

- Kiwanis Community Centre, located at 111 Lakeside Drive, Stratford;
- Community Centre located on Galt Street in the hamlet of Shakespeare;
- Sebringville Community Centre, located on Huron Road, just northwest of Stratford;
- North Easthope Community Centre, located at 2198 Line 40, just north of Shakespeare.

Public library service in Perth County is provided by two libraries – the Perth County Library and the Stratford Public Library. There are numerous churches located within the region. Cemeteries include the Avondale Cemetery, the Lingelbach Cemetery, and the Wartburg Cemetery (see Exhibit 4.3).

[6] *http://www.stratford-festival.on.ca/about/faq.cfm?Jump=SFInformation&Type=History&Question=Q2sfhis, June 1, 2007.*

The analysis area within the County of Perth is served by Avon Maitland District School Board and Huron Perth Catholic District School Board. A total of 20 schools including, 17 elementary and three secondary, are found in this portion of the analysis area. Out of the total, 15 schools are located in the City of Stratford**,** four within or in the vicinity of rural Perth East communities of Kinkora, Wartburg, Shakespeare and Amulree, and one near St. Pauls in rural Perth South. Avon Maitland District School Board also provides adult education for Perth County residents through its Centre for Employment & Learning located in Stratford.

Conestoga College, a post-secondary institution specializing in technology and advanced learning, has one campus within the analysis area located in the City of Stratford at 130 Young Street.

Perth District Health Unit provides community health services for the county residents, including health education, promotion and disease prevention**.** One of the unit's offices is located in Stratford, at 653 West Gore Street.

The Stratford General Hospital, located in the City of Stratford at 46 General Hospital Drive, provides general and specialized short-term care, diagnostic, long-term treatment, emergency and outpatient services. Three local ambulances are on 24-hour call to deliver emergency care to patients. There are also a wide variety of medical clinics, nursing services, nursing homes, physiotherapy clinics and medical laboratories that act as support agencies to the hospital. Other health services available in Stratford include The Canadian Red Cross Society, The Victorian Order of Nurses (VON), Community Care, Home Care programs, and Meals on Wheels.

4.2.6.2 Region of Waterloo

Community facilities in the Township of Wilmot include:

- churches (in New Hamburg and St. Agatha)
- local community centres (two in St. Agatha, one in New Hamburg and one in Haysville),
- the New Hamburg Arena,
- Wilmot Community Pool,
- the New Hamburg Municipal Building, and
- Centennial Hall in Baden.

A new multi-use recreational facility that will serve the entire population of the Township of Wilmot is being built in the Township of Wilmot, at the northeast corner of the intersection of Highway 7 & 8 and Nafziger Road. It is scheduled for completion in the fall of 2007.

Public library service in the Township of Wilmot is provided by the Waterloo Regional Library. The Waterloo Regional Library has 2 locations in the analysis area: the Baden Branch Library and the New Hamburg Branch Library. The Headquarters of the Waterloo Regional Library are also located in the Township of Wilmot, in Phillipsburg. The New Hamburg Toy Library is located in New Hamburg.

There are three cemeteries in the Region of Waterloo – Mount Hope Cemetery, Parkview Cemetery, and Waterloo Cemetery.

The Waterloo Region District School Board and Waterloo Catholic District School Board serve the analysis area within the Waterloo Region. A total of six schools, including five elementary and one secondary, are found in this portion of the analysis area. The schools are located in the following communities of the Township of Wilmot: New Hamburg (three schools), Baden (two schools), and St. Agatha (one school).

No hospitals have been identified within the analysis area in the Region of Waterloo. One nursing home, Nithview Home, is located at 200 Boullee Road, New Hamburg. The delivery of ambulance service in the Township of Wilmot is the responsibility of the Region of Waterloo Emergency Medical Services (EMS) Division of Public Health. Out of the eight ambulance stations operated by the Region of Waterloo EMS, one is located in the analysis area, on 99 Foundry Street, Baden.

4.2.6.3 Oxford County

Community facilities in the Township of East Zorra-Tavistock include four churches, a Public Library, and the Tavistock and District Recreation Centre (Tavistock Arena and Memorial Hall). In the Township of Blandford Blenheim are the Plattsville Library and the Plattsville Memorial Community Arena and pavilion.

The analysis area within Oxford County is served by Thames Valley District School Board and English Language #38 Catholic District School Board. A total of two schools (both elementary) are found in this portion of the analysis area, one in Tavistock (Township of East Zorra-Tavistock) and another one in Plattsville (Township of Blandford Blenheim). There are no post-secondary education facilities in the analysis area.

Ambulance services in the Township of East Zorra-Tavistock and the Township of Blandford-Blenheim are provided by the Oxford County Public Health Department (Oxford County Board of Health). There are no Emergency Medical Service (EMS) stations in the analysis area. The closest stations are located in Hickson (Township of East Zorra-Tavistock) and Drumbo (Township of Blandford-Blenheim).

The Townships are served by the Woodstock General Hospital located in Woodstock, Township of Blandford-Blenheim. Three nursing homes were identified in the Village of Tavistock: Bonnie Brae Health Care Centre, PeopleCare Tavistock, and The Maples Home for Seniors.

4.2.7 Municipal Infrastructure/Public Service

4.2.7.1 County of Perth

In the analysis area within the County of Perth, municipal water supply and wastewater treatments services are provided in the City of Stratford. The Perth East population is on private

wells and septic systems, with the exception of the hamlet of Shakespeare, serviced by a municipal well water supply system. The Township of Perth East Public Works Department oversees the Shakespeare Water Supply System. In the fall of 2004, a Class Environmental Assessment Study for the village of Shakespeare wastewater services was completed and the Township has been in the process of securing funding for the project. The majority of the population of Perth South is on private wells and septic systems. However, just outside the analysis area, in the village of St. Mary's, the population is serviced by a municipal well water supply system.

Waste management services in the Township of Perth East, including the hamlets of Shakespeare, Nithburg, Sebastopol, Sebringville, Wartburg, Kinkora, and Gads Hill, are provided by the Township of Perth East Public Works Department. The Public Works Department oversees curbside garbage and recycling collection (which is contracted out to Bluewater Recycling Association) and is responsible for the operation and maintenance of 2 landfill sites: Ellice Landfill Site and South Easthope Landfill Site. The South Easthope Landfill Site is located in the analysis area (west of Sebastopol on Line 29), and the Ellice Landfill Site is just north of analysis area, at Line 52 and Road 126 (see Exhibit 4.6).

Waste management services in the Township of Perth South are provided by the Township of Perth South Sanitation Department. Curbside garbage and recycling collection is contracted out to Bluewater Recycling Association. The Department is responsible for the operation and maintenance of the Downie Ward Landfill Site, which serves the population in the analysis area and is located on Perth Road..

The City of Stratford is serviced by a municipal water supply system that derives water from groundwater resources. Water towers are located in the south end of the City in the vicinity of Walnut Street and Dufferin Street, and in the north end of the City off Forman Avenue. The City also has its own Water Pollution Control Plant, which is located on West Gore Street, in the southwest portion of the City. The operation of the sewage treatment plant is contracted to the Ontario Clean Water Agency.

Waste management services, including curbside garbage and recycling collection, in the City of Stratford are provided by the City's Engineering and Public Works Department. The City operates its own landfill site, which accepts only garbage generated within the city boundaries. The Stratford Landfill Site is located on Romeo Street in the southeast part of the City.

Fire prevention and fire protection services in the analysis area within Perth County are provided by the Perth East Fire Department and the Stratford Fire Department. The Perth East Fire Department operates three Fire Stations in the Township of Perth East. Out of these stations, two are located in the analysis area, one in Sebringville and another one in Shakespeare. The third station is located outside the analysis area, in Milverton. The City of Stratford has its own Fire Department. The Stratford Fire Department operates two fire stations located on Erie St. and on McCarthy Rd. The Township of Perth South does not have its own fire department and receives fire services from surrounding municipalities. The Township portion that falls into the analysis area is serviced by the Perth East Fire Department.

Police services in the analysis area within Perth County are provided by the Ontario Provincial Police and the Stratford Police Department. The Township of Perth East and the Township of Perth South receive police services from the Ontario Provincial Police. The Stratford Police Department serves the population of the City of Stratford. The Department is located in downtown Stratford on George Street.

4.2.7.2 Region of Waterloo

In the Township of Wilmot portion of the analysis area**,** municipal water supply services are provided to the population of New Hamburg, Baden, St. Agatha and Shingletown. The water is treated and supplied by the Region of Waterloo to the distribution system owned and operated by the Township of Wilmot and then delivered to the service areas. Wastewater services are provided to the areas of New Hamburg and Baden. The Baden/New Hamburg Waste Water Treatment Plant is located just south of New Hamburg, at Tye Road and Concession Road. The rest of the population is on private wells and septic systems.

Waste management services in the Township of Wilmot are provided by the Waste Management Division of the Regional Municipality of Waterloo. This division provides collection, recycling and waste reduction programs and operates the Regional and rural solid waste disposal facilities. There are no waste disposal facilities in the analysis area portion of the Township of Wilmot. The closest facilities include the Wilmot Waste Transfer Station (located north of New Dundee) and the Waterloo Waste Management Centre (located in the City of Waterloo east of Wilmot Township boundary).

The analysis area within the Region of Waterloo is served by the Township of Wilmot Fire Department. Out of the three Fire Stations operated by the department, two are located in the analysis area, in the areas of Baden and New Hamburg. The third station is located outside the analysis area, in New Dundee. The Waterloo Regional Police District includes the cities of Kitchener, Cambridge, and Waterloo, and the townships of Woolwich, Wilmot, Wellesley and North Dumfries. The Waterloo Regional Police Service has one substation (Division 1A) that is located in New Hamburg and serves the entire Township of Wilmot.

4.2.7.3 Oxford County

Two thirds of the County residents are on municipal water systems and the rest are on private wells. The municipal water and sewage systems in the Township of East Zorra-Tavistock and the Township of Blandford Blenheim are operated and maintained by the Water and Wastewater Office in the County's Department of Public Works. The County maintains well supply systems and wastewater treatment plants in Tavistock (Township of East Zorra-Tavistock) and Plattsville (Township of Blandford Blenheim).

Waste management services became a County responsibility on January 1, 2002. All residents in the County of Oxford receive weekly curbside collection. Municipal staff collects recycling in Woodstock and South West Oxford. The remaining portion of the County, which includes the Township of East Zorra-Tavistock and the Township of Blandford Blenheim, is contracted out to Waste Services Inc. All of the garbage collected across the County goes to the County of Oxford

landfill. The landfill site is located outside the analysis area, in the Township of South-West Oxford. Within the Village of Tavistock, the Sewage Treatment Facility is located in the southeast part of town.

Fire services in the analysis area within Oxford County are provided by the Township of East Zorra-Tavistock Fire Department and the Township of Blandford-Blenheim Fire Department. The Township of East Zorra-Tavistock Fire Department operates three fire stations. One fire station is located in the analysis area, in the Village of Tavistock. The other two stations are located outside the analysis area, one in Hickson and another one in Innerkip. The Township of Blandford-Blenheim Fire Department has four stations, one in each of the four villages of the Township.

Police services in the Township of East Zorra-Tavistock and the Township of Blandford-Blenheim are provided by the Oxford Community Police Service. One of the three police divisions operated by the Oxford Community Police Service is located in the analysis area, in Tavistock.

4.3 Noise Sensitive Areas

The main types of Noise Sensitive Areas (NSAs) in the analysis area are residential land uses, as described in previous sections of the report.

A noise assessment study will be carried out in accordance with the MTO/MOE Noise Protocol during the study. The noise assessment study will analyze existing noise conditions and compare them to future noise levels expected from Highway 7 & 8 under a "do nothing" and the "Recommended Plan" scenario.

In the vicinity of existing Highway 7 & 8, traffic is a major source of noise. Noise levels from the existing highway fluctuate and depend on the topography, seasonal traffic volumes, percentage of truck traffic and the frequency of Highway 7 & 8 users entering and exiting roads, and entrance ways along the highway.

4.4 Land Use/Resources

4.4.1 First Nation Treaty Rights and Interests and Use of Land and Resources for Traditional Purposes

First Nation land use and community interests will be confirmed during consultation as part of this study. Typically, they relate to the traditional uses (i.e., hunting, fishing etc.) of these areas as well as the lands themselves, as a potential resource to the communities.

The Department of Indian and Northern Affairs Canada has indicated that there are several land claims that may be relevant to the analysis area, namely:

- Stoney Point Indian Reserve (court file #T-702-85);

- Chippewas of Kettle and Stoney Point (court files #24085/96, #13182/92, #T-863-95 and #T-3077-94); and
- Walpole Island First Nation (court file #00-CV-189329).

Additional information will be collected regarding the nature of these claims during this study.

4.4.2 Agriculture

The Provincial Policy Statement (PPS) 2005 sets out the following policies with respect to protection of agricultural resources:

- Prime agricultural areas shall be protected for long-term use for agriculture. Specialty crop areas shall be given the highest priority for protection followed by Classes 1, 2 and 3 soils, in this order of priority.
- Planning authorities shall designate specialty crop areas in accordance with evaluation procedures established by the Province, as amended from time to time.

The PPS policies also include the following:

"When planning for corridors and rights-of-way for significant transportation and infrastructure facilities, consideration will be given to "significant natural heritage, water, agricultural, mineral, cultural heritage and archaeological resources".

The following definitions are important to understanding the direction set out in the Provincial Policy Statement:

- Prime agricultural area means areas where prime agricultural lands predominate. This includes: areas of prime agricultural lands and associated Canada Land Inventory Class 4 to 7 soils, and additional areas where there is a local concentration of farms which exhibit characteristics of ongoing agriculture. Prime agricultural areas may be identified by the Ontario Ministry of Agricultural and Food using evaluation procedures established by the Province as amended from time to time, or may also be identified through an alternative agricultural land evaluation system approved by the Province (Canada Land Inventory found in Appendix D).
- Prime agricultural land means land that includes specialty crop areas and/or Canada Land Inventory Classes 1, 2 and 3 soils, in this order of priority for protection.
- Specialty crop area means areas designated using evaluation procedures established by the Province, as amended from time to time, where specialty crops such as tender fruits (peaches, cherries, plums), grapes, other fruit crops, vegetable crops, greenhouse crops, and crops from agricultural developed organic soil lands are predominantly grown, usually resulting from:
  - Soils that have suitability to produce specialty crops, or lands that are subject to special climatic conditions, or a combination of both; and/or
  - A combination of farmers skilled in the production of specialty crops, and of capital investment in related facilities and services to produce, store, or process specialty crops.

Methodology

Existing background data sources were reviewed to provide a summary of the physical resources features and characteristics associated with the analysis area. These published data sources included the following:

- Soil survey information – County of Perth, County of Oxford and former County of Waterloo;
- Official Plans for the upper tier municipalities in the analysis area (Agricultural policies and planning schedules);
- Canada Land Inventory (CLI) mapping of Soil Capability for Agriculture,
- Surficial geology mapping; and
- Aerial photography and NTS 1:50,000 topographic mapping.

Based on a review of these data, an accurate description and understanding of the distribution of prime agricultural resources in the analysis area was obtained.

As part of the second phase of study, background mapping will be collected to determine the historic distribution of agricultural land use systems and artificial tile drainage. Also, during the next stage of data collection, reconnaissance level investigations of the study area will be completed to field verify the agricultural resource areas.

4.4.2.1 Specialty Crop Areas

From a provincial perspective, the main areas of the Province that are recognized as Specialty Crop Areas include the following:

- portions of the Niagara Escarpment (including Meaford/Thornbury area and southern extent of the Regions of Niagara and City of Hamilton);
- Holland Marsh;
- Essex/Leamington area;
- Kent County;
- Portions of Prince Edward County; and
- Southern portions of Brant County and the former regions of Haldimand/Norfolk.

These areas are recognized as the primary fruit and vegetable growing regions in the Province, owing to the unique microclimate and/or soil characteristics that allow for commercial cultivation of these crops.

However, to a lesser extent, specialty crops may be grown in other portions of the Province. In an effort to identify potential specialty crop areas, the Upper Tier Official Plans (i.e. Perth County, Oxford County and Region of Waterloo) have been reviewed. No specialty crop areas were designated in municipal Official Plans.

Specialty Crop Areas have not been identified in the Official Plans for the municipalities in the Highway 7 & 8 analysis area. However, it is reasonable to anticipate that smaller areas of specialty crop production and individual specialty crop operations exist in the analysis area. The identification of these features will be an important study assignment associated with future agricultural land use and field investigations planned for future phases of the study. Site-specific information on specialty crop areas will be obtained through consultation with local landowners and farmers in the analysis area.

4.4.2.2 Prime Agricultural Areas

Much of the analysis area is designated Prime Agricultural Area. This is not an unexpected finding as this portion of southern Ontario is well regarded as the heartland for agricultural production. In the County of Perth for instance, over 90 percent of the County's total land area is classified as having Canada Land Inventory (CLI) Classes 1-3 soil capability for agriculture. A similar composition is occurs in the Region of Waterloo and County of Oxford, which is known as the dairy capital of Canada.

However, it is noted that portions of the analysis area are comprised of lower capability agricultural soils. These isolated pockets of lower capability land tend to be associated with river and valley systems, undulating topography associated with kames and kettles, and wetland areas.

4.4.2.3 Agricultural Soils and Soil Capability for Agriculture

Agricultural soils in the analysis area are generally found on loamy limestone till materials in areas where the melting ice has left deposits of considerable depth that have not been subsequently modified to any appreciable extent by water. Till deposits show a lack of sorting and stones, ranging in size from fine grit to large boulders, are scattered irregularly through the matrix of sand, silt and clay in varying proportions.

Agricultural soils in Perth County generally comprise the following soil series:

- Huron clay loam – well-drained soil developed on heavy textured limestone till,
- Perth silt loam – imperfectly drained soil developed on heavy-textured limestone till, and
- Harriston silt loam – well-drained soil developed on medium textured limestone till.

These soil series are good quality general purpose agricultural soils, with few significant constraints for agricultural production. Artificial drainage is often required for the imperfectly drained soils and nutrient enhancement may be needed, depending on the type of crop planted.

In relative terms, small inclusions of lower capability soils such as the Waterloo sandy loam (well drained sandy loam associated with irregular and/or steep topography), alluvial (bottom land soils associated with watercourses) and Muck (poorly drained organic soils) occur in the eastern portion of Perth County in the analysis area.

Although different soil series are encountered in the Region of Waterloo, the same general trend is found. Soils with deep beds overlying medium-textured till deposits and/or lacustrine deposits are common. On lands east of the Nith River, coarse and medium textured soils formed on outwash and lacustrine deposits are prevalent. These soils tend to be well-drained and low in inherent fertility.

The analysis area includes a small portion of the northeastern corner of the County of Oxford. The main soil series in this area is the Honeywood silt loam, a well-drained silty alluvial deposit developed over calcareous loam till. The silt loam is almost free of small stones. These soils are capable of producing a range of cereal grains, hays and pasture land but soil erosion is a concern with this soil series.

The distribution of agricultural soils throughout the analysis area has been mapped on Exhibit 4.5.

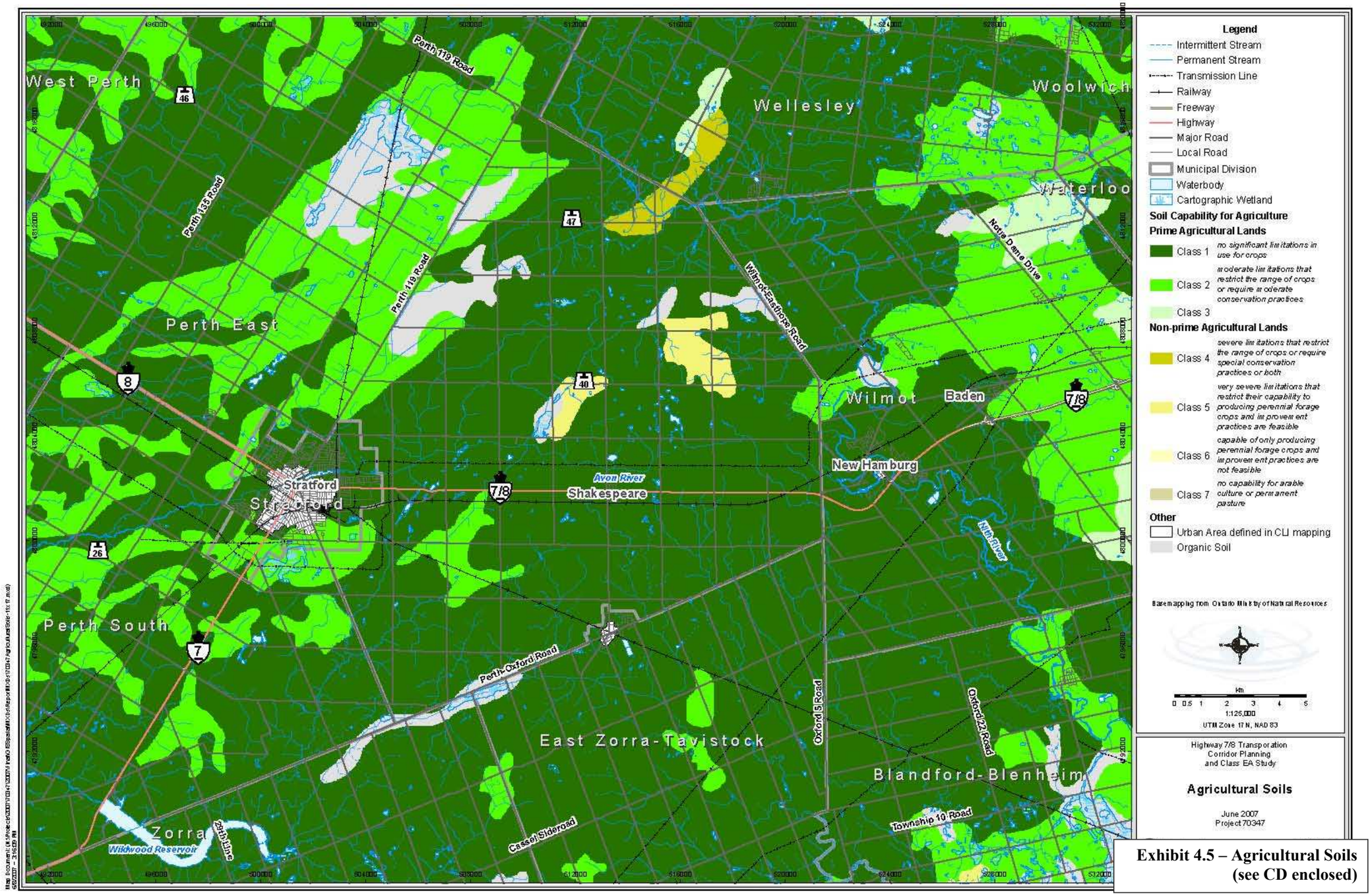


Exhibit 4.5 – Agricultural Soils (see CD enclosed)

4.4.3 Parks and Recreational Areas

No provincial parks or conservation areas were identified within the analysis area. The County of Perth OP identifies recreational uses east of Perth Road 107 between Highway 7 & 8 and Perth 43 Line. Recreational features in the County include the Thistledown Equestrian Centre, located at 2547 Perth Line 43 in Shakespeare, the Stratford Country Club, the Stratford Municipal Golf Course, and the Little Lakes Golf Centre. Within the Town of Stratford, approximately 115 acres of formal parkland and nearly 60 acres of natural area are present. Community parks in the New Hamburg area include Fountain Park and WJ Scott Park. MTO provides a small park/picnic area on Highway. 7 & 8 just west of Shakespere.

Within the Region of Waterloo are a number of recreational features. The Township of Wilmot OP identifies Major Recreation Areas in Foxboro Green, to the north of Baden, and adjacent to Petersburg along Highway 7 & 8. The former is the Foxwood Golf Club, a 27-hole public facility.

In the County of Oxford, the Village of Tavistock contains two parks, and the Tavistock Golf Course immediately to the south. The Plattsville Community Park offers one ball diamond with field lights. There is also a community park with a baseball diamond and other recreational areas in Shakespeare.

Within the City of Stratford there are six recreational areas containing baseball diamonds: (1) Anne Hathaway Park, (2) Dufferin Park, (3) Stratford Recreational Centre, (4) Optimist Recreational Park, (5) Packham Park, and (6) Stratford Educational and Recreation Centre. While some of these parks provide one diamond without any additional services, several areas, such as the diamonds located at Packham Park provide services such as washroom facilities and food vendors.

4.4.4 Aggregate and Mineral Resources

The County of Perth OP identifies Mineral and Petroleum Resources and Aggregate Licenses. There are a number of licensed pits or quarries to the north of Highway 7 & 8 in the vicinity of Shakespeare. Another licensed pits or quarry is located to the north of Stratford.

The Region of Waterloo OP identifies Mineral Aggregate Resource Areas. Two such areas are located to the east of Baden along Highway 7 & 8. A large Mineral Aggregate Resource Area is located south of Highway 7 & 8 along the eastern edge of the analysis area, and a small area is located to the west of the Nith River.

The County of Oxford OP identifies mineral aggregate resources. There is an existing aggregate license to the southwest of Plattsville at the edge of the analysis area. To the west of this licensed area is an identified natural gas pool.

4.5 Major Utility Corridors

4.5.1 Utilities

There are no major hydro transmission corridors or pipelines within the analysis area.

Buried gas lines exist at various locations within the highway ROW throughout the study area. Most of the gas lines exist along the 2-lane and 4-lane sections between Stratford and Waterloo Road 1. Within the section of Highway 7&8 holding the Class II staged freeway/expressway, in the New Hamburg area, Union Gas has limited presence.

Rogers FOTS exists within the corridor between Stratford and Waterloo Road 1. This plant is both overhead and buried. Although there are no lines within the corridor between Waterloo Road 1 and Waterloo Road 51, there are various locations where it crosses the highway.

The presence of utilities along Class II expressway/freeway corridor is limited. Kitchener-Wilmot Hydro do have overhead transmission lines crossing Highway 7 & 8 at various locations. There is also an overhead line that parallels the highway on the south side between Waterloo Road 5 and the former intersection at Waterloo Road 6.

4.5.2 Railways

The Goderich-Exeter Railway corridor runs parallel to Highway 7 & 8 from Stratford easterly to Kitchener. The railway is generally located 400 m to the south of Highway 7 & 8 from Stratford to approximately 1.5 km west of the intersection with Waterloo Regional Road 1 where the railway crosses the highway. This rail corridor then extends eastward paralleling Highway 7 & 8 to the north through New Hamburg.

His section of rail carries approximately 8 to 10 trains per day. The volume of rail traffic consists of both freight and passenger trains using this rail corridor are traveling from destinations to the west, from as far as Sarnia and Chicago, and from Toronto in the east. Via Rail and Amtrack use this track for their passenger service.

4.6 Contaminated Property and Waste Management

4.6.1 Methodology

A preliminary environmental review of the analysis area was conducted to determine the presence of any actual and/or potential environmental issues associated with contaminated lands. The review consisted of a desktop survey that included the following secondary source information:

- Orthophotography for a 424 km^2 area of the central part of the analysis area
- Historical aerial photographs from 1966 (central and western portions of analysis area) and 1971 (northeastern portion) from National Air Photo Library

- *Preliminary Environmental Review Of Contaminated Property And Waste Management, Secondary Source Group4 Water Investigation Highway 7 And 8 From New Hamburg To Stratford, Ontario*, by URS Canada Inc, March 10,2006
- Ecolog ERIS report
- Electronic city directories

The Ecolog ERIS search area, as shown on Exhibit 4.6, was an elliptical area centered on the Village of Shakespeare, with an area of approximately 300 km^2 overlying the central part of the analysis area. The Ecolog ERIS report included a search of the following databases for this area:

- Anderson's Waste Disposal Sites
- Automobile Wrecking & Supplies
- Chemical Register
- Coal Gasification Plants
- Compliance and Convictions
- Occurrence Reporting Information System
- Private Fuel Storage Tanks
- Ontario Regulation 347 Waste Receivers Summary
- Waste Disposal Site Inventory

Mappable records were found for all datasets excluding Coal Gasification Plants. Records indicated that one such facility was formerly located in Stratford; however, no location information for this facility was provided in the Ecolog ERIS databases.

Based on the secondary source investigations including use of electronic city directories, and aerial photographs, the following land uses were identified. General locations for the following features are shown on Exhibit 4.6.

4.6.2 Waste Disposal Sites /ERIS

Waste disposal site areas are delineated areas of suspected existing and former waste disposal sites. The Anderson's Waste Disposal Site Inventory provides estimated positions of former waste disposal sites from 1860 to present that may be missing from the Ontario MOE Waste Disposal Site Inventory. The database also identifies certain auto wreckers and scrap yards. A total of 11 records were found in the Ecolog ERIS survey area.

Level of Environmental Concern: High
Data sources: Ecolog ERIS
Years: 1860-present
Spatial Accuracy: Various Methods (moderate) verified by GLL with orthophotography where possible (high)

The Provincial Waste Disposal Sites database is based on the Ontario Ministry of Environment, Waste Management Branch inventory of known existing and former waste disposal sites in the Province of Ontario. A total of four records were found in the analysis area.

Level of Environmental Concern: High

Data sources: Ecolog ERIS
Years: 1970-2002
Spatial Accuracy: Lot and Concession (low) verified with orthophotography where possible (high)

A total of eight waste disposal site areas were identified in the orthophotography coverage area, ranging from 0.25 - 5 ha.

Level of Environmental Concern: High
Data sources: Aerial Photographs
Years: Aerial photos from 1966, 1971, 2006
Spatial Accuracy: Archive aerial photos and orthophotography (high)

4.6.3 Automobile Fuel or Repairs

This category includes automobile service garages and gasoline service stations, which frequently use aboveground or underground storage tanks (ASTs or USTs) for petroleum storage. Approximately 90 records were found in the analysis area, of which approximately 75 were located in built-up urban areas of Stratford.

Level of Environmental Concern: Moderate to High
Data sources: Electronic City Directories
Years: 2002-2005
Spatial Accuracy: Postal Code (moderate)

4.6.4 Automobile Wrecking/Scrapyard

The information from this dataset provides known locations that are involved in the scrap metal, automobile, wrecking/recycling, and automobile parts & supplies industry. One record was found in Ecolog ERIS survey area.

Level of Environmental Concern: High
Data sources: Ecolog ERIS
Years: 2002-2005
Spatial Accuracy: Unknown (moderate) verified by GLL with orthophotography where possible (high)

In addition, a total of five areas of existing and suspected former scrap yards and auto wrecking yards were identified in the orthophotography coverage area, ranging from 1 - 3 ha.

Level of Environmental Concern: High
Data sources: Aerial Photographs
Years: Aerial photos from 1966, 1971, 2006
Spatial Accuracy: Archive aerial photos and orthophotography (high)

4.6.5 Coal Gasification Facility

The review showed the location of one former coal gasification facility identified in the Ecolog ERIS report. Although no geocoding information was provided by the Ecolog report, supplemental information from the 2006 investigation indicated that the facility was located in

the vicinity of the intersection of Wellington Street and St. David Street in Stratford. No sources of information were provided to verify the location.

Level of Environmental Concern: High
Data sources: Ecolog ERIS/URS
Years: all prior to data collection in 1988
Spatial Accuracy: Unknown

4.6.6 Drycleaning Facilities

Exhibit 4.6 includes listed drycleaning facilities that may use or store solvents on-site. Five records were found in the analysis area, of which four were located in built-up urban areas of Stratford.

Level of Environmental Concern: Moderate to High
Data sources: Electronic City Directories
Years: 2002-2005
Spatial Accuracy: Postal Code (moderate)

4.6.7 MOE Spills Reporting

This database identifies approximate locations of spills and occurrences within Ontario that have been reported to the MOE. Approximately 135 records were found in the analysis area, of which approximately 115 were located in built-up urban areas of Stratford. The 2006 report indicated that 17 of these spills were of a quantity and nature to be a potential concern.

Level of Environmental Concern: Moderate
Data sources: Ecolog ERIS
Years: 1988-2002
Spatial Accuracy: MOE Municipal Address (moderate)

4.6.8 Petroleum Wells

Information on petroleum extraction wells was available only for the County of Oxford. Exhibit 4.6 includes listed existing and former petroleum extraction wells in the County of Oxford. A total of nine records were found.

Level of Environmental Concern: Moderate
Data sources: County of Oxford GIS
Years: Unknown
Spatial Accuracy: Unknown

4.6.9 Underground Storage Tanks

The Fuels Safety Branch of the Ontario Ministry of Consumer and Commercial Relations maintained a database of all registered private fuel storage tanks from 1989-1996. A total of 19 records were found in the analysis area, of which approximately 11 were located in built-up urban areas of Stratford.

Level of Environmental Concern: High

Data sources: Ecolog ERIS
Years: 1988-2002
Spatial Accuracy: Municipal Addresses (moderate)

In addition, the County of Oxford GIS database listed four records of registered underground storage tanks.

Level of Environmental Concern: High
Data sources: County of Oxford GIS
Years: Unknown
Spatial Accuracy: Unknown

4.6.10 MOE Registered Waste Receivers

A total of five records of registered receivers of regulated wastes, as defined by O. Reg 347 were identified by registration number, company name and address. All five records were located in built-up urban areas of Stratford.

Level of Environmental Concern: moderate to high
Data sources: Ecolog ERIS
Years: 1986-2005
Spatial Accuracy: Municipal Addresses (moderate)

4.6.11 Quarries and Aggregate Pits

Existing and suspected former aggregate extraction, some of which may use backfill materials of unknown quality are delineated in the quarries and aggregate pits database. A total of 22 areas were identified in the orthophotography coverage area, ranging in area from approximately 1 to 200 ha.

Level of Environmental Concern: Low to Moderate
Data sources: Aerial Photographs, MNR Ontario Base Mapping
Years: Aerial photos from 1966, 1971, 2006, mapping 1983
Spatial Accuracy: OBM mapping (moderate) verified by GLL with archive aerial photos and orthophotography where possible (high)

4.6.12 Heavy Industrial Land Uses

A total of four areas of suspected existing and former heavy industrial land uses were identified in the orthophotography coverage area, ranging in size from 3 - 24 ha. These areas are not readily identifiable on Exhibit 4.6 given their area (i.e., size) relative to the overall analysis area.

Level of Environmental Concern: High
Data sources: Aerial Photographs
Years: Aerial photos from 1966, 1971, 2006
Spatial Accuracy: Archive aerial photos and orthophotography (high)

4.6.13 Light Industrial Land Uses

A total of fours areas of suspected existing light industrial land uses were identified in the orthophotography coverage area east of the urban built-up area of Stratford.

Level of Environmental Concern: Low to moderate
Data sources: Aerial Photographs
Years: Aerial photos from 2006
Spatial Accuracy: Orthophotography (high)

4.7 Landscape Composition

Landscape composition is typically described in terms of landscape features including vegetation, notable views from the highway and views from sensitive viewer groups to the highway.

The landscape composition in most of the analysis area is dominated by rural farmland. The built-up areas are concentrated in New Hamburg on the east, Shakespeare in the middle and Stratford in the west.

Outside the built up areas, many of the rural residences are set back a distance from the existing Highway 7 & 8 in which case the highway does not dominate their view.

The topography is relatively flat west of Shakespeare and gently rolling towards New Hamburg and the existing Highway 7 & 8 is on a long tangent throughout most of the analysis area. The flat topography and long sections of straight highway make the views from the highway somewhat unremarkable.

4.8 Significance/Sensitivity of Socio-Economic Environment

At this stage of the study process, general and preliminary land use constraints have been identified. Potential displacement of existing residences, businesses or institutional uses is recognized as the highest land use constraint to corridor development. Consequently, existing developed urbanized areas pose significant land use constraints, as do developed areas of villages and hamlets, clustered rural residential development and existing community institutional features. Isolated residences, industrial development, recreational use or other special area uses are also recognized as significant land use constraints.

The next level of significance for land use impact is undeveloped, but fully serviced areas and approved Plans of Subdivision. This recognizes the investment in infrastructure and the anticipated development potential of these areas.

The identification and protection of specialty crop areas and prime agricultural lands are important in the analysis area, as supported by OMAFRA policies regarding agriculture. As per provincial policy, the following priority will be given to agricultural resource lands within the analysis area:

- Specialty crop areas,
- CLI Class 1 soils,
- CLI Class 2 soils,
- CLI Class 3 soils,
- Other soils.

Recreational trails pose a moderate constraint to corridor development. Further investigation will be conducted to identify existing and planned trails during the study.

Areas containing significant aggregate resources also present a moderate constraint in terms of the potential disruption/displacement of an active extraction activity, as well as the need to protect identified areas containing this non-renewable resource. The resource can be extracted prior to corridor development if required. Potential adverse impacts on active aggregate business operations will be considered.

Based on the size of the analysis area and diversity of land uses noted, the potential for environmental issues related to contaminated properties has been assessed from a broad perspective only. However, several areas with potential for environmental contamination have been identified based on this preliminary review. Further review and site inspections will be completed once the alternatives have been generated to determine if these sites are of concern and to identify other potential sites of environmental concern.

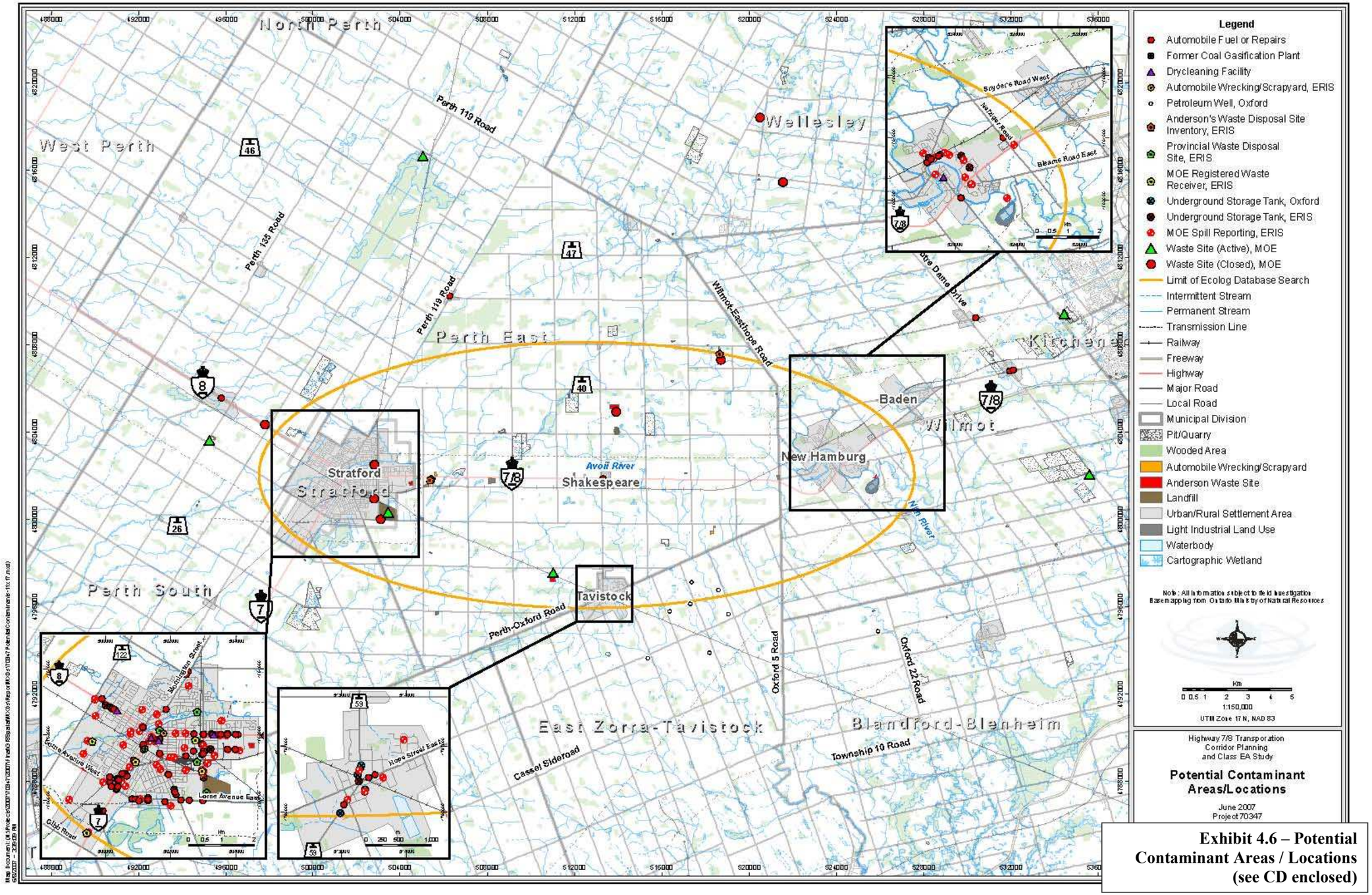


Exhibit 4.6 – Potential Contaminant Areas / Locations (see CD enclosed)

5.0 CULTURAL ENVIRONMENT

5.1 Cultural Heritage - Built Heritage and Cultural Landscapes

The main purpose of this Stage 1 study is to identify recognized resources within the analysis area through the collection of listings in existing heritage inventories. A previous report for a covering portion of the analysis area, *Description of Man-Made Heritage in the Environment: Preliminary Report,* by Paul Dilse (1981), provides a detailed inventory of built heritage resources within roughly one and a half concessions north and south of Highway 7 & 8 from just east of Stratford to east of New Hamburg. No other equally comprehensive inventories exist for any of the constituencies within the current analysis area. This section provides a summary of the Stage 1 Study.

5.1.1 Methodology

The Project Team contacted municipal clerks, planners, and archivists in each of the jurisdictions to ascertain what kinds of heritage registers had been compiled and to gain access to those listings. The sites on those inventories were then mapped. The structures determined to be significant in the Dilse (1981) study were also reviewed, updated, and mapped. Longitude, latitude and UTM coordinates were collected for each building or resource located in the field using a WAAS-enabled hand held GPS unit manufactured by Garmin.

Since the main emphasis was on obtaining and contextualizing existing registers, an independent survey is not provided at this stage of the analysis; the understanding is that surveys of the present route of Highway 7 & 8 and of any alternate routes will occur when various transportation options have been defined. However, a considerable amount of time was spent on field investigations to: (1) determine which listings were within the analysis area, (2) to clarify addresses and to determine mapping coordinates, (3) to photograph relevant structures, and (4) to get a sense of how essential a more comprehensive survey would be, in order to provide a valid portrayal of the extent and importance of built heritage within the analysis area.

The inventories were mapped by Timmins Martelle Heritage Consultants Inc. To procure the information required for accurate mapping, the Project Team relied on municipal addresses provided in the inventories, street maps, interactive internet maps, historic atlases, and field surveys. The latter helped to confirm locations in the field and determine that some of the identified structures and bridges had been demolished or heavily altered since being listed on their respective inventories.

5.1.2 History of the Area

The analysis area falls within Perth, Oxford and Waterloo Counties. The historical review summarized in this section focuses on the origin and early settlement of the communities and townships within these counties. A short description of the founding of a selection of major and minor centres throughout the analysis area is also provided. This is meant to provide a summary

of the general history of the area in an effort to contextualize the built heritage resources that exist therein.

The Canada Company and the Huron Tract

Much of the analysis area falls within what was once known as the Huron Tract. The Tract consisted of one million acres of (then) relatively uncleared land that was purchased by the Canada Company from the Crown in 1828 for three shillings and sixpence per acre. The Crown had purchased the lands from the Chippewa on April 26, 1825 (Lee 2004:39). The Canada Company was headed by John Galt, a Scot who had come to Canada in 1820 to head a committee for the Revision of the War Claims of 1812. Galt and his advisors envisioned the formation of a company empowered to purchase lands at a nominal cost and sell them through a system of deferred payment. By doing so, the company would facilitate settlement in the region and, hopefully, earn a profit at the same time. A portion of the Company's profits were to be used for the construction and maintenance of public works (e.g., roads, bridges, schools) (Kearsley 1962:6).

Highway 7 & 8 once formed part of one of the earliest roads constructed by the Canada Company – first named the Goderich Road and later the Huron Road. The road was opened in 1828 and connected two major planned centres established by the Canada Company – Goderich, on the shore of Lake Huron, and Guelph. The road, which extended from Wilmot Township to Goderich, was originally a native trail and early sleigh road (Lee 2004:158). It was surveyed by Deputy Provincial Surveyor John McDonald and travels the general course of modern Highway 8. The Company actively worked to promote travel between the two centres and to encourage settlement along the roadway. In so doing, they offered financial grants or assistance to individuals who would erect inns along the route, and often funded the construction of schools, and prepared town plans for communities in strategic locales. Several historic properties along Highway 7 & 8 and within the analysis area were established as Canada Company projects. One of these is the Fryfogel Inn, east of Shakespeare.

Perth County

Perth County was originally part of the Huron Tract. It became a formal municipality in 1850, with a government based in Stratford (Johnston 1902:46). Sebastian Fryfogel and Andrew Sebach, along with their families, are credited with being the first permanent residents of Perth County. Fryfogel erected a log cabin along the Huron Road in 1828 or 1829 where he offered meals and accommodations to travelers (McNichol 1967:9).

Ellice Township (now in the Municipality of Perth East)

Ellice Township was named in honor of one of the director's of the Canada Company, Edward Ellice. The township was surveyed and opened for settlement in 1828 (Johnston 1902:276). The first settler (and second in Perth County) was Andrew Sebach of Bavaria, who came to Canada in 1828 with a family of five and settled along the Huron Road on Lot 31, Concession I, west of Sebringville. He received a grant from the Canada Company to open a tavern for accommodating settlers and prospectors, which he opened on his lot (H. Belden & Co. 1879:xvi). The first settler

to locate in the rear of the Huron Road was George Brunner in 1832. Settlement in the more remote portions of the township was slow. Several of the more prominent smaller centres to emerge included Sebringville, Kinkora, Wartsburg and Gads Hill.

Sebringville was named for John Sebring who was responsible for building the Canada Company's mill at Stratford. After settling on the Ellice side in September 1834, Sebring constructed a saw mill a year later, followed soon after by a grist mill. The saw mill was in use until 1878 when it was torn down and replaced by John Pearson (H. Belden & Co. 1879: xiv). Sebring then went on to erect a saw and grist mill in Egmondville for the Canada Company (which was later purchased by the Van Egmond family). Many families joined Sebring in 1835 in what was then known as the Black Creek Village (DTHBC 2002:2). The first store in Sebringville was established in 1842 (H. Belden & Co. 1879: xiv). Several German families established the Evangelical Association in 1840 and held regular religious services (Johnston 1902:286). Sebringville prospered with the construction of the railway and by 1879 the community boasted more than 40 businesses (including hotels, a tannery, cooperage, wagon and blacksmith shops, as well as an office of the Montreal Telegraph Company) and a population of over 400 (DTHBC 2002:2; H. Belden & Co. 1879: xiv).

Gads Hill (Gadshill), at one time covered by dense swamp, was founded by Henry Ratz who built a saw mill at this location subsequent to the construction of a gravel road to Mornington (Johnston 1902:282). The town's location along a major roadway that was in close proximity to Stratford led to a measure of commercial importance. By 1879, the population exceeded 100 persons and contained several steam saw, stave, and shingle mills, in addition to a number of minor industries. Daily mail was serviced through Stratford and a station of the Stratford and Huron Railway (H. Belden & Co. 1879:xv). The first post office was opened in 1865 with W. B. Crinkley serving as postmaster (Johnston 1902:136).

Richard Coulton, a school teacher who built the first building in 1857, is widely credited with being the founder of Wartburg, originally named Totness (McNichol 1967:67; Johnston 1902:141). Many of the settlers to the area were Lutherans. The Canada Company granted an application for the site for the Evangelical Church of St. John in 1856. It was for this reason that, in 1869, the Rev. Mr. Schaffarnock petitioned to have the name Totness changed to Wartburg, in honor of the town in Germany where Martin Luther served a ten month prison sentence. Wartburg served as the seat of government for several years (Johnston 1902:282).

To the west, the community of Kinkora was settled by Irish families. In 1844, James Hearsnep, John Stock, James Keagan, the Heishons, and Crowleys formed what was called "St. Patrick's Settlement". William Hearsnip was appointed first postmaster when Kinkora opened its post office in 1857 (Johnston 1902:136). Some of the community's earliest businessmen were Ed Brown, who operated a blacksmith shop, Joseph Stock, who owned the saw mill and John Daly who was a cheesemaker (McNichol 1967:81).

The 1879 map of Ellice Township demonstrates that the majority of lots were settled by that time and, with the exception of a few lots within the vicinity of Black Creek and the Ellice Swamp, the concession roads were typically open. The crossroads communities of Kinkora and Wartburg appear to have contained schools and churches, while early industries (mills, brickyard) are

shown along Highway 8 in Sebringville and Stratford. These small historic centres, now largely rural crossroad communities, played important roles in the early social and economic lives of Ellice Township residents. In general, the historic structures are situated adjacent to the concession roads.

Downie Township (now in the Municipality of Perth-South)

The township of Downie was surveyed in two parts, divided by the Stratford and St. Mary's Road (Highway 7 and 19). The northwest section was referred to as the township proper or square, while the Gore encompassed the southeast, wedged between what were known as South Easthope and Zorra townships. Survey of the township along the first concession began in January of 1829. The Gore was completed by 1835 while the township proper was finished in 1839 (DTHBC 2002:1). Like other townships in the region, Downie was named in honor of a director in the Canada Company, in this case Robert Downie (Johnston 1902:176).

Although there were other settlers in the townships of Perth County, the general settlement of Downie was the first and most rapid. The population rose from just a handful in 1832 to more than 1,800 by 1844 (DTHBC 2002:1). The earliest settlement coincided with the founding of "Little Thames" or Stratford as it was to become known. Most of the settlers arrived from Germany and Britain and leased their land from the Canada Company for roughly two hundred and fifty dollars per 100 acres. Most settlers could not afford to pay such a large sum up front, so they would lease the land and make yearly payments until receiving full title and deed (DTHBC 2002:1). The railway came to Dowie Township in 1857 when the Buffalo, Brantford and Goderich Railway Co. constructed a line from Stratford to Goderich. That company would later go bankrupt and its assets were granted to the Buffalo and Lake Huron Railway. The Grand Trunk Railway also opened a line in 1857, which ran from Stratford to Sarnia (DTHBC 2002:2).

St. Paul's Station emerged as a prominent centre in Downie. Established as a stop on the main line of the Grand Trunk Railway and benefiting from its central location in the township, St. Paul's experienced a degree of prosperity in the mid to latter part of the 19th century (H. Belden & Co. 1879: xiv). It received its name officially in 1875 when it was granted a post office with Charles Wilson serving as first postmaster (DTHBC 2002:2). A large white-brick Town Hall was built in 1877, which was used not only for municipal meetings, but Sunday school classes and religious services as well (H. Belden & Co. 1879: xiv).

The community of Avonton, to the northwest of St. Paul's Station, was established in 1857 by Presbyterian families. Settlers took advantage of its location on the Avon River to construct mills. Sam Inman, one of these settlers, erected a saw mill and carding mill on Lot 17, Concession VII in 1854. The first log buildings were constructed on Lots 15 and 16, Concessions VI and VII, respectively. Later houses were built from stone brought in from St. Mary's. Archibald Shiells opened a store and in 1863 became the settlement's first postmaster (DTHBC 2002:2).

The community of Harmony came into existence when a Methodist missionary named Cleghorn lost his way while traveling from Shakespeare to West Zorra. He is said to have come upon a settler's house where he remained for some time. Services were held at the house attracting

backwoodsmen with an interest in religious exercise, who formed the foundation of a small congregation known as "Harmony". The society continued to hold worship each week in private houses or the local school until a frame building was constructed in 1864 ministered by John S. Fisher. The church was founded on Lot 1, Concession VII (Johnston 1902:184). It was replaced with a brick structure in 1874 (DTHBC 2002:2). The community was provided a post office in 1867 with Edmond Corbett holding position of postmaster from that year until 1875 (DTHBC 2002:2). By 1879, Harmony had within its limits an Orange Lodge, saw mill, blacksmith, wagon shop, and general store serving a population of about 75 individuals (H. Belden & Co. 1879: xiv).

The historic atlas map for Downie Township shows that most lots were settled by 1879 and virtually all of the concession roads were open. The Grand Trunk railway opened a line through the township in 1857, resulting in the growth of the City of Stratford and the emergence of stations like St. Paul's in the central portion of the township. The majority of historic buildings are situated adjacent to the concession roads.

North Easthope Township (now in the Municipality of Perth East)

David Bell settled on Lot 21, Concession 1 in June of 1832 and is credited as being the township's original pioneer (H. Belden & Co. 1879: xiv). The first wave of settlement came in a group of families from Perthshire, Scotland, after whom the county was subsequently named. Another party from Perthshire arrived in 1833. Many of these families located along the 2nd and 3rd Concession lines, east of Bell's settlement (H. Belden & Co. 1879: xiv). Settlement slowed somewhat after 1834 (H. Belden & Co. 1879: xv). The first school house in the township was built on Lot 21, Concession II although school had been previously taught in Mr. Linton's house on Lot 27, Concession I (H. Belden & Co. 1879:xv). The school house on Lot 21 was also used for religious services and township meetings (H. Belden & Co. 1879:xv).

The earliest settlement in the township emerged in proximity to the village of Shakespeare, originally named Bell's Corners, after David Bell, its founder. The community's first post office came in 1848 and operated out of the hotel. By 1879, 415 persons made the community their home and were served by two large general stores, two groceries, three hotels, and two Canadian Express offices (Walker & Miles 1876:5).

A number of smaller communities, mostly crossroads centres, emerged in the township north of Shakespeare. One of these, Amulree, contained a hotel, blacksmith shop and steam mill by 1879, in addition to a church, school, shops and a cheese factory (H. Belden & Co. 1879:xv). Many of the community's earliest settlers were of Scottish descent (Johnston 1902:132) and, because of this, the community inherited its name from a small place of the same name in Perthshire, Scotland. Lisbon, along the eastern boundary, was a small postal village settled first by Lorenz Hohl in 1854 (Wilmot Historical Committee 1967:37). Hampstead, originally called Grant's Corners, was settled at least by the early 1840s when a schoolhouse was known to exist at the main intersection (H. Belden & Co. 1879:xv). Historic maps also indicate that by the late 19th century, a cheese factory was in operation.

As with the townships previously described, the lots within North Easthope Township were almost entirely settled by 1879 and the concession roads were open. Structures are typically shown very close to the roadways.

South Easthope Township (now in the Municipality of Perth East)

The former Township of South Easthope can lay claim to the county's first and one of its most notable settlers. Born in Berne, Switzerland, Sebastian Fryfogel immigrated to America in 1806 where he lived for 21 years before arriving in Canada in 1827. While living in Waterloo he was persuaded by Col. Van Egmond to open a tavern on the Huron Tract where the Canada Company was offering substantial cash bonuses to persons who could keep such taverns for six months. Mr. Fryfogel moved into the tavern on Lot 14, Concession I on Christmas Day, 1829 (some reports say 1828; H. Belden & Co. 1879:xv). The second settler to the township was Andrew Riddell from Berwickshire, Scotland. Arriving in 1831-32 and settling less than a mile from Sebastian Fryfogel, Riddell, most notably, held all of the elective and appointed offices of the township at one time or another. Andrew Helmer who had worked in the tract since 1829 under Col. Van Egmond, married the Colonel's daughter and settled in 1832 (H. Belden & Co. 1879:xv).

Settlement in the township progressed gradually and occurred mainly along Huron Road and the eastern corner of the township. The remainder witnessed no real settlement until 1842 when Douglas MacTavish of Perthshire, Scotland and his five sons with their families arrived, occupying nearly 1,200 acres of land (H. Belden & Co. 1879: xv). At that time there were two schools in the township: an English school on Lot 10, Concession I and a German school at Sebastapol (H. Belden & Co. 1879: xv).

The 1879 map of South Easthope Township illustrates structures on most lots by that time, mainly in proximity to the concession roads. Town centres are shown for the settlement areas described above.

City of Stratford

By 1832, the Canada Company had surveyed enough of the Huron Tract to open it to settlement. In expectation of the increased number of settlers, a number of extra taverns and inns had been constructed along the tract for their accommodation, including one on the "Little Thames" at the eastern limits. An Irishman named William Sargint was hired by the Company to build and keep the new tavern. English names had already been chosen for the other locations in Guelph, named for the royal family, and Goderich, for the British prime minister. The location of Sargint's inn and subsequent settlement was to be called Stratford-upon-Avon, named for the birthplace of Shakespeare. This also led to the renaming of the "Little Thames" River to the Avon River. Sargint's inn, appropriately named "The Shakespeare Inn," also serving as a store and used for early religious services, was destroyed by fire in 1849 (Johnston 1902:468). In 1833, John Corry Wilson Daly was hired to set up a Canada Company office in Stratford in order to contract and supervise the construction and operation of a dam, grist mill, saw mill, general store and distillery (Bart-Riedstra and Riedstra 1999:18). J. J. E. Linton arrived the same year as Daly's

hiring by the Company. Linton opened a private school and is credited as being the first school teacher in the county (Johnston 1902:468,484). In 1832, a town plan was developed and laid out by Deputy Provincial Surveyor John McDonald in 1834 (Lee 2004:123).

The first wave of settlement consisted mainly of settlers from the British Isles and Germany, where the Canada Company had advertised extensively. This coincided with a general increase in immigration to Canada between the years 1832 to 1837 (Bart-Riedstra and Riedstra 1999:18). The second wave of settlers to the area peaked between 1842 and 1847, the latter year being significant because of the famine in parts of Europe and Ireland. By 1850, the population of Stratford numbered around 900 (Johnston 1902:470). Like in others parts of the region, the Scottish immigrants were mainly from the Lowlands and Perthshire in the Highlands, while the Germans came from Hesse, Hanover, Alsace, and Bern in Switzerland. Immigration continued into the 1860s, represented significantly by Germans from Eastern Europe, Mecklenburg, Prussia, and Saxony (Bart-Riedstra and Riedstra 1999:18). Progress was slow during the 1830s with only a few independent businesses emerging. During that decade a foundry was built by John Sharman, and William May opened a cabinet making shop. Stratford's social institutions progressed more rapidly. A log school built in 1836 was replaced by a brick one in 1855. In 1838, St. Andrew's Presbyterian Church was organized with a frame building being constructed in 1840.

Incorporating parts of several townships, Stratford ceased to be a unified entity until Perth County was created in 1850, with Stratford serving as its capital. Upon completion of the construction of a courthouse and jail in 1853, Stratford was incorporated as a village in 1854. Stratford purchased stock in the Northern Gravel Road which opened 10 miles to Mornington and brought important increased trade to the town. Investments and improvements to several leading streets enhanced its position as a bustling village. The completion of the Grand Trunk and Buffalo and Lake Huron railways in 1857 assured Stratford's commercial supremacy in Perth County. This was augmented with the construction of the Port Dover and Stratford and Huron railways in 1875 (Johnston 1902:476). The Grand Trunk Railway also built and operated a number of its locomotive repair shops within the town, providing abundant employment opportunities (Leitch 1980). The movement of goods both to and from Stratford led to greater prosperity for many, which in turn led to a steadily increasing population. By 1864 the population of Stratford reached 3,600 (Johnston 1902:476).

Oxford County

Oxford County was settled even before it was established as a municipality and had formal boundaries (Dawe 1980:3). In 1793 it drew the attention of the Lieutenant Governor of Upper Canada, John Graves Simcoe, who was led here by native guides who showed him the way through Oxford County as they traveled from Brantford to the Thames River and what now is Beachville (Dawe 1980:3). Simcoe's surveyor Augustus Jones surveyed the district along the Thames River, where settlement would initially grow. Settlement elsewhere in the county was somewhat slower. Zorra and Nissouri Townships witnessed settlement by immigrants mainly from the highlands of Scotland, while German settlers arrived and began settling in the rear of Blandford in East and West Zorra (Walker & Miles 1876:6).

Blandford Township (now in the Municipality of Blandford-Blenheim)

Settlement in Blandford was initially stalled by the fact that the government had made a decision in 1799 to withhold its land for sale, so that it could be used in the future to help finance the construction of schools throughout the province (Dawe 1980:22). Into the first three decades of the 1800s, Blandford was set aside as "School Reserves." By 1829, the township contained an estimated 16,000 acres of school reserves, 8,000 acres in Crown and Clergy Reserves, and less than 5,000 acres were available to the government for sale (Dawe 1980:44). The available lands were quickly depleted as they were granted to retired military officers in payment for their loyalty. Nonetheless, when these military men arrived on their properties in Blandford, many found there to be squatters on their lands (Dawe 1980:44). For the most part, these earliest settled properties were in the southern portion of the township, in the vicinity of what would become Woodstock.

Only a small portion of Blandford falls within the analysis area. This particular portion of it was first settled by Scottish families, many of whom established homesteads in the vicinity of Ratho (to the south of the analysis area) by the mid 1800s. By the mid 1870s most of the area appears to have been settled and accessible by opened concession roads. While structures are typically not shown on individual lots, a church is illustrated on the property of J. Wilson on the 12th Concession, along the southern analysis area boundary.

Blenheim Township (now in the Municipality of Blandford-Blenheim)

Plans to create Blenheim Township began in July of 1793, even before Oxford was established as a county unto its own (Dawe 1980:5). Lieutenant Governor Simcoe granted Thomas Watson and Effingham Lawrence of Borden Town, New Jersey, the right to promote settlement in the township. Watson's nephew Thomas Horner would play a key role in the development of the township, establishing milling sites on Horner's Creek in 1793 (Dawe 1980:6). Both Smith's Creek and Horner's Creek were popular locales for early settlement, as they provided many excellent mill sites. Watson was afforded the township lands as repayment for his service to Simcoe when he was a prisoner in Borden Town during the Revolutionary War (Dawe 1980:6). By 1794 the earliest settlers were moving into Blenheim Township, assisted by the completion of survey lines and the opening of roadways. Simcoe ordered the survey of three concessions and a suitable site was chosen for the construction of a mill. The mill was completed in 1795 but broke down before it was in operation. A saw mill that Horner subsequently built was destroyed by fire in 1809; an inauspicious beginning for the early years of Blenheim Township (Walker & Miles 1876:6).

Although settlement occurred early along Horner's Creek and within the southern concessions of Blenheim, it was more delayed in the remaining portions of the township. However, by the mid-19th century Plattsville, too, had been established as a milling centre (Dawe 1980:89). By the year 1876, Plattsville was the largest and most important village in Blenheim Township with a population of nearly five hundred people (Walker & Miles 1876:9). Situated on Nith River (formerly Smith's Creek), the community boasted two general stores, two large flouring mills, a saw mill, foundry, a large cabinet factory, as well as several mechanics of various specialties (Walker & Miles1876:9). Mr. A. Tew, a former Warden of the county, is considered to be one

of the driving forces behind the commercial and economic prosperity of Plattsville (Walker and Miles 1876:9).

All of the lots within the analysis area appear to have been settled by 1876 and the concession roads were open by that time. Because the historic atlas map lacks detail, the approximate location of buildings is not known.

East Zorra Township (now in the Municipality of East Zorra-Tavistock)

The townships of East and West Zorra were surveyed by Shubal Parke in 1820 and organized in 1822 by a warrant issued by Charled Ingersoll and Peter Teeple. At this time there were only 145 acres cleared in the whole township, 39 of which were cultivated (RCT 1968:9). The first lot sold was on the ninth concession, along the western township boundary (RCT 1968:9).

Tavistock was first settled by a former Prussian soldier, Henry Eckstein, who arrived in 1848, and was responsible for the construction of the first hotel and several commercial buildings in the centre. He may have arrived via an old stage road that is reported to have existed before 1829 and connected the town to Punkeydoodles Corners, Haysville and Galt (RCT 1968:20). Eckstein and other early settlers originally established homesteads in Sebastapol, a smaller centre to the north of the Tavistock town core and eventually encompassed by the ever growing village. Sebastopol once contained a number of commercial and industrial buildings, including a cider mill (RCT 1968:20). Tavistock thrived with the arrival of the Buffalo and Lake Huron Branch of the Grand Trunk Railway and many of the families living in Sebastopol relocated to the railway peripheries by the mid-to-late 1800s (RCT 1968:26). In 1867 Tavistock is said to have contained four general stores, two shoe shops, one harness shop, two wagon shops, two blacksmith shops, a tannery and three hotels, in addition to a steam-flouring mill, grist mill and flax mill (RCT 1968:40). Caleb Caistor is said to have established a tavern on the east side of Highway 59, south of Tavistock.

By 1876 most of the lots within the township were settled. However, the historic atlas map does not provide details regarding the location of buildings. It is likely that homesteads were erected close to the concession roads.

Waterloo County

Waterloo County history can be traced back partly to the 1795 conveyance of what was then Blocks 1, 2 and 3 of Haldimand Tract (later Dumfries, Waterloo and Woolwich Townships) and partly to initial land grants made by the Crown to Mennonite settlers.

Wilmot Township

Wilmot Township (formerly known as the German Block) would not be settled until much of the land in the adjoining Waterloo Township had already been populated, largely by Pennsylvania German Mennonite families from Pennsylvania and overseas. The founder of Wilmot's first community was Christian Nafziger (Wilmot Historical Committee 1967:18). Coming to

America in 1820, Nafziger was charged with finding a suitable location for an Amish Mennonite colony. He was aided in his search by Jacob Erb of Waterloo Township and other Niagara area Mennonites (Hayes 1997:10). Pleased with the prospect of securing settlement, the government promised a free grant of 50 acres to each settler, with any excess of that sold at a low rate (H. Parsell & Co. 1881:9). The first stream of immigrants began to arrive in 1824, mainly from the low countries of Europe (Hayes 1997:10; H. Parsell & Co. 1881:3). A second group arrived in 1826 as the Amish continued to spread over the northern two thirds of the township, "almost to the exclusion of others" (H. Parsell & Co. 1881:9). The influx of Anglo-Saxons did not commence until about 1830 and was confined mainly to the southern third of the township (H. Parsell & Co. 1881:3).

The opening of Huron Road attracted settlers from various regions. Samuel and Jacob Reichard were granted 100 acres of land by the Canada Company for clearing two miles of road. They built a saw mill on Lot 5, Concession 1 in 1828 (Young 1888:20). In 1830, John Millar from Scotland purchased land and began a saw milling operation at the site of what would come to be known as New Dundee. Many English immigrants settled further west along the road. William Hobson was responsible for surveying parts of the road and eventually purchased land on Smith's Creek (Nith River) where he opened a large hotel (Hayes 1997:12).

Wilmot Township is peppered with large and small historic centres, all of which were important to the founding Amish populations and continue to be of importance today. These centres include Philipsburg and St. Agatha on Erb's Road, Petersburg, Baden and New Hamburg on Snyder's Road and Wilmot Centre on Bleam's (historically Bleem's) Road. Baden's first European occupants arrived in the 1820s and 30s. Baden's mid-century growth and success is attributable to the work of several prominent businessmen, including James Livingston of J. & J. Livingston, a prominent flax mill. Livingston built the majestic estate of Castle Kilbride at 60 Snyder's Road. The community also grew with the construction of the Grand Trunk Railway. St. Agatha was settled in 1840 to service the Mennonite community on the east half of Erb's Road. It once incorporated a post office, store and tavern and, in 1856, also became a stop on the railroad line (Hayes 1997:13, 39). Petersburg was settled by German Lutherans in the 1830s and 1840s, and like St. Agatha, grew in importance as a station on the Grand Trunk Railway (Hayes 1997:13). The hamlet of Wilmot Centre was formerly the township's seat of government, where school and religious services were held at least as early as 1849 (Wilmot Historical Committee 1967:105). Settlement south of Bleam's Road, in what is now called "Block A", was assisted by the Canada Company when they paid to have the Dundas Road cut through the first and second concessions (H. Parsell & Co. 1881:9). The emergence of Haysville in 1832 followed the construction of the roads and by 1833 land was being cleared on the east side of the Nith. This was followed by the establishment of mills and hotels and later a post office (Hayes 1997:12).

New Hamburg is the largest community in Wilmot Township and was founded in 1831 when William Scott built a cabin and constructed a saw mill on Smith's Creek (Nith River). In the early 1830s he was followed by others and by 1847, the community had grown to incorporate several businesses, including a blacksmith shop, wagon repair and foundry. Both New Hamburg and Baden are known for housing some of the earliest earthenware potteries in southwestern Ontario.

The first settler to the area of Haysville, south of New Hamburg, arrived in 1832 following the cutting and construction of the Dundas Road between the first and second concessions of Wilmot by the Canada Company (H. Parsell & Co. 1881:9). William Hobson, a native of Northern Ireland, took up land just east of what is now Haysville. Hobson and another settler named Edward Everett settled on the east side of Nith River and both opened hotels in addition to attending to the necessity of clearing the land (H. Parsell & Co. 1881:9). Formerly called Wilmot, the town is named for a miller from Northern Ireland named Robert Hays (Hayes 1997:12). Hays erected a saw and grist mill here in 1836 and by 1837 a post office was established in the community.

A smaller town of note along the northern boundary of the analysis area is Berlett's Corners. It is essentially a crossroads community and was founded by Christian Snyder from Pennsylvania in 1837. The town contained a school, hotel, cheese factory and several businesses, as well as an early cemetery associated with the Evangelical Lutheran Protestant Mission established there (Wilmot Historical Committee 1967:36). The cemetery still exists today.

The town curiously named Punkeydoodle's Corners at one time contained a one-and-a-half storey hotel, blacksmith shop, cider mill, as well as stables to quarter settlers' teams. The original farm was purchased by Noah Roth at the turn of the century. The buildings were torn down shortly after the purchase leaving only Roth's farm buildings to suggest any history of the settlement (Wilmot Historical Committee 1967:88).

The historic atlas map for Wilmot Township provides little detail about both landowners and the location of early structures. This is likely due to the fact that owners were charged a subscribers fee to be listed in the atlas. Many chose not to pay and are subsequently not named. However, Tremaine's 1861 map of the township does show that most lots were indeed settled by that time. The major roadways within the township (e.g., Snyder's Road, Erb's Road, Bleem's (now Bleam's) Road) are particularly significant historically as locales of first settlement.

5.1.3 Character of Built Heritage

The towns and villages of the analysis area contain a variety of late nineteenth and early twentieth century urban styles, including many particularly fine examples. The rural architecture of the area is especially interesting in that a very large proportion of the rural villages are relatively early and little changed. Most buildings are frame or brick, though there are some fine stone structures, and most feature typical farmhouse designs, with a three-bay façade, a gable roof with the ridge running parallel to the front façade, and, in some later examples, a cross gable featuring an ornamental window over the front door. Many of these farm houses are very well proportioned. The large number of pioneer cemeteries in the area reflects both the richness of its past and the respect with which it early residents were regarded. Some of the cemeteries are associated with still extant churches, while others are not. Most are clearly marked by stones but at least two, the Old Baden Mennonite Burying Ground and the Old Evangelical United Brethren Cemetery, are completed unmarked. Further, some of the extant cemeteries within the analysis area are not listed on local heritage inventories. There are only a few significant heritage bridges, partly because the landscape in many areas demands few crossings over watercourses. Some

former heritage bridges, like the Haysville Truss Bridge and Hartman Bridges in Wilmot, have been demolished and replaced with modern structures.

5.1.4 Existing Inventories of Built Heritage within the Analysis Area

***Description of Man-Made Heritage within the Environment,* by Paul Dilse**

Paul Dilse produced *Description of Man-Made Heritage within the Environment* in 1981 as part of a Group Ac, Type I Environmental Assessment submitted to the Ministry of Transportation and Communication and the Ministry of Culture and Recreation in connection with a study of Highway 7 & 8 undertaken at that time. Dilse's report contains a general description of historical context, a cultural landscape assessment, an assessment of the built environment and a summary of public perceptions toward man-made heritage. His study area was focused on Highway 7 & 8 between (but excluding) Stratford, New Hamburg and Baden, but including Shakespeare.

In the cultural landscape assessment, Dilse recorded 10 significant heritage landmarks, including the Baden Hills, the church steeples of Holy Family Roman Catholic Church and Trinity Lutheran Church in New Hamburg, Trinity Church in Sebastopol (north of Tavistock and then outside of his study area but within the current area of concern) and St. Anthony of Padua Roman Catholic Church, as well as concrete silos and continuous bush lines (Dilse 1981:12-13). Several scenic views were identified along Highway 7 & 8 from Waterloo Regional Road 6 to Stratford's east limits. The most scenic views or landscapes he describes are listed on page 17 in his report and include:

1. the view of New Hamburg and the Baden Hills from Highway 7 & 8 between Bleam's Road and the Waterloo-Perth boundary;
2. the Shildroth Farmstead and Neighbouring Otto Farmstead;
3. the landscape along Highway 7 & 8 from Lingelbach Cemetery (Sideroad 10) to the Andrew Riddell Junior Farmstead, west of Sideroad 15 and just east of Shakespeare;
4. All of Shakespeare except the twentieth century development in the west end;
5. the Little Lakes;
6. the Avon River highlands including the northern limits of Shakespeare;
7. the Wilmot Creek hill landscape with views of the Baden Hills, east of the Avon River highlands;
8. the height of land above Punkeydoodles corners; and
9. the landscape along South Easthope Concession Road 203 from about Sideroad 10 to Highway 59.

His built heritage assessment, based on a detailed visual assessment and reliable historical research, identified 63 sites with heritage significance within a study area that extended approximately 1 and a half concessions along both sides of the highway between Stratford and New Hamburg, and then narrowed to a generous road allowance south and east of New Hamburg. Thirteen sites were identified in Wilmot Township, 22 in North Easthope Township

and 28 in South Easthope. The Project Team has reviewed most of these sites, and revised Dilse's inventory in cases where buildings have been demolished or significantly altered. Several sites are clustered in Shakespeare. It should be noted that two of Dilse's identified sites occur on other inventories. The Riverside Cemetery, Dilse's Reference 7, is also included in the cemeteries register for the Regional Municipality of Waterloo, and the Fryfogel Inn (Dilse's Reference 26) is also listed on the Ministry of Culture's built heritage inventory.

The sites listed in the Dilse inventory include single structures (houses, schools, industrial buildings, barns, churches, outbuildings) and structure clusters (e.g., farmsteads, streetscapes). There are several examples of Pennsylvania German barns, Gothic Revival, Italianate, and Georgian structures. Four cemeteries are also mentioned (Riverside, Lingelbach, James Rankin, South Easthope), although one is associated with the James Rankin farmstead (Dilse Reference 47) and not treated separately from it.

Perth County: Township of Perth South
Perth South does not have a Heritage Committee, and the only official inventory of heritage structures is that of designated buildings in the *Ontario Heritage Properties Database* maintained by the Ministry of Culture. The *Database* lists six properties in Perth South, one of which has been demolished. It must be noted that the only designated building that falls within the analysis area, the building on Highway 8 identified as that of the Downie OPP Detachment, no longer serves that purpose.

Perth County: Township of Perth East
The Township of Perth East does not have a Heritage Committee acting in an official advisory capacity to the Township Council, but it does have a committee that looks after the Fryfogel Inn and considers heritage issues in the township. However, like Perth South the township has as its only official inventory of heritage structures the listing of nine designated properties in the *Ontario Heritage Properties Database,* four of which are within the analysis area. These include the Brocksen School, now a museum and marked with a heritage plaque, Knox North Easthope Presbyterian Church, the Fryfogel Inn and St. Patrick's Roman Catholic Church in Kinkora.

Perth County: City of Stratford
The City of Stratford Heritage Committee has initiated what is to be an elaborate web-based inventory that will feature and rate every building in the older sections of Stratford. A good deal of research has been done on the project, but it is not yet complete or accessible to the public.

The listed sites within the city include residential dwellings, municipal buildings, schools, churches, bridges, and commercial sites. Most of these buildings are within the historic downtown core of the community, within an established heritage district. The City of Stratford established a Heritage Conservation District (HCD), under Part V of the Ontario Heritage Act that encompasses much of the city core. Approved in 1997 (City of Stratford Heritage Conservation District Standards 1997:1), the HCD is linked with a Community Improvement Plan, which has as its goals "to preserve the heritage aspects of Stratford's Heritage Conservation District by encouraging the restoration, rehabilitation, and adaptive reuse of buildings" within the area, "to improve the economic and social climates of the area and increase the supply of residential units within the Heritage Conservation District to ensure a sizable

downtown population" (City of Stratford Heritage Conservation District Community Improvement Plan n.d.: 1). The district forms a roughly triangular area bounded by Lake Victoria and both St. Patrick and Waterloo streets.

Oxford County: Township of Blandford-Blenheim

The Township of Blandford-Blenheim has no official Heritage Committee and its only designated property is not within the analysis area. Nonetheless, Oxford County has required each township within the county to compile a *Heritage Resources Inventory* and these are included in the County Official Plan. Each *Inventory* contains four sections that are potentially pertinent to this report: a list of Places of Worship within the township, a list of Cemeteries, a very brief list of Cultural/Architectural Resources, and a list of Plaques and Monuments. Included in these lists are two churches and one cemetery within the analysis area.

The sites listed on the Blandford-Blenheim inventory fall within the community of Plattsville, in the southeast corner of the analysis area.

Oxford County: East Zorra-Tavistock

The Township of East Zorra-Tavistock also has the inventory required by the County, listing, among others, a large number of structures in Tavistock. Like most other townships in the analysis area, East Zorra-Tavistock has no Heritage Committee and no comprehensive listing of significant heritage structures. The sites that have been identified are primarily churches and cemeteries, although three plaques (one honoring the founder of Tavistock, one posted in Punkeydoodle's Corners, and one marking the location of Caleb Caister's Tavern) are also listed. Only one heritage building *per se* has been included in the township register and that is the Glass Swan on Highway 59 in Tavistock. The Tavistock Grand Trunk and Buffalo and Lake Huron Railway stations are also listed in the Ministry database but do not appear on the township register.

Waterloo County: Township of Wilmot

The Township of Wilmot has an official Heritage Committee, which is beginning to compile an inventory of heritage resources, but no official listing. Several buildings are designated in the analysis area, especially in the Town of New Hamburg where the Township has also established a Heritage Conservation District. The latter incorporates much of the downtown core, stretching southward roughly from Burn Street, east of the river and including portions of Union, Mill, Burns, Huron, Peel, Wilmot and Seyler streets. Municipal staff has also indicated that there are a few areas of interest, although these are not inventoried (and are subsequently not mapped in this report). These locales include the Wilmot Line (the original boundary road between the City of Waterloo and Township of Wilmot), the New Hamburg Arena (WWII aircraft hanger that was moved and converted into an arena), the New Hamburg Grandstands (designated by Council in December 2006, burned down due to vandalism in January 2007), the Hartman Bridge (downtown New Hamburg, now refurbished), and various (unnamed) pioneer cemeteries (Elliot Fung, personal communication).

Regional Municipality of Waterloo

The Regional Municipality of Waterloo has GIS mapping of various kinds of resources, including significant built structures, designated structures, cemeteries, pre-1881 churches, and

heritage bridges. To a large extent, the mapping is based on inventories compiled by the various jurisdictions, but in the case of Wilmot the Regional Municipality seems to have more information at its disposal than does the Township. Eighty-three sites are listed in the municipality's GIS inventory. There are 26 cemeteries listed, 46 structures and 11 bridges. The buildings include churches, residences, farmsteads, barns, as well as commercial and industrial sites. A significant number of buildings fall within New Hamburg's core, particularly in its Heritage Conservation District. However, several inventoried buildings have been demolished or severely altered. Although Dilse identified 13 sites within Wilmot Township, only one of these (the Riverside Cemetery) is listed on any R.M. of Waterloo inventory. Further, five of the Waterloo Region listings are also found in the Ministry of Culture database. Somewhat curiously, Castle Kilbride in Baden is not listed in the region's inventory but does appear on the Ministry of Culture's listing. Several of the bridges have recently been demolished or altered.

5.2.1 Cultural Heritage - Archaeology

A Stage 1 Archaeological assessment overview and background study has been conducted to gather information about known and potential cultural heritage resources within the analysis area. Landscape and environmental conditions were reviewed using physiographic, topographic and soils mapping for the area. Early historic maps and historical summaries for townships within the project lands were consulted and a review of the Provincial registered archaeological sites database was carried out. A review of background documents was supplemented by a preliminary field reconnaissance of the analysis area to photo-document existing conditions.

When compiled, this information was used to create a summary of the characteristics of the analysis area and evaluate its archaeological potential. For the Province of Ontario, the Ministry of Culture has identified a number of criteria that can be used to determine if an area has archaeological potential. These criteria primarily relate to geographic and cultural-historic features which would have influenced past land and resource use, as well as encouraged settlement (MCCR 1994:11). The presence or absence of such features allows a researcher to estimate the likelihood of ancient land use and thus the presence of archaeological sites.

Typically, a Stage 1 assessment will determine potential for precontact aboriginal and historic Euro-Canadian or aboriginal sites independently. This is due to the fact that lifeways varied considerably between the prehistoric and historic eras so that criteria used to evaluate potential for each type of site also varies.

5.2.2 Registered Archaeological Sites

Registered Sites in Oxford (Exhibit 5.1)

There are 12 registered sites within the portion of the analysis area that falls within Oxford County. Four of these fall within the former Blandford Township and eight are within Blenheim Township. All of these sites were originally reported by William Wintemberg and have been registered by subsequent researchers. It is not known how many of these sites exist, nor if the locations were ever verified in the field. All but two of the sites are attributed to the Archaic

period (circa 10,000 – 3,000 years before the present), although three of these also have Iroquoian components. One other is assigned an Early Woodland affiliation and the last site, AhHe-5 –Dixon, is recorded as a historic period native burial. Few details of the sites are provided in the Ministry database records for any of the sites. However, the historic aboriginal burial is described as containing "birchbark, needlecase, rusty knife, piece of amethyst, brass kettle." It is not known how Wintemberg came to hear of the burial, whether he observed it himself, or whether it still exists (archaeological site clusters for all counties are shown on Exhibit 5.2).

Exhibit 5.1: Registered Archaeological Sites Within the Analysis Area, Oxford County

Borden	Name	Township	Time Period	Function	Researcher
AhHe-5	Dixon	Blandford	historic	burial	Wintemberg
AhHe-3	Henderson	Blandford	Archaic	camp	Wintemberg
AhHe-4	Scott	Blandford	Archaic	camp	Wintemberg
AiHe-6	Facey	Blandford	Archaic	camp	Wintemberg
AhHd-34	Hall	Blenheim	Archaic	unknown	Wintemberg
AhHd-39	Hewitt	Blenheim	Archaic	unknown	Wintemberg
AhHd-40	Estate	Blenheim	Early Woodland	unknown	Wintemberg
AhHd-41	Fair	Blenheim	Archaic	camp	Wintemberg
AhHd-42	Hagedorn	Blenheim	Archaic	camp	Wintemberg
AhHd-6	Wintemberg 2	Blenheim	Archaic/Iroquoian	unknown	Wintemberg
AhHd-5	Wintemberg 1	Blenheim	Archaic/Iroquoian	camp	Wintemberg
AhHd-7	Lass	Blenheim	Archaic/Iroquoian	camp	Wintemberg

Although it is inappropriate to provide specific details about site locations, it can be said that the sites within Blandford Township typically fall near the county line and eastern township boundary. The Blenheim Township sites are clustered in similar areas and around the community of Plattsville.

Registered Sites in Perth (Exhibit 5.3)

There are 11 registered sites in Perth County. Three fall within North Easthope Township and 8 within South Easthope. The majority of sites are historic era or EuroCanadian residential or industrial sites and the temporal affiliation of the other two is not known. All but two of the sites were registered by Paul Lennox during his survey of lands to be impacted by Highway 7 & 8 construction. Given the lack of archaeological assessments carried out in Perth County, it is therefore not surprising that the only sites registered within the analysis area are those recorded by Lennox for the highway project. To reiterate, there are no registered sites in the portions of

the analysis area that fall within Perth County, except for those along Highway 7 & 8. This is not due to a lack of sites in the area, but merely a lack of survey and site registration.

Exhibit 5.3: Registered Archaeological Sites Within the Analysis Area, Perth County

Borden	Name	Township	Time Period	Function	Researcher
AiHf-2	Heinkel	North Easthope	unknown	unknown	Lennox
AiHf-3	Stratford - Little Lakes	North Easthope	unknown	unknown	unknown
AiHe-27	Bushler	North Easthope	EuroCanadian	house	Lennox
AiHf-1	Easthope Kiln	South Easthope	EuroCanadian	kiln	Lennox
AiHf-4	Stratford - Little Lakes	South Easthope	EuroCanadian	house	Lennox
AiHe-21	Fryfogel Inn	South Easthope	EuroCanadian	house	Chapman
AiHe-22	Riddell 1	South Easthope	EuroCanadian	homestead	Lennox
AiHe-23	Riddell 2	South Easthope	EuroCanadian	homestead	Lennox
AiHe-24	Fryfogel	South Easthope	EuroCanadian	cheese factory	Lennox
AiHe-25	Amacher	South Easthope	EuroCanadian	homestead	Lennox
AiHe-26	Guilk	South Easthope	EuroCanadian	unknown	Lennox

The presence of so many historic era archaeological sites along Highway 7 & 8 is not surprising, since the highway was once the Huron Road, an early 19th century major east-west thoroughfare. Many of the sites along this road reflect early, mid and late 19th century farmsteads. Other buildings of the same period are still standing and some of these have been designated under the Ontario Heritage Act or are listed on municipal heritage building inventories. Of particular note in this listing is the Fryfogel Inn, discussed earlier in this report and investigated in some detail by Don Chapman (1976).

Registered Sites in Waterloo County (Wilmot Township) (Exhibit 5.4)

The majority (48) of the 71 archaeological sites within the analysis area fall within Waterloo County, specifically Wilmot. The reason for this does not necessarily reflect its archaeological richness or potential but instead the fact that considerably more archaeological investigations have been carried out here. Eight sites are of an unknown cultural and temporal affiliation (one lithic scatter, one camp) but because of their nature they do not likely relate to historic-era occupations. Four others have been assigned as “precontact aboriginal of an undetermined age” (two find spots, one unknown, one camp site). Sixteen sites are attributed to the Archaic period

(circa 10,000 to 3,000 years before the present) and include camp sites (n = 7), find spots (n = 5) and sites of an as yet undetermined function (n = 4). Two sites date to the earlier part of that period (circa 10,000 to 8,000 years before the present) and one to the later part of the same (circa 4,500 – 3,000 years before the present). Two sites are described as Woodland camps and eight others have been given a Late Woodland/Iroquoian affiliation. The latter include so described precontact and Neutral sites, including one communal burial or ossuary (situated along Highway 7 & 8 and previously protected from roadwork), four village sites and three camps. Another site has both an Archaic and Woodland component and the last nine sites are historic era EuroCanadian domestic (n = 7) and industrial (n = 2) sites. The historic sites are typically concentrated in the historic communities of Baden and New Hamburg, although they appear elsewhere as well.

In general, the registered sites within Wilmot Township are typically clustered along Highway 7 & 8 and within historic centres. Nonetheless, there are several scattered throughout the southern portion of the township and along other major roadways like Erb's Road, Berlettt's Road, Snyder's Road and Wilmot Centre Road. Many of the sites along the eastern periphery of the analysis area and within the small emergent commuter centres west of Waterloo and Kitchener have been recorded during recent cultural resource assessments conducted prior to subdivision construction.

Exhibit 5.4: Registered Archaeological Sites Within the Analysis Area, Waterloo County, Wilmot Township

Borden	Name	Time Period	Function	Researcher
AiHd-82	Sluyter	Late Woodland	village	Lennox
AiHe-31	Good Enough	precontact aboriginal	find spot	RM Waterloo
AiHe-34	Morningside	Archaic	camp	Janusas
AiHd-81	Hofstetter	Iroquoian	ossuary	Lennox
AiHe-36	Nuhrgang	precontact aboriginal	unknown	Mayer
AiHe-33	Shantz	EuroCanadian	midden	RM Waterloo
AiHe-4	Cressman 1	Archaic	unknown	unknown
AiHe-35	Helmuth	precontact aboriginal	find spot	RM Waterloo
AiHd-83	Hunsburger Creek	Archaic	camp	Lennox
AiHd-90	Ranger	Late Woodland/Iroquoian	camp/midden	Lennox
AiHe-38	Castle Kilbride	EuroCanadian	farmstead	Knight
AiHe-47	n/a	EuroCanadian	farmstead	Wilson
AiHe-6	Brodrecht	Archaic	unknown	H I Smith
AiHe-7	New Hamburg 1	Iroquoian/Neutral	village	unknown
AiHd-91	Baden Brewery	EuroCanadian	brewery/creamery	RM Waterloo
AiHe-9	Wagner 1	Archaic	find spot	H I Smith
AiHd-99	n/a	Late Archaic	find spot	ASI
AiHe-1	Bender	Archaic	camp	H I Smith
AiHe-10	n/a	unknown	unknown	H I Smith
AiHe-45	n/a	unknown	lithic scatter	Wilson

Borden	Name	Time Period	Function	Researcher
AiHe-46	n/a	EuroCanadian	midden	Wilson
AiHe-8	Rudy	Archaic	camp	H I Smith
AiHe-44	n/a	Early Archaic	find spot	Wilson
AiHe-5	Cressmand 2	Archaic	find spot	unknown
AiHd-12	Zimmer	Archaic	unknown	Wintemberg
AiHd-13	Brown	Early Woodland	unknown	Wintemberg
AiHd-16	Shantz	unknown	unknown	H I Smith
AiHd-17	Spongy Lake	Woodland	camp	Hurley
AiHd-18	Baden Hill	Late Woodland/Iroquoian	village	Wintemberg
AiHd-2	Baden	unknown	unknown	H I Smith
AiHd-112	Petersburg 2	unknown	camp	Mayer
AiHd-5	Patterson	Archaic	unknown	WLU
AiHd-6	Stemmler	Archaic/Woodland	camp	H I Smith
AiHd-69	Schout	unknown	unknown	Mayer
Borden	Name	Time Period	Function	Researcher
AiHd-20	Wolf	Late Woodland/M. Iroquoian	village	Wintemberg
AiHd-110	Michel	Early Archaic	find spot	Knight
AiHd-111	Petersburg 1	precontact aboriginal	camp	Mayer
AhHe-2	Cressman	Late Woodland/Neutral	camp	H I Smith
AiHe-11	n/a	unknown	unknown	H I Smith
AiHe-12	n/a	unknown	unknown	H I Smith
AiHe-14	Bergey 1 and 2	Archaic	camp	unknown
AiHe-15	New Hamburg 1	Archaic	camp	H I Smith
AiHe-20	Boehler Pottery	EuroCanadian	pottery	Woolfrey
AiHe-28	Bearinger	EuroCanadian	midden	Janusas
AiHe-29	Nader	EuroCanadian	house	Janusas
AiHe-3	Linseman	Archaic	camp	H I Smith
AiHe-30	Nevill	EuroCanadian	midden	RM Waterloo
AiHd-74	Baechler	Late/Middle Woodland	camp	Lennox

In general, these sites span a period occupation from roughly 10,000 years ago to the mid-to-late 19th century. A summary of the chronology of native settlement in the general area was provided in the previous report by Archaeological Services Inc. and is not duplicated here. Suffice it to say, the region contains potential for the discovery of archaeological sites from the earliest periods of native occupation in the province circa 12,000 years ago (i.e., Paleoindian times) to the historic era.

It should be noted that not all of the sites listed in the Provincial database are still extant. For example, several are sites or find spots were either mitigated during cultural resource assessments or not deemed worthy of mitigation in the first place. Others have likely been either fully or partially destroyed by highway and building construction.

Exhibit 5.2 Registered Archaeological Sites (see CD enclosed)

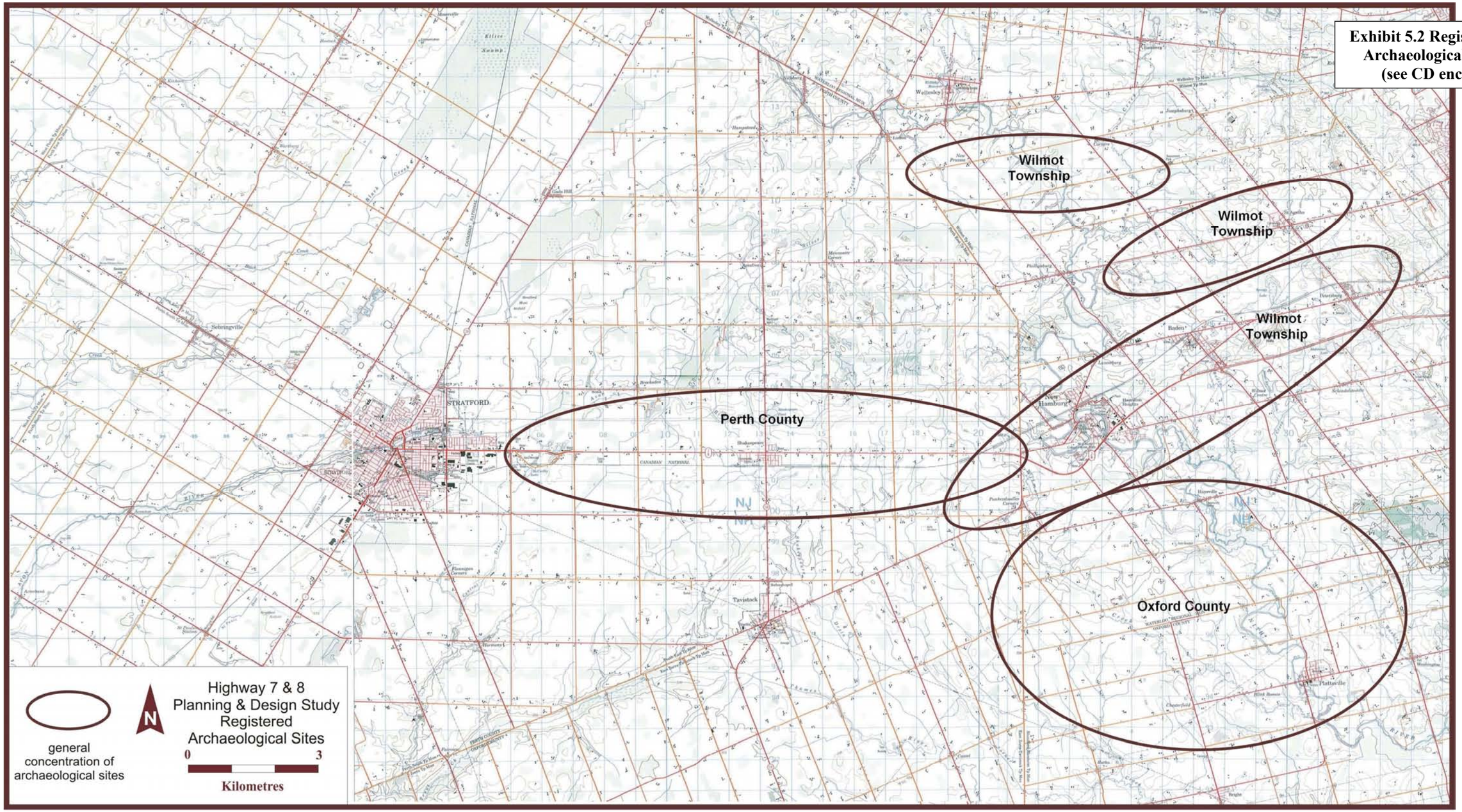


Exhibit 5.2 - Registered Archaeological Sites

Stratford, Ontario 1:50,000 Scale Topographic Map 40 P/7 Edition 9, 1998
St. Marys, Ontario 1:50,000 Scale Topographic Map 40 P/6 Edition 6, 2001

5.2.3 Historic Cultural Features

Historic cultural features, particularly relating to areas of early historic settlement, also influence archaeological potential. Lands near places of early military or pioneer settlement, adjacent to early transportation routes, or historically used natural resources typically have archaeological potential. A description of historic cultural features in each township/county is provided in Section 5.1.2. This section summarizes the general location of historic cultural features in the analysis area. Township historic maps are provided in Exhibits 5.5 to 5.12.

Ellice Township, Perth County (northwest portion of the analysis area)

In general, the historic structures are situated adjacent to the concession roads. As a result, those lands within roughly 100 metres of these roads demonstrate archaeological potential.

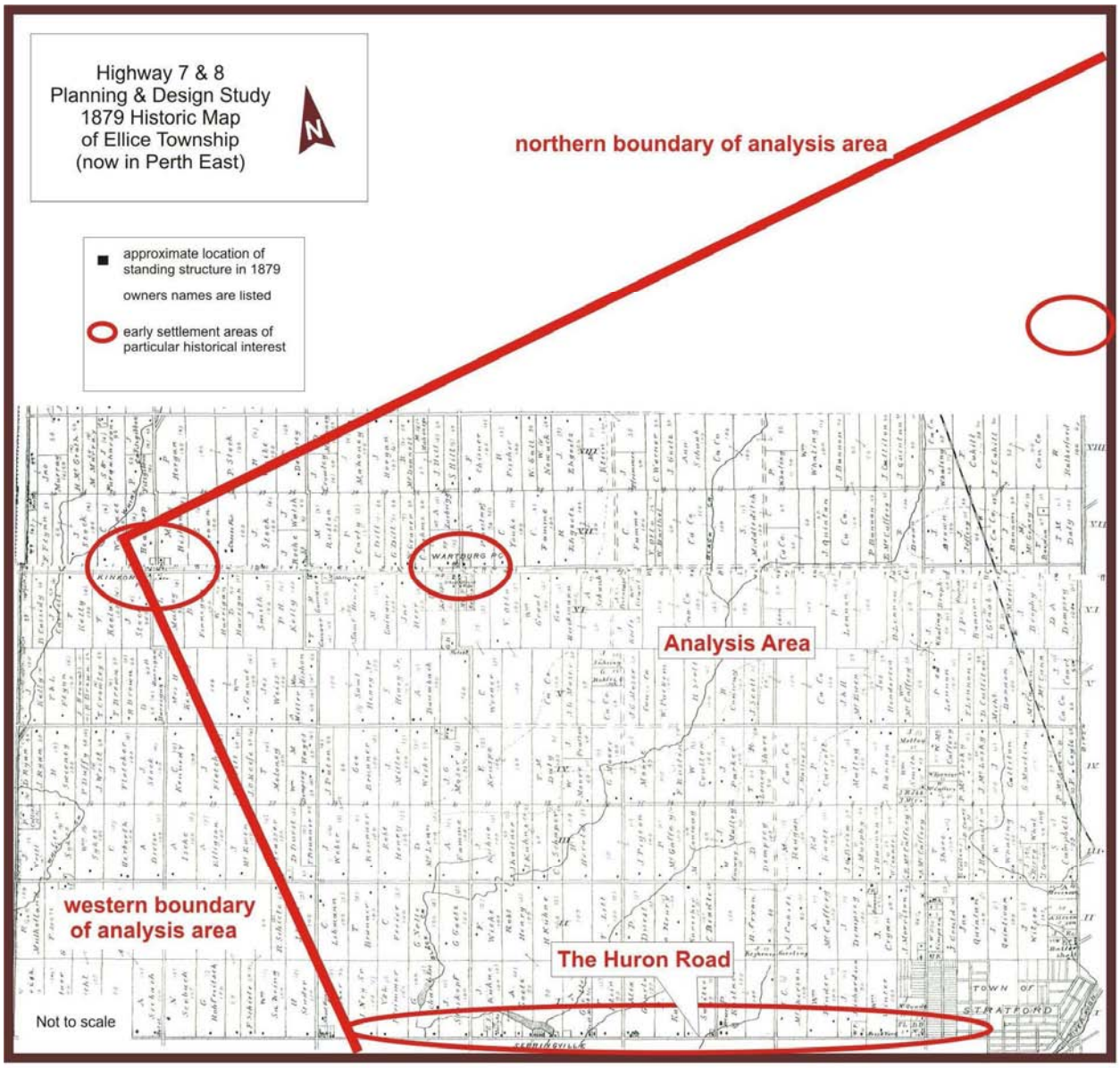


Exhibit 5.5 - Ellice Township Historic Map

Map of Ellice Township
Illustrated Historical Atlas of Perth County, Ontario
H. Belden & Co. 1879; page 16-17

Downie Township, Perth County (southwest portion of the analysis area)

The historic atlas map for Downie Township shows that most lots were settled by 1879 and virtually all of the concession roads were open (see Exhibit 5.6). The Grand Trunk railway opened a line through the township in 1857, resulting in the growth of the City of Stratford and the emergence of stations like St. Paul's in the central portion of the township. The majority of historic buildings are situated adjacent to the concession roads. In addition to the lands associated with the early historic centres, those in proximity to the thoroughfares have archaeological potential.

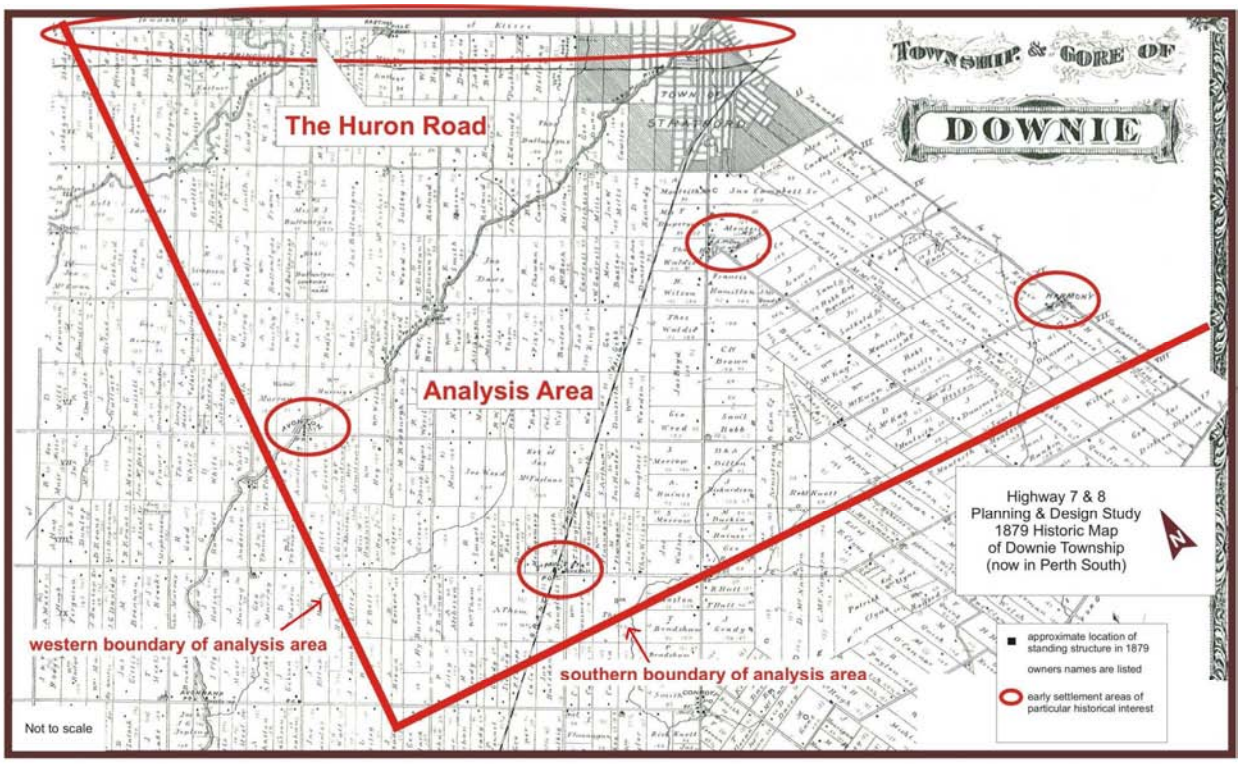


Exhibit 5.6 - Downie Township Historic Map

Township & Gore of Downie
Illustrated Historical Atlas of Perth County, Ontario
H. Belden & Co. 1879; page 24-25

South Easthope Townships, Perth County (central portion of the analysis area)

The 1879 map of South Easthope Township illustrates structures on most lots. In addition to the general vicinity and town cores of Shakespeare and Tavistock, as well as the lands adjacent to the Huron Road, the lands immediately beside the concession roads of the township also show archaeological potential as they all appear to have been open by the last quarter of the 19th century (see Exhibit 5.7).

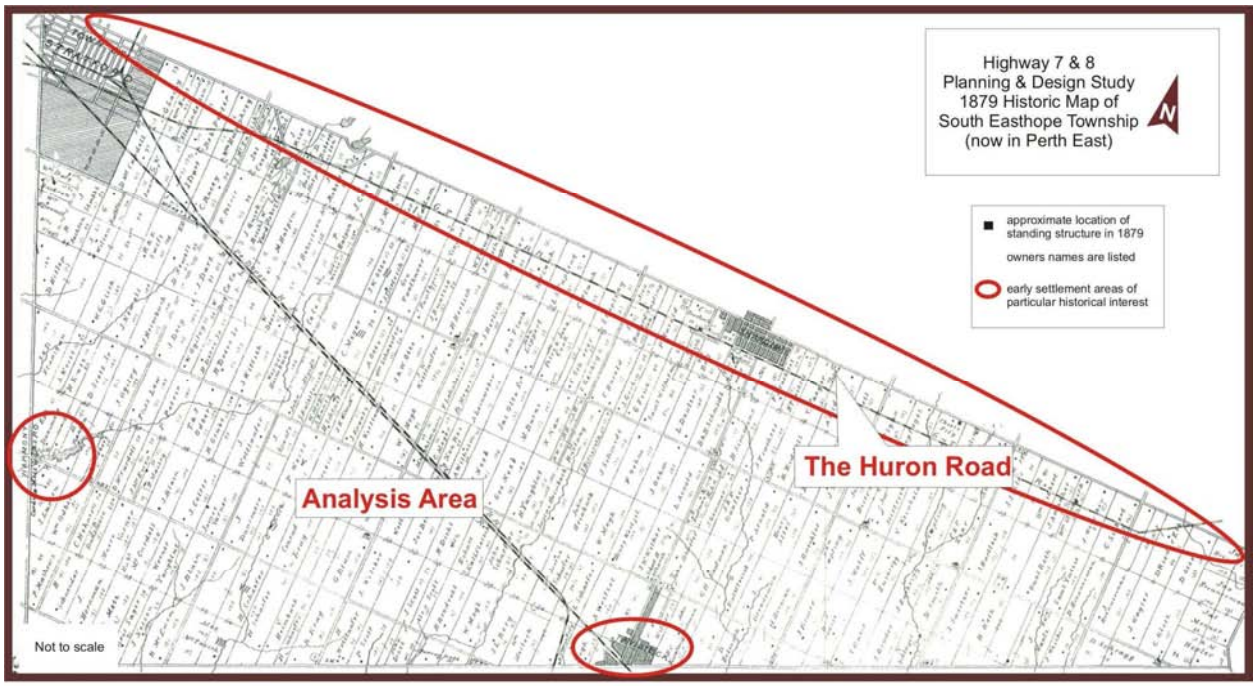


Exhibit 5.7 - South Easthope Township Historic Map

S. Easthope Township
Illustrated Historical Atlas of Perth County, Ontario
H. Belden & Co. 1879; page 46

North Easthope Township, Perth County (central portion of the analysis area)

As with the townships previously described, the lots within North Easthope Township were almost all settled by 1879 and the concession roads were apparently open (Exhibit 5.8). High potential for historic sites exists around the early settled communities described as well adjacent to the concession roads.

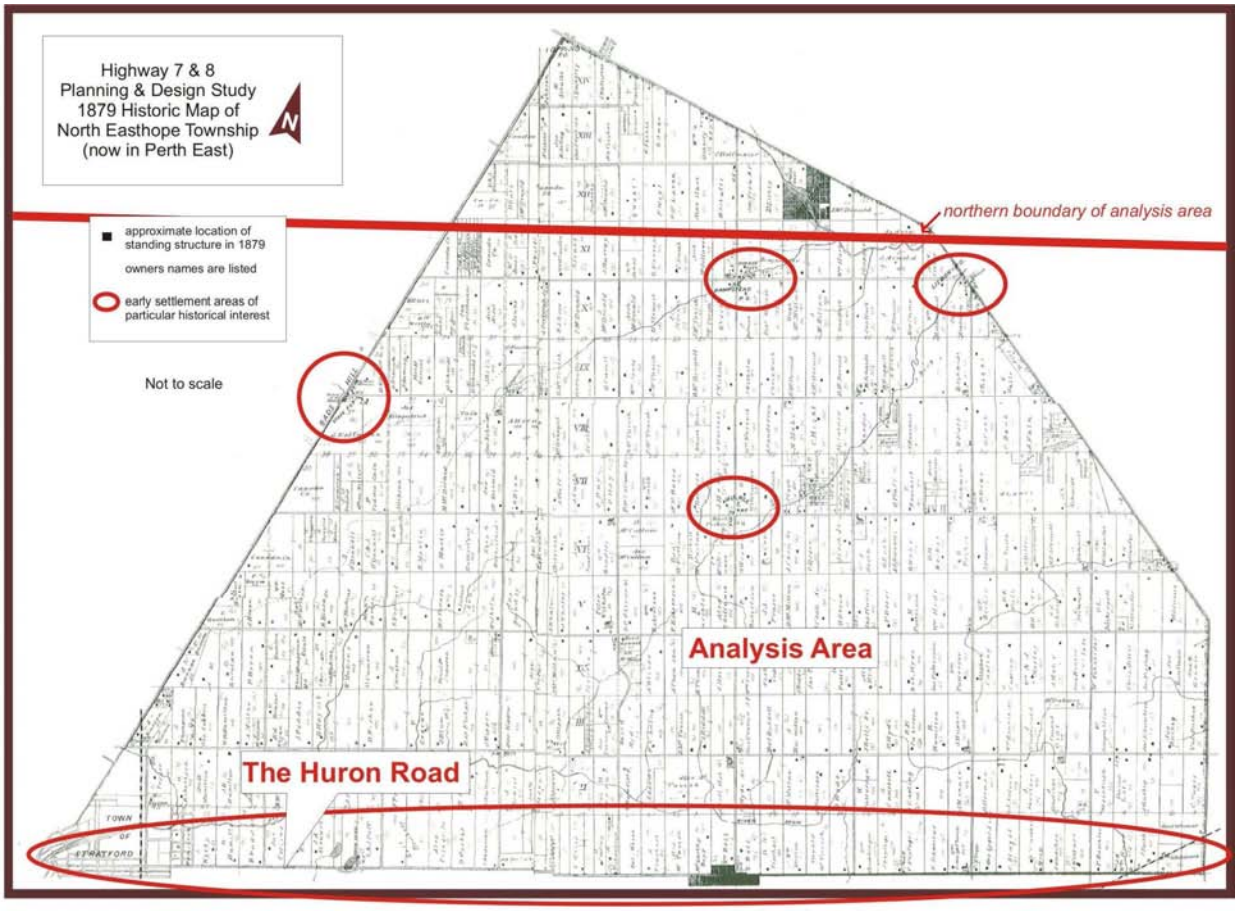


Exhibit 5.8 - North Easthope Township Historic Map

Map of N. Easthope Township
Illustrated Historical Atlas of Perth County, Ontario
H. Belden & Co. 1879; page 18-19

East Zorra Township, Oxford County (south-central portion of the analysis area)

East Zorra Township was surveyed in 1820 but by 1822 only 145 acres were cleared in the township. The first lot sold was on the ninth concession (RCT 1968:9), along the western township boundary. There are few communities within the portion of the township that falls within the analysis area. Tavistock is the main one and its history has already been described. Caleb Caistor is said to have established a tavern on the east side of Highway 59, south of Tavistock. This highway was also a major route at the time. By 1876 most of the lots within the township were settled (see Exhibit 5.9).

Township of Blenheim, Oxford County (southeastern portion of the analysis area)

Only a very small portion of the analysis area falls within Blenheim Township. Nonetheless, the area of concern contains two small historic centres, namely Plattsville and Chesterfield (see Exhibit 5.10).

Township of Blandford, Oxford County (southeastern portion of the analysis area)

Only a small portion of Blandford falls within the analysis area. Although there are no early settlements within the Blandford Township portion of the analysis area, the areas along the concession roads do have some archaeological potential for the recovery of historic era sites.

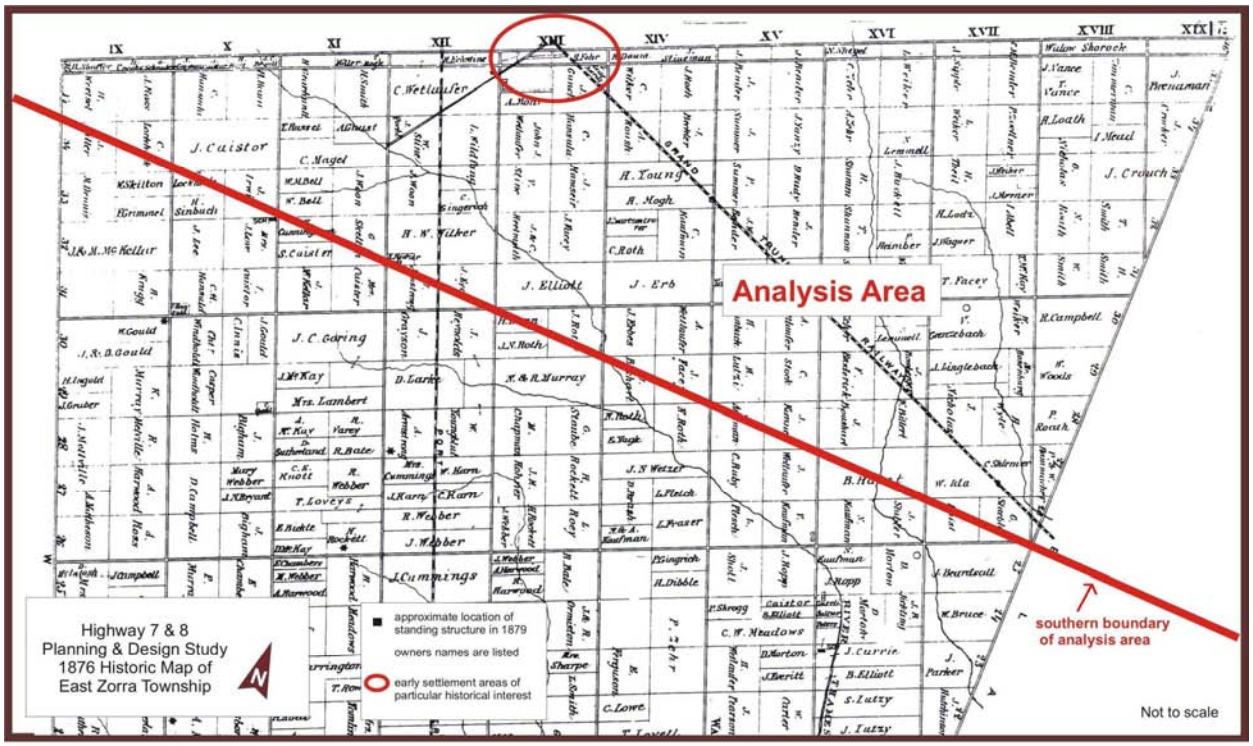


Exhibit 5.9 - East Zorra Township Historic Map

East Zorra Township
Illustrated Historical Atlas of Oxford County, Ontario
Walker & Miles 1876; page 24-25

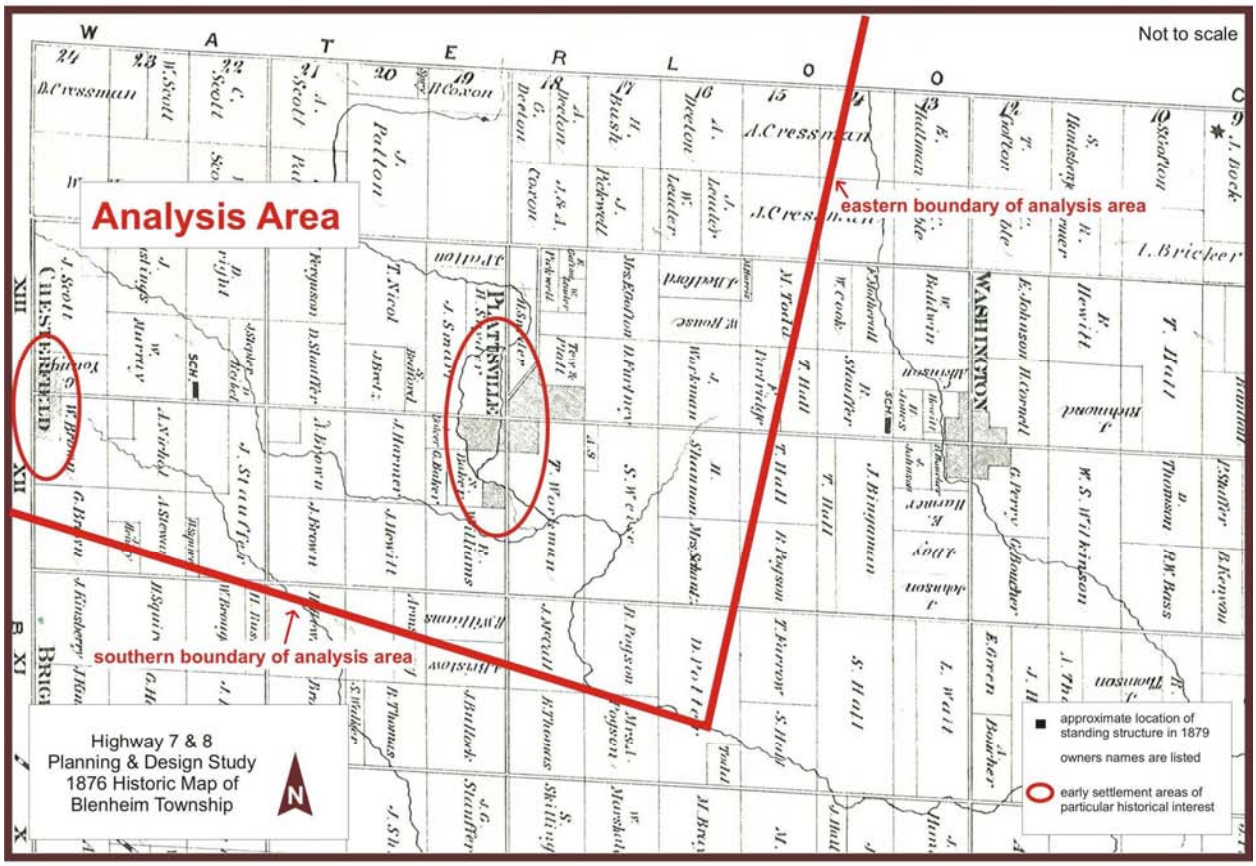


Exhibit 5.10 - Blenheim Township Historic Map

Blenheim Township
Illustrated Historical Atlas of Oxford County, Ontario
Walker & Miles 1876; page 30

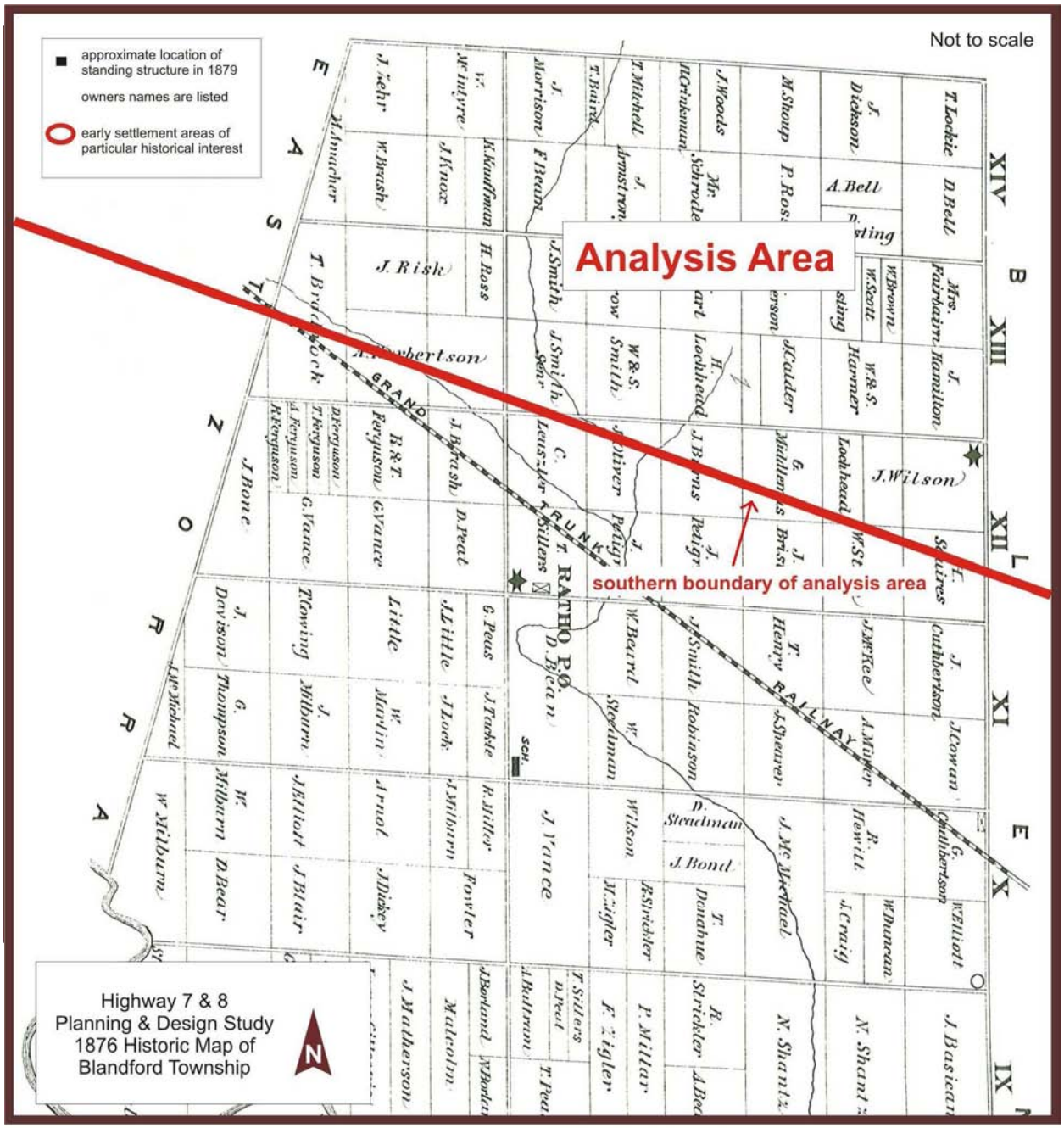


Exhibit 5.11 - Bladford Township Historic Map

Blandford Township
Illustrated Historical Atlas of Oxford County, Ontario
Walker & Miles 1876; page 26

Township of Wilmot, Waterloo County (northeastern portion of the analysis area)

New Hamburg is the largest community in Wilmot Township and was founded in 1831 when William Scott built a cabin and constructed a saw mill on Smith's Creek (Nith River). In the early 1830s he was followed by others and by 1847, the community had grown to incorporate several businesses, including a blacksmith shop, wagon repair and foundry. Both New Hamburg

and Baden are known for housing some of the earliest earthenware potteries in southwestern Ontario.

A smaller town of note along the northern boundary of the analysis area is Berlett's Corners. It is essentially a crossroads community and was founded by Christian Snyder from Pennsylvania in 1837. The town contained a school, hotel, cheese factory and several businesses, as well as an early cemetery associated with the Evangelical Lutheran Protestant Mission established there (Wilmot Historical Committee 1967:36). The cemetery still exists today

The historic atlas map for Wilmot Township (Exhibit 5.12) provides little detail about both landowners and the location of early structures. This is likely due to the fact that owners were charged a subscribers fee to be listed in the atlas. Many chose not to pay and are subsequently not named. However, Tremaine's 1861 map of the township does show that most lots were indeed settled by that time. The major roadways within the township are particularly significant historically as locales of first settlement. However, all of the concession roads were open fairly early and, as such; the areas along the roadways are considered to have historic archaeological potential in addition to the lands within the centres of early settlement.

It should also be noted that there are numerous designated and undesignated historic structures in Wilmot Township, along Highway 7 & 8 and within the historic crossroads communities described in all of the relevant townships. By Ministry of Culture criteria, proximity to these, also suggests historic potential for adjacent lands. Many of the standing structures identified in local registers of heritage buildings relate to the time of the initial founding of communities and townships.

5.2.4 Project Area and Application of Specific Information

Two miscellaneous criteria are also considered when evaluating archaeological potential. These include local knowledge and recent disturbance. Local knowledge of the presence of archaeological sites, usually determined through the identification and/or collection of artifacts from an area, automatically confirms potential and triggers the need for Stage 2 field survey. We are certainly aware of some local knowledge of archaeological sites within Wilmot, Blandford and Blenheim Townships at least, yet this information is not specific enough to determine the location of sites per se. The disturbance of natural soil horizons through development-related activities, primarily road construction, subdivision development, infrastructure projects and the like, can negate potential for the recovery of archaeological resources. Throughout the analysis area there are several locales where prior, extensive disturbance can be confirmed, including along roadways and in the more urban zones. Other, less noticeable, disturbance likely also exists in several areas but this would have to be confirmed by an on-site inspection.

5.3 Summary of Significant/Sensitivity of Cultural Environment

5.3.1 Built Heritage

Heritage resources in the analysis area have been very unevenly catalogued and mapped by the various jurisdictions. Concentrated areas of heritage resources need to be respected: the many significant buildings along Highway 7 & 8, for example, reflect its early age and importance. But it is also essential to note that the uncanvassed parts of the analysis area also contain important resources (note the number of early settlements indicated in historic maps shown earlier) and a survey of uncanvassed areas will be enacted at a later point in this study process when the potential for transportation alternatives to be located in these areas is known. The fact that many municipal listings have not considered various types of resources, including plaques, bridges and cemeteries, further supports the need for additional survey.

5.3.2 Archaeological Heritage

The details provided above demonstrate that a good portion of land within the analysis area has archaeological potential for either precontact aboriginal sites, historic sites or both. Any corridor that would cross east-west or north-south through the analysis area will likely cross watercourses and other features signaling a high probability for finding archaeological sites. The lands adjacent to Highway 7 & 8 have very high archaeological potential, particularly with respect to EuroCanadian sites. However, it should be considered that virtually all of the right-of-way has been subject to some degree of disturbance or archaeological study in the past.

Given the very high potential of most of the analysis area it does not seem that a corridor could be planned that will avoid potential site areas. Nonetheless, a few observations can be offered that may assist with the planning process. First, any work within and adjacent to the existing highway right-of-way is likely to result in the discovery of historic era archaeological sites. If such sites are found, they are likely to relate to early structures along the Huron Road and will undoubtedly require mitigation. Second, the central and southern portion of Wilmot Township is exceptionally rich in both native and EuroCanadian archaeological sites of great importance. Any work in this area will also undoubtedly require extensive assessment. Although less is known of the archaeological record north and south of Stratford, much of this area appears to have slightly less historic settlement and fewer watercourses, suggesting a higher percentage of property with low archaeological potential. While this view may be biased from a lack of good information, it conforms with the known information about archaeological site distributions in the general region.

6.0 SUMMARY OF SIGNIFICANT ENVIRONMENTAL FEATURES AND ISSUES

A summary of existing environmental conditions and constraints has been provided at the end of each of the previous sections on the natural, socio-economic and cultural environments. The information collected on environmental conditions, confirms that the evaluation criteria, to be used in identifying and evaluating planning alternatives are relevant to the analysis area. The criteria will be used to collect information on, generate, compare and select a preferred planning alternative, detailed planning alternative and ultimately a preliminary design alternative that satisfies the goals of this transportation study.

A summary of the key environmental features is provided below. The reader should keep in mind that these findings are based on secondary source investigations and enhanced through discussions with staff at municipalities, agencies, etc. The significant features of the environment in the analysis area will be confirmed through the consultation and outreach program as the study progresses.

Exhibit 6.1 – Summary of Significant Environmental Features in Analysis Area

Factor	Sub-Factor	Significant Features in Highway 7 & 8 Analysis Area	Shown on Exhibit	Described in Section
Natural Environment				
Fisheries and Aquatic Ecosystems	Fish Habitat	Nith River, Horner Creek, Upper Grand, Avon River, Trout Creek, Black Creek, Whirl Creek	Exhibit 3.1	Section 3.1.3
	Fish Community	Cold water, cool water and warm water fish communities Aquatic Species at Risk (SAR) in watersheds include black redhorse, silver shiner, wavy-rayed lampmussel, rayed bean mussel and redside dace	Exhibit 3.1	Section 3.1.3
Terrestrial Ecosystems	Wildlife/Wildlife Habitat	Wildlife data pending from MNR Species at Risk (SAR) mapping includes protected mussel species in Nith tributaries crossing Highway 7 & 8	Exhibit 3.2	Sections 3.2.1 and 3.1.4
	Wetlands	Provincially Significant Wetlands: Central Whitemans/Horner Creek Complex, Ellice Swamp, Gads Hill South, Haysville Wetland Complex, Little Lakes Swamp Complex, New Hamburg Oxbow Wetland Complex, Phillipsburg Swamp, Spongy Lake Several Locally Significant Wetlands also located in analysis area	Exhibit 3.2	Section 3.2.2
	Forest Cover (e.g. woodlands [forest stands, woodlots and interior forest habitat] and significant valley lands [valley and stream corridors])	Minimal forest cover in analysis area (<5%). Nith Valley supports Carolinian biota and lowland deciduous forests, including one plant Species at Risk (Showy Goldenrod)	Exhibit 3.2	Section 3.2.3
	Vegetation Communities and Flora)	Nith Valley supports Carolinian biota and lowland deciduous forests, including one plant Species at Risk (Showy Goldenrod)	Exhibit 3.2	Section 3.2.4
	Designated/Special Areas (such as world biosphere reserves, heritage rivers, ESAs, ESPAs, ANSIs, environmental plan areas, conservation reserves; and the designated special areas of national parks, provincial parks, conservation areas, etc)	Little Lakes Bog and Swamp Forest – ANSI- Life Science (LS) Phillipsburg Forest ANSI –LS Phillipsburg Swamp ANSI – LS Spongy Lake Bog ANSI – LS St. Agatha Beech-Maple Forest ANSI - LS Baden Hills Kames ANSI – Earth Science (ES) Harmony Cut ANSI – ES Seebach Hill Spillway ANSSI – ES Wartbrug Road Cut ANSI – ES Easthope Moraine ANSI – ES International Biological Program Sites - Ellice Huckleberry Marsh, Gads Hill Agreement Forest and Spongy Lake Bog and Sand Hills	Exhibit 3.2	Sections 3.2.5 and 3.2.6

Factor	Sub-Factor	Significant Features in Highway 7 & 8 Analysis Area	Shown on Exhibit	Described in Section
Groundwater	Areas of Groundwater Recharge and Discharge	Regionally significant recharge occurs through surficial sands and gravel deposits in northwest section of analysis area, as well as Easthope and Gads-Hill Moraine Discharge areas created by topographical depressions (i.e.. wetlands, streams and isolated ponds) receive limited groundwater discharge on a seasonal basis	Exhibit 3.5	Section 3.3.4.2
	Groundwater Source Areas and Wellhead Protection Areas	Capture zones and groundwater source areas have been mapped	Exhibit 3.5	Section 3.3.4.3
	Large Volume Wells	42 municipal wells and three communal supply wells in analysis area - mainly located east of Baden, west of Stratford, one in Tavistock	Exhibit 3.5	Section 3.3.4.4
	Private Wells	Private wells (2,718 well records) scattered throughout analysis area – clustered along existing roadways	Exhibit 3.5	Section 3.3.4.4
	Groundwater-Dependent Commercial Enterprises	To be confirmed through field investigations		-
	Groundwater-Sensitive Ecosystems (e.g. groundwater fed wetlands, coldwater streams)	Groundwater divide occurs near Easthope Moraine along a line running north of Shakespeare towards Gads Hill – separating Nith River watershed in east and Avon River watershed in south. Moraine areas are most sensitive	Exhibit 3.4 to 3.7	Section 3.3.4.3
Surface Water	Watershed / Sub-Watershed Drainage Features/Patterns	Grand River Watershed – Nith River, Horner Creek, Upper Grand Thames River Watershed – Avon River, Trout Creek, Black Creek and Whirl Creek	Exhibit 3.1	Section 3.4
	Surface Water Quality and Quantity	Existing watercourses and watersheds are significant throughout analysis area, as named above	Exhibit 3.1	Section 3.4
Air Quality	Local and Regional Air Quality (Total contaminant and greenhouse gas emissions)	90th percentile contaminant concentrations meet provincial ambient air quality criteria and national ambient air quality objectives. However, measured levels of PM2.5 were found to occasionally exceed the respective air quality criteria, which is typical in Southwestern Ontario	Exhibit 3.8	Section 3.5
	Sensitive receptors to air pollutants and greenhouse gas emissions	Residential areas in New Hamburg and Stratford as well as residences close to transportation facilities	Exhibit 4.2	Section 4.2.3
Socio-economic Environment				
Land Use Planning Policies, Goals, Objectives	First Nation Land Claims	Huron Tract Claims as identified by Indian and Northern Affairs Canada: Stoney Point Indian Reserve (court file #T-702-85); Chippewas of Kettle and Stoney Point (court files #24085/96, #13182/92, #T-863-95 and #T-3077-94); Walpole Island First Nation (court file #00-CV-189329)	Exhibit 4.1	Section 4.1.1

Factor	Sub-Factor	Significant Features in Highway 7 & 8 Analysis Area	Shown on Exhibit	Described in Section
	Provincial/Federal land use planning policies/goals/ objectives	Provincial Policy Statement Golden Horseshoe Growth Plan	Exhibit 4.2	Section 4.1.2
	Municipal (regional and local) Land use planning policies/ goals/objectives (Official Plans)	Official Plans in County of Perth, City of Stratford, Regional Municipality of Waterloo, Township of Wilmot and County of Oxford are relevant to analysis area	Exhibit 4.2	Section 4.1.3
	Development Objectives of Private Property Owners	Throughout analysis area especially in designated growth area in Region of Waterloo	Exhibit 4.2	Section 4.1.3
Land Use / Community	First Nation Reserves	None in analysis area	-	Section 4.2.1
	First Nations Sacred Grounds	Locations to be confirmed through consultation with First Nations	-	Section 4.2.2
	Urban and Rural Residential	Urban residential (existing and future) in Stratford and New Hamburg, Shakespeare Rural residential scattered throughout analysis area	Exhibit 4.2	Section 4.2.3
	Commercial/Industrial	Commercial/industrial land uses in Stratford and New Hamburg Scattered commercial uses along existing Highway 7 & 8 Shakespeare has cluster of commercial businesses on existing Highway 7 & 8	Exhibit 4.2	Section 4.2.4
	Tourist Areas and Attractions (e.g. museums, theatres, etc.)	Stratford Festival is very significant tourist destination, attracting over 600,000 visitors per year from across Ontario and United States Theatres, parks, restaurants, hotels, etc. are primarily located in Stratford to accommodate festival. Fryfogel Inn is historic/tourist destination in Shakespeare.	Exhibit 4.3	Section 4.2.5
	Community Facilities / Institutions (e.g. hospitals, schools, places of worship, unique community features)	Community facilities, libraries, schools, churches, arenas etc. are primarily located in built-up areas of Stratford and New Hamburg with some facilities in Shakespeare	Exhibit 4.3	Section 4.2.6
	Municipal Infrastructure and Public Service Facilities (e.g. sewage and water services, police/emergency services, local utilities)	Municipal infrastructure in Stratford and New Hamburg Shakespeare has municipal well and water supply system	-	Section 4.2.7
Noise Sensitive Areas (NSAs)	Highway Noise	Noise levels near a highway fluctuate depending on topography, seasonal traffic volumes, percentage of truck traffic and frequency of users entering and exiting roads or entrance ways	-	Section 4.3
	Construction Noise	Residential areas and sensitive institutional uses adjacent to proposed construction areas are sensitive to construction noise	-	Section 4.3

Factor	Sub-Factor	Significant Features in Highway 7 & 8 Analysis Area	Shown on Exhibit	Described in Section
2.4 Land Use / Resources	First Nation Treaty Rights or Use of Land and Resources for Traditional Purposes (e.g. hunting, fishing, harvesting of country foods, harvesting of medicinal plants)	Huron Tract Claims as identified by Indian and Northern Affairs Canada: Stoney Point Indian Reserve (court file #T-702-85); Chippewas of Kettle and Stoney Point (court files #24085/96, #13182/92, #T-863-95 and #T-3077-94); Walpole Island First Nation (court file #00-CV-189329)	Exhibit 4.1	Section 4.4.1
	Agriculture	Agriculture is a significant land use in analysis area Most lands are Class 1 and 2 soils – considered as prime agricultural soils No specialty crop areas identified in local Official Plans	Exhibit 4.5	Section 4.4.2
	Recreation (e.g. conservation areas, municipal parks, public spaces, golf courses, trails, greenways and open space linkages)	Thistledown Equestrian Centre (in Shakespeare) Stratford Country Club Stratford Municipal Golf Course Little Lake Golf Centre (in Stratford) Foxwood Golf Club (in Petersburg) Tavistock Golf Course Plattsville Community Park Shakespeare Optimist Park and Community Centre	Exhibits 4.2 and 4.3	Section 4.4.3
	Aggregates, Mineral-Resources	A number of licensed pits/quarries north of Highway 7 & 8 near Shakespeare and one north of Stratford Other aggregate resources areas on fringes of analysis area	Exhibit 4.2	Section 4.4.4
Major Utility Transmission Corridors	Railroads, hydro, gas, oil etc.	Goderich-Exeter Railway corridor which runs parallel to Highway 7 & 8 from Stratford easterly to Kitchener.	-	Section 4.5
Contaminated Property and Waste Management	Landfills, Hazardous Waste Sites, "Brownfield" Areas, other known contaminated sites, and high-risk contamination areas	Two active waste disposal sites in analysis area (one northwest of Tavistock and in southeast Stratford) Four closed waste disposal sites in analysis area (one north of Shakespeare and three in Stratford) Other areas of potential contamination include auto wrecking/scrap yards, Anderson Waste Disposal Site and light industrial areas	Exhibit 4.6	Section 4.6
Landscape Composition	Scenic Composition (total aesthetic value of landscape components)	Flat to gently rolling terrain Landscape is dominated by farming activities	Exhibit 3.4	Section 4.7
	Sensitive Viewer Groups	Residential areas as described above, concentrated in Stratford, New Hamburg and Shakespeare	Exhibit 4.2	Section 4.7
	Scenic value of views/vistas from the transportation facility	Views from existing Highway 7 & 8 are dominated by agricultural land uses (i.e. active farms)	-	Section 4.7

Factor	Sub-Factor	Significant Features in Highway 7 & 8 Analysis Area	Shown on Exhibit	Described in Section
		Flat topography and long straight sections of existing highway result in relatively unremarkable views from highway		
	Specimen Trees	Specimen Trees to be identified as protection priorities	Exhibit 3.2	-
Cultural Environment				
Cultural Heritage – Built Heritage and Cultural Landscapes	Built heritage resources identified through designation or heritage conservation easement under Ontario Heritage Act	Fryfogel Inn (in Shakespeare) designated under Ontario Heritage Act Castle Kilbride in Baden on Ministry of Culture's listing Several other built heritage resources identified by local heritage committees and municipalities are scattered throughout analysis area, primarily concentrated in built-up villages or communities, including Stratford, Shakespeare and New Hamburg Township of Wilmot and City of Stratford have a "Heritage Conservation Districts (HCD)"	Exhibit 5.7 to 5.12	Section 5.1
	Heritage Bridges	Limited documentation on heritage bridges City of Stratford Heritage Committee is assembling a list Hartman Bridge (downtown New Hamburg)	-	Section 5.1.2
	Areas of Historic 19th Century Settlement	Wilmot Township has large and small historic centres that were important to founding Amish populations in Philipsburg, St. Agatha, Petersburg, Baden and New Hamburg	Exhibits 5.7 to 5.12	Sections 5.1 and 5.2
	Cultural Landscapes (collection of individual man-made features modifying pristine landscape)	Scenic views with cultural landscapes include: Views of New Hamburg and Baden Hills from Highway 7 & 8; Shildroth and Otto Farmsteads; View to Lingelbach Cemetery (Sideroad 10); Shakespeare area; Little Lakes area; Avon River highlands and northern limits of Shakespeare; Wilmot Creek hill landscape; and Height of land at Punkeydoodle's corners.	-	Section 5.1.4
	First Nation Burial Sites	To be confirmed through consultation with First Nation	-	Section 5.2.1
	Cemeteries	Scattered throughout analysis area – four documented in Built Heritage Report dated 1981	Exhibit 4.3	Section 5.1.4
Cultural Heritage - Archaeology	Pre-Historic and Historic First Nation Sites	Analysis area is rich in archeological potential throughout - Southern and central portions of Wilmot Township are exceptionally rich in both native	Exhibits 5.7 to 5.12	Section 5.2.1
	Historic Euro-Canadian Archaeological Sites	Analysis area is rich in archeological potential throughout - Southern and central portions of Wilmot Township are exceptionally rich in both native and EuroCanadian archaeological sites	Exhibits 5.2	Section 5.2.2 and 5.2.3

7.0 SUMMARY OF INPUT RECEIVED ON ENVIRONMENTAL CONDITIONS AS IDENTIFIED THROUGH OUTREACH AND CONSULTATION, AND MTO RESPONSE/CHANGES

APPENDIX A

Federal Provincial EA Coordination

FEDERAL/PROVINCIAL EA CO-ORDINATION

Under the Canadian Environmental Assessment Act (*CEAA*), the following information needs to be provided in a class environmental assessment conducted as a screening (paraphrasing):

- a description of the existing environment;
- any change the project may cause in the environment including: land, water, air, organic and inorganic matter, living organisms, and the interaction of natural systems;
- any effects that the project may cause to a listed wildlife species, its critical habitat or residences of individuals of that species, as those terms are defined in subsection 2(1) of the *Species at Risk Act*;
- the effects of a project-related environmental change on: health and socio-economic conditions; physical and cultural heritage; the current use of lands and resources for traditional purposes by aboriginal persons; and any structure, site or thing that is of historical, archeological, paleontological or architectural significance;
- any such project change or effect occurring both within or outside Canada;
- all environmental effects that may result from the various phases of the project (construction, operation, modification, abandonment and decommissioning);
- the environmental effects of accidents and malfunctions;
- the effects of the environment on the project (including effects due to climate change);
- the cumulative environmental effects of this project that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
- the likelihood of significant adverse environmental effects;
- the need for and requirements of a follow-up program;
- comments from the public obtained in accordance with *CEAA*;
- any measures to be taken that would mitigate identified environmental effects;
- any other matter that the responsible authority deems to be necessary including those required for a comprehensive study, mediation or panel.

Additional factors to be considered for a comprehensive study, mediation or panel include:

- the purpose of the project;
- alternatives means of carrying out the project;
- design of a follow up program;
- the capacity of renewable resources affected by the project to meet the needs of the present and those of the future.

If the decommissioning and abandonment phases are not currently part of the proposed project, the proponent may explain this in its EA document, and the responsible authority

under *CEAA* may decide not to require further analysis on these phases of the project as part of the current assignment.

Nothing in this document will limit the prerogative of federal authorities to seek additional information as more is learned about the specifics of the projects and its potential effects. Responsible authorities will be making a judgment about the likelihood of significant adverse environmental effects after mitigation, and they have the discretion to determine what information they require before making such a judgment.

APPENDIX B

Overview of Study Process

Exhibit 2.1
Highway 7&8 Transportation Corridor Planning and Class EA Study
Overview of the Study Process

STUDY PHASE	OBJECTIVES AND KEY TASKS	REPORTS	PUBLIC INFORMATION CENTRES (PICs) + INFORMATION PRESENTED	PRELIMINARY SCHEDULE
1. STUDY PLAN	• Establish framework to guide the study work, including: ○ study purpose and objectives ○ overview of study process ○ overview of study reports ○ overview of outreach and consultation ○ study schedule ○ overview of processes, factors & criteria to generate, assess & evaluate alternatives	Report "A": Study Plan for Technical Work, Outreach and Consultation	PIC #1: • Study Newsletter #1 • Recently completed work: ○ drafts of Reports "A", "B" and 1st part of "F" • Proposed approach to upcoming work: ○ process to define 'Area Transportation System' problems and opportunities ○ process and criteria for evaluating and selecting 'Area Transportation System' alternatives ○ process, factors, and criteria for generating, assessing, and evaluating preliminary planning alternatives	April 2007 to August 2007 (PIC #1 July/August, 2007)
EA STAGE 1: ALTERNATIVES TO THE UNDERTAKING - TRANSPORTATION NEEDS ASSESSMENT				
2. AREA TRANSPORTATION SYSTEM PLANNING	• Overview of Transportation, Land Use, Economic and Environmental Conditions within the Analysis Area ○ description and assessment of land use and economic conditions ○ description and assessment of existing transportation conditions ○ preliminary assessment of problems and opportunities based on the above ○ overview of environmental conditions and constraints within analysis area (based upon secondary source information)	Report "B": Working Paper – Overview of Transportation, Land Use and Economic Conditions within the Analysis Area Report "F" – 1st Part: Working Paper –Environmental Conditions and Constraints		
	• Identification of Area Transportation System Problems and Opportunities: ○ Establish travel demand forecasting approach and methodology ○ Forecast future 'Area Transportation System' travel characteristics and patterns ○ Detailed description and assessment of current and future 'Area Transportation System' problems and opportunities	Report "C": Working Paper – 'Area Transportation System' Problems and Opportunities	PIC#2: • Study Newsletter #2 • Recently Completed work: ○ drafts of Reports "C", "D", & "E" • Proposed approach to upcoming work: ○ process and criteria for generating provincial roadway detailed planning alternatives	August 2007 to Spring 2008 (PIC #2 In Spring 2008)
	• Identify 'Area Transportation System' alternatives: ○ Do Nothing ○ Transportation Demand Management (TDM) ○ Transportation System Management (TSM) ○ Local Transit* ○ Inter-regional transit and passenger rail* ○ Air Services* ○ Marine Services* ○ Freight Rail* ○ Municipal Roads* ○ Provincial Highways/Transitways* (* new or improved operations and/or infrastructure) • Determine degree to which individual 'Area Transportation System' alternatives address problems and opportunities • Select and define elements of area transportation system alternatives and group them into combinations: ○ Do nothing ○ Combination #1: Optimize Existing Network ○ Combination #2: New / Expanded Non-Road Infrastructure + Elements of Combination #1 ○ Combination #3: Widen/Improve Roads + Elements of Combination #2 ○ Combination #4: New Municipal Roads and/or Provincial Highways/Transitways + Elements of Combination #3 • Determine the degree to which combination alternatives address the problems and opportunities and select the preferred combination(s) • Select the alternatives that will proceed to Preliminary Planning	Report "D": Working Paper – Area Transportation System Alternatives		
3. PRELIMINARY PLANNING (plans at 1:20,000 scale)	• Generate the detailed elements of the preliminary planning alternatives (as applicable) based on transportation, natural, land use / social, economic and cultural factors: ○ new/expanded services ○ general areas of geometrical improvements and widening to existing facilities ○ new corridors ○ environmental protection for the above (by minimizing intrusion into areas of environmental significance as identified through secondary source information ○ conceptual areas of limitations to highway access • Comparative evaluation of the relative advantages and disadvantages of preliminary planning alternatives • Select alternatives for incorporation into transportation development strategy (including preliminary study area(s)) • Decision if study is to continue through Phases 4-6 *(if provincial roadway alternatives are selected*]	Report "E": Milestone Report – Highway 7&8 Transportation Corridor Needs Assessment		
EA STAGE 2: ALTERNATIVE METHODS FOR CARRYING OUT THE UNDERTAKING				
4. DETAILED PLANNING FOR PROVINCIAL ROADWAYS (plans at 1:10,000 scale)	• Identify environmental conditions and constraints within the detailed planning study area (as identified through field investigations to augment secondary source information)	Report "F" - 2nd Part: Working Paper - Environmental Conditions and Constraints	PIC#3: • Study Newsletter #3 • Recently completed work: ○ draft of Reports "G" & 2nd part of "F" • Proposed approach to upcoming work: ○ process and criteria for evaluating & selecting provincial roadway detailed planning alternatives	Spring 2008 to Fall 2008 (PIC #3 In Fall 2008)
	• Establish final study area(s) for provincial roadways for the preliminary planning alternatives carried forward from Phase 3 • Generate, specific location / type / character and template "footprint" for the following categories of provincial roadway detailed planning alternatives (as applicable): ○ new provincial transitway route location & technology ○ new provincial highway route location & highway type ○ specific location and type of geometrical improvements to existing highways ○ specific location, extent and direction of widening to exisiting highways • Generate specialty engineering alternatives (bridge, drainage & hydrology, foundation, pavement & road base, traffic control & electrical infrastructure) for the above • For highway alternatives, establish specific nature & location of limitations to highway access • Undertake environmental impact assessment for the above (by striving to avoid or prevent major "footprint"-based environmental impacts to the area and its features, including fisheries and aquatic ecosystems, terrestrial ecosystems, groundwater, land use factors, contaminated property, built heritage & cultural landscapes, archaeology, landscape composition, surface water, and designated areas; and by striving to avoid intrusion into noise-sensitive areas)	Report "G": Working Paper - Generation of Detailed Planning Alternatives for Provincial Roadways		

Exhibit 2.1
Highway 7&8 Transportation Corridor Planning and Class EA Study
Overview of the Study Process

STUDY PHASE	OBJECTIVES AND KEY TASKS	REPORTS	PUBLIC INFORMATION CENTRES (PICs) + INFORMATION PRESENTED	PRELIMINARY SCHEDULE

	• Evaluate and select specific location / type / character and template "footprint" of the provincial roadway detailed planning alternatives	Report "H": Milestone Report - Selection of Detailed Planning Alternatives for Provincial Roadways	PIC#4:
			• Study Newsletter #4
			• Recently completed work:
			  ○ draft of Report "H"
			• Proposed approach to upcoming work:
			  ○ process and criteria for generating provincial roadway preliminary design alternatives
				Fall 2008
				to
				Spring 2009
				
				(PIC #4 In Spring 2009)

5. PRELIMINARY DESIGN FOR PROVINCIAL ROADWAYS
 	
(plans at 1:2,000 scale)
	• For the detailed planning alternatives carried forward from Phase 4, generate provincial roadway alternatives for the following categories of preliminary design (as applicable):
	  ○ calculated vertical & horizontal alignment and cross-section
	  ○ highway interchange & intersection preliminary design
	  ○ transitway station preliminary design
	  ○ location/design of private entrances to highway
	• Generate specialty engineering alternatives for the above (bridge, drainage & hydrology, foundation, pavement & road base, traffic control & electrical infrastructure)
	• For the above, develop environmental protection for the area and its features (as identified in Phase 4), including environmental control/mitigation, compensation and/or enhancement to address "footprint" impacts, interference impacts, traffic access modification impacts to property and neighbourhood/commercial areas, timing impacts; and by addressing effects of malfunctions or accidents, cumulative effects from the project in combination with other projects
	• Identify right-of-way and property acquisition requirements
	• Identify utility requirements (relocation etc)
	• Develop preliminary staging of implementation
		Report "I": Working Paper – Generation of Preliminary Design Alternatives for Provincial Roadways	PIC#5:
			• Study Newsletter #5
			• Recently completed work:
			  ○ draft of Report "I"
			• Proposed approach to upcoming work:
			  ○ process and criteria for evaluating & selecting provincial roadway preliminary design alternatives
			  ○ process and criteria for evaluating and selecting provincial highway access management alternatives
				Spring 2009
				to
				Fall 2009
				
				(PIC #5 In Fall 2009)

	• Evaluate and select provincial roadway preliminary design alternatives, and develop final access management plan	Report "J": Milestone Report – Selection of Preliminary Design Alternatives for Provincial Roadways	PIC#6: • Study Newsletter #6 • Recently Completed Work ○ drafts of Reports "J" and "K"	Fall 2009 to Winter 2010 (PIC #6 In Winter 2010)
6. TRANSPORTATION ENVIRONMENTAL STUDY REPORT	• Filing of report, formal public review, and environmental "clearance"	Report "K": Transportation Environmental Study Report (documentations overall study)	NO PIC • Study Newsletter #7	TESR filed in Spring 2010
PHASE 7: DETAIL DESIGN (documented in a Design and Construction Report) - **NOT PART OF THIS STUDY**				

APPENDIX C

Species List

Element Occurrence	Scientific Name Binomial	**Common Name**	TNC Global rank	NHIC rank	National protection status (COSEWIC)		Date	MAPNUM	MAPSQUARE	COUNTYCODE
91151	Lampropeltis triangulum	Milksnake	G5	S3	SC	SC	1989-?	040P01	17NH68	BRANT
91146	Lampropeltis triangulum	Milksnake	G5	S3	SC	SC	1990-09-25	040P08	17NH58	BRANT
91145	Lampropeltis triangulum	Milksnake	G5	S3	SC	SC	1988-?	040P08	17NH58	BRANT
91142	Lampropeltis triangulum	Milksnake	G5	S3	SC	SC	1987-05-23	040P08	17NH69	BRANT
91139	Lampropeltis triangulum	Milksnake	G5	S3	SC	SC	1989-06-?	040P08	17NH59	BRANT
90783	Thamnophis sauritus	Eastern Ribbonsnake	G5	S3	SC	SC	1924-08-04	040P08	17NJ50	WATERLOO
90667	Thamnophis sauritus	Eastern Ribbonsnake	G5	S3	SC	SC	1978-?	040P08	17NH59	WATERLOO
90668	Thamnophis sauritus	Eastern Ribbonsnake	G5	S3	SC	SC	1989-06-25	040P08	17NH59	BRANT
91719	Perithemis tenera	Eastern Amberwing	G5	S3			2002-08-04	040P08	17NH59	BRANT
65766	Conioselinum chinense	Hemlock Parsley	G5	S3			1993-07-18	040P01	17NH58	BRANT
65679	Lithospermum canescens	Hoary Puccoon	G5	S3			1990-05-21	040P01	17NH57	BRANT
65541	Quercus ellipsoidalis	Northern Pin Oak	G4	S3			2001-08-01	040P08	17NH59	WATERLOO
65682	Ranunculus hispidus var. hispidus	Bristly Buttercup	G5T5	S3			1992-10-03	040P08	17NH58	BRANT
91117	Lampropeltis triangulum	Milksnake	G5	S3	SC	SC	1988-10-09	040P08	17NJ50	WELLINGTON
91120	Lampropeltis triangulum	Milksnake	G5	S3	SC	SC	1989-10-03	040P08	17NJ50	WATERLOO
91134	Lampropeltis triangulum	Milksnake	G5	S3	SC	SC	1991-07-01	040P08	17NH59	WATERLOO
91128	Lampropeltis triangulum	Milksnake	G5	S3	SC	SC	1987-05-23	040P08	17NH69	WATERLOO
91667	Graptemys geographica	Northern Map Turtle	G5	S3	SC	SC	1989-07-12	040P08	17NH59	WATERLOO
33019	Gentianella quinquefolia	Stiff Gentian	G5	S2			1902-09-13	040P08	17NH59	WATERLOO
2878	Carex emoryi	Emory's Sedge	G5	S3			1990-08-18	040P01	17NH57	BRANT

6136	Sporobolus heterolepis	Northern Dropseed	G5	S3			1990-08-18	040P01	17NH57	BRANT
63563	Draba reptans	Carolina Whitlow-grass	G5	S2			1997-06-12	040P01	17NH57	BRANT
1655	Sanicula canadensis var. grandis	Long-stlyed Canadian Snakeroot	G5T3T5	S2			1904-07-06	040P08	17NJ50	WATERLOO
2946	Carex mesochorea	Midland Sedge	G4G5	S1			1990-06-17	040P01	17NH57	BRANT
33565	Desmodium canescens	Tick-trefoil	G5	S2			1990-06-17	040P01	17NH57	BRANT
6133	Sporobolus asper	Longleaf Dropseed	G5	S1S2			1990-08-18	040P01	17NH57	BRANT
12006	Chlidonias niger	Black Tern	G4	S3B	NAR	SC	1967-06	040P08	17NH58	BRANT
2231	Carya glabra	Sweet Pignut Hickory	G5	S3			1980-08-26	040P01	17NH58	BRANT
256	Buteo lineatus	Red-shouldered Hawk	G5	S4B	SC	SC	1989-05-06	040P08	17NJ50	WELLINGTON
41359	Somatochlora walshii	Brush-tipped Emerald	G5	S3			1996-08-24	040P08	17NH59	WATERLOO
41505	Nannothemis bella	Elfin Skimmer	G4	S3			1926-06-24	040P08	17NH59	WATERLOO
60356	Valeriana edulis var. ciliata		G5T3	S1			1898-06-05	040P08	17NJ50	WATERLOO
4510	Dendroica cerulea	Cerulean Warbler	G4	S3B	SC	SC	1963-06-21	040P08	17NH59	WATERLOO
59555	Quercus ellipsoidalis	Northern Pin Oak	G4	S3			1980-08-24	040P08	17NH59	WATERLOO
6169	Vulpia octoflora	Slender Eight-flowered Fescue	G5	S2			1903-06-27	040P08	17NH59	WATERLOO
22750	Asterocampa clyton	Tawny Emperor	G5	S2S3			1981-09	040P08	17NJ50	WATERLOO
22342	Nuttallanthus canadensis		G5	S1			1978-1979	040P01	17NH58	BRANT
2187	Frasera caroliniensis	American Columbo	G5	S2	SC	SC	2001-07-03	040P01	17NH58	BRANT
5150	Eupatorium purpureum	Sweet Joe-pye-weed	G5	S3			1902-08-30	040P08	17NH59	WATERLOO
2221	Carya glabra	Sweet Pignut Hickory	G5	S3			1960-05-27	040P01	17NH58	BRANT
59849	Glycyrrhiza lepidota	Wild Licorice	G5	S3			1902-07-	040P08	17NH59	WATERLOO

							04			
2809	Arisaema dracontium	Green Dragon	G5	S3	SC	SC	1904-09	040P08	17NH59	WATERLOO
15512	Notropis photogenis	Silver Shiner	G5	S2S3	SC	SC	1981-05-14	040P08	17NH59	WATERLOO
7681	Notropis photogenis	Silver Shiner	G5	S2S3	SC	SC	1981-05-14	040P08	17NH59	WATERLOO
59845	Glycyrrhiza lepidota	Wild Licorice	G5	S3			1916-09-17	040P08	17NJ50	WATERLOO
662	Seiurus motacilla	Louisiana Waterthrush	G5	S3B	SC	SC	1990-06-15	040P08	17NH59	WATERLOO
2674	Aureolaria virginica	Downy False-foxglove	G5	S1			1990-07-28	040P08	17NH59	WATERLOO
59690	Asimina triloba	Pawpaw	G5	S3			1891-08-04	040P08	17NJ50	WATERLOO
60242	Onosmodium molle ssp. hispidissimum	Shaggy False Gromwell	G4G5T4	S2			1940-06-29	040P08	17NH59	WATERLOO
3465	Muhlenbergia tenuiflora	Slender Muhly	G5	S2			1901-07-30	040P08	17NJ50	WATERLOO
3461	Muhlenbergia tenuiflora	Slender Muhly	G5	S2			1989-10-12	040P08	17NH59	BRANT
59298	Carex jamesii	Nebraska Sedge	G5	S3			1903-06-13	040P08	17NJ50	WATERLOO
33279	Euonymus atropurpureus		G5	S3			1902-08-01	040P08	17NJ50	WATERLOO
60274	Monarda didyma	Bee-balm	G5	S3			1892-07	040P08	17NJ50	WATERLOO
59944	Linum virginianum	Virginia Yellow Flax	G4G5	S2				040P08	17NJ50	WATERLOO
60092	Erigenia bulbosa	Harbinger-of-spring	G5	S3			1910-04-01	040P08	17NJ50	WATERLOO
59424	Juncus acuminatus	Sharp-fruit Rush	G5	S3			1902-08-18	040P08	17NJ50	WATERLOO
59170	Koeleria macrantha	Prairie June Grass	G5	S3			1901-06-30	040P08	17NJ50	WATERLOO
3081	Schoenoplectus smithii	Smith's Club-rush	G5?	S2?			1902-08-30	040P08	17NJ50	WATERLOO
3011	Carex trichocarpa	Hairy-fruited Sedge	G4	S3			1987-06-21	040P08	17NH59	WATERLOO
2498	Phlox subulata	Moss Phlox	G5	S1?			1895-05-17	040P08	17NJ50	WATERLOO
35046	Moxostoma valenciennesi	Greater Redhorse	G4	S3			1999-05-21	040P01	17NH68	BRANT
65999	Lithospermum canescens	Hoary Puccoon	G5	S3			2000-05-23	040P01	17NH67	BRANT

60295	Aureolaria pedicularia	Fernleaf Yellow False-foxglove	G5	S3			1955-09-07	040P01	17NH68	BRANT
14807	Moxostoma erythrurum	Golden Redhorse	G5	S4	NAR	NAR	1971-08-07	040P01	17NH68	BRANT
17362	Arisaema dracontium	Green Dragon	G5	S3	SC	SC	1980-PRE	040P01	17NH68	BRANT
68049	Enallagma anna	River Bluet	G5	S2			2001-08-01	040P08	17NH69	HAMILTON/ WENTWORTH
35370	Ambystoma hybrid pop. 1		GNA	S2			1990-04-21	040P08	17NH58	BRANT
2854	Carex emoryi	Emory's Sedge	G5	S3			1989-06-02	040P08	17NH59	BRANT
3009	Carex trichocarpa	Hairy-fruited Sedge	G4	S3			1989-07-12	040P08	17NH59	BRANT
2714	Valeriana edulis var. ciliata		G5T3	S1			1895-06-08	040P01	17NH58	BRANT
91814	Amphiagrion saucium	Eastern Red Damsel	G5	S3			1935-07-01	040P08	17NH59	BRANT
41911	Arigomphus furcifer	Lilypad Clubtail	G5	S3			1939-06-26	040P08	17NH59	BRANT
41415	Somatochlora williamsoni	Williamson's Emerald	G5	S3				040P08	17NH59	BRANT
34927	Carex schweinitzii	Schweinitz's Sedge	G3G4	S3			1987-06-21	040P08	17NH59	BRANT
33566	Desmodium cuspidatum	Toothed Tick-treefoil	G5	S3			1993-09-19	040P08	17NH58	BRANT
4158	Buteo lineatus	Red-shouldered Hawk	G5	S4B	SC	SC	1972-08-03	040P08	17NJ40	WATERLOO
15517	Notropis photogenis	Silver Shiner	G5	S2S3	SC	SC	1981-05-13	040P08	17NJ50	WATERLOO
91742	Castanea dentata	American Chestnut	G4	S2	END	END-NR	2002-08-07	040P08	17NH59	BRANT
5395	Castanea dentata	American Chestnut	G4	S2	END	END-NR	1983	040P08	17NJ50	WELLINGTON
21307	Castanea dentata	American Chestnut	G4	S2	END	END-NR	2002-08-07	040P08	17NH59	BRANT
68149	Emys blandingii		G4	S3	THR	THR	2003-09-16	040P08	17NJ50	WATERLOO
5354	Castanea dentata	American Chestnut	G4	S2	END	END-NR	1987	040P08	17NH58	BRANT

21355	Castanea dentata	American Chestnut	G4	S2	END	END-NR	2003	040P08	17NH58	BRANT
5393	Castanea dentata	American Chestnut	G4	S2	END	END-NR	1993	040P08	17NH59	BRANT
1347	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NJ50	WATERLOO
3628	Ambystoma jeffersonianum	Jefferson Salamander	G4	S2	THR	THR	1989-06-17	040P08	17NH59	BRANT
5394	Castanea dentata	American Chestnut	G4	S2	END	END-NR	1983	040P08	17NH59	WATERLOO
21312	Castanea dentata	American Chestnut	G4	S2	END	END-NR	1988	040P08	17NJ40	WATERLOO
2937	Carex lupuliformis	False Hop Sedge	G4	S1	END	END-R	1902-09-13	040P08	17NJ50	WATERLOO
68227	Lampsilis fasciola	Wavy-rayed Lampmussel	G4	S1	END	END	1998-07-03	040P08	17NH59	WATERLOO
22573	Lampsilis fasciola	Wavy-rayed Lampmussel	G4	S1	END	END	2001-08-13	040P08	17NJ50	WATERLOO
65765	Juglans cinerea	Butternut	G3G4	S3?	END	END-NR	1989-08-31	040P01	17NH57	BRANT
22576	Lampsilis fasciola	Wavy-rayed Lampmussel	G4	S1	END	END	2001-08-03	040P08	17NH59	BRANT
2664	Agalinis gattingeri	Gattinger's Agalinis	G4	S2	END	END-NR	1952-09-01	040P08	17NH59	BRANT
41415	Somatochlora williamsoni	Williamson's Emerald	G5	S3				040P08	17NH59	BRANT
41359	Somatochlora walshii	Brush-tipped Emerald	G5	S3			1996-08-24	040P08	17NH59	WATERLOO
41911	Arigomphus furcifer	Lilypad Clubtail	G5	S3			1939-06-26	040P08	17NH59	BRANT
2150	Quercus prinoides	Dwarf Chinquapin Oak	G5	S2			1992-06-17	040P01	17NH57	BRANT
15517	Notropis photogenis	Silver Shiner	G5	S2S3	SC	SC	1981-05-13	040P08	17NJ50	WATERLOO
15517	Notropis photogenis	Silver Shiner	G5	S2S3	SC	SC	1981-05-13	040P08	17NJ50	WATERLOO
15512	Notropis photogenis	Silver Shiner	G5	S2S3	SC	SC	1981-05-14	040P08	17NH59	WATERLOO
15517	Notropis photogenis	Silver Shiner	G5	S2S3	SC	SC	1981-05-13	040P08	17NJ50	WATERLOO
15517	Notropis photogenis	Silver Shiner	G5	S2S3	SC	SC	1981-05-13	040P08	17NJ50	WATERLOO

1347	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NJ50	WATERLOO
1343	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NH59	BRANT
1343	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NH59	BRANT
1343	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NH59	BRANT
1343	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NH59	BRANT
1343	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NH59	BRANT
1347	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NJ50	WATERLOO
1347	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NJ50	WATERLOO
1347	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NJ50	WATERLOO
1347	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NJ50	WATERLOO
1343	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NH59	BRANT
5395	Castanea dentata	American Chestnut	G4	S2	END	END-NR	1983	040P08	17NJ50	WELLINGTON
5395	Castanea dentata	American Chestnut	G4	S2	END	END-NR	1983	040P08	17NJ50	WELLINGTON
21355	Castanea dentata	American Chestnut	G4	S2	END	END-NR	2003	040P08	17NH58	BRANT
32407	Emys blandingii		G4	S3	THR	THR	2003-06-07	040P08	17NH59	WATERLOO
32407	Emys blandingii		G4	S3	THR	THR	2003-06-07	040P08	17NH59	WATERLOO
32407	Emys blandingii		G4	S3	THR	THR	2003-06-07	040P08	17NH59	WATERLOO
32407	Emys blandingii		G4	S3	THR	THR	2003-06-07	040P08	17NH59	WATERLOO
32407	Emys blandingii		G4	S3	THR	THR	2003-06-07	040P08	17NH59	WATERLOO
32407	Emys blandingii		G4	S3	THR	THR	2003-06-07	040P08	17NH59	WATERLOO
32407	Emys blandingii		G4	S3	THR	THR	2003-06-07	040P08	17NH59	WATERLOO
32407	Emys blandingii		G4	S3	THR	THR	2003-06-07	040P08	17NH59	WATERLOO

22575	Lampsilis fasciola	Wavy-rayed Lampmussel	G4	S1	END	END	1998-07-09	040P08	17NJ40	WATERLOO
15517	Notropis photogenis	Silver Shiner	G5	S2S3	SC	SC	1981-05-13	040P08	17NJ50	WATERLOO
15512	Notropis photogenis	Silver Shiner	G5	S2S3	SC	SC	1981-05-14	040P08	17NH59	WATERLOO
41911	Arigomphus furcifer	Lilypad Clubtail	G5	S3			1939-06-26	040P08	17NH59	BRANT
41415	Somatochlora williamsoni	Williamson's Emerald	G5	S3				040P08	17NH59	BRANT
41359	Somatochlora walshii	Brush-tipped Emerald	G5	S3			1996-08-24	040P08	17NH59	WATERLOO
5395	Castanea dentata	American Chestnut	G4	S2	END	END-NR	1983	040P08	17NJ50	WELLINGTON
5395	Castanea dentata	American Chestnut	G4	S2	END	END-NR	1983	040P08	17NJ50	WELLINGTON
1347	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NJ50	WATERLOO
1343	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NH59	BRANT
1347	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NJ50	WATERLOO
6169	Vulpia octoflora	Slender Eight-flowered Fescue	G5	S2			1903-06-27	040P08	17NH59	WATERLOO
22750	Asterocampa clyton	Tawny Emperor	G5	S2S3			1981-09	040P08	17NJ50	WATERLOO
41359	Somatochlora walshii	Brush-tipped Emerald	G5	S3			1996-08-24	040P08	17NH59	WATERLOO
60356	Valeriana edulis var. ciliata		G5T3	S1			1898-06-05	040P08	17NJ50	WATERLOO
59555	Quercus ellipsoidalis	Northern Pin Oak	G4	S3			1980-08-24	040P08	17NH59	WATERLOO
65999	Lithospermum canescens	Hoary Puccoon	G5	S3			2000-05-23	040P01	17NH67	BRANT
35046	Moxostoma valenciennesi	Greater Redhorse	G4	S3			1999-05-21	040P01	17NH68	BRANT
60295	Aureolaria pedicularia	Fernleaf Yellow False-foxglove	G5	S3			1955-09-07	040P01	17NH68	BRANT
2221	Carya glabra	Sweet Pignut Hickory	G5	S3			1960-05-27	040P01	17NH58	BRANT
59849	Glycyrrhiza lepidota	Wild Licorice	G5	S3			1902-07-04	040P08	17NH59	WATERLOO

59845	Glycyrrhiza lepidota	Wild Licorice	G5	S3			1916-09-17	040P08	17NJ50	WATERLOO
5150	Eupatorium purpureum	Sweet Joe-pye-weed	G5	S3			1902-08-30	040P08	17NH59	WATERLOO
60092	Erigenia bulbosa	Harbinger-of-spring	G5	S3			1910-04-01	040P08	17NJ50	WATERLOO
3461	Muhlenbergia tenuiflora	Slender Muhly	G5	S2			1989-10-12	040P08	17NH59	BRANT
3465	Muhlenbergia tenuiflora	Slender Muhly	G5	S2			1901-07-30	040P08	17NJ50	WATERLOO
59690	Asimina triloba	Pawpaw	G5	S3			1891-08-04	040P08	17NJ50	WATERLOO
59298	Carex jamesii	Nebraska Sedge	G5	S3			1903-06-13	040P08	17NJ50	WATERLOO
2674	Aureolaria virginica	Downy False-foxglove	G5	S1			1990-07-28	040P08	17NH59	WATERLOO
3011	Carex trichocarpa	Hairy-fruited Sedge	G4	S3			1987-06-21	040P08	17NH59	WATERLOO
3081	Schoenoplectus smithii	Smith's Club-rush	G5?	S2?			1902-08-30	040P08	17NJ50	WATERLOO
33279	Euonymus atropurpureus		G5	S3			1902-08-01	040P08	17NJ50	WATERLOO
60242	Onosmodium molle ssp. hispidissimum	Shaggy False Gromwell	G4G5T4	S2			1940-06-29	040P08	17NH59	WATERLOO
2809	Arisaema dracontium	Green Dragon	G5	S3	SC	SC	1904-09	040P08	17NH59	WATERLOO
2498	Phlox subulata	Moss Phlox	G5	S1?			1895-05-17	040P08	17NJ50	WATERLOO
59170	Koeleria macrantha	Prairie June Grass	G5	S3			1901-06-30	040P08	17NJ50	WATERLOO
7681	Notropis photogenis	Silver Shiner	G5	S2S3	SC	SC	1981-05-14	040P08	17NH59	WATERLOO
59944	Linum virginianum	Virginia Yellow Flax	G4G5	S2				040P08	17NJ50	WATERLOO
60274	Monarda didyma	Bee-balm	G5	S3			1892-07	040P08	17NJ50	WATERLOO
59424	Juncus acuminatus	Sharp-fruit Rush	G5	S3			1902-08-18	040P08	17NJ50	WATERLOO
63563	Draba reptans	Carolina Whitlow-grass	G5	S2			1997-06-12	040P01	17NH57	BRANT
6133	Sporobolus asper	Longleaf Dropseed	G5	S1S2			1990-08-18	040P01	17NH57	BRANT
33565	Desmodium canescens	Tick-trefoil	G5	S2			1990-06-17	040P01	17NH57	BRANT
2878	Carex emoryi	Emory's Sedge	G5	S3			1990-08-	040P01	17NH57	BRANT

							18			
2946	Carex mesochorea	Midland Sedge	G4G5	S1			1990-06-17	040P01	17NH57	BRANT
1655	Sanicula canadensis var. grandis	Long-stlyed Canadian Snakeroot	G5T3T5	S2			1904-07-06	040P08	17NJ50	WATERLOO
6136	Sporobolus heterolepis	Northern Dropseed	G5	S3			1990-08-18	040P01	17NH57	BRANT
2231	Carya glabra	Sweet Pignut Hickory	G5	S3			1980-08-26	040P01	17NH58	BRANT
15512	Notropis photogenis	Silver Shiner	G5	S2S3	SC	SC	1981-05-14	040P08	17NH59	WATERLOO
33019	Gentianella quinquefolia	Stiff Gentian	G5	S2			1902-09-13	040P08	17NH59	WATERLOO
17362	Arisaema dracontium	Green Dragon	G5	S3	SC	SC	1980-PRE	040P01	17NH68	BRANT
14807	Moxostoma erythrurum	Golden Redhorse	G5	S4	NAR	NAR	1971-08-07	040P01	17NH68	BRANT
35370	Ambystoma hybrid pop. 1		GNA	S2			1990-04-21	040P08	17NH58	BRANT
2714	Valeriana edulis var. ciliata		G5T3	S1			1895-06-08	040P01	17NH58	BRANT
41415	Somatochlora williamsoni	Williamson's Emerald	G5	S3				040P08	17NH59	BRANT
41911	Arigomphus furcifer	Lilypad Clubtail	G5	S3			1939-06-26	040P08	17NH59	BRANT
2854	Carex emoryi	Emory's Sedge	G5	S3			1989-06-02	040P08	17NH59	BRANT
3009	Carex trichocarpa	Hairy-fruited Sedge	G4	S3			1989-07-12	040P08	17NH59	BRANT
34927	Carex schweinitzii	Schweinitz's Sedge	G3G4	S3			1987-06-21	040P08	17NH59	BRANT
33566	Desmodium cuspidatum	Toothed Tick-treefoil	G5	S3			1993-09-19	040P08	17NH58	BRANT
22342	Nuttallanthus canadensis		G5	S1			1978-1979	040P01	17NH58	BRANT
2187	Frasera caroliniensis	American Columbo	G5	S2	SC	SC	2001-07-03	040P01	17NH58	BRANT
15517	Notropis photogenis	Silver Shiner	G5	S2S3	SC	SC	1981-05-13	040P08	17NJ50	WATERLOO
4158	Buteo lineatus	Red-shouldered Hawk	G5	S4B	SC	SC	1972-08-03	040P08	17NJ40	WATERLOO
12006	Chlidonias niger	Black Tern	G4	S3B	NAR	SC	1967-06	040P08	17NH58	BRANT

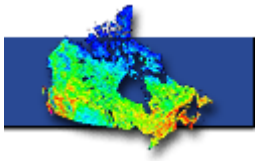
662	Seiurus motacilla	Louisiana Waterthrush	G5	S3B	SC	SC	1990-06-15	040P08	17NH59	WATERLOO
256	Buteo lineatus	Red-shouldered Hawk	G5	S4B	SC	SC	1989-05-06	040P08	17NJ50	WELLINGTON
4510	Dendroica cerulea	Cerulean Warbler	G4	S3B	SC	SC	1963-06-21	040P08	17NH59	WATERLOO
5395	Castanea dentata	American Chestnut	G4	S2	END	END-NR	1983	040P08	17NJ50	WELLINGTON
3628	Ambystoma jeffersonianum	Jefferson Salamander	G4	S2	THR	THR	1989-06-17	040P08	17NH59	BRANT
5394	Castanea dentata	American Chestnut	G4	S2	END	END-NR	1983	040P08	17NH59	WATERLOO
21307	Castanea dentata	American Chestnut	G4	S2	END	END-NR	2002-08-07	040P08	17NH59	BRANT
5354	Castanea dentata	American Chestnut	G4	S2	END	END-NR	1987	040P08	17NH58	BRANT
21355	Castanea dentata	American Chestnut	G4	S2	END	END-NR	2003	040P08	17NH58	BRANT
5393	Castanea dentata	American Chestnut	G4	S2	END	END-NR	1993	040P08	17NH59	BRANT
1347	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NJ50	WATERLOO
21312	Castanea dentata	American Chestnut	G4	S2	END	END-NR	1988	040P08	17NJ40	WATERLOO
2937	Carex lupuliformis	False Hop Sedge	G4	S1	END	END-R	1902-09-13	040P08	17NJ50	WATERLOO
22573	Lampsilis fasciola	Wavy-rayed Lampmussel	G4	S1	END	END	2001-08-13	040P08	17NJ50	WATERLOO
22576	Lampsilis fasciola	Wavy-rayed Lampmussel	G4	S1	END	END	2001-08-03	040P08	17NH59	BRANT
2664	Agalinis gattingeri	Gattinger's Agalinis	G4	S2	END	END-NR	1952-09-01	040P08	17NH59	BRANT
41415	Somatochlora williamsoni	Williamson's Emerald	G5	S3				040P08	17NH59	BRANT
41911	Arigomphus furcifer	Lilypad Clubtail	G5	S3			1939-06-26	040P08	17NH59	BRANT
2150	Quercus prinoides	Dwarf Chinquapin Oak	G5	S2			1992-06-17	040P01	17NH57	BRANT
15512	Notropis photogenis	Silver Shiner	G5	S2S3	SC	SC	1981-05-14	040P08	17NH59	WATERLOO
15517	Notropis photogenis	Silver Shiner	G5	S2S3	SC	SC	1981-05-	040P08	17NJ50	WATERLOO

							13			
15517	Notropis photogenis	Silver Shiner	G5	S2S3	SC	SC	1981-05-13	040P08	17NJ50	WATERLOO
32407	Emys blandingii		G4	S3	THR	THR	2003-06-07	040P08	17NH59	WATERLOO
32407	Emys blandingii		G4	S3	THR	THR	2003-06-07	040P08	17NH59	WATERLOO
32407	Emys blandingii		G4	S3	THR	THR	2003-06-07	040P08	17NH59	WATERLOO
32407	Emys blandingii		G4	S3	THR	THR	2003-06-07	040P08	17NH59	WATERLOO
32407	Emys blandingii		G4	S3	THR	THR	2003-06-07	040P08	17NH59	WATERLOO
32407	Emys blandingii		G4	S3	THR	THR	2003-06-07	040P08	17NH59	WATERLOO
41359	Somatochlora walshii	Brush-tipped Emerald	G5	S3			1996-08-24	040P08	17NH59	WATERLOO
1343	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NH59	BRANT
1343	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NH59	BRANT
1343	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NH59	BRANT
1347	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NJ50	WATERLOO
1347	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NJ50	WATERLOO
1347	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NJ50	WATERLOO
1347	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NJ50	WATERLOO
1343	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NH59	BRANT
1343	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NH59	BRANT
1343	Regina septemvittata	Queen Snake	G5	S2	THR	THR	2001-08-03	040P08	17NH59	BRANT
5395	Castanea dentata	American Chestnut	G4	S2	END	END-NR	1983	040P08	17NJ50	WELLINGTON
5395	Castanea dentata	American Chestnut	G4	S2	END	END-NR	1983	040P08	17NJ50	WELLINGTON
21355	Castanea dentata	American Chestnut	G4	S2	END	END-NR	2003	040P08	17NH58	BRANT
22576	Lampsilis fasciola	Wavy-rayed Lampmussel	G4	S1	END	END	2001-08-03	040P08	17NH59	BRANT

APPENDIX D

Canada Land Inventory Soil Capability System

Canada Land Inventory (CLI)



This document can be found at the Ministry of Natural Resources, located at:
http://geogratis.cgdi.gc.ca/CLI/frames.html

The Canada Land Inventory is a comprehensive multi-disciplinary land inventory of rural Canada, covering over 2.5 million square kilometers of land and water. Land capability for agriculture, forestry, wildlife, recreation, wildlife (ungulates and waterfowl) was mapped. Over 1000 mapsheets at the 1:250,000 scale are available on this site for on-line map making and download of desktop publishing, or GIS formats

The Canada Council on Rural Development in a report on land use, acclaimed The Canada Land Inventory (CLI) as the most significant and productive federal influence on rural land use in Canada.

In the past access and use of CLI data was restricted to government agencies, consultants and academics and interest groups with significant GIS computer capabilities. Now the WWW and on-line mapping and analysis, combined with the easily understood rating system, make the CLI a powerful tool for public involvement in the sustainable development of regions and rural communities

The CLI and the Next Millennium: The CLI remains an important digital data base and strategic information source particularly suitable for the use through the information highway. The ecosystem based land classification approach ensures that information is “timeless”. The only riders are urban development, reservoirs, and subtle impacts of climate change

Many significant spin offs resulted from the Canada land Inventory, including the first operational geographic information system (GIS) in the world, and ecological land classification and zoning.

The Government of Canada developed the Canada Land Inventory (CLI) under the auspices of the Department of Regional and Economic Expansion (1963-1971) and the Department of the Environment (renamed Environment Canada), (1971- 1994). The program was officially discontinued in 1994. The process to transfer the data and intellectual property to the National Archives of Canada started in 1995. Since 1995 several Canadian federal departments have been instrumental in extracting the data from the old tapes to modern formats and media, including: National Archives of Canada, Agriculture and Agri-Food Canada, Statistics Canada, and Natural Resources Canada.

The current initiative by Natural Resources Canada has and continues to develop files in a variety of formats and projections for free distribution on the public Internet site known as GeoGratis (http://geogratis.cgdi.gc.ca) with the intellectual property held by the National Archives of Canada.

Canada

Updated 11 January 2000

This document can be found at the Provincial Agricultural Land Commission under the Government of British Columbia, located at:
http://www.alc.gov.bc.ca/alr/ag_cap_details.htm

Capability Classes

The capability class, the broadest category in the classification, is a grouping of lands that have the same relative degree of limitation or hazard for agricultural use. The intensity of the limitation or hazard becomes progressively greater from Class 1 to Class 7. The class indicates the general suitability of the land for agricultural use.

Two sets of classes exist, one for mineral soils and one for organic soils. The classes are as follows:

LAND CAPABILITY CLASSES FOR MINERAL SOILS

The seven land capability classes for mineral soils are defined and described as follows:

CLASS 1 LAND IN THIS CLASS EITHER HAS NO OR ONLY VERY SLIGHT LIMITATIONS THAT RESTRICT ITS USE FOR THE PRODUCTION OF COMMON AGRICULTURAL CROPS.

Land in Class 1 is level or nearly level. The soils are deep, well to imperfectly drained under natural conditions, or have good artificial water table control, and hold moisture well. They can be managed and cropped without difficulty. Productivity is easily maintained for a wide range of field crops.

CLASS 2 LAND IN THIS CLASS HAS MINOR LIMITATIONS THAT REQUIRE GOOD ONGOING MANAGEMENT PRACTISES OR SLIGHTLY RESTRICT THE RANGE OF CROPS, OR BOTH.

Land in class 2 has limitations which constitute a continuous minor management problem or may cause lower crop yields compared to Class 1 land but which does not pose a threat of crop loss under good management. The soils in Class 2 are deep, hold moisture well and can be managed and cropped with little difficulty.

CLASS 3 LAND IN THIS CLASS HAS LIMITATIONS THAT REQUIRE MODERATELY INTENSIVE MANAGEMENT PRACTISES OR MODERATELY RESTRICT THE RANGE OF CROPS, OR BOTH.

The limitations are more severe than for Class 2 land and management practices are more difficult to apply and maintain. The limitations may restrict the choice of suitable crops or affect one or more of the following practices: timing and ease of tillage, planting and harvesting, and methods of soil conservation.

CLASS 4 LAND IN THIS CLASS HAS LIMITATIONS THAT REQUIRE SPECIAL MANAGEMENT PRACTISES OR SEVERELY RESTRICT THE RANGE OF CROPS, OR BOTH.

Land in Class 4 has limitations which make it suitable for only a few crops, or the yield for a wide range of crops is low, or the risk of crop failure is high, or soil conditions are such that special development and management practices are required. The limitations may seriously affect one

or more of the following practices: timing and ease of tillage, planting and harvesting, and methods of soil conservation.

CLASS 5 LAND IN THIS CLASS HAS LIMITATIONS THAT RESTRICT ITS CAPABILITY TO PRODUCING PERENNIAL FORAGE CROPS OR OTHER SPECIALLY ADAPTED CROPS.

Land in Class 5 is generally limited to the production of perennial crops or other specially adapted crops. Productivity of these suited crops may be high. Class 5 lands can be cultivated and some may be used for cultivated field crops provided unusually intensive management is employed and/or the crop is particularly adapted to the conditions peculiar to these lands. Cultivated field crops may be grown on some Class 5 land where adverse climate is the main limitation, but crop failure can be expected under average conditions. Note that in areas which are climatically suitable for growing tree fruits and grapes the limitations of stoniness and/or topography on some Class 5 lands are not significant limitations to these crops.

CLASS 6 LAND IN THIS CLASS IS NONARABLE BUT IS CAPABLE OF PRODUCING NATIVE AND OR UNCULTIVATED PERENNIAL FORAGE CROPS.

Land in Class 6 provides sustained natural grazing for domestic livestock and is not arable in its present condition. Land is placed in this class because of severe climate, or the terrain is unsuitable for cultivation or use of farm machinery, or the soils do not respond to intensive improvement practices. Some unimproved Class 6 lands can be improved by draining and/or diking.

CLASS 7 LAND IN THIS CLASS HAS NO CAPAPBILITY FOR ARABLE OR SUSTAINED NATURAL GRAZING.

All classified areas not included in Classes 1 to 6 inclusive are placed in this class. Class 7 land may have limitations equivalent to Class 6 land but they do not provide natural sustained grazing by domestic livestock due to climate and resulting unsuitable natural vegetation. Also included are rockland, other non-soil areas, and small water-bodies not shown on maps. Some unimproved Class 7 land can be improved by draining or diking.

LAND CAPABILITY FOR ORGANIC SOILS

Organic soils are grouped into seven classes, designated as 01 to 07. The organic soil class definitions are equivalent in terms of their relative capabilities and limitations for agricultural use to those defined for mineral soil.

Capability Subclasses

The subclass indicates lands with similar kinds but varying intensities of limitations and hazards. It provides information on the kind of management problem or use limitation. Except for Class 1 and O1 lands, which have no significant limitations, the capability classes are divided by subclasses on the basis of type of limitation to agricultural use. Each class can include many different kinds of soil, similar with respect to degree of limitation: but soils in any class may require unlike management and treatment as indicated by the subclasses shown. For detailed definitions and guidelines refer to MOE Manual 1, 1983.

LAND CAPABILITY SUBCLASSES FOR MINERAL SOILS

A SOIL MOISTURE DEFICIENCY:
Crops are adversely affected by droughtiness caused by soil and/or climate characteristics. Improved by irrigation.

***C** ADVERSE CLIMATE:
Thermal limitations to plant growth. Minimum temperature near freezing and/or insufficient heat units during the growing season and/or extreme minimum temperatures during the winter season. NOT IMPROVABLE.

D UNDESIRABLE SOIL STRUCTURE AND/OR LOW PERVIOUSNESS:
Soils are difficult to till, require special management for seedbed preparation, pose trafficability problems, have insufficient aeration, absorb and distribute water slowly, and/or have the depth of rooting zone restricted by conditions other than high water table, bedrock, or permafrost. Improvement practises vary; no improvement is assumed in the absence of local experience.

E EROSION:
Past damage from erosion limits agricultural use due to loss of productivity and hampering of access by gullies. NOT IMPROVABLE.

***F** FERTILITY:
Lack of available nutrients, low cation exchange capacity or nutrient holding ability, high acidity or alkalinity, high levels of carbonates, presence of toxic elements or compounds, or high fixation of plant nutrients. Usually improvable through fertilizers and amendments.

***I** INUNDATION:
Overflow by streams, lakes or marine tides causes crop damage or restricts agriculture use. Improvable by diking if a major reclamation project is not required.

M MOISTURE:
A low moisture holding capacity, caused by adverse inherent soil characteristics, limits crop growth. (Not to be confused with climatic drought.)

***N** SALINITY:
Soluble salts in the soil reduce crop growth or restrict the range of crops. Improvement practises and their success in alleviating limitations due to salinity vary depending on site and soil conditions.

P STONINESS:
Coarse fragments significantly hinder tillage, planting and harvesting. Note that in areas which are climatically suitable for growing tree fruits and grapes, a Class 5 level stoniness limitation may not be a significant limitation to these crops.

R DEPTH TO SOLID BEDROCK:
Bedrock near or t the surface restrict rooting depth and cultivation. NOT IMPROVABLE.

T TOPOGRAPHY:
Steepness or the pattern of slopes hinders the use of farm machinery, decreases the uniformity of growth and maturity of crops, and/or increases the potential for water erosion. NOT IMPROVABLE. Note that in areas which are climatically suitable for growing tree fruits and grapes, a Class 5 level topography limitation may not be considered a significant limitation to these crops.

***W** EXCESS WATER:
Excess free water, other than from flooding, limits agricultural use and may be due to poor drainage, high water tables, seepage, and/or runoff from surrounding areas. Improvable by drainage; feasibility and level of improvement is assessed on a site-specific basis.

***Z** PERMAFROST:
Permafrost maintains undesirably cold soil temperatures and causes drainage and subsidence problems when it is near the surface. NOT IMPROVABLE.

LAND CAPABILITY SUBCLASSES FOR ORGANIC SOILS

B WOOD IN THE PROFILE:
Layers of wood interfere with cultivation and/or with ditching and drain installation. No improvement is assumed in the absence of local expertise.

H DEPTH OF ORGANIC SOIL OVER BEDROCK AND/OR ROCKINESS:
Bedrock near the surface restricts rooting depth and the feasibility of subsurface drainage, and/or rock outcrops restrict agricultural use. NOT IMPROVABLE.

L DEGREE OF DECOMPOSITION — PERMEABILITY:
Degree of decomposition affects drainage, permeability capillary rise of water and rate of subsidence. Layers of mineral soil in an organic profile may pose a limitation to optimum crop yield and to drainage. NOT IMPROVABLE.

APPENDIX E

References

Natural Environment and Land Use

Barnard, R., B. Robinson, W. Moore, S. Pennington and M. Miller. 1994:
Southern Ontario Wetland Evaluation, Data and Scoring Record- Gads Hill South. Third

Earth Science Database, 1998 Edition.
August 11-12, 1993, August 24- 25, 1994 and November 23, 1994. Ontario Ministry of Natural Resources. Manuscript. 57 pp + 1 map + 2 pp supplement.

Barnard R., W. Moore, B. Robinson and G. Pascol. 1994:
Southern Ontario Wetland Evaluation, Data and Scoring Record - Gadshill Swamp North. Third
Edition. June and August 1994. Ontario Ministry of Natural Resources. Manuscript. 40 pp + 2 maps + 3 pp supplement.

Beaudette, S. and K. Tubman. 1986:
Wetland Evaluation and Data Record- Little Lakes. Second Edition. September 18-19, 1986. Ontario Ministry of Natural Resources. Manuscript. 23 pp + 1 map.

Cooke, S. 2006. Water Quality in The Grand River: A Summary of Current Conditions (2000-2004) and Long Term Trends. Grand River Conservation Authority. Available at: http://www.grandriver.ca/index/document.cfm?Sec=67&Sub1=2.

Coulson D. P. and P. Ertel. 1985:
Wetland Evaluation and Data Record - Spongy Lake. Second Edition. July 22, 1985. Ontario Ministry of Natural Resources. Manuscript. 31 pp + 3 maps.

Coulson, D., and A. Timmerman. ND. Guelph District Wetland Species List.. Ontario Ministry of Natural Resources. 29 pp.

Cudmore, B., C.A. MacKinnon and S.E. Madzia. 2004. Aquatic species at risk in the Thames River watershed, Ontario. Can. MS Rpt. Fish. Aquat. Sci. 2707: v + 123 p.

Drabick, R., Coulson, D., Ertel, P., Roberts, P., Cornelisse, K. and A. Timmerman. 2003:
Spongy Lake Wetland Evaluation - 3rd Edition. OMNR. 43 pp.

Drabick, R., Moore, W., Robinson, B. and R. Barnard. 2003:
Phillipsburg Swamp Wetland Evaluation, 3rd Edition. Ontario Ministry of Natural Resources. 41 pp.

Drabick, R., Timmerman, A., Cornelisse, K., Hendrickson, C. 2003:
Haysville Wetland Complex Wetland Evaluation, 3rd edition. OMNR. 45 pp.

Ecolog ERIS Environmental Risk Information Service, July 2004: Hwy7&8 Stratford to New Hamburg ON for URS Canada Inc.

Energy Mines and Resources Canada, 1966, 1971, Aerial photographs of southern Ontario, nominal scales 1:15,000-1:25,000

Falls, J.B., I.D. Macdonald and T.J. Beechey. 1990. Catalogue of IBP/CT Areas in Ontario with an Assessment of their Current Conservation Status. Unpublished report. 94 pp.

Gartner Lee Limited, 2006:
Internal database of environmental information.

Hay, S.G. 1971. International Biological Programme, Checksheet for Region 5, Area 248: Gads Hill Agreement Forest.

Hendrickson, C. 1996:
Southern Ontario Wetland Evaluation, Data and Scoring Record- Haysville Wetland Complex. Third Edition (March). Sept 22, 28, Oct 6, 20 and 27, 1995. Environmental Studies, University of Waterloo and the Ontario Ministry of Natural Resources. Manuscript. 39 pp + 2 pp supplement.

J.D. Barnes/First Base Solutions, Orthophotography of Southern Ontario, 2005, nominal scale 1 pixel=30cm.

Karrow, P.F., 1993. Quaternary geology, Stratford-Conestoga area; Ontario Geological Survey, Report 283, 104p.

Klea, R., S. Rake and J. Haggeman. 1985:
Wetland Data Record and Evaluation - Ellice Swamp. Second Edition. June 12, 14, 17-19, August 7, 12, 13, 1985. Ontario Ministry of Natural Resources. Manuscript. 29 pp + 3 maps.

Klinkenberg, R. 1984:
Life Science Areas of Natural and Scientific Interest in Site District 6-1: A Review and
Assessment of Significant Natural Areas in Site District 6-1. Ontario Ministry of Natural
Resources, Parks and Recreational Areas, Southwestern Region, London. SR OFER 8406. vii + 81 pp. + maps.

Moore W. and B. Robinson. 1995:
Southern Ontario Wetland Evaluation, Data and Scoring Record - Little Lakes Swamp Complex. Third Edition. July 15, 16, 19, 1993 and May 25, 1995. Ontario Ministry of Natural Resources. Manuscript. 52 pp + 6 maps.

Maaskant, K., C. Quinlan and I. Taylor. 2001. The Upper Thames River Watershed Report

Cards. Upper Thames River Conservation Authority. Available at: http://www.thamesriver.on.ca/Watershed_Report_Cards/Watershed_Report_Cards.htm.

Moore W., B. Robinson and R. Barnard. 1993:
Southern Ontario Wetland Evaluation, Data and Scoring Record- Phillipsburg Swamp. Third Edition. August 25, 1993. Ontario Ministry of Natural Resources. Manuscript. 41 pp + 4 maps + 10 pp supplement.

Ontario Ministry of Environment (MOE), 2006: Water Well Record Database.

Ontario Ministry of Natural Resources (OMNR) and Grand River Conservation Authority (GRCA). 1998. Grand River Fisheries Management Plan. 105p.

Ontario Ministry of Natural Resources (MNR), 2006: Ontario base Maps (Computer file). Web site: www.mnr.gov.on.ca.

Ontario Ministry of Natural Resources, 1983:
Topographic base map series, nominal scale 1:10,000.

Oxford County, 2007:
Geographic Information System Groundwater Risk Layers

Scheifele, G., G. Perfect, L. Michalak, and M. Robinson. 1996:
Southern Ontario Wetland Evaluation, Data and Scoring Record- New Hamburg Oxbow
Wetland Complex. Third Edition (March). Sept 19, 21, 26, 1995; June 2, 12, 17, 1996. Prime Environmental Consultants Limited. Manuscript. 40 pp + 1 pp supplement.

Scott, R., and J. Imhof. 2005. Exceptional Waters: State of the Resource Report. Grand River Fisheries Management Plan. Available at: http://www.grandriver.ca/index/document.cfm?Sec=47&Sub1=0&sub2=0.

Thames River Ecosystem Recovery Team. 2005. The Thames River Watershed Synthesis **Report**. Upper Thames River Conservation Authority. Avaliable at: http://www.thamesriver.on.ca/Species_at_Risk/publications.htm

URS Canada Inc, March 2006 Preliminary Environmental Review of Contaminated Property and Waste Management, Secondary Source Groundwater Investigation, Highway 7 and 8 from New Hamburg to Stratford, Ontario

Walshe, S. 1970. International Biological Programme, Checksheet for Region 5, Area 164: Spongy Lake Bog and Sand Hill

Waterloo Hydrogeologic, 2003: Perth County Groundwater Study, Final Report.

Wright, J., and J. Imhof. 2001. Technical Background Report for the Grand River Fisheries Management Plan. Ontario Ministry of Natural Resources and Grand River Conservation Authority.

Agriculture

Canada Department of Agriculture., 1965:
Soil Capability classification for agriculture. The Canada Land Inventory Report No. 2.

Chapman and Putnam., 1984:
Physiography of Southern Ontario.

County of Perth Official Plan. june 1998.

County of Oxford Official Plan.1995.

Hoffman, D.W. and N.R. Richards. 1952. Soil Survey of Perth County. Report No. 15 of the Ontarion Soil Survey.

MMAH., 2005:
Provincial Policy Statement.

Presant and Wicklund., 1971:
The Soils of Waterloo County.

Regional Official Policies Plan. December 1998.

Wicklund, R.E. and N. R. Richards, 1961. The Soil Survey of Oxford County. Report No. 28 of the Ontario Soil Survey.

Built Heritage

Bart-Riedstra, Carolynn and Lutzen H. Riedstra

1999 *Stratford: Its Heritage and Its Festival*. Toronto: James Lorimer & Company Ltd.

City of Stratford

1997 *City of Stratford Heritage Conservation District Standards*. On file with the City of Stratford.

n.d. *City of Stratford Heritage Conservation District Community Improvement Plan*. On file with the City of Stratford.

Dawe, Brian

1980 *Old Oxford is Wide Awake! Pioneer Settlers & Politicians in Oxford County 1793-1853*. John Deyell Company.

Dilse, Paul

1981 *Description of Man-Made Heritage in the Environment: Preliminary Report*. On file with the Ministry of Transportation, Southwestern Region.

Downie Township Heritage Book Committee (DTHBC)

2002 *Memories of Downie: Volume I*. Downie Township.

H. Belden & Co.

1879 Illustrated Historical Atlas of Perth County. Reprint Edition.

H. Parsell & Co.

1881 *Illustrated Historical Atlas of Waterloo County.* Reprint Edition.

Hayes, Geoffrey

1997 *Waterloo County: An Illustrated History.* Waterloo: Waterloo Historical Society.

Johnston, William

1902 [1976]*History of Perth County 1825-1902.* Reprint Edition. Stratford: Beacon Herald Fine Printing Division.

Kearsley, Anthony L.

1962 *Paths of History in Huron and Perth*. Stratford: British Mortgage and Trust Company.

Lee, Robert C.

2004 *The Canada Company and the Huron Tract, 1826-1853*. Toronto: Natural Heritage Books.

Leitch, Adelaide
1980 *Floodtides of Fortune*. Stratford: The Corporation of the City of Stratford.

McNichol, Vera Ernst
1967 *Reveries of a Pioneer*. Kitchener: Dixon Press Limited.

Ministry of Culture, Ontario
2007 *Ontario Heritage Properties Database.* (www.culture.gov.on.ca/english/culdiv/heritageprops.dababase.hpd.htm)

Natural Resources Canada
1998 *Stratford, Ontario*. 1:50,000 Scale Topographic Map. Section 40 P/7. Edition 9.

1999 *St. Marys, Ontario*. 1:50,000 Scale Topographic Map. Section 40 P/6. Edition 6.

Oxford County
2007 *Heritage Resources Inventory. Blandford-Blenheim, East-Zorra Townships*. On file with the County of Oxford.

Regional Municipality of Waterloo
2006 GIS Data, Heritage-related Layers.

Rotary Club of Tavistock (RCT)
1968 *Fact & Fantasy: A History of Tavistock & District*. Centennial Book Committee: Tavistock.

Walker & Miles
1876 *Illustrated Historical Atlas of Oxford County.* Reprint Edition.

Wilmot Historical Committee
1967 *More Than A Century in Wilmot Township*. Wilmot Township: New Hamburg – Wilmot Township Centennial Committee.

Young, James
1888 Reminisces of the Early History of Galt and the Settlement of Dumfries in the Province of Ontario in *Waterloo County: An Illustrated History.* Kitchener: Waterloo Historical Society.

Archaeology

Archaeological Services Inc.

2004 *Stage 1 Archaeological Assessment, Highway 7 and 8 from Stratford to New Hamburg, Township of Perth East, Perth County and Township of Wilmot, Regional Municipality of Waterloo, Ontario.* Report on file with the Ministry of Culture, Toronto.

Bart-Riedstra, Carolynn and Lutzen H. Riedstra

1999 *Stratford: Its Heritage and Its Festival*. Toronto: James Lorimer & Company Ltd.

Chapman, Don

1976 *Excavations at Fryfogel Inn: Preliminary Report*. With Appendix by J. Andersen, Perth County Historical Board. Report on file with the Ministry of Culture, London.

Chapman L.J. and D.F. Putnam

1966 *The Physiography of Southern Ontario*. Second Edition. Toronto: University of Toronto Press.

Downie Township Heritage Book Committee (DTHCB)

2002 *Memories of Downie: Volume I.* Downie Township.

Fri Ecological Services

2006 *Natural Environment Existing Conditions Report, Study Design Services: Highway 7 & 8 from Stratford to New Hamburg G.W.P. 13-00-00.* Report on file with the Ministry of Transportation Southwestern Region.

H. Belden & Co.

1879 *Illustrated Historical Atlas of Perth County*. Reprint Edition.

H. Parsell & Co.

1881 *Illustrated Historical Atlas of Waterloo County.* Reprint Edition.

Hayes, Geoffrey

1997 *Waterloo County: An Illustrated History*. Waterloo: Waterloo Historical Society.

Hoffman, D.W. and N.R. Richards

1952 *Soil Survey of Perth County. Report No.15 of the Ontario Soil Survey*. Canada Department of Agriculture and the Ontario Agricultural College.

Hurley, W. and R. Field Jr.

1969 *Archaeological Research in Southwestern Ontario*. Report on file with the Ministry of Culture, Toronto and the Regional Municipality of Waterloo.

Johnston, William

1902 [1976]*History of Perth County 1825-1902.* Reprint Edition. Stratford: Beacon Herald Fine Printing Division.

Kearsley, Anthony L.

1962 *Paths of History in Huron and Perth*. Stratford: British Mortgage and Trust Company.

Lennox, Paul

1981 *Report on the Archaeological Survey of Areas Potentially Affected by the Proposed Widening and partial Realignment of Highway 7/8, Stratford to New Hamburg. W.P. #62-72-00 W.O. #80-33-002.* Report on file with the Ministry of Culture, Toronto.

MacDonald, John

1988a *Past Archaeological Research in the Regional Municipality of Waterloo.* Waterloo: Regional Municipality of Waterloo.

1988b *Cultural Implications of the Physiography of the Regional Municipality of Waterloo.* Waterloo: Regional Municipality of Waterloo.

McNichol, Vera Ernst

1967 *Reveries of a Pioneer*. Kitchener: Dixon Press Limited.

Ministry of Citizenship, Culture and Recreation (MCCR)

1997 *Conserving a Future for Our Past: Archaeology, Land Use Planning and Development in Ontario – An Educational Primer and Comprehensive Guide for Non-specialists*. Toronto.

Ministry of Culture, Tourism and Recreation (MCTR - now the Ministry of Culture)

Cultural Programs Branch, Archaeology and Heritage Planning

1993 *Archaeological Assessment Technical Guidelines (Stages 1 – 3 Reporting Format)*. Toronto.

Ministry of Transportation and the Ministry of Natural Resources

1992 *A Protocol for Dealing with Archaeological Concerns on Ministry of Transportation Undertakings.* Toronto: The Queen's Printer for Ontario.

Natural Resources Canada

1998 *Stratford, Ontario*. 1:50,000 Scale Topographic Map. Section 40 P/7. Edition 9.

2000 *St. Marys, Ontario*. 1:50,000 Scale Topographic Map. Section 40 P/6. Edition 6.

New Directions Archaeology Ltd.

2003 *Stage 1-2 Archaeological Assessment of the Highway 7/8, New Hamburg, Regional Municipality of Waterloo*. Report on file with the Ministry of Culture, Toronto.

2004a *Stage 1 Archaeological Assessment of Highway 7/8, Stratford to Shakespeare, Perth County (G.W.P. 3508-02-00).* Report on file with the Ministry of Culture, Toronto.

2004b *Archaeological Assessment of Highway 7/8, Stratford to Shakespeare, Perth County (G.W.P. 3508-02-00).* Report on file with the Ministry of Culture, Toronto.

Ontario Department of Mines and Northern Affairs

1972 *Physiography of the Southwest Portion of Southern Ontario Map 2225*. Ontario

Rotary Club of Tavistock
1967 *Fact & Fantasy: A History of Tavistock & District*. Centennial Book Committee: Tavistock.

URS Corp.
2005 *Highway 7 & 8 Study Design – Greater New Stratford to New Hamburg Area*. Report on file with the Ministry of Transportation, Southwestern Region.

Wagner, N.E.
1975 *Nith River Survey Report (Survey 1974), Manuscript No. 1062*. National Museum of Canada, Ottawa.

Walker & Miles
1876 *Illustrated Historical Atlas of Oxford County.* Reprint Edition.

Wicklund, R.E., and N.R. Richards
1961 *Soil Survey of Oxford County. Report No.28 of the Ontario Soil Survey*. Canada Department of Agriculture and the Ontario Agricultural College.

Wilmot Historical Committee
1968 *More Than A Century in Wilmot Township*. Wilmot Township: New Hamburg – Wilmot Township Centennial Committee.