Canada-United States-Ontario-Michigan
Border Transportation Partnership

Environmental Overview Paper – Canadian Existing Conditions Volume 1

Social, Economic, Archaeological, Cultural Heritage, Acoustics and Vibration, Air Quality, Waste and Waste Management and Technical Considerations

June 2005

Introduction

For the purposes of discussion, review and comment the individual Working Papers documenting the secondary source data collection process for the Preliminary Analysis Area (PAA) have been compiled into this Environmental Overview Paper (EOP June 2005).

The Preliminary Analysis Area corresponds to the key plan presented on page 4 of the Ontario Environmental Terms of Reference, May 2004. The PAA has been developed in order to provided a bounded area for proposes of analysis. Further details on the PAA are also available in Section 1.0 of this document.

This Environmental Overview Paper is comprised of two Volumes. Volume 1 contains the Social, Economic, Archaeological, Cultural Heritage, Acoustic and Vibration, Air Quality, Waste and Waste Management and Technical Considerations existing conditions information, and Volume 2 containts information pertaining to the Natural Environment existing conditions.

The EOP June 2005 documents the focused secondary source data collection process (data collection/sources; study area conditions; feature significance/sensitivity; and identification of data gaps), and provides a snapshot of Preliminary Analysis Area features, opportunities, and constraints. The EOP June 2005 is intended serve as a reference for the use of the project team, public and agencies and ultimately, with updates added during the Detroit River International Crossing Environmental Assessment Process, provide input data to the existing condition component of Environmental Assessment documentation.

Background

The Canada - U.S. – Ontario - Michigan Border Transportation Partnership (The Partnership) is composed of the U.S. Federal Highway Administration and Transport Canada representing the federal levels of government, and the Ontario Ministry of Transportation and the Michigan Department of Transportation representing the provincial/state level. The purpose of the Partnership is to improve the movement of people, goods, and services across the United States/Canadian border within the region of Southeast Michigan and Southwestern Ontario.

The partnership is moving forward with technical and environmental work leading to the selection of a new or expanded border crossing, to address cross-border transportation demands for a 30-year planning period.

The Ontario, Ministry of Transportation (MTO) is leading the Canadian work program in coordination with Transport Canada. The Michigan, Department of Transportation (MDOT), in coordination with the Federal Highways Administration (FHWA), is leading the U.S. work program.

This international transportation improvement project will require approvals from governments on both sides of the border. The Partnership has developed a coordinated process that will enable the joint selection of a recommended river crossing location that meets the requirements of *Ontario Environmental Assessment Act* (OEA), *Canadian Environmental Assessment Act* (CEAA), and *National Environmental Policy Act* (NEPA).

The goal of the partnership is to:

- obtain government approval for a new or expanded crossing with connections to the provincial highway system in Ontario and the interstate freeway system in Michigan, including provisions for processing plazas to improve traffic and trade movements at the Windsor-Detroit border;
- completion of comprehensive engineering to support approvals, property acquisition, design and construction; and,
- submit environmental assessment documents for approval by December 2007.

The Partnership completed a *Planning/Need and Feasibility Study* (P/NF) in January 2004 to address cross-border transportation demands for a 30-year planning period. Included in the documentation for that study was an Environmental Overview Report (as Amended January 2005) which provided an inventory of the existing condition in a Focused Analysis Area. Subsequently, in accordance with the *Ontario Environmental Assessment Act,* MTO prepared and submitted in May 2004 an environmental assessment Terms of Reference to the Ontario Ministry of the Environment for review and approval. The Terms of Reference was approved by the Ontario Minister of the Environment on September 17, 2004. The Terms of Reference outlines the framework that MTO and Transport Canada will follow in completing the Detroit River International Crossing Environmental Assessment (DRIC EA).

As an initial step in the DRIC EA process and to build upon the work completed during the preparation of the Environmental Overview Report (as Amended January 2005), further in-depth secondary source data collection has been conducted. This work has been focused within the Preliminary Analysis Area (PAA) identified in the Environmental Overview Report (as Amended January 2005). The noted data collection effort has been documented in a series of Working Papers. Working Papers have been prepared for the following topics: social impact assessment; economic assessment; archaeological resources; cultural resources; natural heritage; acoustics and vibration; air quality; waste and waste management; and technical considerations.

The purpose of the Working Papers was to document the secondary source data collection process carried out by: describing the data collection/sources used; providing an overview of study area conditions; identifying the significance/sensitivity of features in the study area; identifying gaps in study area data, and to develope Work Plans.

The Work Plans were developed to: fill identified gaps in data; provide a scope for future work requirements; provide a rationale for data collection methodologies, data sources and methods of assessment; provide criteria, indicators and measures; provide consultation strategies; and integrate the work plans of other environmental factors/activities.

The Work Plans have been developed based on current knowledge of existing conditions within the PAA and therefore, should be considered to be living documents which will be subject to agency and public review. The partnership is aware that the assessment and evaluation of alternatives at all phases will require applying the requirements of three pieces of legislation, the *OEA, CEAA* and *NEPA*. Therefore, in preparing the Work Plans, the partnership has sought to integrate the most rigorous requirements.

Environmental Overview Paper – Volume 1

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1. ENVIRONMENTAL OVERVIEW PAPER

Transport Canada (TC) and the Ontario Ministry of Transportation (MTO), in partnership with the United States Federal Highway Administration (FHWA) and the Michigan Department of Transportation (MDOT), are conducting a Route Planning, Preliminary Design and Environmental Assessment Study for the Canadian side of a new or expanded Detroit River International Crossing with a connection to a provincial freeway.

The purpose of this document is to establish the existing environmental conditions in the Preliminary Analysis Area (PAA) (Figure 1) that will define the potential social, economic, and environmental constraints which may preclude or otherwise constrain the generation of feasible transportation alternatives. It will describe information and data that have been acquired and will offer a summary review of that information. It should be noted that the information in this document was gathered from secondary sources.

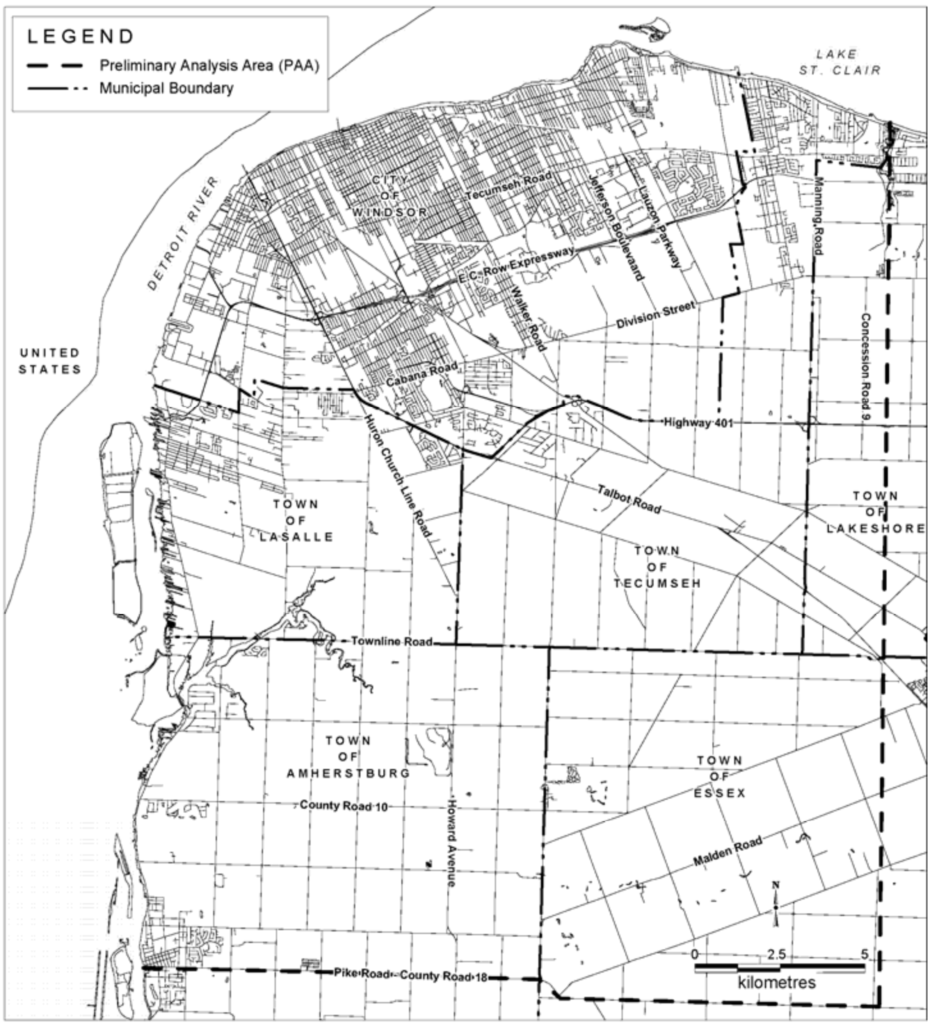


FIGURE 1. KEY PLAN OF THE PRELIMINARY ANALYSIS AREA

The Preliminary Analysis Area referenced to throughout this document corresponds to the key plan presented ont page 4 of the Ontario Environmental Terms of Reference, May 2004. The PAA was developed in order to provide a bounded area for proposes of analysis and is the Study Area for the Detroit River International Crossing, Environmental Assessment Study.

1.1 Social Profile

The social environment of the PAA consists of neighbourhoods, centers of commerce and manufacturing, and residential populations. Potentially adverse effects upon neighbourhoods or communities must be considered. Historical and archaeological sites, parks and recreational areas, museums, libraries, places of worship and cemeteries help define the community, so impacts to them are impacts upon the community itself.

1.2 Economic Analysis

The Windsor Detroit area is one of three major links within a system of highways and trade corridors connecting major urban areas in southwest Ontario to major U.S. centres. A significant amount of trade takes place between Canada and U.S., and the transportation system in southern Ontario plays a key role in facilitating this economic activity. Within Windsor-Detroit, Windsor is by far the smaller of the two urban areas. The Windsor Census Metropolitan Area (CMA) is comprised of the City of Windsor and the Town's of Lakeshore, Amherstburg, Tecumseh, and LaSalle. Windsor represents the major urban area in the CMA with the built up areas of neighbouring Tecumseh and La Salle located along the border. The remainder of the CMA is largely rural with some scattered hamlets and shoreline development. Windsor is strategically located at the end of one highway corridor in Ontario (Highway 401) and the beginning of a much larger system of highways and trade corridors to the U.S. As a result, improving the connection between these two areas could have significant implications for the future.

1.3 Archaeological Resources

The City of Windsor and other local governments in the Windsor area have officially recognized the desire to properly manage archaeological resources, and to ensure that archaeological concerns are addressed during the planning stage of development projects. Effectively managing archaeological resources has become especially important in southern Ontario, where landscape change has been occurring at an ever-increasing rate since 1950. An inventory of previous archaeological research indicates a total of 64 archaeological sites registered in the PAA according to the Ontario Archaeolgical Sites Database. There is a high likely hood of recovery of pre-contact archaeological remains, within the PAA as potable water was the single most important resource necessary for extended human occupation or settlement. Reviews of historical maps to determine the potential for the presence of historical archaeological remains within the PAA indicate that the area was first settled by Europeans in 1701. In keeping with its long standing as a transportation route the Detroit River has been designated as a Canadian and American Heritage River.

1.4 Cultural Heritage Resources

Cultural heritage resources describe both the cultural landscapes and the built heritage resources over 50 years old and above ground. A cultural landscape is perceived as a collection of individual built heritage features and other related features that together form farm complexes, roadscapes and nucleated settlements. Built heritage features are typically individual buildings or structures that may be associated with a variety of human activities, such as historical settlement and patterns of architectural development. Previously identified built heritage features and cultural landscapes within the PAA were researched in conjunction with historial research to identify broad agents or themes of historical change and cultural landscape development in the area. Previously identified heritage resources were then categorized according to their heritage protection status and their inclusion on municipal, provincial and federal inventories and heritage designation lists. The PAA has a long history of Euro-Canadian occupation containing a large number of previously identified heritage areas and properties. This includes numerious aggregate areas of heritage sensitivity, National Historic Sites, properties that have heritage easements placed on them, properties designated under Part IV of the *Ontario Heritage Act*, properties listed on the City of Windsor and Town of Amherstburg heritage inventories, and one bridge listed on the Ontario Heritage Bridge List.

1.5 Acoustics and Vibration

Large transportation projects often generate increases in noise over the ambient level that preceded them. An evaluation of any proposed alternative's impacts upon the population affected will be necessary in order to determine possible and feasible mitigative measures.

1.6 Air Quality

The quality of the air has become an issue of national importance in both Canada and the U.S. In the strictest sense, it is more properly viewed as a health issue than an environmental issue in that the limitations upon certain kinds of materials that the atmosphere may contain are based upon their toxicological concerns or their potential to degrade the atmosphere in ways detrimental to human health or welfare. Areas such as Southwest Ontario and Southeast Michigan are of special concern because the concentrations of people, industries, and transportation have resulted in air quality problems in the past and may do so in the future. The Canadian Air Quality Program is a mix of Canadian and U.S. laws and agreements whose aim is to regulate the source of emissions, promulgate more stringent standards where necessary and improve the monitoring programs. This program includes the Ontario Drive Clean Program, the Ontario Ministry of the Environment Smog Alert Program and Ontario Smog Plan, and various Canada-U.S. bi-national agreements. Special attention has been given to the air quality of the Windsor Detroit area, and numerous air quality studies have been carried out.

1.7 Waste and Waste Management

The City of Windsor is best known as the 'automotive capital' of Canada with General Motors, Ford and Chrysler all having large manufacturing plants in the city. After years of industrialization, the PAA has been left with a legacy of environmental issues related to wastes and disposal issues. Within the PAA, there are several types of waste sources present, including: Federal and Provincial contaminated sites and solid waste landfills, underground storage tanks (UST), landfills (active and closed waste disposal sites), hazardous waste generators, and oil, gas, mineral and disposal wells. Each of these types of waste can be detected in part through a review of their associated databases or inventories. However, waste may also be present on undiscovered sites. In Ontario the test of whether a Site is contaminated is determined by the presence of an adverse effect, which is broadly defined under the Ontario Environmental Protection Act. Owners of properties where an adverse effect has been determined to exist or which has migrated onto adjacent properties must notify the appropriate authority (usually the Ministry of Environment).

1.8 Technical Considerations

The Windsor Detroit area is one of three major links within a system of highways and trade corridors connecting major urban areas in southwest Ontario to major US centres. A critical step during the course of this study is the “development, assessment and evaluation of route alignment and bordering crossing alternatives”, and the overview of Technical Considerations provides a framework by which this step can be conducted. The Technical Considerations Overview involves the engineering and empirical evaluation of several technical disciplines including: engineering considerations, traffic modeling and geotechnical considerations.

2. DESCRIPTION OF THE PRELIMINARY ANALYSIS AREA

The Preliminary Analysis Area (PAA) is centered on the Detroit River and adjacent land areas in Canada and the United States. The Canadian area is roughly bounded by 9th Concession Road in the Town of Lakeshore, County Road 18 in the Town of Amherstburg on its southern extent, and by the Detroit River on its western and northern extent.

The Canadian side of the PAA consists primarily of the urban area of the City of Windsor, the neighbouring Towns of LaSalle, Tecumseh and Amherstburg and a surrounding fringe of rural land uses. It is characterized by both heavily urbanized and intensive agricultural land uses that are interspersed with a patchwork of remnant natural heritage features, including wetlands, prairies, and woodlots.

On the United States side of the Detroit River, the PAA is an intensively developed urban area consisting of intermixed residential, commercial, and industrial areas. There are public parks, playgrounds, recreational areas, public works, schools, cemeteries, and military properties scattered throughout the area.

Underlying both the Canadian and U.S. sides of the Detroit River at a depth of approximately 350 meters (1200 feet) are extensive geological deposits of pure salt. These deposits were mined on the U.S. side from the 1890s to the 1980s. Mining of salt on the Canadian side also began in the 1890s and continues to the present day.

2.1 Brief History of the Preliminary Analysis Area

Canada

The Canadian side of the PAA is a mix of urban and agricultural uses and contains only a small percentage of its original natural features. During the mid to late 1600s, early records of European explorers described the area as characterized by open meadows (prairies), parklands, forest groves, and wetlands along the Detroit River. This diverse habitat exhibited an abundance of wildlife including elk, white tail deer, black bear, wild turkey, passenger pigeons, trumpeter swans and greater prairie chicken. In the early 1700s permanent European colonization began within the PAA on the west bank of the Detroit River with the construction of Fort Ponchartrain. Colonization on the south shore of the Detroit River (Canadian side) ensued in the mid 1700s at what was known as La Petite Cote, where the open terrain was an attraction for farming. Land grants continued into the 19th century and settlers were required to clear the forested land for farming. This requirement continued the alteration of the landscape of the Essex Region.

The arrival of the railroad in the mid 1800s accelerated the urbanization and development of the area. Many wildlife species were extirpated by the end of the century due to loss of habitat and harvest. Extensive loss of natural features continued into the 1900s; over 140,000 acres of forested land were cleared in Essex County by the 1950's. As a result, by the early 1980s approximately 96% of the regional wetlands and 95% of the original forest (Oldham 1983) had been lost.

United States

The City of Detroit dominates the PAA on the United States side. Beginning as a frontier fort over 300 years ago, the city evolved into a regional trade and commerce center. It began to develop heavy industries in the 1870s and became a center of manufacturing. Over the centuries it has been the site of many significant historical events, experienced extensive immigration, and has been the center of many sociological, technological, and economic developments. As a result Detroit, and the portions of adjoining municipalities that make up the PAA, are rich in cultural features of various types and significance.

As this cultural and economic development has progressed, the original natural environment has been extensively modified. Many of the original features such as wetlands, woodlands, wildlife habitat, floodplains, and streams have been very adversely affected or completely obliterated. A growing recognition of the degradation of these resources has led to increasing efforts by the federal, state, and local governments and citizens' groups to protect and rehabilitate those remaining

2.2 Context

The citizens and governments of Canada and the U.S. share many of the same environmental concerns and goals. At the national level, they have designated the Detroit River as a natural resource deserving of the attention and protection of both countries. The objectives of many of their environmental regulatory programs are the same or quite similar in most cases, though the approach and emphasis may differ in some aspects. Some of these differences in approach and emphasis are significant and may present both challenges and opportunities.

The geographical makeup of the PAA is also both similar and different. The Canadian PAA is dominated by a mix of urban and agricultural development. Remaining natural features have been identified or are being identified for protection. The U.S. side consists of an intensely developed urban and industrial area in which few natural features remain, but contains a large number of densely located cultural features.

2.3 Limitations

The information contained in this document was derived from a variety of available secondary sources, including public laws and agency guidelines, public agencies and local units of government, compilations of lists of facilities and features available on the Internet, and books and publications available from the public library. The level of detail available through these sources is deemed appropriate for the purposes of this paper. Those purposes are to identify social, economic, and natural environmental features in the PAA, to identify potential constraints represented by those features, and to assist in the evaluation of any cross border transportation alternatives which may be developed. It is recognized that the information gathered and documented in this overview is not sufficient for identifying and assessing impacts and potential mitigation measures for an environmental assessment/environmental impact study.

3. SOCIAL PROFILE

The socioeconomic cultural environment consists of neighbourhoods, centres of commerce, manufacturing, and residential populations. Potentially adverse effects upon neighbourhoods or communities must be considered. In Canada, parks, recreational areas, and libraries help define the community, so impacts to them are impacts upon the community itself.[1]

The cultural environment consists of places or features that are held to be of special value by society for historical or archaeological reasons. Evaluation of the effects of an alternative upon cultural resources is closely linked to the evaluation of socioeconomic impacts of the alternatives.[2] Potentially adverse effects upon neighbourhoods or communities must be considered.

3.1 Population and Demography

Table 1 lists the population of the Canadian segments of the study area for 1991 and 2001. All three communities experienced growth over the ten year period with higher growth rates experienced in the surrounding Towns of LaSalle and Tecumseh.

TABLE 1. POPULATION IN THE PRELIMINARY ANALYSIS AREA

Population	Windsor	LaSalle	Tecumseh
Population in 2001	208,402	25,285	25,105
Population in 1991	191,435	16,628	10,495
1991 to 2001 population change (%)	9%	23.7%	23.9%

Source: Statistics Canada 2002.

The population is projected to grow moderately over the next twenty years (Table 2). The City of Windsor population has gradually declined since the mid-1990's as the other municipalities have developed. The population in the study area is expected to grow at an average rate of approximately 2 to 2½ %. The exception to this is the Town of LaSalle where the expected rate of growth is projected to be between 2½ and 4% annually. The Town of LaSalle is a rapidly urbanizing municipality.[3]

TABLE 2. FORECASTED POPULATION CHANGES IN THE PRELIMINARY ANALYSIS AREA

Population	Windsor	LaSalle	Tecumseh
Population in 2001	208,402	25,285	25,105
Population in 2020	200,972	32,400	35,259
2001 to 2020 population change (%)	-3.6%	28.1%	40.4%

Source: Statistics Canada 2002.

[1] Canada-United States-Ontario-Michigan Border transportation Partnership Planning/Need and Feasibility Study. Environmental Overview Report. January 2004.
[2] Ibid.
[3] Ibid.

The population characteristics are presented in Table 3 for the three communities. The median age for the City of Windsor is 36 years old, 35 years for the Town of LaSalle and 37 years for the Town of Tecumseh.

TABLE 3. AGE CHARACTERISTICS OF THE POPULATION

Age Characteristics of the Population	Windsor			LaSalle			Tecumseh		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Total - All persons	208,405	101,925	106,475	25,285	12,550	12,730	25,105	12,410	12,690
Age 0-4	13,155	6,810	6,345	1,765	945	820	1,420	725	695
Age 5-14	26,495	13,680	12,810	4,095	2,065	2,025	3,955	2,035	1,920
Age 15-19	12,960	6,555	6,400	1,885	935	945	2,035	1,020	1,015
Age 20-24	15,330	7,600	7,730	1,470	745	725	1,550	810	740
Age 25-44	65,915	33,355	32,560	8,245	3,985	4,255	7,255	3,460	3,790
Age 45-54	26,910	13,220	13,690	3,650	1,800	1,845	4,205	2,055	2,150
Age 55-64	18,305	8,800	9,500	2,190	1,130	1,060	2,385	1,240	1,145
Age 65-74	15,595	7,070	8,530	1,295	665	635	1,435	720	720
Age 75-84	10,645	4,015	6,630	585	245	340	685	280	400
Age 85 and over	3,100	815	2,285	110	30	80	175	60	115
Median age of the population	36.0	34.8	37.2	35.1	34.9	35.3	37.1	36.8	37.4
% of the population ages 15 and over	81.0	79.9	82.0	76.8	76.0	77.6	78.6	77.8	79.4

Source: Statistics Canada, 2002

Tables 4 and Table 5 contain breakdowns of the population by what language is spoken and ethnicity for the three communities.

TABLE 4. LANGUAGE

Language(s) First Learned and Still Understood	Windsor			LaSalle			Tecumseh		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Total - All persons	205,865	101,025	104,840	25,280	12,565	12,710	25,030	12,400	12,630
English only	139,730	68,555	71,195	20,090	9,975	10,110	19,465	9,575	9,885
French only	6,900	3,040	3,855	1,035	525	515	1,245	605	640
Both English and French	1,055	475	575	115	60	50	80	45	30
Other languages	58,180	28,975	29,205	4,045	2,000	2,040	4,245	2,170	2,070

Source: Statistics Canada, 2002

In Table 5, some respondents provided multiple ethnic responses as a result of intermarriage between persons of different ethnic backgrounds. The total responses, provided in the table, indicate the number of persons who reported a specific ethnic origin, either as their only origin or in addition to one or more other ethnic groups.

It should also be noted that the data is available for the Metropolitan Area of Windsor which includes the City of Windsor, the Town of Tecumseh, the Town of LaSalle within the study area and the towns of Amherstburg and Lakeshore outside the study area.

Table 5. Ethnicity for the Metropolitan Area of Windsor

Ethnicity	Windsor
Total population	304,960
Canadian	95,710
French	75,785
English	62,210
Irish	42,645
Scottish	38,545
Italian	30,685
German	24,580
Polish	11,545
Ukrainian	9,195
North American Indian	8,040
Lebanese	6,985
Dutch (Netherlands)	6,815
Hungarian (Magyar)	6,270
Chinese	6,160
East Indian	4,375
Romanian	4,355
American (USA)	3,655
Croatian	3,495
Serbian	3,330
Arab, not included elsewhere	3,220
Filipino	3,035
Welsh	2,860
Slovak	2,700
Greek	2,695
Yugoslav, not included elsewhere	2,680
Iraqi	2,410
Spanish	2,215
African (Black), not included elsewhere	2,160

3.2 Employment and Income

An overview of the employment and income of the three communities in the study area is provided below in Tables 6 and Table 7. Detailed discussion of the economy will be provided in a separate section.

Table 6. Labour Force Indicators

Labour Force Indicators	Windsor	Tecumseh	LaSalle
Participation rate	63.4	71.4	72.1
Employment rate	58.7	68.7	69.5
Unemployment rate	7.5	3.8	3.6

Source: Statistics Canada, 2002

Table 6 shows that participation in the labour force is highest in the Town of LaSalle followed by the Town of Tecumseh consequently, both municipalities experience low unemployment rates, 3.8% and 3.6%, respectively. Comparatively, the Provincial unemployment rate for Ontario was 6.1%. The City of Windsor experiences a slightly lower participation rate and, consequently, a higher unemployment rate. The City of Windsor's 7.5% unemployment rate is slightly higher than the Provincial average.

Table 7. Employment by Industrial Sector

Industrial Sector	Windsor	Tecumseh	LaSalle
Agriculture and other resource-based industries	1,140	230	250
Manufacturing and construction industries	33,920	4,555	4,580
Wholesale and retail trade	13,910	1,815	1,850
Finance and real estate	3,660	715	600
Health and education	15,015	2,460	2,400
Business services	13,600	1,590	1,735
Other services	21,790	2,560	2,485

Source: Statistics Canada, 2002

Approximately 27 percent of employment in Windsor is related to automotive manufacturing machine, tool, die, and mold industry. Its location adjacent to Detroit gives it unique access to the "Big Three" automobile original-equipment manufacturers. Approximately 37,000 jobs in the Windsor/Essex area are in the automotive manufacturing sector. The DaimlerChrysler Canada Auto Assembly Plant, Ford Motor Company Auto Parts Plants, and the Windsor Casino are the three largest employers and together directly provided over 20,000 jobs to the city. The opening of the Windsor Casino in 1995 gave the economy an added boost by increasing tourism from the United States.

Employment in Manufacturing dominates the different employment sectors in the area surrounding the City of Windsor. The presence of skilled labour in the Town of Tecumseh and in the Town of LaSalle keeps the area's industrial sector globally competitive, and supports a diverse employment base. In addition to these industrial pursuits, agriculture will remain one of the area's primary economic sectors. Unless the Official Plan is amended, the amount of land designated for urban purposes will remain unchanged until

2016. A majority of agricultural land will be protected from urban development and will be designated and available for agricultural use or for the conservation and rehabilitation of remaining natural heritage features.[4]

3.3 Households

Data for household and family characteristics are provided in Tables 8 and Table 9 for the Canadian study area.

TABLE 8. HOUSEHOLD CHARACTERISTICS

Selected Household Characteristics	Windsor	Tecumseh	LaSalle
Total – All private households	83,825	8,385	8,380
Households containing a couple (married or common-law) with children	22,645	3,775	3,815
Households containing a couple (married or common-law) without children	21,185	2,420	2,615
One-person households	24,890	1,195	1,065
Other household types	15,105	990	880
Median household income(CDN$) – All households	46,949	80,991	81,022
Median household income(CDN$) – One-person households	24,478	34,023	38,325
Median household income(CDN$) – Two-or-more-persons households	60,099	89,675	88,409
Number of rented dwellings(55)	29,480	785	490
Number of owner-occupied dwellings	54,345	7,570	7,865

Source: Statistics Canada, 2002

The median household income is significantly higher in communities outside of the City of Windsor. As is typical of growth outside major urban areas such as Windsor, the Towns of Tecumseh and LaSalle are composed of double income families living in dwellings they have purchased. In constrast, the City of Windsor comprises of a higher degree of couples without children and a higher number of rental dwellings. In part due to the post secondary institutions such as the University of Windsor, 28% of all households are rentals.

The table below provides an overview of family characteristics as provided by Statistics Canada.

[4] Canada-United States-Ontario-Michigan Border transportation Partnership Planning/Need and Feasibility Study. Environmental Overview Report. January 2004.

TABLE 9. FAMILY CHARACTERISTICS

Family Characteristics	Windsor	Tecumseh	LaSalle
Total number of families	57,085	7,240	7,310
Number of married-couple families	40,370	6,085	6,180
Average number of persons in married-couple families	3.1	3.3	3.3
Number of common-law couple families	5,385	360	410
Average number of persons in common-law-couple families	2.7	2.6	2.8
Number of lone-parent families	11,330	795	720
Average number of persons in lone-parent families	2.5	2.6	2.7
Number of female lone-parent families	9,590	640	610
Average number of persons in female lone-parent families	2.5	2.6	2.7
Number of male lone-parent families	1,740	155	105
Average number of persons in male lone-parent families	2.4	2.6	2.6

Source: Statistics Canada, 2002

3.4 Local Government and Planning

The study area comprises of an upper-tier and lower-tier municipal structure, namely County of Essex and the three municipalities of Windsor, Tecumseh and LaSalle. The Corporation of the County of Essex is comprised of the seven newly restructured municipalities. These municipalities include LaSalle, Tecumseh, Lakeshore, Amherstburg, Essex, Kingsville, and Leamington. As an upper-tier municipality, the County of Essex is responsible for providing services that are common to all municipalities in Essex County thereby avoiding the need for duplicate services and administration. These services include Transportation Services, Libraries, Homes for the Aged, Planning Services, Emergency Management Coordination, Community Services, Land Ambulance and General Government Administration. As well, the County is a funding partner for regional services including: Social Services, Child Care, Social Housing, Public Health, Economic Development, Tourism and Property Assessment.[5]

The City of Windsor is responsible for providing long-range land use planning and policy development, environmental management, recreation, transit and other services (police, fire) for the City. The Official Plan for the City of Windsor provides the policy framework to guide and manage growth within the City.[6] Similarly, the Towns of Tecumseh[7] and

[5] www.countyofessex.on.ca
[6] www.citywindsor.ca
[7] www.town.tecumseh.on.ca

LaSalle[8] will be responsible for long-range land use planning and other services. Each municipality will have an Official Plan to help guide and manage growth. Planning staff from the municipalities will collaborate with the upper-tier planning staff at the County of Essex to ensure future growth is well managed and in compliance with provincial legislation.

3.5 Cultural

3.5.1 Historical and Archaeological Sites

Historic and archaeological sites are protected by a system of overlapping and interlocking statutes and the agencies that administer those statutes. The Ontario Heritage Act assigns responsibility for the stewardship of such sites to the Ministry of Culture. However, depending upon the nature of the proposed development and the nature of the site potentially affected by it, other federal and provincial agencies may become involved in the evaluation of the acceptability of the proposed project. Likewise, depending upon the nature of the project and site, various federal and provincial statutes come into play and interactively carry out the evaluation process. In the case of transportation projects, heritage assessments are undertaken as required by the Ontario Environmental Assessment Act. If clearance is granted, it is granted by the Ministry of the Environment acting with the concurrence of the Ministry of Culture. If the potentially affected site is under federal jurisdiction as set forth in the Historic Sites and Monuments Act, the Department of Canadian Heritage becomes involved with the process in an advisory role. Lastly, if the project involves a federal initiative, federal funding, land under federal jurisdiction, navigable waters, and/or impacts to fish habitat, clearance is required from the Canadian Environmental Assessment Agency.

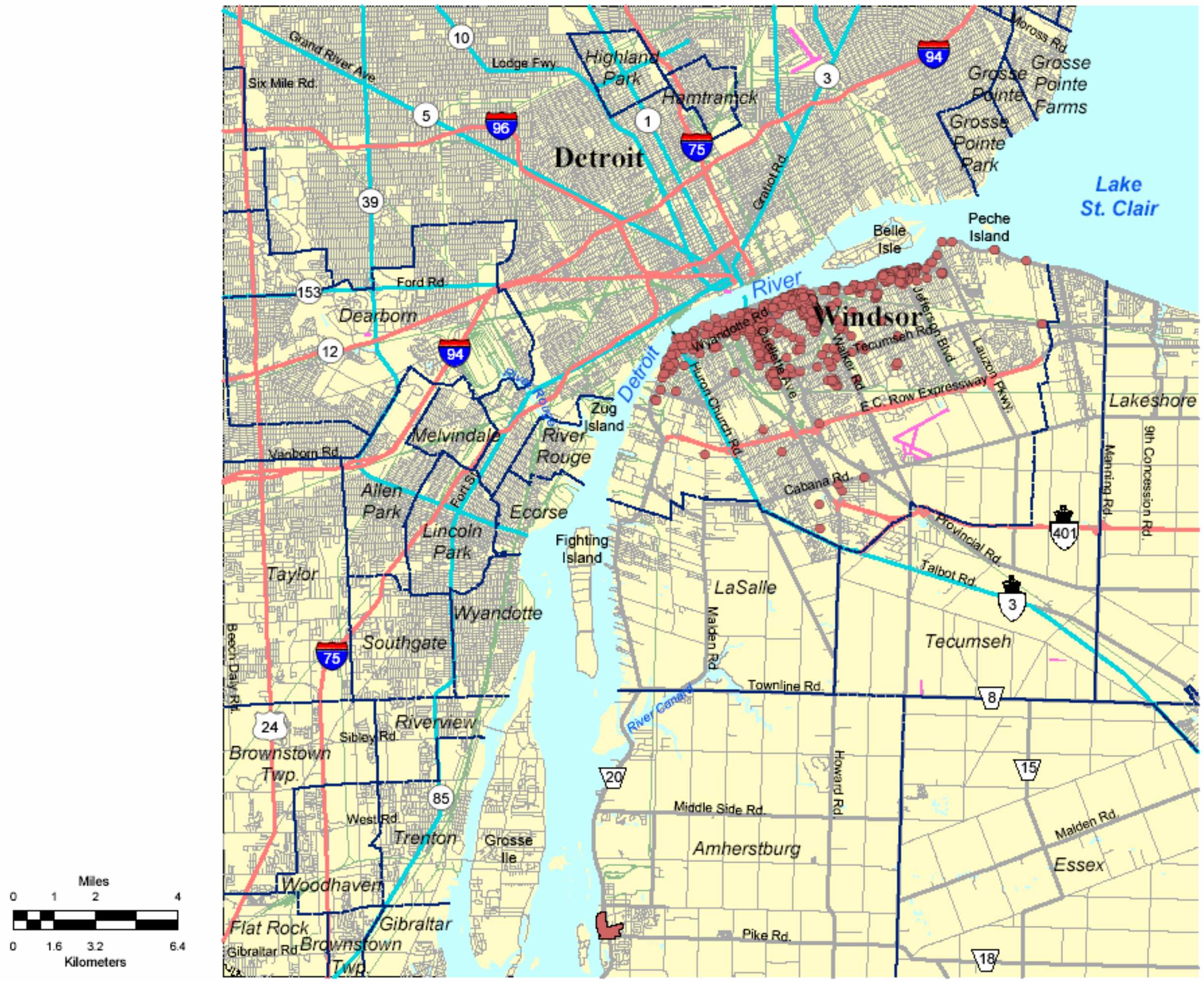
Historic sites are typically structures that are important as representative or unique to their time, geographical locations where important events have taken place or which are associated with historically prominent people. Designated historic sites in the PAA are depicted in Figure 2. Further details on the Archaeological and Cultural Heritage Resources are provided in Section 5 and Section 6 respectively.

Archaeological sites are associated with the recovery and/or study of artefacts that provide information about the people that have occupied the land before its present occupants. Because archaeological sites are particularly vulnerable to vandalism and theft, they cannot by law be depicted in this report. There is a potential for more archaeological finds as new development occurs. Since areas along the Detroit River contain an especially high potential for such finds the undisturbed areas in the Canadian side of the PAA must be considered to have such potential.

3.5.2 Parks/Recreational Areas

Parks and recreational areas are generally considered a social feature in Canada. However, because they are included in the broader definition of cultural features that is utilized by the U.S., they are included here for purposes of continuity, clarity and simplicity

[8] www.town.lasalle.on.ca



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Registered Historical Sites

FIGURE 2

of discussion. There are no National Parks within the PAA. However, located within the City of Windsor and the Town of LaSalle is the Ojibway Prairie Provincial Prairie Reserve, which was regulated under the Provincial Parks Act in 1977 (OMNR 2002). Recently the Ojibway Prairie Park Management Plan was published, which sets out the park management directives for the next twenty years.

As outlined in the Official Plans for the City of Windsor and the Town of LaSalle, there are also numerous parks and Open Space Features that provide recreational opportunities for the public. Municipal parks of note include the Ojibway Park, located immediately adjacent to the Ojibway Prairie Park, and the Black Oak Heritage Park. These parks are associated with lands described as Environmentally Sensitive Areas (ESAs) or Areas of Natural or Scientific Interest (ANSIs).

There are several local parks, playgrounds, and recreation areas located in the study area that are within the jurisdictions of the local municipalities. Two Conservation Areas (CA) in the jurisdiction of Essex Region Conservation Authority (ERCA) are located within the PAA; Devonwood in the City of Windsor and McAuliffe Woods in Tecumseh. These conservation areas are principally for pedestrian use on trail networks, with the natural heritage features serving as the attraction. The Devonwood CA is associated with the Devonwood ESA.

Parks and Recreation areas are presented in Figure 3.

3.5.3 Museums, Zoos, and Aquariums

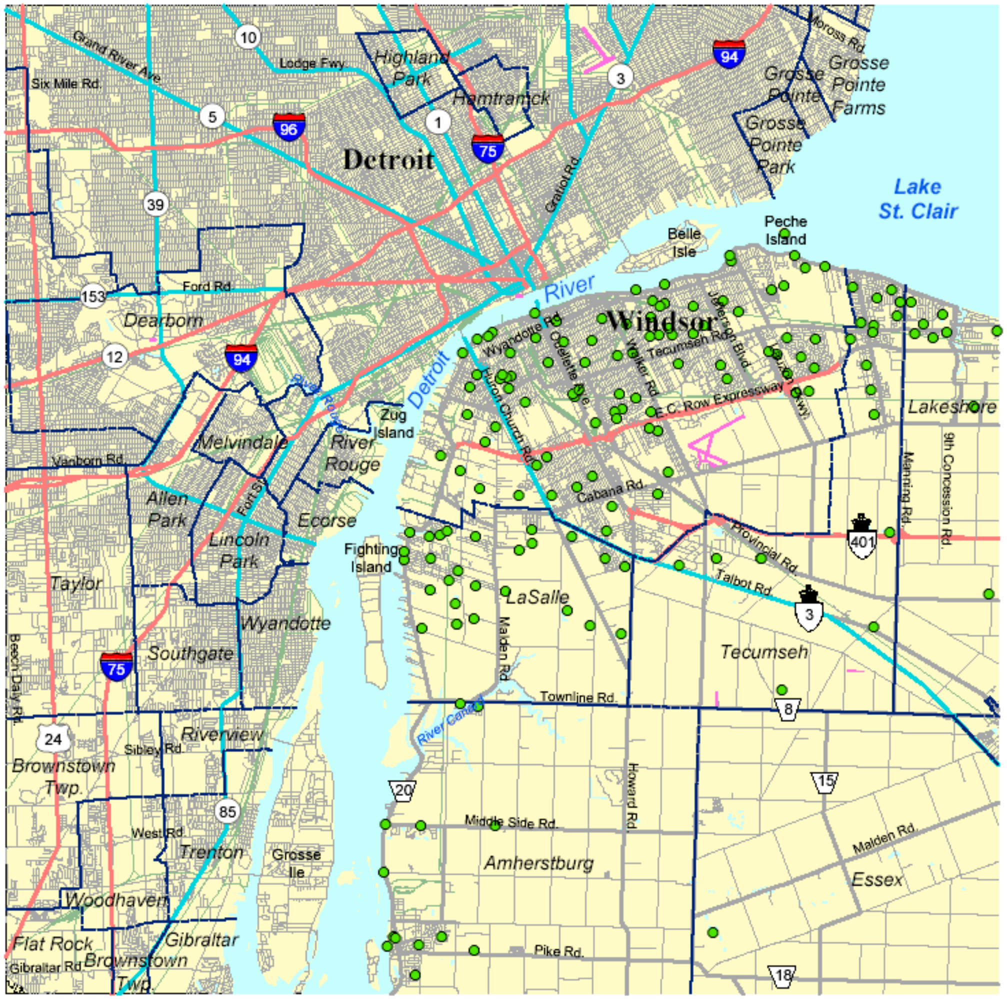
There are no zoos or aquariums on the Ontario side of the PAA, however there are museums on the Ontario side of the PAA. There is no legislation specifically directed at the protection or preservation of museums. The location of zoos, aquariums and museums are depicted in Figure 4.

3.5.4 Public Libraries

There are 16 public libraries in the PAA. One each is located in the Town of Tecumseh and the Town of Amherstburg while the balance is located in the City of Windsor. There are no policies or statutes that specifically protect libraries in the PAA. Libraries are depicted in Figure 5.

3.5.5 Churches, Mosques, Synagogues

The PAA supports a diverse community of faiths. Houses or places of worship often also function as social, recreational or cultural centers and often they are the anchors of community cohesiveness for the neighbourhood. While these factors may be intangible, they are nonetheless real, and often carry with them large emotional attachments by the community they serve. Any alternative proposing the use of such a facility must carefully assess its function in, and ties to, the community. Churches, mosques and synagogues are depicted in Figure 6.



Miles 0 1 2 4
0 1.6 3.2 6.4 Kilometers

N

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Parks/Recreation Areas

FIGURE 3

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Museums, Zoos and Aquariums

FIGURE 4

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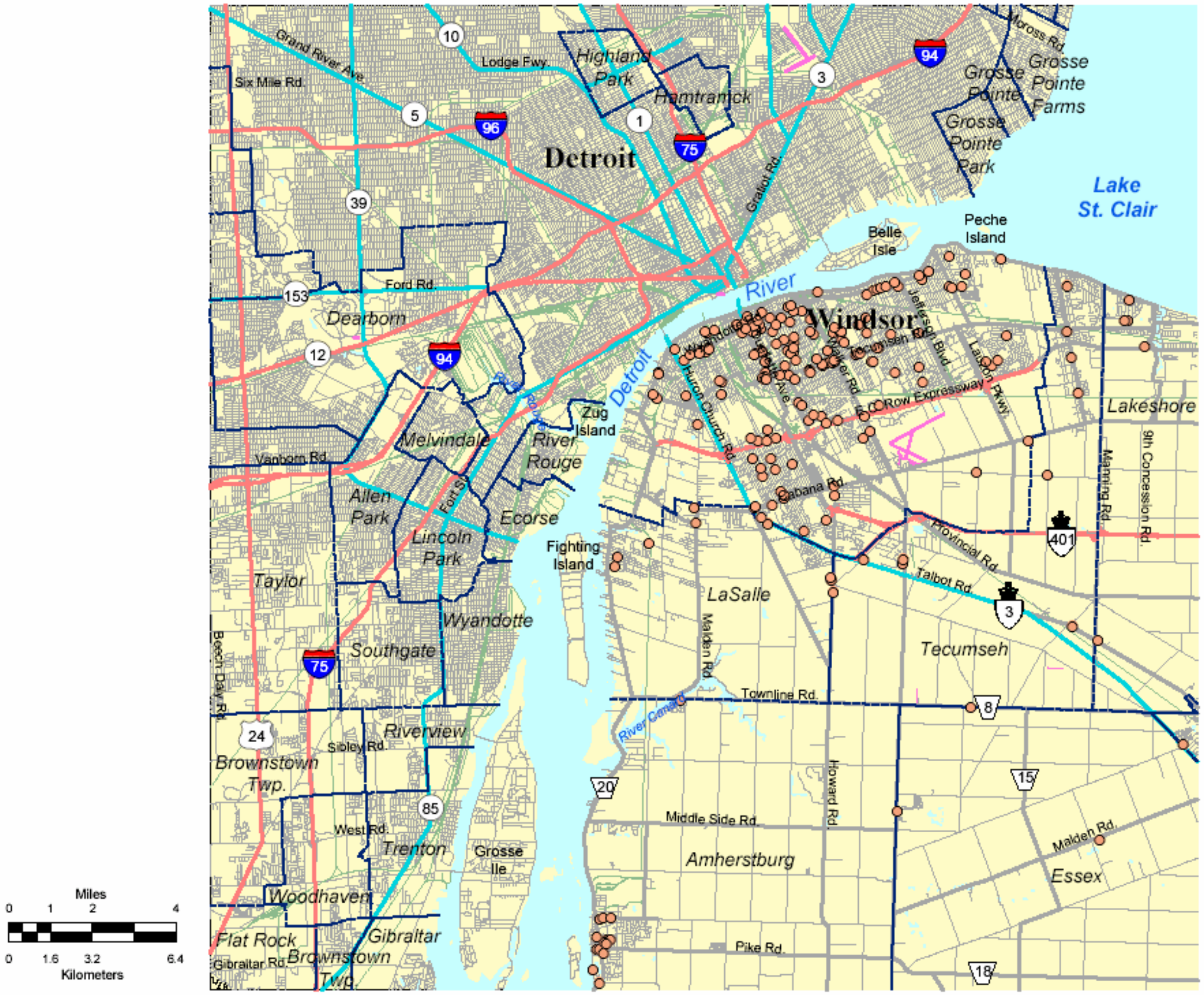
Public Libraries

FIGURE 5

5.4



N	Environmental Overview Paper - Canadian Existing Conditions Volume 1 Detroit River Crossing Study	**Churches, Mosques, Synagogues**	FIGURE 6

3.5.6 Cemeteries

There are over 20 cemeteries in the PAA. Because of their function, there is often a special attachment to them by the communities they serve. In addition to these intangible, powerful emotional attachments, the Cemeteries Act confers jurisdiction for the evaluation of projects that will have an impact upon human remains upon the Cemeteries Registrar of the Ministry of Consumer and Business Services. If the human remains are located on a heritage site, the Ontario Heritage Act will also apply, although jurisdiction remains with the Cemeteries Registrar. In the case of projects involving federal initiatives or funding, the Canadian Environmental Assessment Act will also apply. Proposed impacts upon cemeteries by any alternatives that are developed will, therefore, require careful evaluation and consideration. Several levels of archaeological study of any cemetery potentially impacted by any proposed alternatives may be required; the degree of study and analysis is directly related to the certainty and nature of the potential impacts. Levels of archaeological study range from a records search to test excavation and mitigation measures such as salvage and documentation, or removal of remains for re-interment elsewhere. In general, cemeteries should be avoided by transportation projects. Cemeteries are depicted in Figure 7.

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Cemeteries

FIGURE 7

4. ECONOMIC ANALYSIS

In January 2004, the Canada -US-Ontario-Michigan Border Transportation Partnership prepared a Planning/Need and feasibility (P/NF) report setting out a long-term strategy to meet the needs of the transportation network within the region of southeast Michigan and southwest Ontario. A key element of the recommended strategy is a new or expanded Detroit River International Crossing with a connection to Highway 401 in Windsor. In January 2005, an Environmental Assessment process was initiated for more detailed planning, route selection and preliminary design of this connection. The analysis will be undertaken in two phases:

- Phase I consists of an overview of the existing economic base, urban structure and growth outlook in the study area; and,
- Phase II consists of a detailed analysis of the economic and business impacts of each route, including an examination of the social and economic fabric of the neighbourhoods.

The focus of the analysis is on local economic impacts. There will be regional economic impacts that relate to reducing the cost of congestion but it is difficult to assign these impacts to any particular person or location. Improving transportation is primarily a benefit to society and the enhancement of the role of Windsor-Essex within southern Ontario.

The analysis will consider three main factors:

- The future outlook. A key consideration in determining local economic impact is the effect that a major transportation investment could have on future growth. If the improved capacity results in more rapid growth than is currently anticipated there will be economic impacts related to new jobs and people, the provision of services and property assessment and other land use planning considerations.
- Urban structure. Major highway corridors can be highly influential in directing the location of urban growth and economic activity. Plans are currently in place to accommodate growth in Windsor for about 20 years. If the planned urban structure is changed this would have economic impacts in terms of land use designations, inefficient use of existing investments and additional infrastructure investment to accommodate growth in new locations
- Real estate in the corridor. There will be economic impacts associated with demand for services related to the construction of the facility, the displacement of people and jobs, changes in property values and long term changes in access patterns.

This section provides an overview of the existing conditions in the study area.

4.1 How Will Future Growth be Affected?

4.1.1 Windsor Detroit is a Key Link in a Larger Economic System

As illustrated on the map on the following page, the Windsor Detroit area is one of three major links within a system of highways and trade corridors connecting major urban areas in southwest Ontario to major US centres. As noted in the PNF study, a significant amount of trade takes place between Canada and United States, and the transportation system in southern Ontario plays a key role in facilitating this economic activity. Major connections to the US served by the Windsor Detroit crossing include:

- I-94, which provides access to Chicago and the upper mid west, Western Canada and other parts of the USA;
- I-75 and I-69, which are major auto and manufacturing corridors providing access to Ohio, Indiana, Kentucky, Tennessee, Alabama and to major Mexican manufacturing centres; and
- I-77 and I-79, which provide access to manufacturing in Pittsburgh and Ohio and other southern locations.

Within Windsor-Detroit, Windsor is by far the smaller of the two urban areas. The Windsor Census Metropolitan Area (CMA) is comprised of the City of Windsor and the Town's of Lakeshore, Amherstburg, Tecumseh, and LaSalle. Windsor represents the major urban area in the CMA with the built up areas of neighbouring Tecumseh and La Salle located along the border. The remainder of the CMA is largely rural with some scattered hamlets and shoreline development. Currently the Windsor Census Metropolitan Area (CMA) has a population of about 330,000. This is much smaller than the 5.4 million residents within the Detroit Primary Metropolitan Statistical Area (PMSA). Within the PMSA, Wayne County contains the core urban area within which the City of Detroit is located. The difference in size between Windsor and Detroit is clearly evident in Figure 8, following the transportation system. Because Windsor is relatively small, a major infrastructure investment could have a major economic impact. Windsor is strategically located at the end of one highway corridor in Ontario (Highway 401) and the beginning of a much larger system of highways and trade corridors to the United States. As a result, improving the connection between these two areas could have significant implications for the future economic prospects and growth (Figure 9).

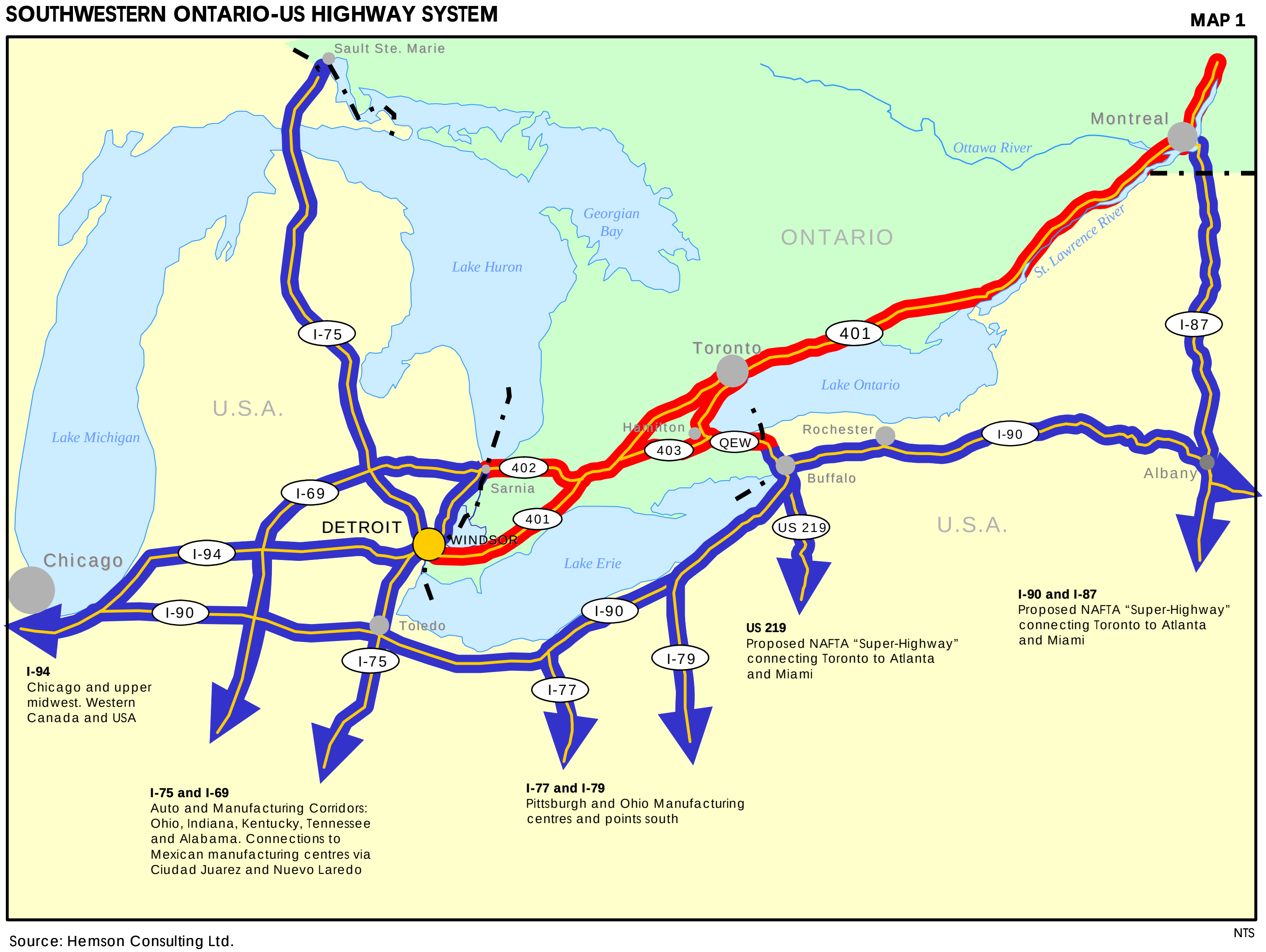

FIGURE 8. SOUTHWESTERN ONTARIO – U.S. HIGHWAY SYSTEM

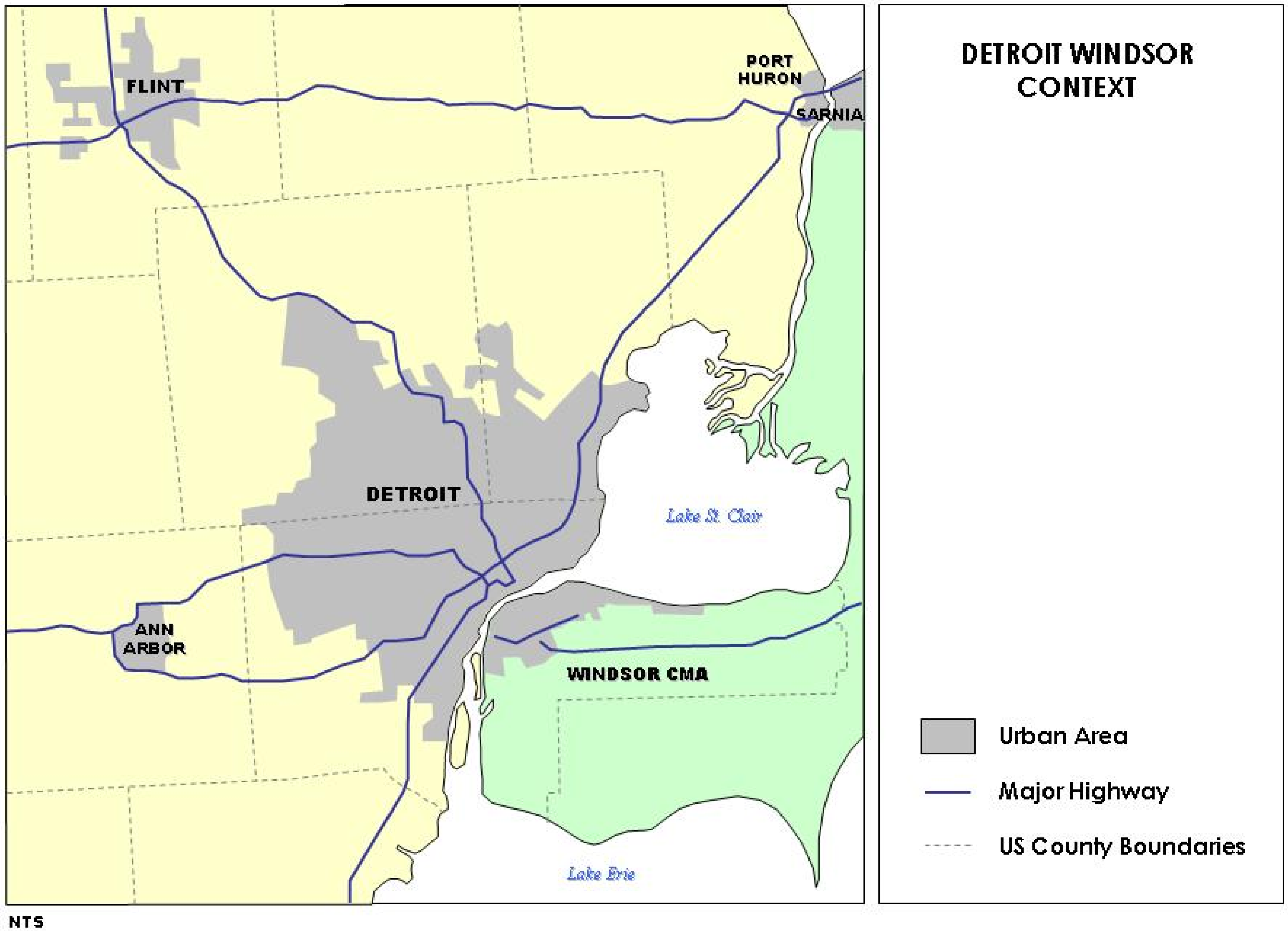

FIGURE 9. DETROIT WINDSOR CONTEXT

4.1.2 Windsor is Smaller than Detroit, But Growing

Overall, the population the Detroit PMSA has remained stable at about 4.5 million since 1970. Wayne County, however, which contains the core urban area, has experienced a steady decline in population, from 2.7 million in 1970 to just less than 2 million in 2003. By comparison the Windsor CMA has grown steadily over the past 30 years adding over 125,000 people, as shown in Figure 10.

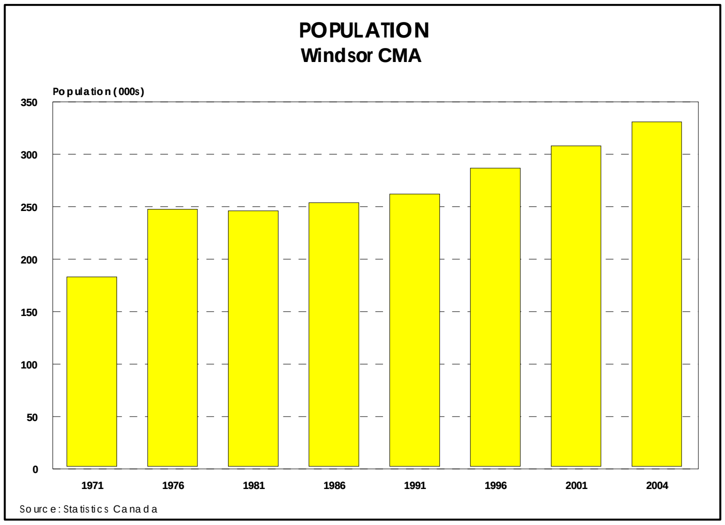

FIGURE 10. POPULATION OF WINDSOR CMA SINCE 1978.

A similar situation is observed with employment. Since 1987, over 30,000 jobs have been added with most of the gains occurring over the last 6 years (Figure 11).

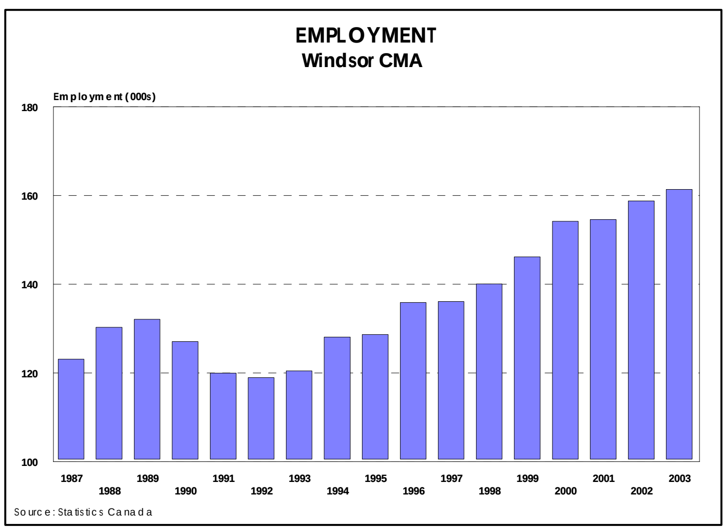

FIGURE 11. EMPLOYMENT IN WINDSOR CMA SINCE 1978.

4.1.3 Building Activity Has Been Strong

Despite some cyclical variations new construction has been strong (Figure 12). Rapid population growth in the 1970s was accompanied by significant housing construction and then halted abruptly by a deep downturn at the start of the 1980s. The remainder of the 1980s and 1990s was characterized by steady growth in new permits.

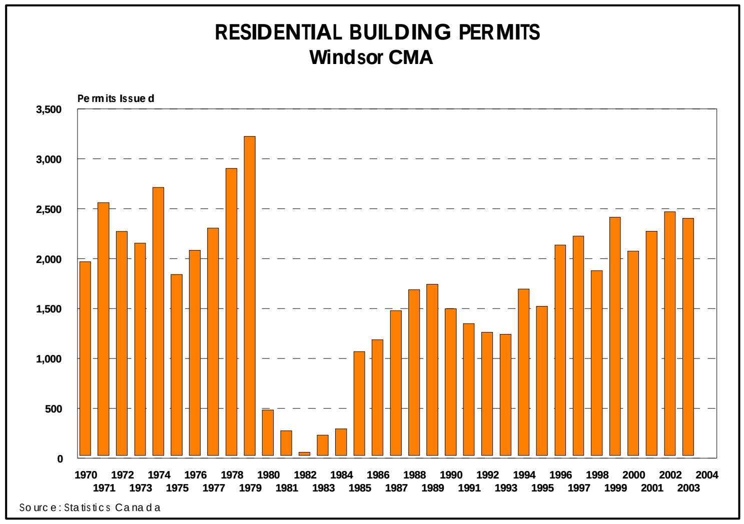

FIGURE 12. RESIDENTIAL BUILDING PERMITS IN WINDSOR CMA SINCE 1970.

In the industrial commercial sector the recession of the early 1980s was followed by more moderate levels of new permit activity. It is only since the 1990s that new construction and investment returned to levels observed in the late 1970s. The peak in 1997 is the Windsor Casino investment, as shown in Figure 13.

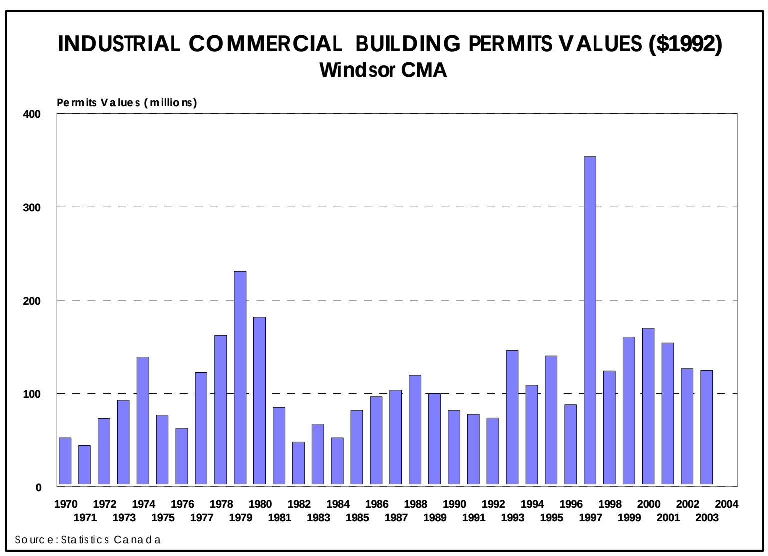

FIGURE 13. INDUSTRIAL COMMERCIAL BUILDING PERMIT VALUES IN WINDSOR CMA SINCE 1970.

4.1.4 Economic Base is Concentrated in the Automotive Sector

Considering the importance of the automotive sector in the Canadian economy, the concentration of vehicle and parts manufacturing in Ontario and Windsor's key location in the broader transportation system it seems logical that Windsor's economic base would also be focussed in the automotive sector.

- The automotive sector is a major contributor to Windsor's manufacturing base. All three of the North American automakers produce cars and car components in Windsor. DaimlerChrysler produces 5 different vehicles models in Windsor, accounting for 12% of the vehicles manufactured in Canada (Figure 14).

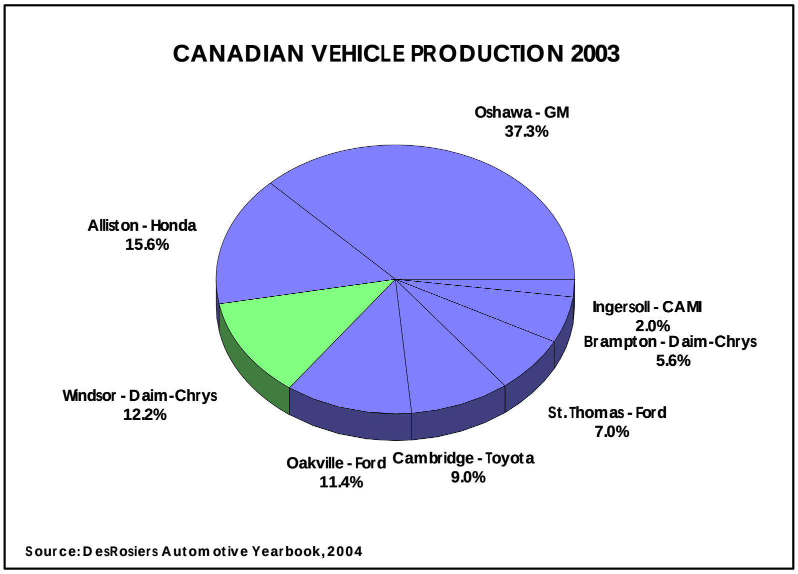

FIGURE 14. CANADIAN VEHICLE PRODUCTION IN 2003.

- Over 300,000 vehicles were produced by DaimlerChrysler at its Windsor plants in 2003. Ford has an engine plant and a test track while General Motors has an engine plant in Windsor among a wide range of other automotive manufacturing activities.
- In addition to production Windsor is home to the DaimlerChrysler Canadian headquarters and its Automotive Research and Development Centre. Together the 3 major North American automakers employ approximately 14,000 people in Windsor, almost 10% of the workforce. In total there are 80 companies involved in automotive parts and assembly in the City of Windsor.
- As a result of the focus on the automotive sector, Windsor has a long history as a manufacturing based economy. In 2004 manufacturing accounted for 46,000 employees and 28 per cent of total employment (Figure 15).

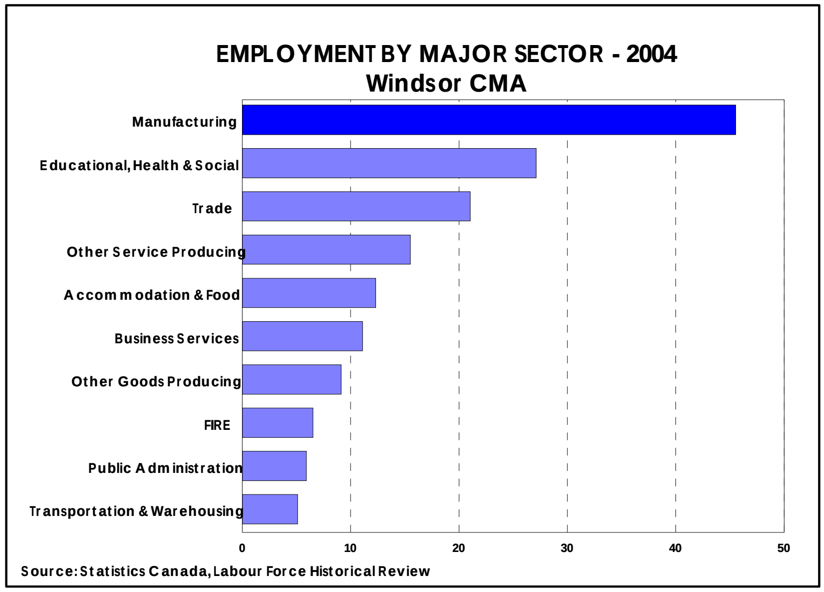

FIGURE 15. EMPLOYMENT BY MAJOR SECTOR IN 2004 IN WINDSOR CMA.

- The focus of Windsor's economic base on manufacturing is clear when compared to Ontario. Manufacturing is also the largest component of employment in Ontario, but there is a greater diversity in other service-providing sectors, as shown in Figure 16.

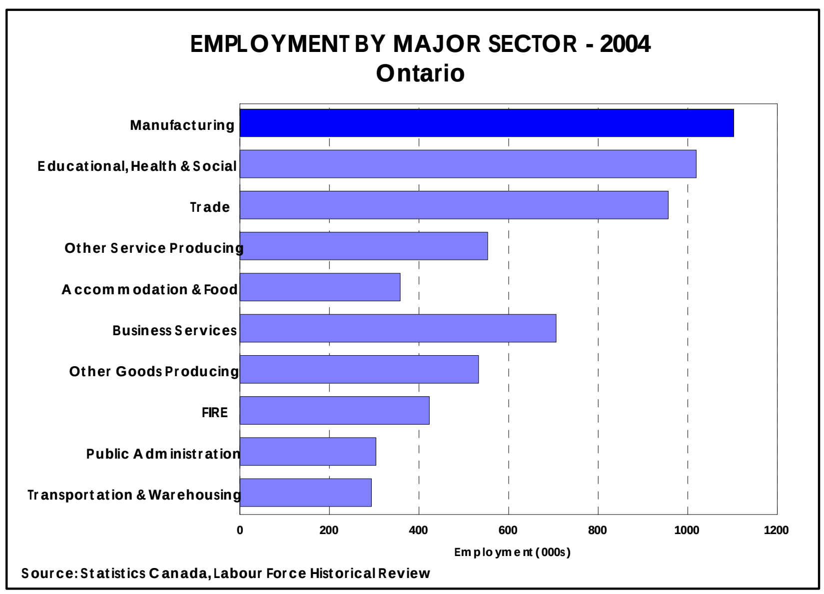

FIGURE 16. EMPLOYMENT BY MAJOR SECTOR IN 2004 IN ONTARIO.

5. ARCHAEOLOGICAL ASSESSMENT

5.1 Background Research

5.1.1 Previous Archaeological Research

In order that an inventory of archaeological resources could be compiled for the study area, three sources of information were consulted: the site record forms for registered sites housed at the Ontario Ministry of Culture; published and unpublished documentary sources; and in house archaeological files.

In Ontario, information concerning archaeological sites is stored in the Ontario Archaeological Sites Database (O.A.S.D.) maintained by the Ontario Ministry of Culture. This database contains archaeological sites registered within the Borden system. Under the Borden system, Canada has been divided into grid blocks based on latitude and longitude. A Borden block is approximately 13 kilometres east to west, and approximately 18.5 kilometres north to south. Each Borden block is referenced by a four-letter designator, and sites within a block are numbered sequentially as they are found. The study area under review is located in the Borden blocks AbHa, AbHr, AaHs, and AaHr.

According to the O.A.S.D., a total of 64 sites have been registered within the Preliminary Analysis Area. Table 10 summarizes the sites.

TABLE 10: REGISTERED SITES LOCATED WITHIN THE PRELIMINARY ANALYSIS AREA

Borden #	Site Name	Cultural/Affiliation	Site Type	Researcher
AaHr-5	Costa	Undetermined Pre-contact	Campsite	P. Reid, 1979, K. Walstedt, 1980
AaHr-6	Coutts	Archaic	Campsite	P. Reid (no recorded date)
AaHs-4	King's Shipyard	Historic Euro-Canadian	Wharf	J. Dewhirst
AaHs-5	Shaw	Archaic	Campsite	P. Reid, 1979
AaHs-6	Dime	Archaic Woodland	Campsite Village	P. Reid, 1979
AaHs-7	Bondy 1	Archaic	Campsite	P. Reid, 1979
AaHs-8	Bondy 2	Archaic	Campsite	P. Reid
AaHs-10	Stratichuck	Unknown	Unknown	P. Reid, 1979
AaHs-11	Mathew Elliot Estate	Historic Euro-Canadian	Home	K. Walstedt & L. Kroon, 1979, D.C. Carey, 1979 & 1980
AaHs-12	Fort Malen	Historic Euro-Canadian	Fort	W.A. Fox (no recorded date)
AaHs-19	Duff 1	Woodland	Campsite	W.A. Fox, 1980
AaHs-20	Duff 2	Woodland (Younge Phase)	Campsite	W.A. Fox, 1980
AaHs-21	Allied Chemicals 1	Undetermined Pre-contact	Isolated Find	MIA, 1980
AaHs-22	Allied Chemicals 2	Undetermined Pre-contact	Isolated Find	MIA, 1980
AaHs-23	Allied Chemicals 3	Historic Euro-Canadian	Deposits of domestic material	MIA, 1980

Borden #	Site Name	Cultural/Affiliation	Site Type	Researcher
AaHs-24	Allied Chemicals 4	Undetermined Pre-contact	Isolated Find	MIA, 1980
AaHs-25	Allied Chemicals 5	Undetermined Pre-contact	Isolated Find	MIA, 1980
AaHs-26	Allied Chemicals 6	Undetermined Pre-contact	Isolated Find	MIA, 1980
AaHs-27	Price	Archaic	Campsite	D.C. Carey, 1980
AaHs-28	E. Butt	Middle-Late Woodland Historic Euro-Canadian	Campsite Home	P.A. Lennox, 1985
AaHs-29	Henderson	Middle-Late Woodland, Early Archaic Historic Euro-Canadian	Campsite Deposits of domestic material	P.A Lennox, 1985
AaHs-30	Gordon House	Late Woodland (Glen Meyer) Historic Euro-Canadian	Unknown Home	MPP, 1987
AaHs-31	St. Jean Baptiste Cemetery	Historic Pioneer	Cemetery	MIA, 1980
AaHs-33	Saugeen Cluster	Middle Woodland (Saugeen)	Campsite	W.B. Stewart, 1994 J. Muller, 1995
AaHs-34	Eastern Shore	Late Archaic	Unknown	W.B. Stewart, 1994 J. Muller, 1995
AaHs-35	Duffy	Undetermined Pre-contact	Lithic Scatter	W.B. Stewart, 1994
AaHs-36	F. Bacon	Historic Euro-Canadian	Military Blockhouse	W.B. Stewart, 1994
AaHs-37	M. Teskey	Undetermined Pre-contact	Unknown	W.B Stewart, 1994
AaHs-38	H. Bosveld	Historic Euro-Canadian	Military Blockhouse	W.B. Stewart, 1994
AaHs-39	--	Early Archaic	Unknown	W.B. Stewart, 1994
AaHs-40	Marvin “O”	Late Archaic	Isolated Find	W.B. Stewart, 1994
AaHs-41	G. Rumble	Undetermined Pre-contact	Unknown	W.B. Stewart, 1994
AaHs-42	Underwood	Undetermined Pre-contact	Unknown	W.B. Stewart, 1994
AaHs-43	Arnold	Middle Archaic (Brewerton)	Campsite	W.B. Stewart, 1994
AaHs-44	Fogt	Undetermined Pre-contact	Isolated Find	W.B. Stewart, 1994
AaHs-45	Fisher	Late Archaic	Unknown	W.B. Stewart, 1994
AaHs-46	Molner	Late Archaic. Late Woodlate Historic Euro-Canadian	Campsite Deposits of domestic material	W.B. Stewart, 1994
AaHs-47	Lister	Historic Euro-Canadian	Deposits of domestic material	W.B. Stewart, 1994
AaHs-48	Rimmer	Undetermined Pre-contact	Unknown	W.B. Stewart, 1994
AaHs-49	Hawthorn	Undetermined Pre-contact	Unknown	W.B. Stewart, 1994
AbHr-1	Renaud	Unknown	Unknown	P. Reid, 1979
AbHr-2	Girard	Unknown	Unknown	P. Reid, 1979
AbHr-3	Lafferty	Unknown	Unknown	D.C. Carey, 1978

Borden #	Site Name	Cultural/Affiliation	Site Type	Researcher
AbHr-4	No Name	Undetermined Pre-contact / 20th Century Euro-Canadian	Isolated Find / Homestead	F.A. Dieterman 1991
AbHr-6	Essex TS	Undetermined Pre-contact	Campsite	Mayer Heritage Consultants 1999
AbHs-1	Lucier	Unknown	Unknown	W.J. Wintemberg (no recorded date), P.J. Wright 1976, P.E.W. Reid 1978
AbHs-2	Broderick 1	Unknown	Unknown	P. Reid 1979
AbHs-3	Broderick 2	Unknown	Unknown	P. Reid 1979
AbHs-4	Kosyk	Unknown	Unknown	P. Reid 1979
AbHs-5	No name	Historic Euro-Canadian	Home	I. Kenyon 1982
AbHs-6	Morton Terminal 2	Historic Euro-Canadian	Home	I. Kenyon 1982
AbHs-7	E.C. ROW	Late Woodland (Younge Phase, Western Basin Tradition)	Large site with structures, burials	P.A. Lennox, Ministry of Transportation 1984
AbHs-8	Lasalle-Lucier	Woodland (Younge phase, Western Basin Tradition)	Campsite	P.A. Lennox, Ministry of Transportation 1986
AbHs-9	Hadley	Late Woodland (Younge phase, Western Basin Tradition)	Campsite	P.A. Lennox, Ministry of Transportation 1986
AbHs-10	Duff-Baby House	Historic Euro-Canadian	House	Payer, Pihl, Poulton & Associates Inc. 1987-1988
AbHs-11	Great Western Park	Late Woodland (Younge phase, Western Basin Tradition) / Historic Aboriginal / Historic Euro-Canadian	Large site with burials	Cataraqui Archaeological Research Foundation 1989, 1991, R. Denunzio 1991
AbHs-12	Mackenzie Hall	Historic Euro-Canadian	House, Court, Jail	Cataraqui Archaeological Research Foundation 1991, R. Denunzio 1992
AbHs-13	Train Depot	Historic Euro-Canadian	Railway depot	Cataraqui Archaeological Research Foundation 1989
AbHs-15	Senator David A. Croll Park	Historic Euro-Canadian	Deposits of domestic material	Mayer, Poulton & Associates Inc. 1991
AbHs-16	Heritage Park Windmill Reconstruction	20th Century Euro-Canadian	Deposits of domestic material	Mayer, Poulton & Associates Inc. 1991
AbHs-17	Ojibway 1	Historic Euro-Canadian	Homestead	W.B. Stewart 1992
AbHs-18	Ojibway 2	Late Archaic / Historic Euro-Canadian	Campsite / Homestead	W.B. Stewart 1992
AbHs-19	Ojibway 3	Historic Euro-Canadian	Homestead	W.B. Stewart 1992
AbHs-20	Ojibway 4	Late Archaic	Campsite? / Burial?	W.B. Stewart 1992

5.1.2 Physiography and Assessment of Pre-contact Archaeological Potential

The Preliminary Analysis Area is located within the St. Clair Clay Plains physiographic region of Southern Ontario. Adjoining Lake St. Clair in Essex and Kent Counties and the St. Clair River in Lambton County are extensive clay plains covering 2,270 square miles (Chapman & Putnam, 1984: 147). Essex County and the southwestern part of Kent County have a fairly uniform environment and may be discussed together as a sub-region (Chapman & Putnam, 1984: 147-149). Standing between the basins of Lake Erie and Lake St. Clair, the surface is a till plain overlaying the Cincinnati Arch which, in this area, is a low swell in the bedrock (*ibid.*). The surface drainage of the plain is nearly all northward to Lake St. Clair, but the gradient is extremely low and the drainage divide near Lake Erie is rather vague (*ibid*.). The prevailing soil type is Brookston clay loan, a dark-surfaced gleycolic soil developed under a swamp forest of elm, black and white ash, silver maple, and other moisture-loving tress (*ibid*.).

Potable water is the single most important resource necessary for any extended human occupation or settlement. Since water sources have remained relatively stable in south central Ontario after the Pleistocene era, proximity to water can be regarded as a useful index for the evaluation of archaeological site potential. Indeed, distance from water has been one of the most commonly used variables for predictive modeling of site location. More specifically, the Detroit River, designated as a Canadian Heritage River in 2001 (and an American Heritage River designation in 1998), would have served as a vital resource for both pre-contact and historic settlement. The Detroit River is the first River with dual designations.

The Ontario Ministry of Culture Primer on Archaeology, Land Use Planning and Development in Ontario (1997: 12-13) stipulates that undisturbed lands within 300 metres of a primary water source, and undisturbed lands within 200 metres of a secondary water source, are considered to exhibit archaeological potential.

Therefore, depending on the degree of previous land disturbance, it may be concluded that there is potential for the recovery of pre-contact archaeological remains within the Preliminary Analysis Area

5.1.3 Assessment of Historic Archaeological Potential: Summary Review of Historical Maps and Euro-Canadian History

The 1881 *Essex Supplement in Illustrated Atlas of the Dominion of Canada* was reviewed to determine the potential for the presence of historical archaeological remains within the Preliminary Analysis Area during the nineteenth century (Figure 17).

FIGURE 17. LOCATION OF THE PRELIMINARY ANALYSIS AREA AS DEPICTED IN THE 1881 *ESSEX SUPPLEMENT* IN *ILLUSTRATED ATLAS OF THE DOMINION OF CANADA*

The Detroit River has been an important asset for the development of Essex County. The first European settlement in the area was in 1701 when Sieur De Lamonthe Cadillac and approximately 100 civilians and military members to settle in Fort Pontchartrain on the Detroit side of the river (the north side of the current Detroit River) (ASI 2002).

European settlement remained largely on the Detroit side until 1748 when the Jesuit mission to the Huron Indians was established on the south shore near the foot of the present Huron Church Road and the Ambassador Bridge. From 1748 to 1760, a French agricultural settlement developed in this area paralleling a similar settlement across the water (ASI 2002).

Although Fort Pontchartrain surrendered to the British in 1760 and the Detroit side of the river was again officially surrendered to the United States in 1783, both sides remained under British control until 1796, when U.S. forces took up actual occupation of Detroit. During this period, the settlement continued to grow but remained predominantly French in population. Few buildings from the period of French settlement have survived, although the street pattern of the City still reflects the French method of agricultural land division (i.e. long narrow farms fronting the river). In 1797, the original townsite of Sandwich was established to accommodate persons of both French and British origin from the U.S. who wished to remain under British rule following American occupation of Detroit. This constituted the first urban settlement in what is now the City of Windsor, and also the first significant migration of English speaking people into the Windsor area. Sandwich developed over the following decades as the seat of government and the courts for the County of Essex (ASI 2002).

As the chief port-of-entry to the region opposite Detroit, the Town of Windsor (now the downtown area) was already catching up to Sandwich, in terms of population, when the Great Western Railway (now part of the CNR system) chose Windsor as its termination point in 1854. The arrival of the railway also marked the beginning of significant industrial development in Windsor. The railway also sparked the foundation of the third of Windsor's oldest settlements, Walkerville. In 1857, Hiram Walker established his distillery at the point east of downtown, where the Great Western Railway first met the waterfront. On his lands running south of the river, Walker planned a complete town including provisions for industry, commerce, residences and agriculture (Walker Farms). The housing, a large part of which was built by Walker's own contractors, ranged from E. Chandler Walker's estate of Willistead (1906), built in the style of a Tudor manor house, to blocks of row housing for his industrial workers (1880s) (ASI 2002).

Although the Ford Motor Car Company was established in Windsor as early as 1904 to gain the benefit of Imperial trade preferences, it was the period during and following World War I that saw the auto industry assume predominance in the city. An area known as Ford City was developed around the industrial complex. Numerous large residences were built overlooking the river at that time although most have since been demolished (ASI 2002).

The automotive industry changed Windsor from a relatively slow growing collection of border communities to a rapidly growing, modern, industrial city. By the early 1930s, the separate Border Cities of Windsor, East Windsor (Ford City), Walkerville and Sandwich amalgamated politically into a single community with a population of over 100,000. During World War II, industrial production increased dramatically attracting many new workers and resulting in substantial residential growth within the city and in the surrounding townships. In 1966 the City annexed the Towns of Riverside and Ojibway, and parts of Sandwich East, Sandwich South and Sandwich West Townships (ASI 2002).

South of Windsor along the Detroit River is the Town of Amherstburg. Amherstburg came into being around 1796 when a portion of the Fort Malden military reserve was laid out as a town site and settled by United Empire Loyalists from Detroit. However, the region's European history can be traced even earlier to the early French explorers, the days of French rule and the arrival of French traders and settlers in the 1730's. By 1763, when France surrendered Canada to the British, several hundred French settlers were scattered along the Detroit River. The French colony continued to flourish under British rule, and few British settlers came to the area until the American Revolution brought an influx of Loyalists. The first to take up land grants in the vicinity of Amherstburg were members of Butler's Rangers who came in 1784 (ASI 2002).

By 1851 the settlement of Amherstburg was separated from the Township of Malden and was incorporated as a village with town powers. Amherstburg was incorporated as a town in 1878 and by the 1880s's it had become a thriving mercantile and manufacturing centre. Amherstburg is also known as an important stop along the Underground Railway that helped black slaves escape from their servitude south of the border. By the 1840s, Amherstburg had become the centre of Ontario's Black population (ASI 2002).

Although separated out in the nineteenth century, Amherstburg amalgamated with the neighbouring Townships of Anderdon and Malden in January of 1999 to create the Town of Amherstburg. Anderdon Township was surveyed as a part of Essex County in 1839, but settlement had already begun prior to that date in the northern portion around the River Canard by French people coming south from Sandwich Township and in the southern portion by United Empire Loyalists. By 1850 there were 774 settlers in the township, concentrated in two main settlements, Gordon on the shore of the Detroit River, and McGregor on the eastern boundary. In the 1860's the Canada Southern Railway was built through the township and this encouraged growth in the largely agricultural township. There remains only three small communities of any size within the original historic boundary: Auld, River Canard and McGregor (ASI 2002).

Malden Township was surveyed as part of Essex County in the early nineteenth century and it likewise contained a mix of early French and Loyalist settlers. Like Anderdon, Malden's rural economy benefited greatly from the construction of the Canada Southern Railway, which constructed a branch line from Amherstburg to Essex (ASI 2002).

For the Euro-Canadian period, the majority of early nineteenth century farmsteads (i.e., those which are arguably the most potentially significant resources and whose locations are rarely recorded on nineteenth century maps) are likely to be captured by the basic proximity to water model outlined above, since these occupations were subject to similar environmental constraints. An added factor, however, is the development of the network of concession roads through the course of the nineteenth century. These transportation routes frequently influenced the siting of farmsteads. Accordingly, undisturbed lands within 100 metres of an early settlement road are also considered to have potential for the presence of Euro-Canadian archaeological sites.

Therefore, depending on the degree of previous land disturbance, it may be concluded that there is potential for the recovery of historic cultural material within the Preliminary

Analysis Area. Furthermore, it should be noted that not every feature of potential interest today would have been illustrated on the nineteenth century mapping.

5.2 Field Review

A field review of the Preliminary Analysis Area will be scheduled for completion once the illustrated route alternatives have been developed. Results will be included in the final Stage 1 report.

5.3 Conclusions and Recommendations

The Stage 1 archaeological assessment for the Detroit River International Crossing determined that 64 archaeological sites are registered within the Preliminary Analysis Area. Additionally, a review of the general physiography of the Preliminary Analysis Area and local nineteenth century land uses suggested that the Preliminary Analysis Area exhibits archaeological potential.

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6. CULTURAL HERITAGE RESOURCES

6.1 Introduction

6.1.1 Purpose and Scope

This cultural heritage assessment considers cultural heritage resources in the context of improvements to specified areas, pursuant to the provincial *Environmental Assessment Act*. This assessment addresses above ground cultural heritage resources over 50 years old.

Changes to transportation corridors have the potential to affect cultural heritage resources in a variety of ways. These include the loss or displacement of resources through removal or demolition and the disruption of resources by introducing physical, visual, audible or atmospheric elements that are not in keeping with the resources and/or their setting.

For the purposes of this assessment, the term cultural heritage resources was used to describe both cultural landscapes and built heritage features. A cultural landscape is perceived as a collection of individual built heritage features and other related features that together form farm complexes, roadscapes and nucleated settlements. Built heritage features are typically individual buildings or structures that may be associated with a variety of human activities, such as historical settlement and patterns of architectural development.

The analysis throughout the study process addresses cultural heritage resources under various pieces of legislation and their supporting guidelines. Under the *Environmental Assessment Act* environment is defined in subsection 1(c) to include:

- Cultural conditions that influence the life of man or a community; as well as,
- Any building, structure, machine or other device or thing made by man.

The Minister of Culture is charged under Section 2 of the *Ontario Heritage Act* with the responsibility to determine policies, priorities and programs for the conservation, protection and preservation of the heritage of Ontario and has published two guidelines to assist in assessing cultural heritage resources as part of an environmental assessment: *Guideline for Preparing the Cultural Heritage Resource Component of Environmental Assessments* (1992) and *Guidelines on the Man-Made Heritage Component of Environmental Assessments* (1980). Accordingly, both guidelines have been utilized in this assessment process.

The *Guidelines on the Man-Made Heritage Component of Environmental Assessments* states the following:

> When speaking of man-made heritage we are concerned with the works of man and the effects of his activities in the environment rather than with movable human artifacts or those environments that are natural and completely undisturbed by man.

In addition, environment may be interpreted to include the combination and interrelationships of human artifacts with all other aspects of the physical environment as well as with the social, economic and cultural conditions that influence the life of the people and communities in Ontario. The *Guidelines on the Man-Made Heritage Component of Environmental Assessments* distinguish between two basic ways of visually experiencing this heritage in the environment, namely as cultural landscapes and as cultural features.

Within this document cultural landscapes are defined as follows:

> The use and physical appearance of the land as we see it now is a result of man's activities over time in modifying pristine landscapes for his own purposes. A cultural landscape is perceived as a collection of individual man-made features into a whole. Urban cultural landscapes are sometimes given special names such as townscapes or streetscapes that describe various scales of perception from the general scene to the particular view. Cultural landscapes in the countryside are viewed in or adjacent to natural undisturbed landscapes, or waterscapes, and include such land-uses as agriculture, mining, forestry, recreation, and transportation. Like urban cultural landscapes, they too may be perceived at various scales: as a large area of homogenous character; or as an intermediate sized area of homogenous character or a collection of settings such as a group of farms; or as a discrete example of specific landscape character such as a single farm, or an individual village or hamlet.

A cultural feature is defined as the following:

> …an individual part of a cultural landscape that may be focused upon as part of a broader scene, or viewed independently. The term refers to any man-made or modified object in or on the land or underwater such as buildings of various types, street furniture, engineering works, plantings and landscaping, archaeological sites, or a collection of such objects seen as a group because of close physical or social relationships.

Additionally, the *Planning Act* and related Provincial Policy Statement make a number of provisions relating to heritage conservation. One of the general purposes of the *Planning Act* is to integrate matters of provincial interest in provincial and municipal planning decisions. In order to inform all those involved in planning activities of the scope of these matters of provincial interest, Section 2 of the *Planning Act* provides an extensive listing. These matters of provincial interest shall be regarded when certain authorities, including the council of a municipality, carry out their responsibilities under the *Act*. One of these provincial interests is directly concerned with:

> 2(d) the conservation of features of significant architectural, cultural, historical, archaeological or scientific interest;...

This provides the context not only for discrete planning activities detailed in the *Act* but also for the foundation of policy statements issued under Section 3 of the *Act*.

In Part IV of the Policy Statement it is mandated that:

> These policies are to be applied in dealing with planning matters. Official Plans will integrate all applicable provincial policies and apply appropriate land use

> designations and policies. Since the policies focus on end results, the official plan is the most important vehicle for the implementation of the Policy Statement.

Those policies of particular relevance for the conservation of heritage features are contained in Section 2, *Resources*, wherein subsection 2.5, Cultural Heritage and Archaeological Resources, makes the following provisions:

> 2.5.1 Significant built heritage resources and cultural heritage landscapes will be conserved.

A number of definitions that have specific meanings for use in a policy context accompany the policy statement. These definitions include built heritage resources and cultural heritage landscapes.

Built heritage resources mean one or more buildings, structures, monuments, installations or remains associated with architectural, cultural, social, political, economic, or military history, and identified as being important to a community.

Cultural landscapes mean a defined geographical area of heritage significance that has been modified by human activities. Such an area is valued by a community, and is of significance to the understanding of the history of a people or place.

In addition, the term "significant" is also more generally defined. It is assigned a specific meaning according to the subject matter or policy context, such as wetlands or ecologically important areas. As cultural heritage landscapes and built heritage resources may be considered another matter, the following definition of significant applies:

> …in regard to other matters, important in terms of amount, content, representation or effect.

Accordingly, the foregoing guidelines and relevant policy statement were used to guide the scope and methodology of the cultural heritage analysis for the assessment of the road improvements in the study area.

6.1.2 Data Collection

For the purposes of determining the existence of previously identified built heritage features and cultural landscapes within the study area, contact was made with the City of Windsor's Heritage Planner and the Town of Amherstburg. The Ministry of Culture's Ontario Heritage Properties Database was consulted, as was the Parks Canada listing of National Historic Sites.

Historical research was conducted for the purposes of identifying broad agents or themes of historical change and cultural landscape development in this area. An historical overview is contained in Section 2.

Previously identified heritage resources were then categorized according to their heritage protection status and their inclusion on municipal, provincial and federal inventories and heritage designation lists. All heritage sites and heritage sensitive areas were mapped using GIS data co-ordinates.

Once alignment alternatives have been selected a field review of the focused analysis area will be conducted.

6.2 Summary Euro-Canadian History

A summary of the Euro-Canadian history of the PAA is described in Section 5.1.3.

6.3 Heritage Sensitive Areas

6.3.1 Introduction

The following areas have been identified through various data sources and are considered to be of special heritage significance. They represent aggregate areas of historic activity and resources.

Results were mapped using GIS data co-ordinates (Figure 18).

6.3.2 Heritage Sensitive Areas

Ambassador Bridge

The Ambassador Bridge, built in 1929, is listed on the Ontario Heritage Bridge List. This list includes approximately 90 heritage bridges of provincial significance. It helps ensure that the significance of these bridges is taken into account when municipalities undertake construction projects covered by the *Environmental Assessment Act*. Alterations to the bridge are subject to a heritage impact assessment and to the approval of the Ontario Ministry of Culture.

Sandwich

The original town of Sandwich retains a number of buildings of the pre-confederation era that are of historical significance and/or which exemplify the Neo-classical and Georgian styles of architecture, which were in vogue during the first half of the nineteenth century. A number of designated heritage properties can be found along the following streets: Russell Street, Sandwich Street, Peter Street, Detroit Street, Mill Street, Brock Street, Chippewa Street, South Street, Watkins Street, Prince Road.

Highway 18 (Ojibway Parkway)

Highway 18 (Ojibway Parkway) is a heritage highway and is generally considered to be the oldest road in Ontario.

Huron Church Road

Between University Avenue and Wyandotte Street West, Huron Church Road has several properties of heritage interest.

Town of Windsor

Due to numerous fires and the continuous redevelopment of the area over the decades, few of the early buildings in downtown Windsor still exist, but a number of late nineteenth century and early twentieth century buildings remain, including in particular a number of larger, upper income houses in areas immediately adjacent to the downtown area. Of particular heritage interest is Victoria Avenue, along which several designated properties are situated.

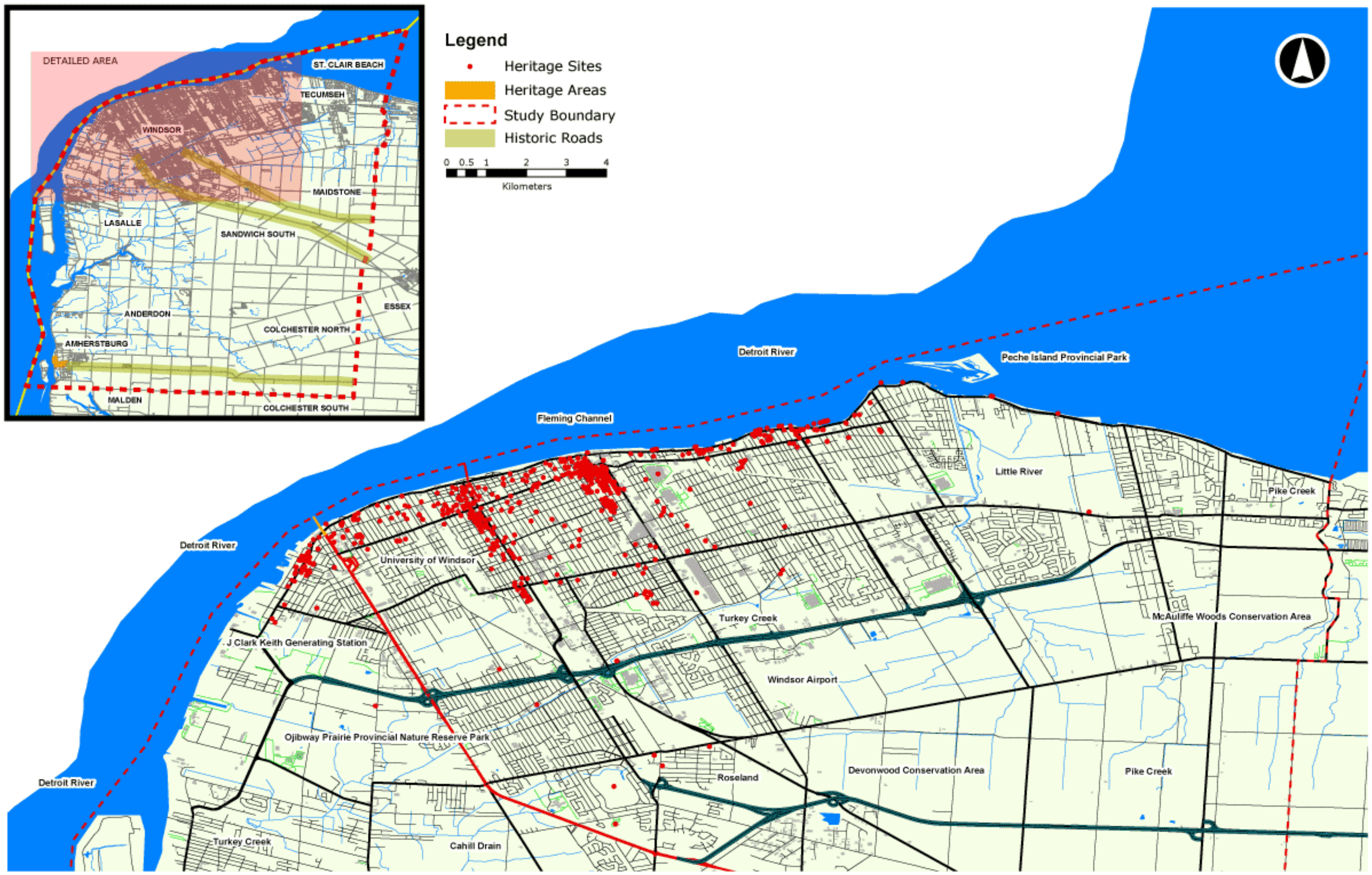

FIGURE 18. HERITAGE RESOURCES WITHIN THE PRELIMINARY ANALYSIS AREA

Highway 3 (The Talbot Road)

First surveyed by Colonel John Talbot beginning in 1809, the Talbot Road (the old Indian trail and now Highway 3) was interrupted by the War of 1812, but reached Essex County in 1818. The Talbot Road was surveyed to follow a natural ridge of glacial moraine which stretched from Windsor to Point Pelee. It was termed a corduroy road for in areas of swampy land, three inch planks, flattened on the upward side, were laid down side by side across the road. Highway 3 (the Talbot Road) is celebrated with a provincial plaque west of St. Thomas that attests to its heritage interest and value. Significant villages along the route include Oldcastle and Maidstone.

Highway 46 (The Middle Road)

Also surveyed by Colonel Talbot (and incorporating a native trail), the settlers along the Middle Road were largely emigrants from Ireland who came to escape the potato famine of the 1840s. Along the Middle Road and up toward Lake St. Clair the "Irish Settlement" grew, and fourth and fifth generation descendants remain today. The village of Maidstone was the centre of the Irish community.

Amherstburg

Bounded by the Detroit River to the west, Alma Street to the north, the Lowes Side Road to the south and Meloche Road to the east, and situated approximately 32km southwest of Windsor across from Boblo Island (Bois Blanc), Amherstburg is one of the oldest towns in the province. As early as 1640, French explorers, Jesuit and Recollect missionaries, are known to have paddled the river past the site where Amherstburg now stands. In 1796, the British military post was re-established and the area played a major role in the War of 1812 with the Capture of Fort Detroit and the Canadian Rebellion of 1837-38. In 1851 when the Municipal Act was passed, Amherstburg was one of the first towns to be incorporated as a “village with town powers”, thus entering into its independent existence. Being the nearest British town, Amherstburg served as a launching point into Canada for fugitive slaves fleeing from American states. The North American Black Historical Museum is located here as is Fort Malden National Historic Park. Restoration architect Peter J. Stokes completed a preliminary inventory of heritage properties in 1976 and it has not been updated. However, the following streets have the highest concentration of heritage structures and are therefore considered to be of particular heritage interest: Brock Street, George Street, King Street, Seymour Street, Sandwich Street, Bathurst Street, Ramsay Street, Dalhousie Street, North Road, Rankin Avenue, Richmond Street, Murray Street, Gore Street, Simcoe Street, and Park Streett.

Despite its modern business establishment and plants, Amherstburg retains its historic atmosphere. In the older section of town the streets are narrow and houses front directly on the sidewalk.

Fort Malden National Historic Park

Located on Laird Avenue in Amherstburg, Fort Malden preserves elements of the second fort built by the British on the eastern bank of the Detroit River to defend the Canadian border from American attack in the first half of the 19th century. The first post, known as Fort Amherstburg, was constructed in 1796 near the mouth of the Detroit River where it empties into Lake Erie. This post was the headquarters for the British forces in southwestern Upper Canada during the War of 1812. Fort Malden was erected after the war and rebuilt in 1838-40 and served once again as a centre for the British defence during the Upper Canada Rebellion of 1837-39. Today the 4.5-hectare site includes remains of the 1840-period earthworks and four buildings, including a restored and furnished 1819 brick barracks.

6.4 Heritage Properties in the Preliminary Analysis Area

6.4.1 Introduction

The following properties have been previously identified as being of heritage significance. They have been grouped according to the status and protection conferred upon them by various easements and government designations. Results were mapped using GIS data co-ordinates (Figure 18).

6.4.2 National Historic Sites of Canada

The Ministry of the Environment has designated the following properties as *National Historic Sites of Canada*:

TABLE 11. NATIONAL HISTORIC SITES OF CANADA IN THE PRELIMINARY ANALYSIS AREA

Street Location	Town	Site	Date
3652 Peter Street	Windsor	Sandwich First Baptist Church	1851
254 Pitt Street West	Windsor	Francois Baby House	1811
Boblo Island	Amherstburg	Bois Blanc (Boblo) Lighthouse	1837
Boblo Island	Amherstburg	Bois Blanc (Boblo) Blockhouse	1839
240-250 Dalhousie Street	Amherstburg	Amherstburg Naval Yard	1831
525 Dalhousie Street	Amherstburg	Bellevue House	1816
277 King Street	Amherstburg	Nazrey A. M. E. Church (museum)	1848
100 Laird Avenue	Amherstburg	Fort Malden Barracks	1819
100 Laird Avenue	Amherstburg	Fort Malden Earthworks	1838

6.4.3 Heritage Easements

The following properties have heritage easements held on them in perpetuity by either the local municipality or the Ontario Heritage Foundation:

TABLE 12. HERITAGE EASEMENT SITES IN THE PRELIMINARY ANALYSIS AREA

Street Location	Town	Site	Date
350 Huron Church Road	Windsor	Assumption R.C. Church	1843
Riverside Drive West near Huron Church Road	Windsor	Assumption Park	
3277 Sandwich Street	Windsor	Mackenzie Hall - Court House	1855
350 Devonshire Road	Windsor	Walkerville Town Hall (relocated)	1904
420 Devonshire Road	Windsor	Walkerville post office	1914
546 Devonshire Road	Windsor	Semi-detached house	1889
548 Devonshire Road	Windsor	Semi-detached house	1889
606-610 Devonshire Road	Windsor	Bank building	
650 Devonshire Road	Windsor	Semi-detached house	
3203 Peter Street	Windsor	Mason-Girardot House	1877
224 Sunset Avenue	Windsor	Jasperson-Appel House	
694 Victoria Avenue	Windsor	Abner F. Nash House	
1900-42 Wyandotte Street	Windsor	Imperial Building	

Street Location	Town	Site	Date
East			
317 Ramsay Street	Amherstburg	Christ Anglican Church	1818

6.4.4 Designated Under Part IV of the *Ontario Heritage Act*

The following properties are protected under Part IV of the Ontario Heritage Act:

TABLE 13. PROTECTED PROPERTIES UNDER PART IV OF THE ONTARIO HERITAGE ACT IN THE PRELIMINARY ANALYSIS AREA

Street Location	Town	Site	Date
253 Freedom Way/37 University Avenue East	Windsor	Property	
401 Sunset Avenue	Windsor	The University of Windsor	1857
3069 Alexander Boulevard	Windsor	Masson-Deck House	1924
819 Argyle Road	Windsor	Wallmay Carriage House	
823 Argyle Road	Windsor	Elmscroft Carriage House	
378 Brock Street	Windsor	Windsor Jail MBS-ORC	1925
356 Brock Street	Windsor	Registry Office - Windsor Jail	1876
567 Church Street	Windsor	Revell-D'Avignon House	
City Hall Square	Windsor	All Saints Anglican Church	1855
204 Curry Street	Windsor	Robert Gordon House	
908 Dawson	Windsor	fieldstone & stucco bungalow	1925
378-396 Devonshire Road	Windsor	Crown Inn	1892
982 Devonshire Road	Windsor	Foxley	1924
415 Devonshire Road	Windsor	Bank of Commerce	1907
656 Devonshire Road	Windsor	Semi-detached house	
325 Devonshire Road	Windsor	Walker Power Building	1911
1094 Drouillard Street	Windsor	St. John the Divine Church	1950
705 Erie Street East	Windsor	St. Angela Merici Church	1939
Farm Lot 108	Windsor	Property/Building	
167 Ferry Street	Windsor	Windsor Star Building	1926
115 Giles Street East	Windsor	Shaar Hashomayim Congregation	1929
400 Huron Church Line	Windsor	Assumption University	1875
849 Kildare Road	Windsor	The Cobbles	1906
889 Kildare Road	Windsor	Griggs House	
904 Lawrence Road	Windsor	property/building	1920
711 McEwan Street	Windsor	Holy Name of Mary Church	1928
1960 Meldrum	Windsor	Grachanica Serbian Church	1951
363 Mill Street	Windsor	Sandwich Fire Hall & Stable	1921
351 Mill Street	Windsor	Langlois house	1888
245 Mill Street	Windsor	Queen Anne Revival style house	1895
221 Mill Street	Windsor	Duff-Baby House	1798
245 Mill Street	Windsor	Property	
716 Monmouth Road	Windsor	Semi-detached house	
704 Monmouth Road	Windsor	Semi-detached house	
756 Monmouth Road	Windsor	Semi-detached house	
744 Monmouth Road	Windsor	Semi-detached house	
1899 Niagara Street	Windsor	Willistead Manor	1906

Street Location	Town	Site	Date
1899 Niagara Street	Windsor	Willistead Manor gatehouse	1906
1899 Niagara Street	Windsor	Queen Victoria Fountain	1897
1899 Niagara Street	Windsor	Willistead Manor coach house	1906
2021 Ontario Street	Windsor	Low-Martin house	1928
374 Ouellette	Windsor	Canada Building	1930
986 Ouellette Avenue	Windsor	Border Masonic Temple	
1011 Ouellette Avenue	Windsor	Medical Arts Building	
Park Street East	Windsor	St. Alphonsus RC Church	1871
280 Park Street West	Windsor	Royal Windsor Apartments	1929
511 Pelissier Street	Windsor	YMCA	1925
Pelletier Street	Windsor	Windsor CN railway station	1910
3281 Peter Street	Windsor	Gauthier House 1	1895
2100 Richmond Street	Windsor	Walkerville High School	1922
Riverside Drive	Windsor	Our Lady of the Rosary Church	1909
4371 Riverside Drive East	Windsor	Patrice Parent House	
2072 Riverside Drive East	Windsor	Hiram Walker & Sons Building	1892
5325 Riverside Drive East	Windsor	property/building	1928
3200-04 Sandwich Street	Windsor	Robinet Winery	1895
3118 Sandwich Street	Windsor	McGregor-Cowan House	1809
3201 Sandwich Street	Windsor	Sandwich post office	1905
3164 Sandwich Street	Windsor	Wigle-Nanaka house	1890
3140 Sandwich Street	Windsor	Dominion House	1880
3199 Sandwich Street	Windsor	John Spiers' general store	1880
3402 Sandwich Street	Windsor	Baby-Lajeunese house	1855
3305 Sandwich Street	Windsor	St. John's Church & cemetery	1871
1983 St. Mary's Gate	Windsor	St. Mary's Church & rectory	1904
Sunset Street	Windsor	Dillon Hall - University of Windsor	1928
166 Tecumseh Road West	Windsor	St. Clare of Assisi church	1931
245 Tecumseh Street East	Windsor	W. C. Kennedy High School	1929
37 University Avenue East	Windsor	Windsor Armoury	1900
101 University Avenue West	Windsor	The Capitol Theatre	
719 Victoria Avenue	Windsor	Treble-Large House	1895
803 Victoria Avenue	Windsor	Henderson House	1900
742 Victoria Avenue	Windsor	Taylor-Growe House	
1148 Victoria Avenue	Windsor	property/building	
916-918 Victoria Avenue	Windsor	William McGregor House	1917
Victoria Avenue and Park Street West	Windsor	St. Andrew's Presbyterian Church	1895
739 Walker Road	Windsor	Semi-detached house	
753 Walker Road	Windsor	Semi-detached house	
731 Walker Road	Windsor	Semi-detached house	
749 Walker Road	Windsor	Semi-detached house	
721 Walker Road	Windsor	Semi-detached house	
763 Walker Road	Windsor	Semi-detached house	
2011 Willistead Crescent	Windsor	Easton House	
2086 Willistead Crescent	Windsor	Dr. Charles Hoare Residence	
1799 Wyandotte Street East	Windsor	Bank of Montreal building	1912
1495 Wyandotte Street West	Windsor	John Richardson Library	

Street Location	Town	Site	Date
225 Brock Street	Amherstburg	St. John the Baptist RC Church	1844
214 Dalhousie Street	Amherstburg	Pensioner's Cottage	
214 Dalhousie Street	Amherstburg	Park House Museum	1796
240-250 Dalhousie Street	Amherstburg	Callam Residence – Commissariat	1831
252 Dalhousie Street	Amherstburg	Salmoni Building	1849
262 Dalhousie Street	Amherstburg	Gordon House	1798
267 Dalhousie Street	Amherstburg	Bullock's Tavern	1836
273 Dalhousie Street	Amherstburg	Jones China Shop	1849
449 Dalhousie Street	Amherstburg	Murray Smith Residence	1870
455 Dalhousie Street	Amherstburg	Robertson Residence	
459 Dalhousie Street	Amherstburg	Fox Residence	1875
232 George Street	Amherstburg	First Baptist Church	1849
109 Gore Street	Amherstburg	Lloyd Brown Residence	1865
193 Gore Street	Amherstburg	Gibb House	1837
197 Gore Street	Amherstburg	Blacksmith Shop	
207 Gore Street	Amherstburg	Bondy Residence	1837
217 Gore Street	Amherstburg	Ralph Jimmerfield saltbox house	
246 King Street	Amherstburg	Church of God in Christ	
266 King Street	Amherstburg	St. John the Baptiste Parish Hall	1875
277 King Street	Amherstburg	North American Black Historical Museum and Taylor Log Cabin	1860
281 King Street	Amherstburg	Melvin Simpson residence	
187 Murray Street	Amherstburg	Adriano Tonon Residence	
273 Ramsay Street	Amherstburg	Dunbar residence	1849
284 Ramsay Street	Amherstburg	Frank Kehl residence	1840
296 Ramsay Street	Amherstburg	Chittendon House	1840
298 Ramsay Street	Amherstburg	John Askin residence	
140 Richmond Street	Amherstburg	Michigan Central Railway Station	1892
259 Richmond Street	Amherstburg	Roman Catholic Convent	1850
232 Sandwich Street	Amherstburg	Carnegie Public Library	1911
129 Simcoe Street	Amherstburg	St. Andrew's Presbyterian Church	
9399 Townline Road	Amherstburg	St. Joseph's Church	1910

6.4.5 Ontario Heritage Bridge List

The following sites have been placed on the Ontario Heritage Bridge List compiled by the Ministry of Culture:

TABLE 14. ONTARIO HERITAGE BRIDGES IN THE PRELIMINARY ANALYSIS AREA

Town	Site	Date
Windsor	Ambassador Bridge	1929

6.4.6 Municipal Heritage Inventories

The City of Windsor and Town of Amherstburg Heritage Inventories contain listings of over 700 properties with heritage structures. These sites may be worthy of designation under Part IV of the *Ontario Heritage Act*, or they may simply contribute to the character of the street through their surviving heritage features. Regardless of their provincial status, all identified heritage resources are subject to survey when municipalities undertake road projects covered by the *Environmental Assessment Act.* Appropriate mitigation measures must be municipally approved (in consultation with the Windsor or Amherstburg Architectural Conservation Advisory Committees, advisory bodies to City Councils and municipalities on matters pertaining to built heritage in the City of Windsor and the Town of Amherstburg) when disruptions or disturbances are anticipated for inventoried properties.

The City of Windsor's inventory is updated on an on-going basis and the current listing as at April 2005 has been mapped using GIS co-ordinates (Figure 18).

The Town of Amherstburg's inventory was compiled in 1976 by restoration architect Peter J. Stokes and has not been updated since that time. Given the age of the document, the Amherstburg inventory needs to be field checked to confirm accuracy. However, Section 6.3.2 lists streets of particular heritage interest within the town centre. These streets were chosen because they contain a high concentration of previously inventoried structures. The boundary of this heritage sensitive area has been mapped using GIS co-ordinates (Figure 18).

6.5 Conclusions

The results of background historic research and a review of secondary source material, including municipal, provincial, and federal heritage inventories, revealed a study area with a long history of Euro-Canadian occupation containing a large number of previously identified heritage areas and properties.

Within the Preliminary Analysis Area there are nine aggregate areas of heritage sensitivity, nine National Historic Sites, 14 properties that have heritage easements placed on them, 114 properties designated under Part IV of the *Ontario Heritage Act*, one bridge listed on the Ontario Heritage Bridge List and 700 properties listed on the City of Windsor and Town of Amherstburg heritage inventories. All heritage sites have been mapped using GIS data co-ordinates.

Rural township areas outside of the urban centres of Amherstburg and Windsor have not established heritage inventories. It is therefore anticipated that a field review will reveal previously unrecorded built heritage features and cultural landscapes.

7. ACOUSTICS AND VIBRATION

7.1 Overview

The PAA lies within a highly urbanized corridor that includes the City of Windsor and the neighbouring towns of LaSalle and Tecumseh. Transportation noise, including road, rail, air and watercraft, is a major contributor to the existing noise environment. Industrial, including several large complexes, and commercial activities are also significant sources of existing noise.

It is expected that the study area will also include rural areas, some with intensive agricultural land uses. The existing noise environment in these areas is characterized by sounds of nature, domestic activities and farm machinery noises.

7.2 Significance/Sensitivity

Significance is determined by the comparing the largest noise and vibration excess associated with the proposed project to existing/background noise and vibration levels. To do so, one must:

1) establish existing/background noise and vibration levels at sensitive receptors;
2) determine the worst-case noise and vibration levels from the proposed project at the receptor locations;
3) predict any noise and vibration excesses associated with the proposed project;
4) determine the efficacy of mitigation measures in reducing noise and vibration excess at sensitive receptors; and,
5) verify the significance of any residual noise at the sensitive receptors.

7.3 Data Collection/Sources

Existing acoustics and vibration data was obtained from the following sources:

- The City of Windsor website;
- The province of Ontario Environmental Bill of Rights (EBR) and EA Project Updates;
- Canadian Environmental Assessment Agency (CEAA) Federal Environmental Assessment (FEAI) for EAs completed in Windsor up until October 2003, Canadian Environmental Assessment Registry (CEAR) for EAs completed or underway in Windsor since October 2003, and communications with CEAA's staff at its Ontario Region Office (in Toronto) and Ottawa Head Office;
- Transport Canada, the responsible authority for several CEAA Screening Environmental Assessment Reports in the Essex-Windsor area;
- National Energy Board, the responsible authority for a CEAA Screening Environmental Assessment Report for a project in the City of Windsor;
- Canadian Transportation Agency, the responsible Authority for a CEAA Screening Environmental Assessment Report for a project in the City of Windsor;

- Project Information, including Environmental Overview Paper, June 2005, GIS mapping; and,
- Previsious studies and reports including background noise monitoring results for areas within the City of Windsor.

8. AIR QUALITY

8.1 Overview

The air quality issue is of national importance both in United States and Canada, especially due to its effect on human health and welfare. The Canadian air quality program is a complex mix of intergovernmental agreements between provinces, national law, and international agreements with the United States. The aim of the program is to regulate the sources of emission, promulgate more stringent standards where it is deemed necessary and improve all aspects of air quality monitoring programs.

Southern Ontario is part of a regional airshed that stretches from the U.S. Midwest into Quebec and the northeastern U.S. states. Local air pollution sources are outweighed by pollutants entering the province from U.S. sources. Prevailing wind patterns make U.S. pollution sources the largest contributors to air pollution in Ontario. This is especially true for smog. On average more than 50% of Ontario smog originates south of the border.

The air quality of Southwestern Ontario and Southeastern Michigan are of special concern because of the past air quality problems that have been experienced in these areas. The increased air quality episodes in this region are mainly attributed to high population density in the region, large number of heavy industries and transportation (major border crossings between the U.S. and Canada). Special attention has been given to the air quality of these regions to reduce/prevent episodes of bad air quality by identifying the major contributing sources of pollutants and coordinating efforts to reduce/prevent pollutant emissions.

In recent years, there have been increased traffic delays due to heightened security checks at the U.S. – Canada border. This has resulted in concerns regarding the local air quality. As a result, numerous local air quality studies have been (and continue to be) carried out by the MOE, EC and other organizations such as the University of Windsor. These studies mainly consist of data collection using real-time pollutant monitoring equipment, discussion of the air quality trends over the past few years and assessment of possible implications of the compromised air quality on human health. The results from these studies are briefly discussed in this report. Some of these studies were preliminary, or the data was not released pending QA/QC. The data from these studies will be included in the final version of this report, if possible.

8.2 Governmental Programs for Air Quality Improvement

8.2.1 Drive Clean Program

The Ontario Drive Clean Program, implemented in 1999, is a mandatory vehicle emissions inspection and maintenance program, designed to cut smog-causing emissions from vehicles (especially NO_x and VOCs). The program requires that light-duty cars, trucks, and vans have an emission test every two years for registration renewal. The program applies to the vehicles that are more than three model years old and less than 20 model years old and requires a pass or conditional pass for vehicle registration renewal.

8.2.2 Smog Alert Program

The Ontario Ministry of the Environment administers the Smog Alert program for locations in Ontario, including Windsor. Citizens can register to receive email smog alerts at the www.airqualityontario.com website. This website also includes Air Quality Indices for various localities updated hourly, based on the concentrations of six common air pollutants. As a part of Ontario Regulation 127/01, "Airborne Contaminant Discharge Monitoring and Reporting", the Ministry also administers the OnAir program, which gives citizens access to reports on emissions from stationary sources in the province's industrial, commercial, institutional and municipal sectors. The OnAir website is http://www.ene.gov.on.ca/environet/onair/splash.htm

The Ontario Ministry of the Environment has set an Air Quality Target for Smog. This target is to achieve, by 2015, a 75 percent reduction in the number of times the 80 ppb one hour ozone criterion is exceeded. The reduction is based on the average number of exccedences in the years from 1990 to 1994. The Ontario Smog Plan works towards this target. Ontario's Smog Plan is a partnership effort that sets regional and sectoral targets for emission reductions. One of the goals of the plan is to reduce emissions of NO_x and VOCs by 45 percent from 1990 levels by the year 2015.

8.2.3 Canada – U.S. Bi-National Agreement

Transboundary air pollution has been defined as air pollution whose physical origin is situated wholly or in part with the area under the jurisdiction of one Party and which has adverse effects, other than effects of a global nature, in the area under the jurisdiction of the other party. Transboundary air pollution can cause major harm to natural resources of vital environmental, cultural and economical importance, and to human health in both countries. Therefore, the two countries have developed agreements to control it and to improve air quality. The text of these agreements can be found in the Memorandum of Intent Concerning Transboundary Air Pollution of 1980, in the 1986 Joint Report of the Special Envoys on Acid Rain, as well as in the ECE Convention on the Long-Range Transboundary Air Pollution.

8.3 Existing Air Quality Conditions in the Area

The Ontario Ministry of the Environment (MOE) measures air contaminants at various locations throughout Ontario, and reports on the state of Ontario's air quality on an annual basis. In "Air Quality in Ontario: 2000 report", the MOE reported trends from 1991 to 2000 for ozone, inhalable particles, nitrogen dioxide, carbon monoxide, and sulphur dioxide, for nine U.S and Canadian cities in the Great Lakes Basin Area, including Windsor. The report showed that Windsor's mean concentrations for these contaminants were below respective U.S. NAAQS and Ontario ambient air quality criteria for all contaminants, with the exception of ozone. The mean concentration of ozone in Windsor during this period exceeded Ontario's standard of 80 ppb. The report states that air quality in the province as a whole has improved significantly.

For the Windsor – Essex area the existing air quality is influenced by local and long-range (cross-border) contaminants generated in upwind urban and industrial areas. The predominant wind directions in Windsor are from the west to southsouthwest. These bring contaminants from the heavily industrialised areas of Detroit and nearby communities. Air quality impacts are dominated by the substances that combine to produce smog or acid rain such as carbon monoxide (CO); nitrogen oxides (NO_x); volatile organic compounds (VOCs); sulphur dioxide (SO_2); and particulate matter (SPM) [Environment Canada 1999a].

To assess the current air quality in the area, historical air quality monitoring data from provincial (MOE) [MOE 1999 - 2003] and federal (Environment Canada) [Environment Canada 1999 - 2003] stations, in close proximity to the study area were considered.

8.3.1 Historical Ambient Monitoring Data

Air quality monitoring stations that were located in the vicinity of the study area and had the most complete set of data were selected for use in this study. The following stations were used:

1) 467 University Avenue (Station #060204 C);

2) College/South St. (Station #060211R);

3) Wright/Water St. (Station #060212I); and,

4) Tecumseh, 9725 Riverside Drive East (Station #012009) (note: removed from the network in 2002).

The location of these ambient air monitoring stations are presented in Figure 19.

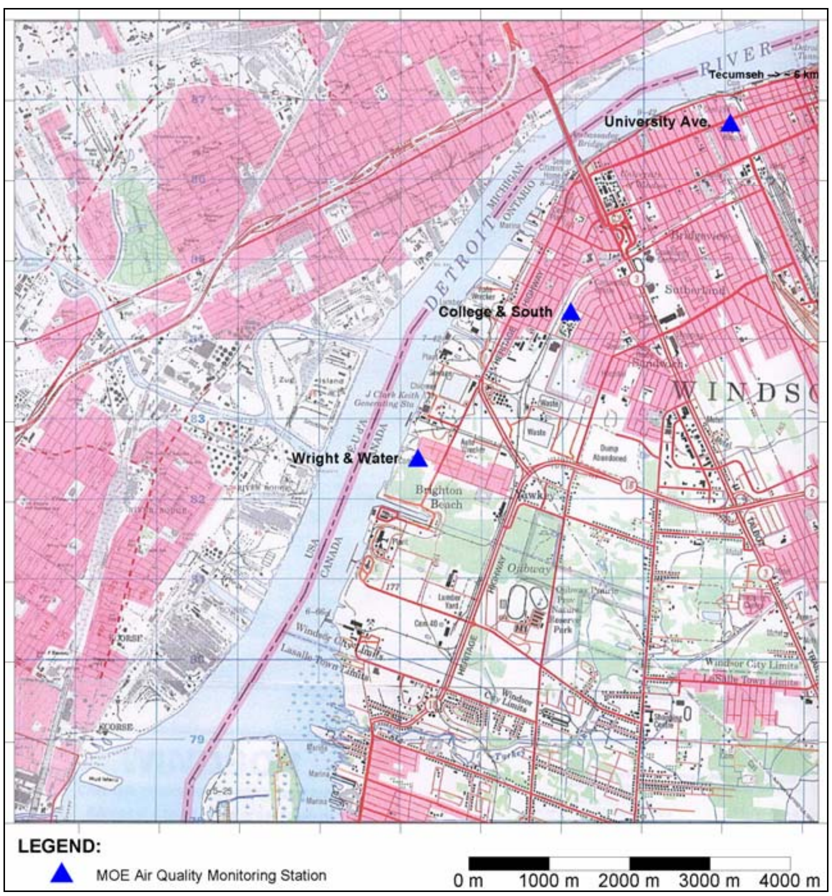

FIGURE 19. LOCATION OF LOCAL AMBIENT AIR QUALITY MONITORING STATIONS

The most recent available data (for 1999 to 2003) collected from these air monitoring stations are summarized by pollutant in Tables 5.1 to 5.7. Statistical analyses for each pollutant, including the mean, maximum and 90th percentile as well as the measured concentrations for different averaging times (e.g. 1-hour, 24-hour, etc.) are presented in the tables. Where applicable, numbers of exceedances (when the measured concentrations exceed the ambient air quality criteria (AAQC) for a certain averaging time) are also presented in the tables. With the exception of the annual monitoring data for VOCs and PAHs, which is collected by Environment Canada, all other data for conventional pollutants are from the MOE ambient monitoring stations in the study area.

The stations shown in the figure above are representative of overall air quality conditions in the City of Windsor. They do not reflect particular local conditions, such as the present heavy traffic conditions on Huron-Church Road, nor do they reflect air quality conditions in the LaSalle area, where there are currently no monitoring stations.

Nitrogen Oxides (NO_x) / Nitrogen Dioxide (NO_2)

Nitrogen oxides (NO_x) are present in the atmosphere as various species of NO, NO_2, N_2O, etc. In Ontario, NO_x refers to the sum of nitrogen dioxide (NO_2) and nitric oxide (NO), represented in NO_2 equivalents. As a result, NO_2 concentrations (rather than total NO_x) are typically compared to the AAQC. Both the NO_x and NO_2 are monitored at three of the four monitoring locations, namely at College/South Street, Riverside Drive, and University Avenue, however, monitoring at the Riverside Drive Station was halted as of 2002 (Table 15 and 16). The 1-hour and 24-hour maximum NO_2 concentrations measured at the three stations did not exceed the AAQC of 200 and 100 ppb, respectively.

TABLE 15. MOST RECENT AMBIENT AIR QUALITY MONITORING DATA FOR NITROGEN OXIDES – WINDSOR / ESSEX

Station ID	Station Location	Averaging Time	Nitrogen Oxides (ppb)					
			AAQC	Year				
				1999	2000	2001	2002	2003
#060211-R	College/South Street.	Mean	-	-	INS	31.1	3.25	INS
		90th Percentile	-	-	71	58	56	69
		1-Hour Maximum	-	-	412	347	717	655
		24-Hour Maximum	NAC	-	149.3	123	320	221
# 012009	Tecumseh, 9725 Riverside Drive East	Mean	-	21.6	23.4	INS	-	-
		90th Percentile	-	43	44	43	-	-
		1-Hour Maximum	-	229	328	203	-	-
		24-Hour Maximum	NAC	75.1	98.7	79	-	-
#060204-C	467 University Avenue	Mean	-	37	36	30.5	29.2	INS
		90th Percentile	-	67	64	57	53	72
		1-Hour Maximum	-	370	527	261	313	613
		24-Hour Maximum	NAC	124.3	159.4	97	190	164
#060212-I	Wright/Water St.	Mean	-	-	-	-	-	-
		90th Percentile	-	-	-	-	-	-
		1-Hour Maximum	-	-	-	-	-	-
		24-Hour Maximum	NAC	-	-	-	-	-

TABLE 16. RECENT AMBIENT AIR QUALITY MONITORING DATA FOR NITROGEN DIOXIDE – WINDSOR / ESSEX

Station ID	Station Location	Averaging Time	Nitrogen Dioxide (ppb)					
			AAQC	Year				
				1999	2000	2001	2002	2003
#060211-R	College/ South Street	Mean	-	-	INS	20.8	19.6	INS
		90th Percentile	-	-	35	35	33	37
		1-Hour Maximum	200	-	61	69	93	97
		24-Hour Maximum	100	-	41.5	44	62	49
		No. of Times above AAQC (1-Hour)	-	-	0	0	0	0
		No. of Times above AAQC (24-Hour)	-	-	0	0	0	0
# 012009	Tecumseh, 9725 Riverside Drive East	Mean	-	14.1	16	INS	-	-
		90th Percentile	-	28	31	30	-	-
		1-Hour Maximum	200	85	73	63	-	-
		24-Hour Maximum	100	40.3	39.6	40	-	-
		No. of Times above AAQC (1-Hour)	-	0	0	0	-	-
		No. of Times above AAQC (24-Hour)	-	0	0	0	-	-
#060204-C	467 University Avenue	Mean	-	22.9	21.6	19.4	19.1	INS
		90th Percentile	-	39	37	33	32	39
		1-Hour Maximum	200	90	104	87	69	80
		24-Hour Maximum	100	49.5	44.7	41	46	50
		No. of Times above AAQC (1-Hour)	-	0	0	0	0	0
		No. of Times above AAQC (24-Hour)	-	0	0	0	0	0
#060212-I	Wright/ Water Street	Mean	-	-	-	-	-	-
		90th Percentile	-	-	-	-	-	-
		1-Hour Maximum	200	-	-	-	-	-
		24-Hour Maximum	100	-	-	-	-	-
		No. of Times above AAQC (1-Hour)	-	-	-	-	-	-
		No. of Times above AAQC (24-Hour)	-	-	-	-	-	-

NAC No Applicable Ambient Air Quality Criterion
INS Insufficient data to calculate average; ppm: concentration in parts per million - volume, ppb: concentration in parts per billion – volume; $\mu g/m^3$: concentration in micrograms per cubic meter; * Ontario interim criteria; ** CWS proposed criteria

Sulphur Dioxide (SO_2)

Ambient monitoring data for SO_2 concentration was collected at all four monitoring locations examined in this study. However, the monitoring at Riverside station and at Wright / Water St. Station were halted in 2002 and 2003, respectively. The available data indicate that the annual mean and the 1-hour and 24-hour maximums were not exceeded at any of the four stations, for the years 1999 to 2003 (Table 17).

TABLE 17. RECENT AMBIENT AIR QUALITY MONITORING DATA FOR SULPHUR DIOXIDE WINDSOR/ESSEX

Station ID	Station Location	Averaging Time	Sulphur Dioxide (ppb)					
			AAQC	Year				
				1999	2000	2001	2002	2003
#060211-R	College/ South Street	Mean	20	9.6	8.8	9.3	7.9	INS
		90th Percentile	-	21	20	20	48	15
		1-Hour Maximum	250	138	182	158	127	110
		24-Hour Maximum	100	41.8	45.1	41	40	31
		No. of Times above Criteria (1-Hour)	-	0	0	0	0	0
		No. of Times above Criteria (24-Hour)	-	0	0	0	0	0
		No. of Times above Criteria (Annual)	-	0	0	0	0	0
# 012009	Tecumseh, 9725 Riverside Drive East	Mean	20	4	4.4	INS	-	-
		90th Percentile	-	10	10	10	-	-
		1-Hour Maximum	250	68	98	73	-	-
		24-Hour Maximum	100	14.7	18	15	-	-
		No. of Times above Criteria (1-Hour)	-	0	0	0	-	-
		No. of Times above Criteria (24-Hour)	-	0	0	0	-	-
		No. of Times above Criteria (Annual)	-	0	0	0	-	-
#060204-C	467 University Avenue	Mean	20	6.7	6.2	6.1	5.7	5.9
		90th Percentile	-	15	15	15	40	14
		1-Hour Maximum	250	91	91	82	73	98
		24-Hour Maximum	100	37.5	25.2	21	29	41
		No. of Times above Criteria (1-Hour)	-	0	0	0	0	0
		No. of Times above Criteria (24-Hour)	-	0	0	0	0	0
		No. of Times above Criteria (Annual)	-	0	0	0	0	0
#060212-I	Wright/ Water Street	Mean	20	5.4	5.6	6.3	4.8	-
		90th Percentile	-	12	12	13	29	-
		1-Hour Maximum	250	58	100	69	73	-
		24-Hour Maximum	100	21	20.2	29	23	-
		No. of Times above Criteria (1-Hour)	-	0	0	0	0	-
		No. of Times above Criteria (24-Hour)	-	0	0	0	0	-
		No. of Times above Criteria (Annual)	-	0	0	0	0	-

NAC No Applicable Ambient Air Quality Criterion
INS Insufficient data to calculate average; ppm: concentration in parts per million - volum, ppb: concentration in parts per billion – volume; µg/m^3: concentration in micrograms per cubic meter; * Ontario interim criteria; ** CWS proposed criteria

Continuous PM_{10} Measurements

Continuous ambient monitoring data for PM_{10} were collected only at one of the four monitoring locations, namely, the College/South Street Station. However, this monitoring was halted as of 2002. The available data indicate that the Ontario interim criterion of 50 µg/m^3 was exceeded greater than 9 times for all the three years of available data, i.e. 1999 to 2001 (Table 18).

TABLE 18. RECENT AMBIENT AIR QUALITY MONITORING DATA FOR PM_{10} – WINDSOR/ESSEX

Station ID	Station Location	Averaging Time	PM_{10} (µg/m³)					
			AAQC	Year				
				1999	2000	2001	2002	2003
#060211-R	College/ South Street	Mean	-	25.9	24.2	23	-	-
		90th Percentile	-	48	45	43	-	-
		1-Hour Maximum	-	247	307	180	-	-
		24-Hour Maximum	50*	79	78.2	73	-	-
		No. of Times above AAQC	-	15	9	17	-	-
# 012009	Tecumseh, 9725 Riverside Drive East	Mean	-	-	-	-	-	-
		90th Percentile	-	-	-	-	-	-
		1-Hour Maximum	-	-	-	-	-	-
		24-Hour Maximum	50*	-	-	-	-	-
		No. of Times above AAQC	-	-	-	-	-	-
#060204-C	467 University Avenue	Mean	-	-	-	-	-	-
		90th Percentile	-	-	-	-	-	-
		1-Hour Maximum	-	-	-	-	-	-
		24-Hour Maximum	50*	-	-	-	-	-
		No. of Times above AAQC	-	-	-	-	-	-
#060212-I	Wright/ Water Street	Mean	-	-	-	-	-	-
		90th Percentile	-	-	-	-	-	-
		1-Hour Maximum	-	-	-	-	-	-
		24-Hour Maximum	50*	-	-	-	-	-
		No. of Times above AAQC	-	-	-	-	-	-

NAC No Applicable Ambient Air Quality Criterion
INS Insufficient data to calculate average; ppm: concentration in parts per million - volume , ppb: concentration in parts per billion – volume; µg/m³: concentration in micrograms per cubic meter; * Ontario interim criteria; ** CWS proposed criteria

Continuous $PM_{2.5}$ Measurements

Ambient monitoring data for $PM_{2.5}$ are available for all four stations. However, the monitoring started in 2002 at the College/South Street Station, in 2001 at the 467 University Avenue Station, and ended in 2001 for the Riverside Drive Station. Only two years of data was collected at the Wright/Water Street Station. Achievement of the CWS is based on the 98th percentile over 3 years, which is equivalent to approximately 22 exceedences during this period. The available data indicate that the proposed Canada Wide Standard of 30 µg/m³ was exceeded at all the four stations for all the years of available data (Table 19).

Ozone (O3)

Ambient monitoring data for O3 concentration is available only for two of the ambient monitoring stations, namely, the College/South Street Station and the 467 University Avenue Station. The available data indicate that the 1-hour maximum concentrations at both stations exceeded the AAQC of 80 ppb for the years 1999 to 2003 (Table 20).

TABLE 19. RECENT AMBIENT AIR QUALITY MONITORING DATA FOR $PM_{2.5}$ - WINDSOR/ESSEX

Station ID	Station Location	Averaging Time	$PM_{2.5}$ (µg/m³)					
			AAQC	Year				
				1999	2000	2001	2002	2003
#060211-R	College/ South Street	Mean	-	-	-	-	11.8	9.6
		90th Percentile	-	-	-	-	26	20
		1-Hour Maximum	-	-	-	-	74	64
		24-Hour Maximum	30**	-	-	-	56	41
		No. of Times above Benchmark	-	-	-	-	18	7
# 012009	Tecumseh, 9725 Riverside Drive East	Mean	-	17	13	INS	-	-
		90th Percentile	-	36	2.5	20	-	-
		1-Hour Maximum	-	147	88	42	-	-
		24-Hour Maximum	30**	73.2	38.6	44	-	-
		No. of Times above Benchmark	-	37	8	5	-	-
#060204-C	467 University Avenue	Mean	-	-	-	9.4	9.8	8.5
		90th Percentile	-	-	-	20	21	19
		1-Hour Maximum	-	-	-	72	75	64
		24-Hour Maximum	30**	-	-	40	56	43
		No. of Times above Benchmark	-	-	-	7	10	5
#060212-I	Wright/ Water Street	Mean	-	-	-	INS	12.2	-
		90th Percentile	-	-	-	18	26	-
		1-Hour Maximum	-	-	-	41	82	-
		24-Hour Maximum	30**	-	-	33	54	-
		No. of Times above Benchmark	-	-	-	1	14	-

NAC No Applicable Ambient Air Quality Criterion
INS Insufficient data to calculate average; ppm: concentration in parts per million - volume , ppb: concentration in parts per billion – volume; µg/m³: concentration in micrograms per cubic meter; * Ontario interim criteria; ** CWS proposed criteria

TABLE 20. RECENT AMBIENT AIR QUALITY MONITORING DATA FOR OZONE – WINDSOR/ESSEX

Station ID	Station Location	Averaging Time	Ozone (ppb)					
			AAQC	Year				
				1999	2000	2001	2002	2003
#060211-R	College/ South Street	Arith. Mean	-	18.9	17	19	20.2	22.8
		90th Percentile	-	44	40	43	50	47
		1-Hour Maximum	80	129	106	112	127	123
		24-Hour Maximum	-	66.8	59.3	58	66	73
		No. of Times above Criteria (1-Hour)	-	79	13	58	164	90
# 012009	Tecumseh, 9725 Riverside Drive East	Arith. Mean	-	-	-	-	-	-
		90th Percentile	-	-	-	-	-	-
		1-Hour Maximum	80	-	-	-	-	-
		24-Hour Maximum	-	-	-	-	-	-
		No. of Times above Criteria (1-Hour)	-	-	-	-	-	-

Station ID	Station Location	Averaging Time	Ozone (ppb)					
			AAQC	Year				
				1999	2000	2001	2002	2003
#060204-C	467 University Avenue	Arith. Mean	-	21.7	18.6	20.5	21.9	22.9
		90th Percentile	-	47	41	45	49	46
		1-Hour Maximum	80	112	103	112	124	111
		24-Hour Maximum	-	76.9	61.4	62	64	61
		No. of Times above Criteria (1-Hour)	-	106	22	63	153	60
#060212-I	Wright/ Water Street	Arith. Mean	-	-	-	-	-	-
		90th Percentile	-	-	-	-	-	-
		1-Hour Maximum	80	-	-	-	-	-
		24-Hour Maximum	-	-	-	-	-	-
		No. of Times above Criteria (1-Hour)	-	-	-	-	-	-

NAC No Applicable Ambient Air Quality Criterion
INS Insufficient data to calculate average; ppm: concentration in parts per million - volume , ppb: concentration in parts per billion – volume; µg/m^3: concentration in micrograms per cubic meter; * Ontario interim criteria; ** CWS proposed criteria

Carbon Monoxide (CO)

Ambient monitoring data for CO concentration is available only for one of the ambient monitoring stations, namely, the 467 University Avenue Station. The available data indicate that the 1-hour and 8-hour maximum concentrations at both stations did not exceeded the AAQC of 30 and 13 ppm from 1999 to 2003, respectively (Table 21).

TABLE 21. RECENT AMBIENT AIR QUALITY MONITORING DATA FOR CARBON MONOXIDE WINDSOR/ESSEX

Station ID	Station Location	Averaging Time	Carbon Monoxide (ppm)					
			AAQC	Year				
				1999	2000	2001	2002	2003
#060211-R	College/ South Street	Mean	-	-	-	-	-	-
		90th Percentile	-	-	-	-	-	-
		1-Hour Maximum	30	-	-	-	-	-
		8-Hour Maximum	13	-	-	-	-	-
		No. of Times above AAQC (1-Hour)	-	-	-	-	-	-
		No. of Times above AAQC (24-Hour)	-	-	-	-	-	-
# 012009	Tecumseh, 9725 Riverside Drive East	Mean	-	-	-	-	-	-
		90th Percentile	-	-	-	-	-	-
		1-Hour Maximum	30	-	-	-	-	-
		8-Hour Maximum	13	-	-	-	-	-
		No. of Times above AAQC (1-Hour)	-	-	-	-	-	-
		No. of Times above AAQC (24-Hour)	-	-	-	-	-	-

Station ID	Station Location	Averaging Time	Carbon Monoxide (ppm)					
			AAQC	Year				
				1999	2000	2001	2002	2003
#060204-C	467 University Avenue	Mean	-	0.5	0.027	0.26	0.46	INS
		90th Percentile	-	1	0.6	0.57	1.1	1.2
		1-Hour Maximum	30	7	11.82	4.97	4.25	4.34
		8-Hour Maximum	13	3.1	3.57	2	2.77	2.45
		No. of Times above AAQC (1-Hour)	-	0	0	0	0	0
		No. of Times above AAQC (24-Hour)	-	0	0	0	0	0
#060212-I	Wright/ Water Street	Mean	-	-	-	-	-	-
		90th Percentile	-	-	-	-	-	-
		1-Hour Maximum	30	-	-	-	-	-
		8-Hour Maximum	13	-	-	-	-	-
		No. of Times above AAQC (1-Hour)	-	-	-	-	-	-
		No. of Times above AAQC (24-Hour)	-	-	-	-	-	-

VOCs and PAHs

Ambient monitoring data for VOC and PAH concentrations was collected at Environment Canada's monitoring station for the City of Windsor. With the exception of benzo(a)pyrene and one year of data for naphthalene, the data set for the organic contaminants of interest is complete for the period of 1999 to 2003. When compared against the AAQC values, the maximum 24-hour values for the pollutants of concern are all below the associated criteria (Table 22).

TABLE 22. RECENT AMBIENT AIR QUALITY MONITORING DATA FOR SELECTED VOCS AND PAHS - WINDSOR/ESSEX

Pollutant Type	Compound	AAQC	Statistical Parameter	Year				
				1999	2000	2001	2002	2003
VOCs	Acrolein	23.3 (1-hour)	Mean	0.054	0.12	0.109	0.108	0.134
			90th Percentile	0.123	0.219	0.207	0.156	0.284
			Maximum	0.189	0.349	0.398	0.691	0.315
	Benzene	-	Mean	1.753	2.161	1.692	1.497	1.746
			90th Percentile	2.8	4	3.352	3.321	2.833
			Maximum	8.354	5.17	4.47	7.09	6.287
	Formaldehyde	65 (24-hour)	Mean	2.326	2.555	2.605	2.672	3.141
			90th Percentile	3.683	4.157	3.569	5.044	4.957
			Maximum	5.081	4.49	9.595	15.021	11.347
	Acetaldehyde	500 (24-hour)	Mean	1.67	1.841	1.856	1.731	1.711
			90th Percentile	2.614	2.685	2.62	3.04	2.738
			Maximum	3.449	3.417	5.606	6.04	4.569
	1,3- butadiene	-	Mean	0.143	0.187	0.143	0.13	0.109
			90th Percentile	0.26	0.3	0.227	0.21	0.218

Pollutant Type	Compound	AAQC	Statistical Parameter	Year				
				1999	2000	2001	2002	2003
			Maximum	0.38	0.43	0.44	0.619	0.459
PAHs	Naphthalene	22.5 (24-hour)	Mean	0.879	-	0.858	0.979	0.809
			90th Percentile	2.173	-	2.332	1.78	1.919
			Maximum	3.71	-	4.24	2.044	5.39
	Benzo(a)pyrene	0.0011 (24-hour) 0.00022 (annual)	Mean	-	-	-	-	-
			90th Percentile	-	-	-	-	-
			Maximum	-	-	-	-	-

VOCs: Volatile Organic Compounds
PAHs: Polycyclic Aromatic Hydrocarbons
- Indicates no data available.

8.4 Other Ambient Air Quality Studies

In recent years, in light of increased air quality episodes in the Windsor area, numerous studies have been and are continuing to be carried out, including the following:

- Ambient Air Quality During 2003 and 2004 in Windsor, Ontario, by David Yap of MOE;
- Preliminary Air Quality Assessment Related to Traffic Congestion at Windsor's Ambassador Bridge, 2004, by Dr. Gerald Diamond and Michael Parker of MOE;
- Studies by Prof. Iris Xu of the University of Windsor; and
- Ongoing studies of ambient air in Windsor, by Environment Canada.

In the paper by David Yap, the ambient air data collected over past 34 years are examined, and provide the following conclusions regarding the air quality status of Windsor:

- The overall air quality in Windsor has improved significantly during the past 34 years (1971 – 2004), despite increases in population, economic activity and vehicle-kilometres travelled;
- The sulphur dioxide concentrations have decreased by 89% (1971 – 2004);
- The carbon monoxide concentrations have decreased by 90% (1971 – 2004);
- The nitrogen dioxide concentrations have decreased by 37% (1971 – 2004);
- The 1-hour maximum ozone concentrations have decreased from 1980 to 2004, however, there is an increasing trend in the mean ozone concentration over the same period; and
- According to this paper, unique climatic features in the region have resulted in elevated episodes of poor air quality in the region.

The study also examines the correlation between ozone and $PM_{2.5}$, for which data from a 6-day sampling of ozone (1-hour average) and $PM_{2.5}$ (24-hour average) was used. The data shows some correlation between the two pollutants.

In the paper by Dr. G. Diamond and Michael Parker, results from series of short-term real-time monitoring of particulate matter and VOCs, taken in the neighbourhood of the

Ambassador Bridge and Huron Church Road were examined. The particulate measurements were collected using GRIMM particulate monitors (particle counters), and the VOCs were measured using a protable GC and sorbent tubes. The key conclusions of the report include:

- During normal traffic, TSP levels were 6 to 8 $\mu g/m^3$ above background levels near the road and decreased with distance from the road. When long border delays were experienced, the TSP levels showed an increase of 10 to 25 $\mu g/m^3$ near the road and decreased sharply as distance from the road increased. Increases in TSP alone suggest that there are influences at work other than diesel exhaust, possibly road dust or tire wear.
- During normal traffic, PM_{10} levels increased by only 2 $\mu g/m^3$, but when long border delays were experienced, the PM_{10} levels varied from 2 $\mu g/m^3$ on average to levels as high as 69 $\mu g/m^3$. This large variance would suggest that meteorological conditions have a significant effect on the levels of PM_{10}. In general, the PM_{10} levels dropped with increasing distance from the road.
- During normal traffic, $PM_{2.5}$ levels showed very minor increases near the road and increased slightly further from the road. The distance to which those increases were felt was not determined in this study. During episodes of long border delays the $PM_{2.5}$ levels varied anywhere from 2 $\mu g/m^3$ to 14 $\mu g/m^3$ probably due meteorological conditions. The $PM_{2.5}$ levels increased with increasing distance from the road but by 250 metres from the road $PM_{2.5}$ levels had peaked and were approaching background levels.
- All VOC sampling results exhibited minor increases to background VOC levels.

As also mentioned in this study, the data has not been yet accurately assessed to incorporate variations in meteorological conditions. Given the known limitations that these selected portable particulate and VOC measuring devices have, and the short duration of this sampling campaign as well as the selected sampling locations, there may be issues with the study results.

Based on the information that was obtained from Environment Canada, their monitoring program in the Windsor area is at a preliminary stage, with only a few samples collected in a non-systematic manner. EC is in the process of creating a systematic approach to continue the monitoring program, and is not expected to release any quality assured data until next year.

SENES is currently attempting obtain data from Prof. Xu of the University of Windsor.

8.5 References

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9. WASTE AND WASTE MANAGEMENT

9.1 Overview

The City of Windsor is the focal point of the PAA on the Canadian side. From 1748 to 1760, agricultural settlement developed along the Windsor side of the river, paralleling a similar settlement on the Detroit side. It was the automotive industry that provided the main impetus for growth in this fragmented community in the 20th century. Today, Windsor is a cosmopolitan city of 200,000 people and is best known as the 'automotive capital' of Canada with General Motors, Ford and Chrysler all having large manufacturing plants in the city. Canada, similarly to the United States, after years of industrialization has been left with a legacy of environmental issues related to wastes and disposal issues.

9.2 Contaminated Sites

The Government of Canada introduced the Federal Contaminated Sites and Solid Waste Landfills Inventory Policy on July 1, 2000. This policy states that departments and agencies that hold property must establish and maintain a database of their contaminated sites and solid waste landfills, and that this information must be submitted to the Treasury Board Secretariat for inclusion in a central inventory.

The inventory includes all known federal contaminated sites for which departments and agencies are accountable. It also includes non-federal contaminated sites for which the Government of Canada has accepted some or all financial responsibility. Suspected sites are not added to the inventory until assessments have confirmed contamination. The inventory does not include properties owned by Crown corporations.

To date the inventory lists 1,211 properties with contaminated sites (204 are located in Ontario). Of the 204 sites in Ontario, one site was identified in the study area, located onshore near the Town of Amherstburg and eight sites were located along the Detroit River on Bois Island and Fighting Island. These eight sites were located along channels and bays in between the mainland and the islands, mostly around navigational towers, dykes and burnpits. The contamination ranges from heavy metals to petroleum hydrocarbons and polyaromatic hydrocarbons. Although these sites are offshore and do not fall within the limits of the study area, their existence may impact construction activity associated with a river crossing.

Legislation applicable to contaminated sites in Ontario is enforced at a provincial level unless the land is owned by the Federal government, a First Nations, is deemed to be of national significance, or has the potential to cross a provincial or international boundary.

Under the Ontario Environmental Protection Act (EPA), liability regarding contaminated sites rests with the owner of the land. Any known liabilities associated with a property must be disclosed at the time of property transfer. For this reason, Phase I and Phase II Environmental Site Assessments are normally conducted prior to property transfer. The onus is on the purchaser of the property to assess whether current or historical contamination exists prior to property transfer. The responsibility for any contamination that is discovered after the transaction rests with the new owner of the property.

The Ministry of Environment has also produced a Waste Disposal Site Inventory that lists all the industrial sites that produced or used coal tar and related tars in Ontario prior to 1988. For each site, information is provided on the location, operating period, evidence of buried wastes, site conditions, site assessments conducted, resource characteristics (i.e., surface water, groundwater, wells), etc. In Ontario, 41 sites are listed on the closed municipal coal gasification plant site inventory and 44 sites are listed on the inventory of industrial sites producing and using coal tar and related tars (Figure 20). A review of the listings identified three sites located in the study area that produced coal tar. Sites contaminated with coal tar tend to involve expansive contamination that can involve extensive clean up of soil and groundwater prior to re-use. Alternative risk management methods for controlling movement and seepage of coal tar can be conducted to mitigate contamination migration and allow the potential re-use of these properties.

While the utilization of contaminated sites must be approached with caution, they do not preclude a route, bridge, or other transportation project. In Canada, the owner of a contaminated property is responsible for the liabilities associated with that contamination.

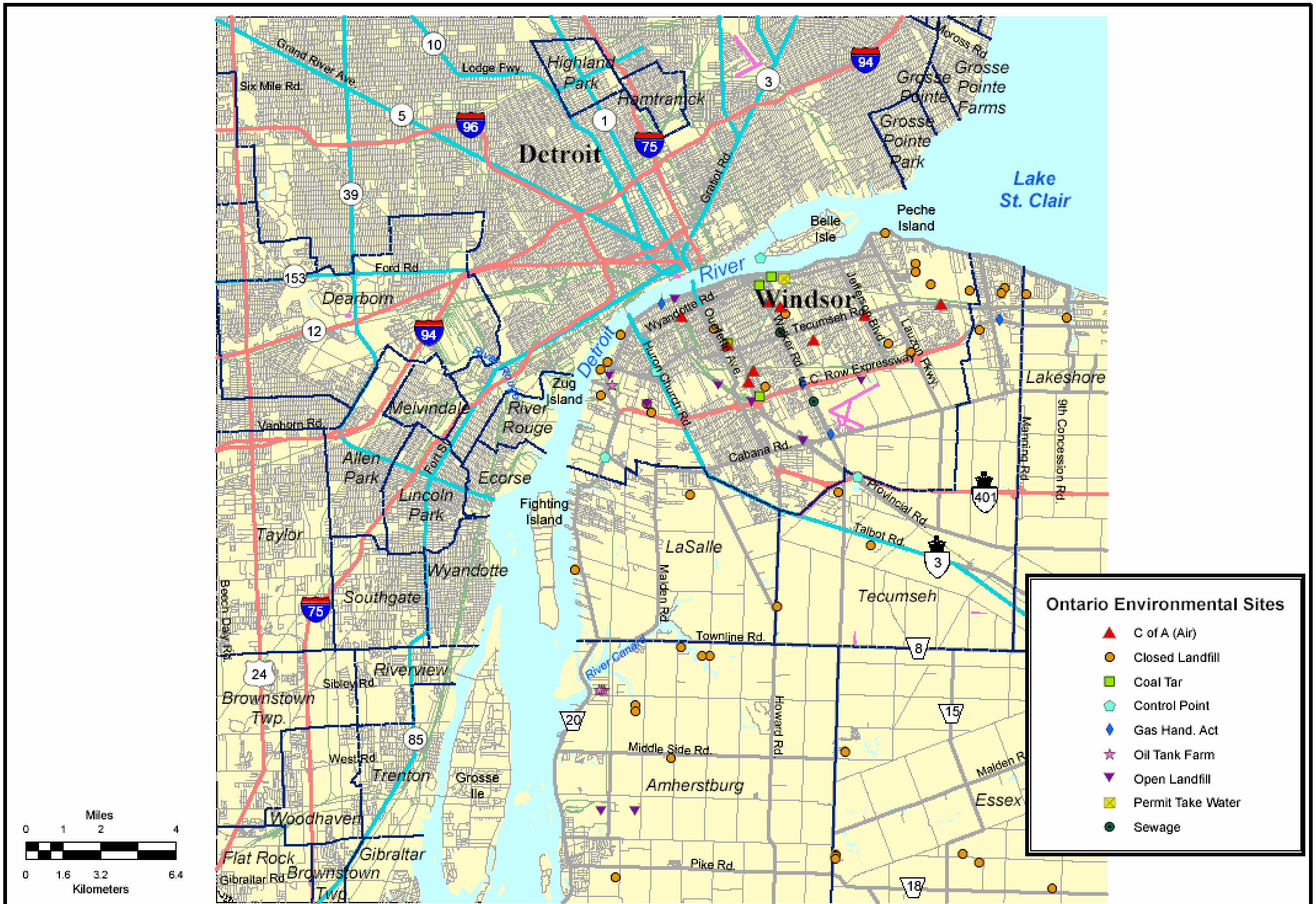
9.3 Underground Storage Tank Sites

In Canada, underground storage tanks containing petroleum products are primarily regulated under the Technical Standards and Safety Act (TSSA) and the Ontario EPA. TSSA and the Ontario Ministry of the Environment and Energy (MOEE) will co-ordinate clean up efforts depending on the extent of contamination, whether there are off-property contaminant migration issues, and whether continued use of the property as a fuelling station is desired. The TSSA maintains a database of all registered tanks containing petroleum products that includes a listing of any work orders associated with the property. Based on the ERIS database search recently conducted, there are 16 registered storage tanks containing petroleum products in the study area. This database can be accessed once a more refined transportation route is chosen.

While underground and leaking underground storage tanks should be avoided if possible, they do not preclude routes, bridges, or other transportation projects. The contamination problems that they pose tend to be localized and relatively easy to address.

9.4 Landfills

A Waste Disposal Site Inventory has been prepared by the Ministry of Environment and Energy, which contains a list of all known active and closed waste disposal sites in the Province of Ontario as of October 31, 1990. The inventory includes 1,358 active sites and 2,334 closed sites. For each site, information is provided on the type of wastes, site locations, and operating period. The inventory includes both sites that were previously approved and operated under an Approval for which there is adequate information regarding the types of wastes that were deposited, and unapproved sites where information regarding waste burial is limited. The sites are classified according to the type of waste, the type of waste it received if known, (industrial, commercial, municipal) and the adjacent land use (urban or rural). Forty-one sites were identified in the study area (Figure 20). Two liquid disposal dumps are located in Anderson Township near Amherstburg while the regional active landfill is located in the southeast corner of the study area. The re-use of these sites is dependent on the setting and previous landfilling activities and could involve extensive remediation and/or waste removal. The Ontario



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Environmental Overview Paper - Canadian Existing Conditions Volume 1 Detroit River Crossing Study

Landfills and Hazardous Waste

FIGURE 20

EPA restricts the re-use of any former landfill site for any other use for a minimum of 25 years from the day of closure and therefore these types of sites should be avoided as they would require extensive legal negotiation for re-use.

9.5 Hazardous Waste Generators

Ontario sites that generate subject wastes must register the types of waste classes that are produced under Regulation 347. Generators range from small printing shops to large automotive parts manufacturers. A database of waste generators is maintained and can be accessed. However, as most of these wastes are shipped off-site for disposal a listing of a waste generator does not necessarily provide any additional information as to the relative risk of acquiring such a site for the purpose of transportation planning. Based on the ERIS database search, there are 122 generators within the study area and two registered waste receiving sites (Figure 20). The types of wastes generated and received at these sites can be identified once a streamlined study area has been defined.

While these facilities may use, generate, store, or dispose of hazardous materials or wastes, they do not preclude a route, bridge, or other transportation project. Their utilization should be approached with caution, but issues associated with their use are generally readily resolved.

9.6 Oil, Gas, Mineral and Disposal Wells

The type of well determines the approvals that are needed for operation. Wells used for disposal of hazardous wastes through deep well injection are regulated under the Ontario Environmental Protection Act by the Ministry of Environment. There are very few licenses for deep well injection of hazardous wastes. Their location can be identified through a search of Class V certificate of approvals under the Ontario Environmental Protection Act. These types of sites should be assessed for potential contamination prior to acquiring for transportation planning.

The Ministry of Natural Resources regulates oil and gas wells. Based on the ERIS database search, nearly 180 wells were identified in the study area. More detailed information about the locations of these wells can be determined once the transportation route is more defined.

While their use should be approached with caution, these facilities and sites would not preclude a route, bridge, or other transportation project and may even, as previously discussed, be encouraged in certain circumstances.

9.7. Undiscovered Sites

In Ontario the test of whether a Site is contaminated is determined by the presence of an adverse effect, which is broadly defined under the Ontario Environmental Protection Act. Owners of properties where an adverse effect has been determined to exist or which has migrated onto adjacent properties must notify the appropriate authority (usually the Ministry of Environment).

Notification to the Occurrence Reporting Incidence System (ORIS) is also required if a spill or release occurs onsite. If the site files an RCS in relation to the contamination it will be listed in a database which can then be searched to determine the presence of these sites along the chosen transportation routes. However, in Ontario, contaminated sites, which are undergoing remediation, are not necessarily public information unless a clean up Order or other legislative instrument has been enacted to control the contamination. The Ministry of Environment will only release information regarding contamination issues if permission from the owner of the property is obtained under the Freedom of Information Act. Once a transportation route is chosen, suspect properties along the route should be more thoroughly investigated by requesting this information from the Ministry of Environment in agreement with the property owners.

In addition, known impacts to soil or groundwater on a property that are demonstrated not to have migrated off-site or which do not fit the definition of an adverse effect need not necessarily be reported. Typically these types of sites may have low levels of contamination which are stable in the environment but which would be disturbed if re-development occurred. Information regarding these types of sites can only be obtained once a transportation route is chosen and property purchase is negotiated at which time an owner must disclose all information regarding potential environmental liabilities on the property.

While they should be approached with caution, these sites would not preclude a route, bridge, or other transportation project.

9.8 Summary

The Preliminary Analysis Area is intensely developed and industrialized and, as such, there are numerous contaminated and/or potentially contaminated sites located within it. These sites vary in the amount of concern that they represent because of the differing degrees of contamination or potential for contamination.

In Canada, the owner of a property is responsible for any contamination on it. However, whether the degree of contamination rises to the actionable level depends upon the context within which it exists. Contaminated properties may be used for transportation projects but the cost-effectiveness and legal entanglements must be carefully evaluated for each specific parcel.

Once alternatives have been identified, it will be necessary to conduct database and map searches specific to those alternatives. A limited field inspection of alternative locations may be necessary in order to determine if there are features that do not appear in the databases or maps but that may, nevertheless, be of concern.

While there are a few exceptions, such as landfills, contaminated or potentially contaminated sites do not preclude a route, bridge, or other transportation project. Barring some unusual factor or circumstance, the technical, legal, and economic issues associated with them are usually resolvable.

10. TECHNICAL CONSIDERATIONS

10.1 Engineering - Background

As illustrated in Figure 21, the Windsor Detroit area is one of three major links within a system of highways and trade corridors connecting major urban areas in southwest Ontario to major US centres. As noted in the Planning Need and Feasibility (PNF) study, a significant amount of trade takes place between Canada and United States, and the transportation system in southern Ontario plays a key role in facilitating this economic activity. Major connections to the US served by the Windsor Detroit crossing include:

- I-94, which provides access to Chicago and the upper mid west, Western Canada and other parts of the USA;
- I-75 and I-69, which are major auto and manufacturing corridors providing access to Ohio, Indiana, Kentucky, Tennessee, Alabama and to major Mexican manufacturing centres; and
- I-77 and I-79, which provide access to manufacturing in Pittsburgh and Ohio and other southern locations.

10.1.1 Purpose of the Study

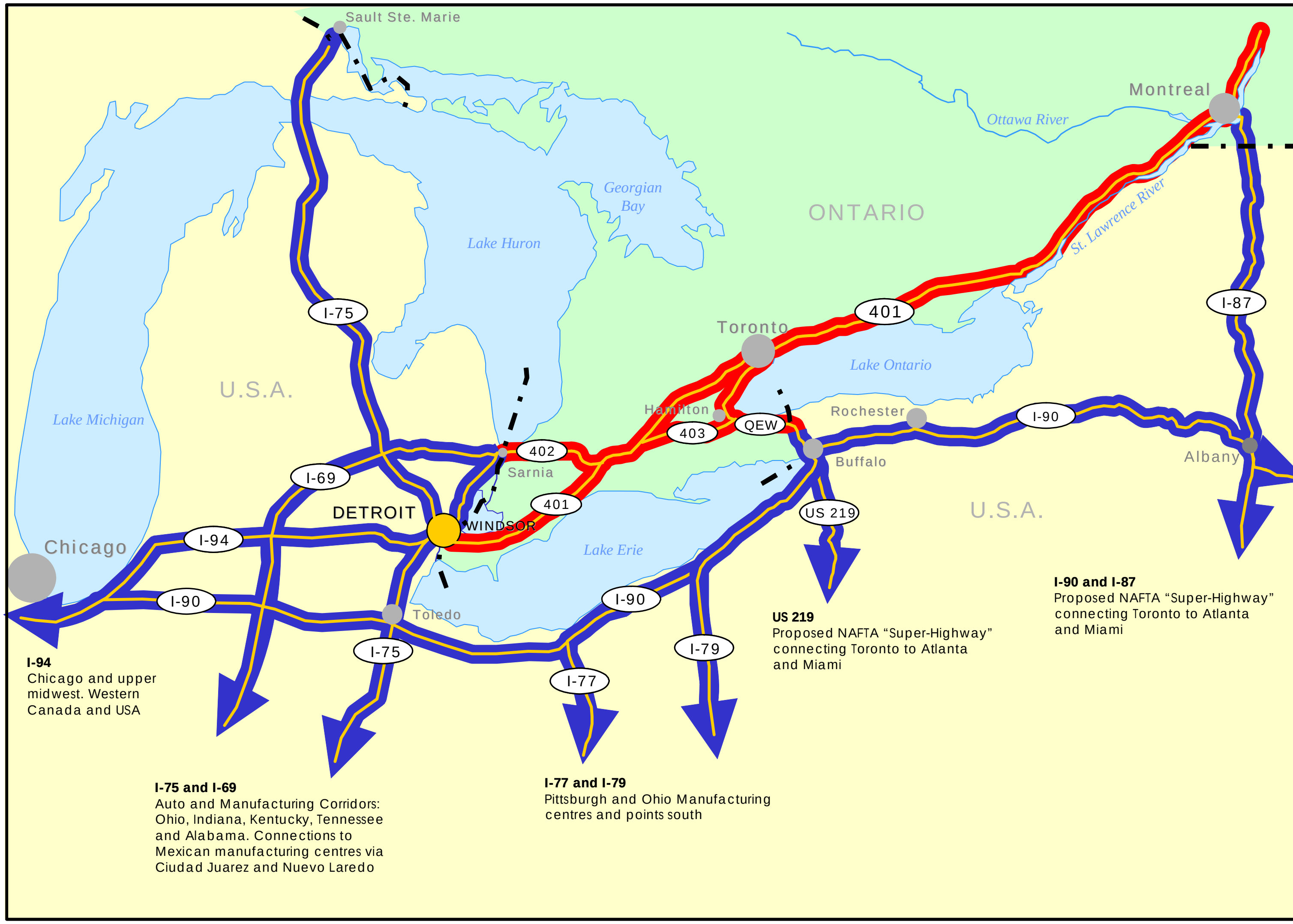
The purpose of the Detroit River International Crossing (DRIC) Environmental Assessment is to identify a new or expanded border crossing which will provide for the safe, efficient and secure movement of people and goods at the Canada-U.S. border in the Detroit River area. This includes Route Planning, Preliminary Concept Design and Environmental Assessment based on a 30-year planning horizon. The study is being conducted by the Canada–U.S.–Ontario–Michigan Border Transportation Partnership (The Partnership).

10.1.2 The Process

As a requirement of the Ontario Environmental Assessment Act, in May 2004 the Ministry of Transportation of Ontario (MTO) prepared and submitted an Environmental Assessment Terms of Reference (TOR) to the Ontario Ministry of the Environment (MOE) for their review and approval. The TOR, approved by MOE on September 17, 2004, outlines the framework that MTO and Transport Canada will follow in completing this environmental assessment.

This environmental assessment includes the following key steps:

1. Finalizing the purpose and need for the study;
2. Assessing planning alternatives;
3. Defining the environmental assessment study area;
4. Identifying study area conditions;



Source: Hemson Consulting Ltd.

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FIGURE 21. SOUTHWESTERN ONTARIO – U.S. HIGHWAY SYSTEM

5. Developing, assessing, and evaluating route alignment and border crossing alternatives;
6. Selecting a recommended alternative and developing the preliminary design for that alternative;
7. Documenting the environmental assessment process and findings; and
8. Obtaining approvals.

This Technical Consideration Overview addresses item 5 by providing an overview of the framework by which the route alignments and border crossing alternatives will be evaluated from a technical viewpoint.

Technical Considerations unlike other elements of the environment do not lend themselves very readily to standard levels of description (data sources, significances, data gaps, etc…). Technical issues tend to be very engineering orientated and empirical based. Therefore, this Technical Consideration Overview has been prepared to provide the reviewer with a brief summary of the key elements of a very large and complex component of the DRIC Study.

10.1.3 Technical Disciplines

The following technical disciplines will provide the input to be used during the evaluation of the Illustrative and Practical route alternatives according to the factors "Improve Regional Mobility" and "Cost":

- Transportation (Systems) Planning – This is the main technical discipline providing measures used in evaluating alternatives according to improved Regional mobility. The Transportation (Systems) Planning component of the Study involves the development of travel demand forecasts and the estimation of the transportation and traffic impacts for each border-crossing alternative under consideration;
- Foundation Engineering – The scope of services generally includes the determination of potentially adverse ground conditions, structure options and construction concerns. This assessment will be carried out using available subsurface and geological information together with field reconnaissance;
- Pavement Engineering – The Pavement Engineering components are to provide the required geotechnical and pavement design input to the required level of detail to support overall planning and preliminary design;
- Bridge Engineering – The Bridge Engineering/Structural Planning component of this EA project will support the Route Planning for Illustrative and Practical Alternatives, Preliminary Concept Design and Environmental Assessment by providing feasible bridge and tunnel solutions tailored for each alternative, including cost information, construability assessment and aesthetic development; and
- Highway Planning – Working with the Environmental and Consultation Teams, the Highway Planning Component ties together virtually all aspects of the engineering work for this EA project.

The remainder of this Technical Considerations Overview provides an overview of how these engineering disciplines will contribute to the evaluation of Illustrative and Practical route alternatives.

10.2 Engineering - Illustrative Alternatives

The Illustrative Alternatives are those initial routes identified in response to the study objectives, and developed according to the following “guiding principles” used to identify viable route alternatives:

1. Utilize existing infrastructure to the maximum extent – taking advantage of existing transportation and other linear corridors may improve usage of the transportation network and/or reduce impacts to other land uses;
2. Seek areas or land uses that are compatible, or areas in transition to compatible land uses – compatible areas are those that are less impacted by new route alignments than other land uses; areas in transition allow the opportunity to incorporate new route alignments in the area planning;
3. Minimize impacts to significant natural features – such features are usually regionally unique and protected by legislation/designations that may preclude a transportation facility, and
4. Minimize impacts to city centres – such areas generally provide a focus for cultural, social and economic activities.

The generation of alignments will be a collaborative effort based on the technical expertise and experience of both the Canadian and U.S. Teams, as well as input received from stakeholders and the public at early consultation activities. Key personnel will conduct field reviews and meetings with agencies, municipalities and utility companies. Information gathered will be documented and incorporated into constraints/opportunities mapping. With the constraints and opportunities mapping prepared and design criteria developed, the Illustrative Alternative route alignments will be generated. Approximately 15 routes will be identified and technically evaluated according to how well they improve regional mobility and to their cost.

10.2.1 Evaluating Illustrative Alternatives by Regional Mobility

The degree to which each Illustrative alternative improves regional mobility will be determined through analysis undertaken using a transportation systems approach. The Transportation (Systems) Planning component of the Study involves the development of travel demand forecasts and the estimation of the transportation and traffic impacts for each border-crossing alternative under consideration.

10.2.2 Approach

The modelling approach for this Study will build extensively on the Planning/Need and Feasibility Study Report, January 2004 (P/NF Study), but with a review of key assumptions given that the original work had to rely on pre-9/11 data. The open structure of the model process, with the detail and market segmentation (e.g. by commodity type and trip purpose) that was provided in the P/NF forecasts, will allow it to be carried forward to prepare 2035 projections with modifications reflecting current data, assumptions and the latest U.S.-Canada trade projections.

The Travel Demand Model forecasts will be updated to reflect new knowledge and data that have become available since the previous P/NF study. Existing travel patterns and characteristics will be updated to reflect more recent data, which better incorporates the impacts of 9/11 and other extreme events (i.e. the War in Iraq, SARS), the opening of casinos in the Detroit area, changing socioeconomic trends (e.g. Canada-US exchange rate, fuel prices), and attitudes on cross-border travel behaviour. Commercial vehicle and car trip matrices, transportation network representation, and crossing choice models will be updated from a 2000 Base Year to a 2004 Base Year to reflect these changes. Trip matrices will be updated from survey-based 2000 data by analyzing a variety of trends influencing commercial and passenger traffic. Transportation network representation will be updated to include greater disaggregation in southern Essex County to accommodate analysis of a south-crossing alternative. The updated 2004 Base Year model will be validated using traffic counts at crossings and along screenlines within the urban areas.

A Level 1 Analysis will be undertaken for Illustrative Alternatives (this analysis will also be conducted as a first level analysis of the Practical Alternatives, in addition to a Level 2 and Level 3 analysis). The Level 1 Analysis will entail, for the crossing alternatives and all affected highways and major roads in the study area, the application of the updated Travel Demand Model. Specific performance measures may include:

- Link Volume-Capacity (V/C) Ratio - the ratio of the flow rate (the equivalent hourly rate at which vehicles, etc. pass a point on a roadway, computed as the number of vehicles) to capacity for the transportation facility;
- Peak Hour Traffic - the volume of traffic that uses the facility during the hour of the day that sees the highest traffic volumes;
- Change in Total Vehicle-Kilometres of Travel vs. No-Build - which will measure total distance travelled in kilometres over the network for a fixed (i.e. peak hour) period for auto, local truck, and international truck and auto;
- Change in Total Vehicle-Hours of Travel vs. No-Build - which will measure total travel duration in hours over the network for a fixed (i.e. peak hour) period for auto, local truck, and international truck and auto;
- Continuous/ongoing River Crossing Capacity (Redundancy) – this measure will assess the degree to which each alternative provides reliability/choice in the network;
- Operational Considerations of Crossing System (Crossing and Plaza) – a measure of plaza/crossing operations during peak travel periods; and
- Operational Considerations of Crossing System (Network) – Potential impacts to network during periods of congestion at border, based on storage capacity at plazas and to freeway connection.

In addition, the transportation assessment of alternatives will examine international commercial vehicle and passenger car and domestic travel markets individually, with overall network performance statistics. It will also include a network analysis for both passenger cars and freight movements that will include an examination of travel paths, description of capacity deficiencies and traffic impacts, and identification of major splits in vehicle movements.

Other measures may be added to the evaluation if appropriate.

10.2.3 Plaza Design

In tandem with the development of route alternatives, potential plaza locations will be identified. Layouts will be developed to be consistent with the Canada Border Services

Agency's "Custom Operations Land Border Facilities Design Guide", or the U.S. General Services Administration Design Guide, "U.S. Land Port of Entry" for any alternative considered for reverse inspection of "Share U.S./Canada Facilities."

A new inspection plaza will most likely require at least 80 to 100 acres of land. The impact of expanding into a new area will need to be compared to the impacts of expansion of an existing inspection plaza to meet current and future inspection and travel needs. These designs must also consider a changing inspection environment, both the opportunities presented and the future constraints that they may impose. These include, but are not limited to, the following:

- Traditional inspection plaza;
- FAST and NEXUS lane(s);
- Off-site staging and targeting of commercial vehicles away from the border;
- Reverse inspection;
- Joint facilities;
- Technology changes and impacts; and
- Inspection staffing at multiple locations.

Plaza designs and their associated environmental and operational impacts may vary greatly, depending on site conditions and whether or not traditional inspections are considered and/or allowed. Many of these alternatives may require changes to each country's policies and laws. The approach that will be used to identify environmental effects will be to lay out traditional inspection plazas, while accounting for changing technology and future area requirements for increased inspection and staffing.

Objectives of the plaza design work include the following:

- Meeting the inspection needs in each country to protect the security and well-being of citizens;
- Moving people and goods safety across the border in a reasonable manner without causing additional environmental impacts such as air pollution and energy use from idling vehicles;
- Meeting the laws and policies of both countries, including the U.S. Bill of Rights and the Canadian Charter of Rights and Freedoms;
- Working closely with the U.S. Consultant team to identify how and/or if any non-traditional inspection activity layouts might reduce the environmental effects in either country for a given alternative; and
- Working closely with the inspection agencies in both countries to ensure alternatives considered will be acceptable to meet their needs.

The scope of the assessment of the local and regional impacts associated with the various Illustrative and Practical Alternatives of this work is addressed by the Socio-economic/Agriculture impact assessment specialists.

10.2.4 Evaluating Illustrative Alternatives by Cost

In addition to evaluating Illustrative Routes according to how well they improve regional mobility, routes will be evaluated according to cost, based on constructability, as well as their associated short and long-term costs. Engineering disciplines providing input will include Foundation, Pavement, and Bridge Engineering, as well as Highway Planning.

Foundation Engineering

The scope of services requiring foundation design input will include an assessment of each alignment alternative with respect to the potential for difficult ground conditions (i.e. swamp, areas of soft ground), potential structure options, and potential construction concerns. This assessment will be carried out using available subsurface and geologic information together with a field reconnaissance.

The foundations and geotechnical engineering work will include a literature search for existing information, and the preparation of a design briefing report that summarizes major geotechnical, hydrogeological, geologic, or historical salt extraction activities that could significantly influence the choice of crossing locations, and will be used in the development of the Illustrative Alternatives. Evaluation will be based on professional judgement.

Pavement Engineering

The Pavement Engineering component of this assignment will provide the required geotechnical and pavement design input to the project team to the required level of detail to support the overall planning and preliminary design of this EA project. Work will include a literature search for existing information and available subsurface information together with a field reconnaissance. Any evaluation of Illustrative Alternatives in terms of pavement engineering will be based on professional judgement, if necessary.

Bridge Engineering

The Bridge Engineering/Structural Planning component of this EA project will support the route planning, preliminary concept design and Environmental Assessment, by providing feasible bridge and tunnel solutions tailored for each alternative, including cost information, constructability assessment and aesthetic development. Work will include office study, field study, detailed bridge study, DRIC alternatives development, and documentation and reporting.

The initial planning stage will require an assessment of viable structure configurations and costs. We will establish structure design requirements including clear span, number of traffic lanes, alignments and profiles, environmental issues, construction limitations and other applicable factors. For each of the Illustrative Alternatives, both bridge and tunnel options will be investigated. Costs will be based on per square metre for similar structures, with appropriate adjustments for special construction and design features. Cost comparisons will be prepared for new complex structures (multi-span), new single span structures and for the rehabilitation, widening and/or replacement of existing structures as required to select the most appropriate structure type. The Bridge Engineering discipline will evaluate Illustrative Alternatives according to the following performance measures:

- Construction Cost (Crossing) – Cost estimates will be based on per square metre of deck area of each type of structure. The preferred alternative for each structure will be determined based on the most cost-effective alternative satisfying the required design criteria; and

- Length of River Crossing – a measure of the crossing's cost based on length of crossing.

Highway Planning

The Highway Planning discipline ties together virtually all engineering aspects of this EA project. Illustrative Alternatives will be evaluated according to the following performance measures:

- Construction Cost (Plaza and Highway) – at a general level, a broad measure of construction highway capital costs; and
- Property Costs – cost of property requirements based on preliminary plans.

10.3 Engineering - Practical Alternatives

Both qualitative and quantitative assessments of Illustrative Route Alternatives, as noted above, will be conducted to determine the set of Practical Route Alternatives. The degree to which each Practical alternative improves Regional mobility will similarly be determined through analysis undertaken using a transportation systems approach.

10.3.1 Evaluating Practical Alternatives by Regional Mobility

As the list of Illustrative Alternatives is reduced to the list of Practical Alternatives, the Level 1 Analysis will be repeated if necessary to reflect any refinements made to the Alternatives as a result of their evaluation. In addition, Level 2 (see below) and Level 3 analyses will also be conducted.

A Level 2 – Highway Capacity Analysis will be conducted. Detailed traffic capacity and Level of Service (LOS) analyses will be undertaken, and will focus on links and facilities connecting the border-crossing plaza to the local road network and/or provincial road network. The analysis will be carried out using the Synchro/SimTraffic Traffic Capacity Software (compatible with Highway Capacity Manual Procedures).

Synchro models will be developed to include existing and proposed lane geometry and turning movement volumes. Turning movement volumes for existing facilities will be obtained from the City of Windsor, where recent counts exist. Where counts are unavailable or out of date, this data will be collected as part of the study. Turning movement counts for new facilities will be estimated using the updated Travel Demand Model (TDM) as well as manual trip generation procedures for major generators along the route, for example a remote truck inspection centre or staging area.

The Level 2 Traffic Analysis Report will include a summary of the analysis undertaken, key assumptions and descriptive performance measures for each of the Practical Alternatives and their respective sub-options.

In addition to the performance measures identified for Illustrative Alternatives, based on a more detailed level of information, the following performance measures of regional mobility for Practical Alternatives may be evaluated:

- Highway Network Effectiveness for the Detailed Service Levels (LOS) - by major facility type, a qualitative measure describing operational conditions within the traffic stream;
- Detailed Volume-Capacity (V/C) Ratio - the ratio of the flow rate (the equivalent hourly rate at which vehicles, etc. pass a point on a roadway, computed as the number of vehicles) to capacity for the transportation facility;
- Peak Hour Traffic – the volume of traffic that uses the facility during the hour of the day that sees the highest traffic volumes;
- Change in Total Vehicle-Kilometres of Travel vs. No-Build - which will measure average distance in kilometres travelled for auto, local truck and international truck and auto;
- Change in Total Vehicle-Hours of Travel vs. No-Build - which will measure average travel duration in hours travelled for auto, local truck and international truck and auto;
- Queue Length – a measure of the line of vehicles waiting to be served by the system in which the flow rate from the front of the queue determines the average speed within the queue;
- Average Link Speed - by major facility type;
- Average Delay - by major facility type;
- Average Travel Time – by major facility type;
- Continuous River Crossing Capacity (Redundancy) – this measure will assess the degree to which each alternative provides reliability/choice in the network;
- Operational Considerations (Plaza Accessibility) – a measure of crossing and plaza operations based on plaza accessibility including emergency access and serviceability, security, and flexibility for joint inspections and future needs;
- Operational Considerations of Crossing System (Crossing and Plaza) – a measure of plaza/crossing operations during peak travel periods; and
- Operational Considerations of Crossing System (Network) – Potential impacts to network during periods of congestion at border, based on storage capacity at plazas and to freeway connection.

10.3.2 Evaluating Practical Alternatives by Cost

Foundation Engineering

Feasibility-level engineering analyses of Practical Alternatives will be conducted to support prioritization of various route and structure alternatives. Tables will be prepared to compare alignment alternatives on the basis of foundation considerations. A scoring system will be developed in consultation with the engineering team and MTO/the Partnership which will allow assessment of the key foundation aspects such as embankment stability, tunnelling risks, mining subsidence risks, and structure foundations. Evaluation will be based on professional judgement.

The presentation of subsurface conditions along the routes will be refined, and a complete feasibility-level engineering analysis of Practical Alternatives will be conducted, to support prioritization of various route and structure alternatives. The results of the assessment will be compiled into a report, leading to the selection of a Preferred Alternative.

Pavement Engineering

The Pavement Engineering discipline will provide support and documentation for the development of the capital cost estimates for the project.

Bridge Engineering

For each viable structural alternative, a Structural Planning Report will be developed and will include a General Arrangement drawing. The General Arrangement drawing will provide preliminary details of the structure type, size and location.

For each of the practical alternatives where new, single span, complex (multi-span), and tunnel structures are required, we will carry out more detailed preliminary structural planning. The more detailed planning studies will include, but not be limited to, reviews of structural surroundings, number of traffic lanes required on municipal roads at overpasses and underpasses, number of future tracks required at Railway crossings, geometric alignments and profiles for overpasses and underpasses, horizontal and vertical structural clearances, navigable water requirements, site accessibility, hydrology requirements, environmental issues and mitigation, available foundation information, property requirements, existing utilities over and under the complex structures (multi-span) and single span structures, traffic constraints, road and railway detours, temporary watercourse diversions, and preliminary cost estimates.

A Structural Planning Report will be prepared for the Practical Alternatives. This report will include recommendations with respect to the preferred alternative for each new complex structure (multi-span), each single span structure and for the rehabilitation, widening and/or replacement of each existing structure. The report will address any unusual requirements, such as traffic, property, environmental, access, construction staging etc.

Bridge components of the Practical Alternatives will be evaluated according to the following:

- Cost (Bridge/Tunnel) – Preliminary cost estimates will be developed. Capital, operating and maintenance costs will be considered.

Highway Planning

Highway Planning Activities tie together virtually all aspects of the engineering work for this EA project. Throughout the process, the principles of Context Sensitive Solutions (CSS) will be used to seek out public input and endorsement while meeting the technical merits of the project. Although in many instances the performance measures will be similar to those used to evaluate Illustrative Alternatives, the evaluation of Practical Alternatives will require and be based on a greater level of detail. Performance measures by cost conducted by this engineering discipline will include the following:

- Construction staging/duration;
- Construction cost (plaza and highway);
- Operating/maintenance costs/life-cycle costs – at a detailed level, operating, maintenance and life-cycle costs; and
- Property costs – cost of property requirements based on preliminary plans.

Comments received from the stakeholders and the public will be used to refine the Practical Alternatives. Together with the U.S. Consultant, our Team will agree on the alignment of the Practical Alternatives at the river crossings, co-ordinate the technical and environmental disciplines and maintain liaison with the Consultation Team. During the analysis of Practical Alternatives, ongoing co-ordination between the two Consultant Teams will be established to maintain a unified approach to dealing with common design issues at the crossing (e.g. tunnel vs. bridge, approach grades, foundation issues) as well as to maintain a common work schedule. The Teams will also co-ordinate key agency meetings requiring bi-national representation (e.g. U.S. Army Corps of Engineers and/or U.S. and Canadian Coast Guard).

Design and refinement of Practical Alternatives to a level of detail that will enable the selection of a Preferred Alternative that can gain approval from the Partnership will be largely dependent on the knowledge of the study area. We expect that in order to respond to issues raised during consultation, aspects of the Practical Alternatives will need to be defined at a level of detail that is just short of the level expected for a typical preliminary design for an MTO facility. As such, we will need to acquire an intimate knowledge of details such as curbs, utility pole locations, impacts to driveways, driveway grades, tangent rollover etc. to refine the Practical Alternatives and to recommend a Preferred Alternative.

10.4 Engineering - Refining the Preferred Alternative

Following the evaluation of Practical Alternatives, one Preferred Alternative will be identified. This preferred route will then be improved and refined to reduce impacts to the environment.

10.4.1 Transportation (Systems) Planning

Following the Level 2 analysis, a Level 3 – Micro-simulation will be conducted. The purpose of the Level 3 Analysis component is to apply the VISSIM software tool to micro-simulate the Preferred Alternative (PA). VISSIM is a microscopic, time-step and behaviour-based simulation tool developed to model urban traffic operations. It is a highly sophisticated and complex tool that can be configured with a high level of detail related to lane configurations and geometry, traffic composition, traffic signal control operations, transit operations and commercial vehicle operations. It can generate highly useful statistics for the derivation and quantification of detailed measures of effectiveness. For this project, the VISSIM micro-simulation tool will be part of a layered analytical approach that will build on the preceding Level 1 and Level 2 analyses and help in the generation of detailed statistics associated with the PA, along with three-dimensional visualization of operations.

The Level 3 Traffic Analysis Report will also include a summary of the analysis undertaken, key assumptions and descriptive performance measures for each of the Practical Alternatives and their respective sub-options. Supporting traffic animations from VISSIM illustrating the findings will supplement the Report.

Building on the Level 3 analysis of the Preferred Alternative (PA), an Analysis of Preferred Alternative Report will be prepared presenting the travel demand forecasts, travel paths and routings, traffic simulations and traffic analyses, discussing the implications on domestic and cross-border commercial vehicle and passenger car traffic. The report will provide a detailed analysis of the LOS and link/intersection volumes, as well as queuing characteristics at all sections of the border-crossing system.

10.4.2 Bridge Engineering

Once the Preferred Alternative has been identified, we will support the route planning with a more detailed structure evaluation for a new or expanded crossing.

Also, for each Preferred Alternative, three-dimensional renderings of the viable structure alternatives will be professionally prepared showing the proposed alternative, pertinent roadway information, and other field data.

10.4.3 Highway Planning

Through this phase of the work, the Preferred Alternative (PA) will be refined to develop a Concept Design. From a Highway Planning perspective, this will require co-ordination and liaison between the Engineering, Environmental and Consultation Teams. We have scheduled a Value Engineering Assessment of the PA, to provide the Partnership a "peer review" of the PA and identified mitigation measures/strategies. As part of the consultation on the PA identified by the Consultant Teams, the Partnership could point to the VE Assessment as a check of the work done to date and a means of having another look at the Alternatives and mitigation measures to reduce even further any potential impacts.

Mitigation strategies, measures and commitments will be identified in the Concept Design, as appropriate. It is likely that some of the mitigation measures will result in the development of Concept Design Alternatives.

Development of the Concept Design

The Concept Design plan will be undertaken to a level of engineering detail necessary to support:

- The development of mitigation measures in consultation with the appropriate agencies;
- A decision under CEAA by each Federal Regulatory Authority (RA) on whether adverse environmental effects (after mitigation) are significant or not;
- MOE approval under OEAA; and
- U.S. Federal Highway Administration (FHWA) approval under NEPA.

Concept Design alternatives will be assessed based on consideration of natural, socio-economic and cultural impacts as well as technical considerations. Mitigating measures will be developed during the concept design phase and, upon selection of the preferred Concept Design, these measures will be incorporated to alleviate the anticipated environmental effects.

Concept Design will require additional co-ordination and liaison with the U.S. Consultant to verify the level of design detail required of common elements (e.g. the crossing and plazas), as it is possible that the decision under NEPA will require a greater level of decision detail of the crossing than is normally associated with Concept Design in Ontario/Canadian Environmental Assessments.

A number of Concept Design alternatives will be considered as part of improving the PA. Such alternatives would include:

- Reconfiguration of the plaza layout;
- Evaluation of replacing a large culvert or existing structure over a watercourse with a new / larger structure; and
- Minor revisions to the plan and/or profile in specific areas along the PA.

The Concept Design, including the description of the PA, the impacts and associated mitigation strategies and measures, will be documented in the DRIC Concept Design Alternative and Assessment Report.

10.5 Traffic Modelling – Introduction

10.5.1 Background

The two international border crossings at the Detroit River – the Ambassador Bridge and the Detroit - Windsor Tunnel – are the two highest-volume crossings between Canada and the U.S. An extensive amount of effort was undertaken in the *Planning/Need & Feasibility (P/N&F) Study* to develop a comprehensive travel demand analysis process for these crossings, resulting in an unprecedented ability to estimate cross-border commercial vehicle and passenger car traffic and diversion impacts, and to assess alternative solutions to anticipated transportation needs through a thirty-year time horizon to 2030, including new or expanded crossings and alternative modes. This detailed level-of-analysis was made possible through origin-destination data collection efforts undertaken for international passenger car and commercial vehicle traffic at Detroit River and St. Clair River crossings in 1999/2000. The conclusion of the P/N&F Study was that additional cross-border road-based capacity was needed at the Detroit River within the study horizon.

The analysis area for the P/N&F Study and the current Detroit River International Crossing (DRIC) Study is broad enough to include decision points where drivers of long distance trips may decide to use either the Ambassador Bridge/Detroit Windsor Tunnel crossings between Windsor and Detroit or the Blue Water Bridge crossing between Sarnia and Port Huron (Figure 22).

For the Detroit River International Crossing (DRIC) Study, travel demand forecasts must be updated to reflect new knowledge and data which has become available since the previous P/N&F Study, with the updated Travel Demand Model applied to provide forecasts and associated analyses to support several key aspects of the study, including:

- Development of Illustrative and Practical Alternatives;
- Identification of traffic impacts of alternatives;
- Identification of facility and system needs related to cross border traffic mobility;
- Identification of key freight mobility issues;
- Evaluation of alternatives;

- Refinement, evaluation and documentation of the Technical Preferred Alternative; and
- Concept design of the proposed plaza, customs and tolling operations.

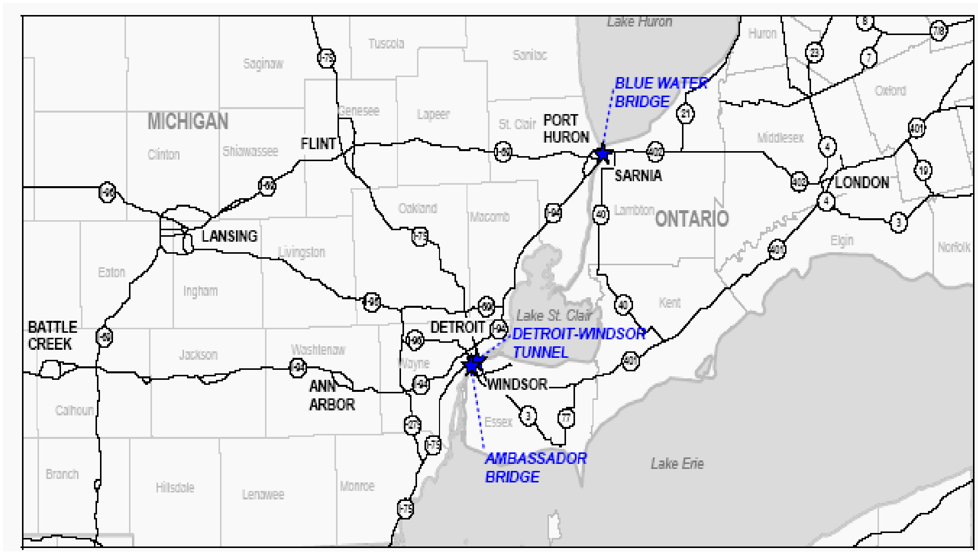


FIGURE 22. SOUTHWESTERN ONTARIO – U.S. CROSSING SITES

10.5.2 Need for a Model Update

The travel demand estimates for the P/N&F Study were carried out in 2002. At the time, the only practical choice for a base year for travel demand analysis was 2000, as 2001 was severely affected by the events of 9/11. It was anticipated that, after recovering from 9/11-related fears and increased border-crossing difficulties, traffic volumes would, in time, recovery to match the traffic levels projected from pre-2001 trends. At the time, it was recognized that 9/11 and other events might have long-reaching impacts that may have structurally changed cross-border travel demand in the study area and increasing the level of uncertainty in the travel demand forecasts. As such, many sensitivity analyses were performed at the time, some of which included a 2002 base year, which meant that the forecasts started from a lower level of traffic than those of 2000.

Three years have passed since the development of the P/N&F study travel demand model, bringing with them the ability to better incorporate the most current knowledge on the impacts of 9/11 and of other extreme events (the War in Iraq, and SARS), changing socio-economic trends (e.g. Canada-US exchange rate, fuel prices), the opening of casinos in the Detroit area, and changing attitudes on cross-border travel behavior. More recent traffic and trade data reveal that cross-border passenger car traffic, in particular, has declined dramatically in the study area, while commercial vehicle traffic has shown a stronger recovery.

There is a need to update existing travel patterns and characteristics to reflect the above changes to provide a new 2004 Base Year for this study. The analysis and update requires a detailed assessment of recent travel trends to determine the extent of the changes, if any, in the absolute number of trips, trip patterns and travel behavior characteristics and use by the different modes over the 2000 and 2004 period. While year 2000 origin-destination (O-D) surveys were available for the 2000 Base Year model developed in the P/N&F Study, no new O-D surveys have been undertaken since, requiring that the update of travel demand be based on analysis of the available data and statistics.

10.5.3 Update Approach

The modeling approach for the current study builds extensively on the P/N&F Study, but with a review of key assumptions, and with modifications reflecting current data and assumptions and the latest US-Canada trade projections. The approach to the model update includes the following components:

- Determining appropriate time periods to be modeled, as changes in traffic can result in changes to the time period that poses the greatest constraints on crossing and network capacities;
- Updating the 2000 passenger car trip tables to the 2004 base year to reflect changing travel patterns by trip purpose;
- Updating the 2000 commercial vehicle trip tables to the 2004 base year to reflect changes in trade flows by commodity type;
- Updating the transportation network representation, in terms of both the changes that have occurred between 2000 and 2004 and the future assumptions regarding facilities and border processing;
- Incorporating passenger car and commercial crossing choice models to more accurately determine the proportion of the total Detroit River/St. Clair River cross-border traffic that uses the Ambassador Bridge/Detroit-Windsor Tunnel crossings versus the Blue Water Bridge. Discrete choice logit models have been developed for this application, with sensitivity to travel time (for both models) and cost (for the commercial vehicle model); and
- Validating the updated model for the 2004 base year using traffic counts at the crossings and along screen-lines within the urban areas.

An updated travel demand model reflecting the above will support the traffic analyses that will be used to address traffic issues identified in the Canadian Terms of Reference and US Purpose and Need statement. The three levels of transportation analyses that will be undertaken to support the Study at major stages are:

- Level 1: Transportation Demand Model and Measures of Effectiveness
  – Application of the updated IBI Transportation Demand Model to generate traffic data to assess cross-border and system-level transportation impacts and which feeds into the analysis of preliminary illustrative alternatives and the subsequent Evaluation of Illustrative Alternatives;
- Level 2: Highway Capacity Analysis
  – Refinement of the Level 1 forecasts through more detailed traffic analysis using Highway Capacity Analysis techniques, as defined in the Highway Capacity Manual 2000 and implemented by several software programs (e.g. HCS, Synchro). This represents a traffic operations analysis at a link-by-link and intersection level and will be applied to the list of Practical Alternatives to

support the Evaluation of Illustrative Alternatives and List of Practical Alternatives; and

- Level 3: Micro-Simulation
  – Use of traffic simulation software to further analyse traffic operations on a microscopic level for the Technically Preferred Alternative(s). The Travel Demand Model outputs refined in the Level 2 analysis, are used as inputs to simulate the behavior of each vehicle at any given point in time in the border crossing system. Traffic performance for each vehicle is evaluated over specified time periods in the simulation, capturing the dynamic aspects of traffic on a network and helping to identify specific areas of traffic congestion and its upstream and downstream effects on traffic operations. This will provide level of detail and accuracy required to verify and refine the Technically Preferred Alternative(s) and to develop a concept design for the proposed plaza, customs and tolling operations.

Traffic micro-simulation software will also provide a highly effective tool in graphically displaying the operations and impacts to all audiences. The Highway Capacity Analysis and Micro-Simulation will involve the development and application of detailed traffic engineering and micro-simulation techniques, which will be based on and consistent with results from the Model Update. These analyses will be documented under separate cover.

10.6 Traffic Modelling - DRIC Study Model Process

The model process utilized within this study is illustrated in Figure 23. The differences between this process and that of the P/N&F Study, as outlined above, are discussed and detailed in the following chapters.

10.7 Traffic Modelling - Modelled Time Periods

The selection of time periods for analysis is one of the most important considerations in the modeling process. For modeling purposes, it is necessary to simulate the peak hours that dictate transportation infrastructure requirements for the crossings and access roads and highways to the crossings. It is also necessary to understand the different temporal distributions and peaking characteristics of the varied users of the border crossings (commercial vehicles, daily commuters, vacationers, etc.) to ensure an appropriate representation of each during the time period selected for modeling.

10.7.1 Seasonal Trends

Seasonal, daily and hourly volumes and trends were examined to determine an appropriate modeling period. Figure 24 shows seasonal trends for Detroit River cross border traffic via plots of monthly traffic for the years 2000 and 2004, for passenger vehicles, commercial vehicles, and total vehicles in passenger car equivalents (PCEs). Monthly passenger-car volumes were 23% to 37% less by month in 2004 compared to 2000. In both years, July and August had the highest levels of passenger-car volumes, followed by March, corresponding to peak travel/vacation periods. With lower proportions of discretionary travel in 2004 compared to 2000, monthly variation is less in 2004 (22%) than in 2000 (29%). This decrease in monthly variation reflects the lower number of same-day discretionary and vacation trips that are being made post 9/11. For commercial vehicle traffic, July has lowest traffic volumes due to annual plant shutdowns and

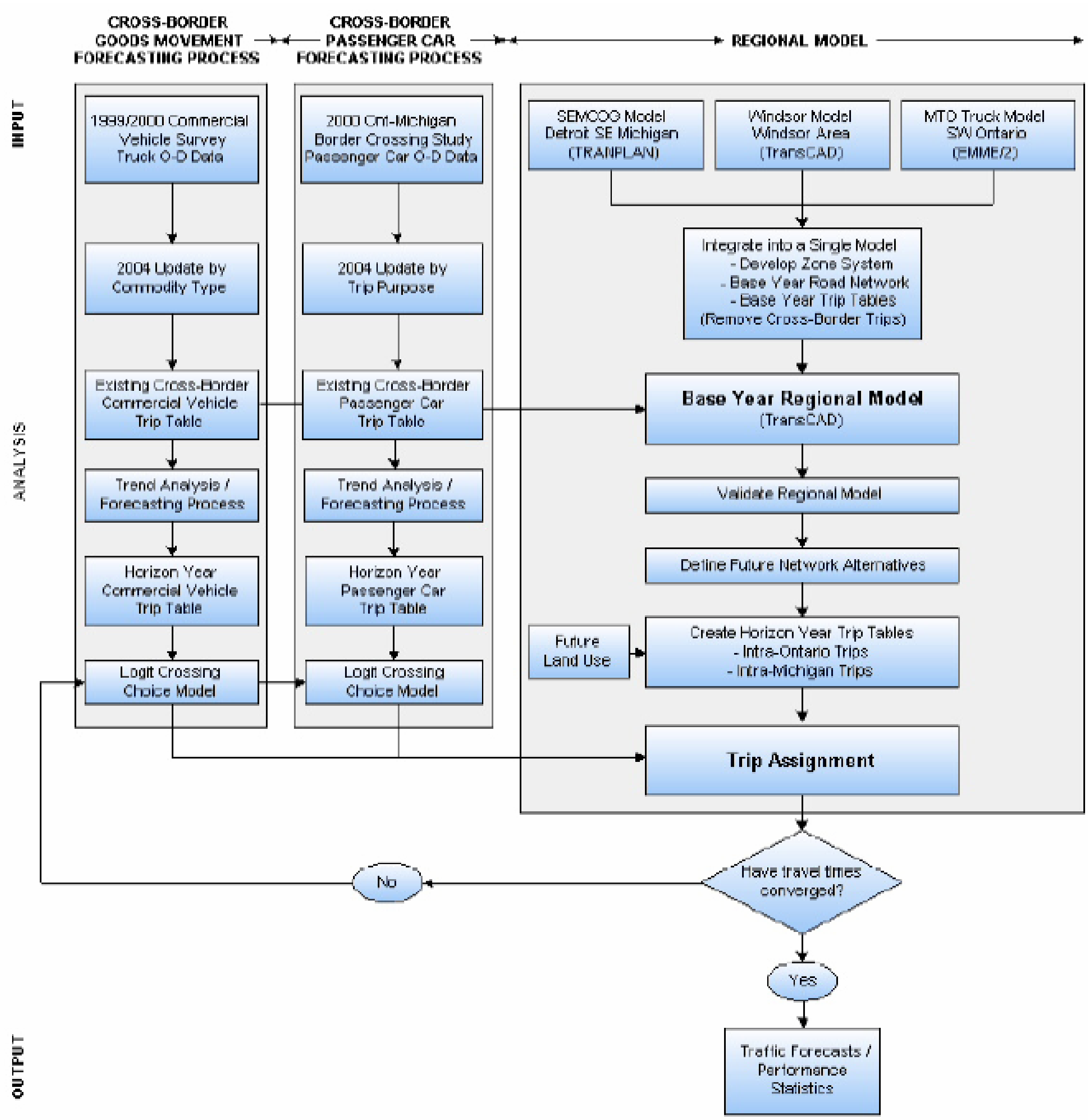
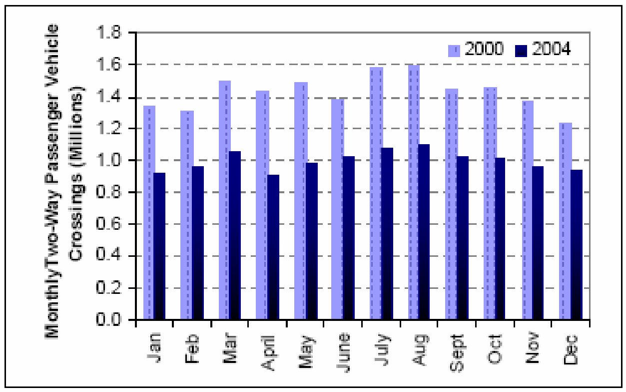


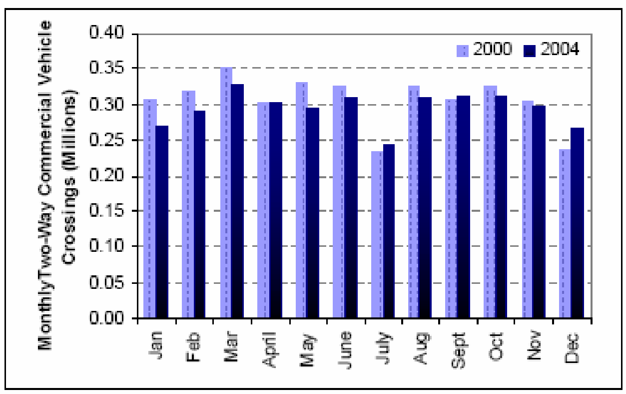
FIGURE 23. TRAVEL DEMAND MODEL PROCESS FLOWCHART

employee vacations. Highest traffic volumes tend to occur in spring, and occurred in March in 2000 and 2004. Monthly commercial vehicle volumes for 2004 were generally slightly less than corresponding 2000 volumes, except for the lowest volume months of July and December. When passenger and commercial vehicle traffic are combined, the highest total traffic volumes in terms of PCEs are in March and August, with late spring and early fall volumes close behind. Monthly total PCE volumes are 10% to 25% less in 2004 compared to the corresponding month in 2000.

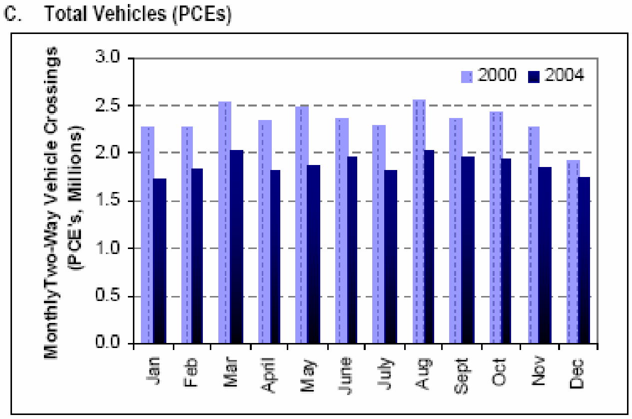
A. Passenger Vehicles



B. Commercial Vehicles



C. Total Vehicles (PCEs)

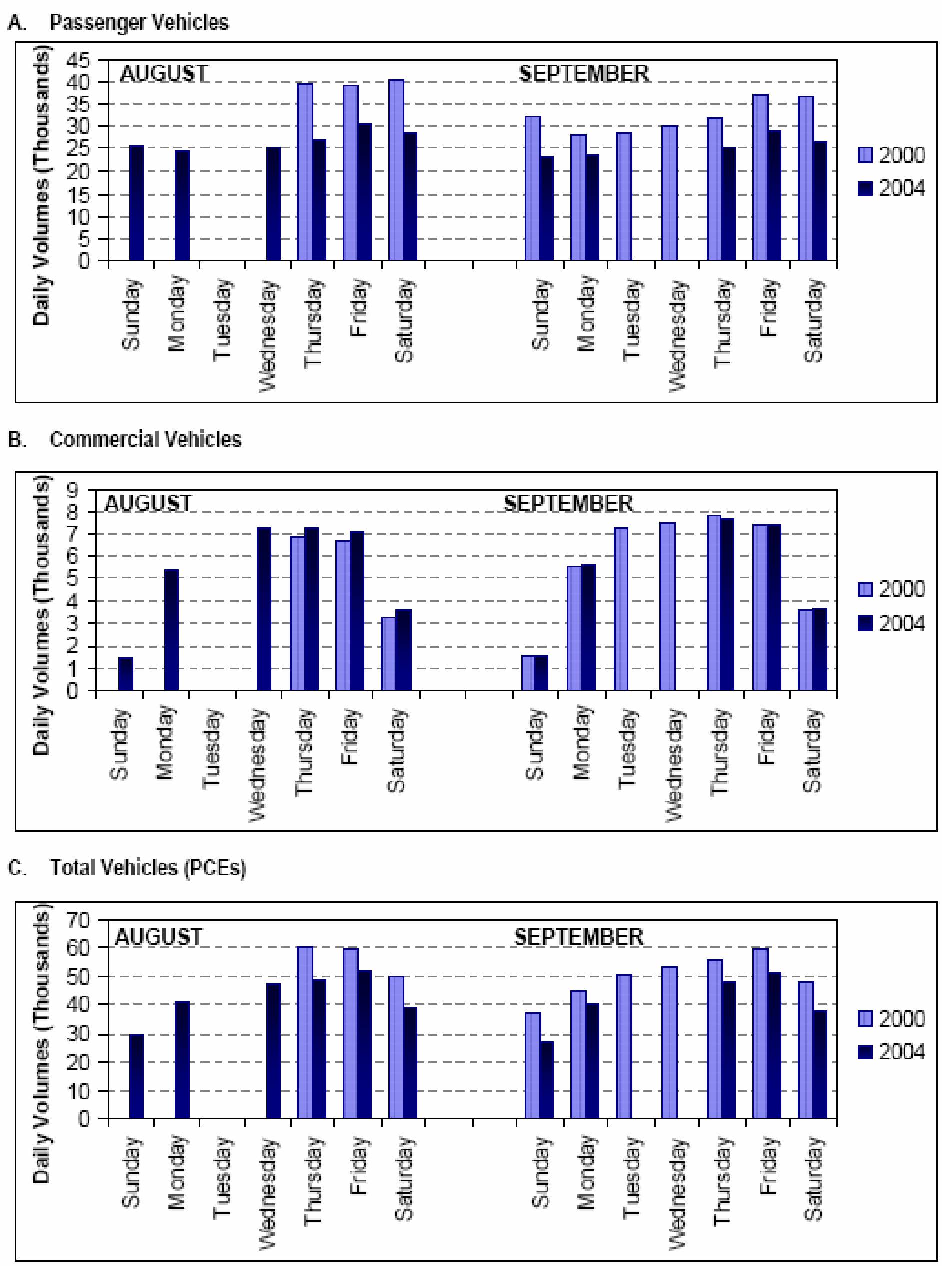


Source: BTOA
Note: One commercial vehicle is assumed to be equivalent to three passenger cars.

FIGURE 24. MONTHLY DETROIT RIVER CROSS-BORDER VEHICLE VOLUMES, 2000 & 2004

10.7.2 Daily Trends

Daily two-way totals were examined for two months: August, to capture summer peak passenger-car travel while avoiding the reduced commercial-vehicle activity that occurs in July; and September, to capture increased work/commuter activity and corresponding higher morning and afternoon peak volumes. These are plotted for available data in Figure 25.



Note: Zero volumes indicate that data were not available. One commercial vehicle is assumed to be equivalent to three passenger cars.

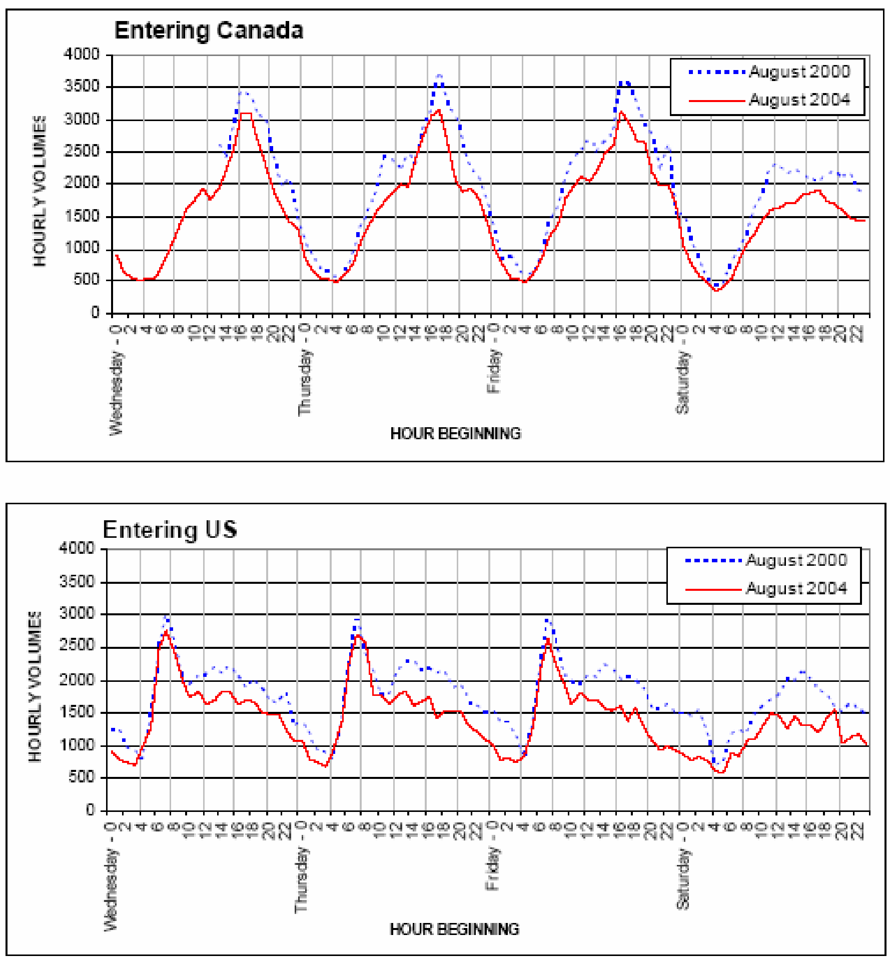
FIGURE 25. DAILY DETROIT RIVER CROSS-BORDER VEHICLE VOLUMES, AUGUST & SEPTEMBER 2000 & 2004

For passenger cars, volumes are generally highest on Fridays, with weekday work travel combined with increased recreational/vacation travel at the beginning of the weekend, followed by Saturdays. Commercial vehicle volumes are highest mid-week (generally Wednesday or Thursday), roughly half of weekday volumes on Saturdays, and roughly one-quarter of weekday volumes on Sundays. Combined in terms of PCEs, Fridays have the highest volumes, followed by Thursdays. In August 2000 however, Thursday volumes were very slightly higher.

10.7.3 Hourly Profiles & Trends

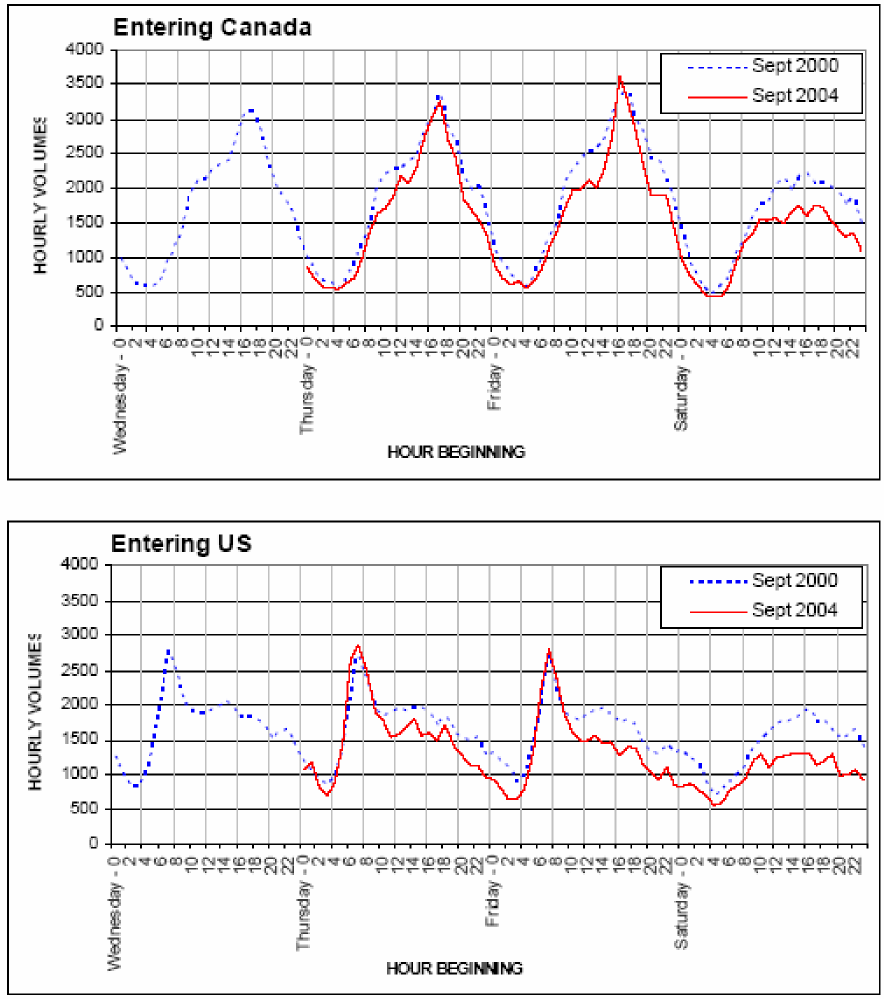
Hourly Detroit River cross-border traffic flows in PCEs by direction are shown over four consecutive August and September days in Figure 26. As indicated in the graphs, the peak hours expressed in PCE terms occur during the traditional morning and afternoon peak periods, given the heavy peaking of passenger cars, while commercial vehicles are more uniformly distributed throughout the day. The magnitude of the peak hours is very similar; with 2004 PCE peak hour volumes only approximately 3% lower than the comparable peaks in 2000.

A. August 2000 & August 2004



Note: One commercial vehicle is assumed to be equivalent to three passenger cars.

B. September 2000 & September 2004



Note: One commercial vehicle is assumed to be equivalent to three passenger cars.

FIGURE 26. HOURLY PCE TRAFFIC DISTRIBUTION, 2000 & 2004

Given the similarity in daily volumes and morning and afternoon peak volumes for Thursdays and Fridays, a Thursday-Friday average day travel characteristics and volumes were used as the basis for travel modeling. Hourly traffic profiles for the Detroit River crossings for a Thursday-Friday average day are shown in Figure 27 for August and September, 2000 and 2004, including passenger cars, commercial vehicles, and PCEs.

In all cases, the peak in US-bound passenger vehicle traffic occurs in the early morning, 6 to 9 a.m.; a high proportion of this travel includes Canadian residents commuting to US work locations. The peak in Canada-bound traffic occurs in the late afternoon (4 to 7 p.m.) with many Canadian commuters returning home. The morning and afternoon peaks are higher in September, while the mid-day volumes and total daily volumes are higher in August. This is due to increased discretionary travel (e.g. vacation/recreation travel) and a corresponding decrease in commuter travel while workers are on vacation in the summer months.

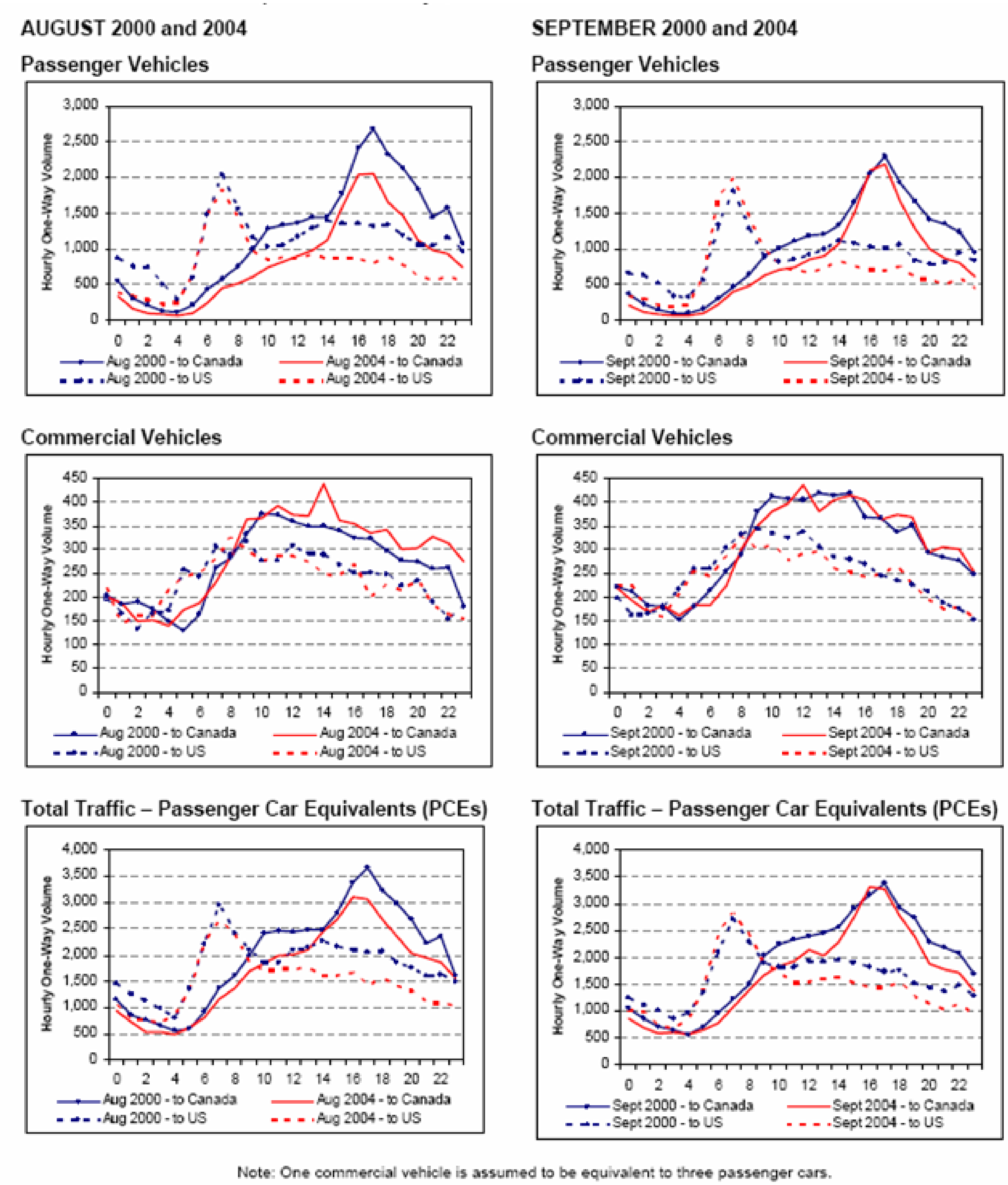


FIGURE 27. HOURLY DETROIT RIVER CROSS-BORDER TRAFFIC PROFILES, AUGUST & SEPTEMBER WEEKDAYS, 2000 & 2004

Commercial vehicles show a more uniform distribution of traffic throughout the day, growing slowly throughout the morning and peaking during the mid-day. Canada-bound commercial vehicle traffic generally peaks around noon, while US-bound commercial vehicle traffic generally peaks earlier, in the mid-to-late morning. The total and distribution of commercial vehicle traffic is relatively similar when comparing 2000 and 2004 volumes. There is also consistency between August and September traffic volumes. The volume and peaking of commercial traffic is noticeably higher in the US to Canada direction than the reverse direction. This reflects the nature of cross-border trucking patterns, with vehicles crossing into the US at one crossing and returning at another to improve efficiency. This triangulation results in the directional imbalances at the Ambassador Bridge and the higher commercial volume flows to Canada than to the US on this facility.

For US-bound traffic, the peak hour of 2,833 PCEs occurs at 7:00 to 8:00 a.m. This corresponds to the peak hour for passenger car traffic (1,982 vehicles). The commercial vehicle volume at this hour is 284 vehicles, while the peak hour for commercial vehicles occurs slightly later at 8:00 a.m. to 9:00 a.m. (327 vehicles). The peak hours for US-bound traffic are consistent at both crossings for passenger cars, commercial vehicles and total vehicles.

For Canada-bound traffic, the peak hour of 3,319 PCEs occurs at 4:00 to 5:00 p.m., at which time there are 2,107 passenger cars and 404 commercial vehicles crossing the Detroit River to Canada. The peak hour for passenger cars is 5:00 to 6:00 p.m. at 2,178 vehicles, but the volume of trucks at this hour is slightly lower (363 vehicles). The peak hour of 435 commercial vehicles occurs at 12:00 to 1:00 p.m. The peak hours for Canada-bound traffic are consistent at both crossings for passenger cars, commercial vehicles and total vehicles.

Significant decreases in passenger car traffic between 2000 and 2004 are evident during the off-peak periods and on weekend days: total summer and Fall weekday volumes decreased by 17% and 12%, respectively, while summer and fall monthly volumes were reduced by 21% and 17%, respectively. However, peak period volumes remained relatively stable, given the consistency of commuter travel over this time period. This is a very important finding, as it indicates that peak hour traffic levels have not decreased significantly in recent years despite large decreases in passenger car traffic.

The change in travel characteristics between 2000 and 2004 indicates a change in the peak hour from a summer afternoon weekday to a Fall afternoon weekday, although the differences are not large. The peak hour remains during the a.m. or morning for travel from Canada to US and in the p.m. or afternoon for US to Canada travel. The commercial vehicle pattern is more uniform throughout the day with the peak hour occurring in the early afternoon, although the increase over the a.m. and p.m. peak hours is marginal.

10.8 Traffic Modelling - Summary

Changes in travel behavior and trip patterns across the Southeast Michigan/Southwestern Ontario border have occurred during the past five years. A decline in the US economy, 9/11, a SARS outbreak in Toronto, the Iraq war, a rising Canadian dollar and the opening of three casinos in Detroit and other events have all contributed to a large decline in cross-border passenger car traffic and has retarded commercial vehicle growth. None of these events were reflected in the previous 2000 base year data that provided the basis for the thirty-year passenger car and commercial vehicle forecasts prepared for the previous Bi-national Partnership P/N&F Study. The Detroit River International Crossing

Study updated Travel Demand Model updates the passenger car and commercial vehicle travel patterns and characteristics to 2004 and the updates the P/N&F Travel Demand Model for the current DRIC Study.

This includes incorporating the changes in traffic levels, trip purpose, trade by commodity group, origin-destination patterns and modal share. The road network has been edited to incorporate new infrastructure as well as proposed additions to existing facilities. A crossing choice logit model has been added to better reflect the estimation of the split of flows between the Detroit River and St. Clair River crossings. The traffic assignment model has also been refined to simulate conditions during three peak hours: the a.m. peak hour (peak Canada to US flows), p.m. peak hour (peak US to Canada flows) and mid-day peak hour (peak commercial vehicle volumes). Finally, a detailed screenline validation of the assignment model has demonstrated that the model generates a reliable representation of traffic conditions along the main corridors used by international traffic in the Windsor area.

The resulting Travel Demand Model Update provides a comprehensive transportation analysis tool that is based on detailed travel origin-destination data for passenger cars and commercial vehicles, reflects local domestic background traffic in urbanized areas, with assignment to detailed presentations of the road and highway network and international crossings. The model provides a current (2004) and sophisticated tool to assess and evaluate the impact of new/expanded crossings on local and international traffic and related transportation impacts.

10.9 Geotechnical –Geology of the Windsor Area

The intent of this section of is to briefly identify and describe the subsurface conditions and the potential effect that these conditions may have on the selection of illustrative and practical routes, and to describe construction technologies that could be utilized.

The subsurface conditions in the Windsor area are characterised by regionally extensive, flat-lying soil and bedrock strata including:

- Surface layers of miscellaneous fill materials associated with industrial, urban and suburban development, typically ranging in thicknesses of 1 to 4 m, though local areas of deeper fills may be present in some areas;
- Native deposits of sand and silt may be present at or near the surface in some locations, particularly in the west end of the City of Windsor and Town of LaSalle;
- Beneath the sand, where present, and overlying bedrock, are thick deposits of silty clay that start out relatively stiff near the surface and become gradually softer and weaker with increasing depth. In the western sections of the study area, beneath the surficial sand deposits identified on Figure 28, the silty clay is generally less stiff than in the eastern part of the study area, and in some areas this silty clay deposit is very soft;
- Bedrock throughout the study area is generally encountered at depths of 20 to 35 m but can be found as shallow as 2 m and as deep as 54 m in localized areas. In many areas, a thin layer of dense glacial till overlies the bedrock; and
- Salt formations are found within the bedrock stratigraphy at depths ranging from about 150 to 400 m.

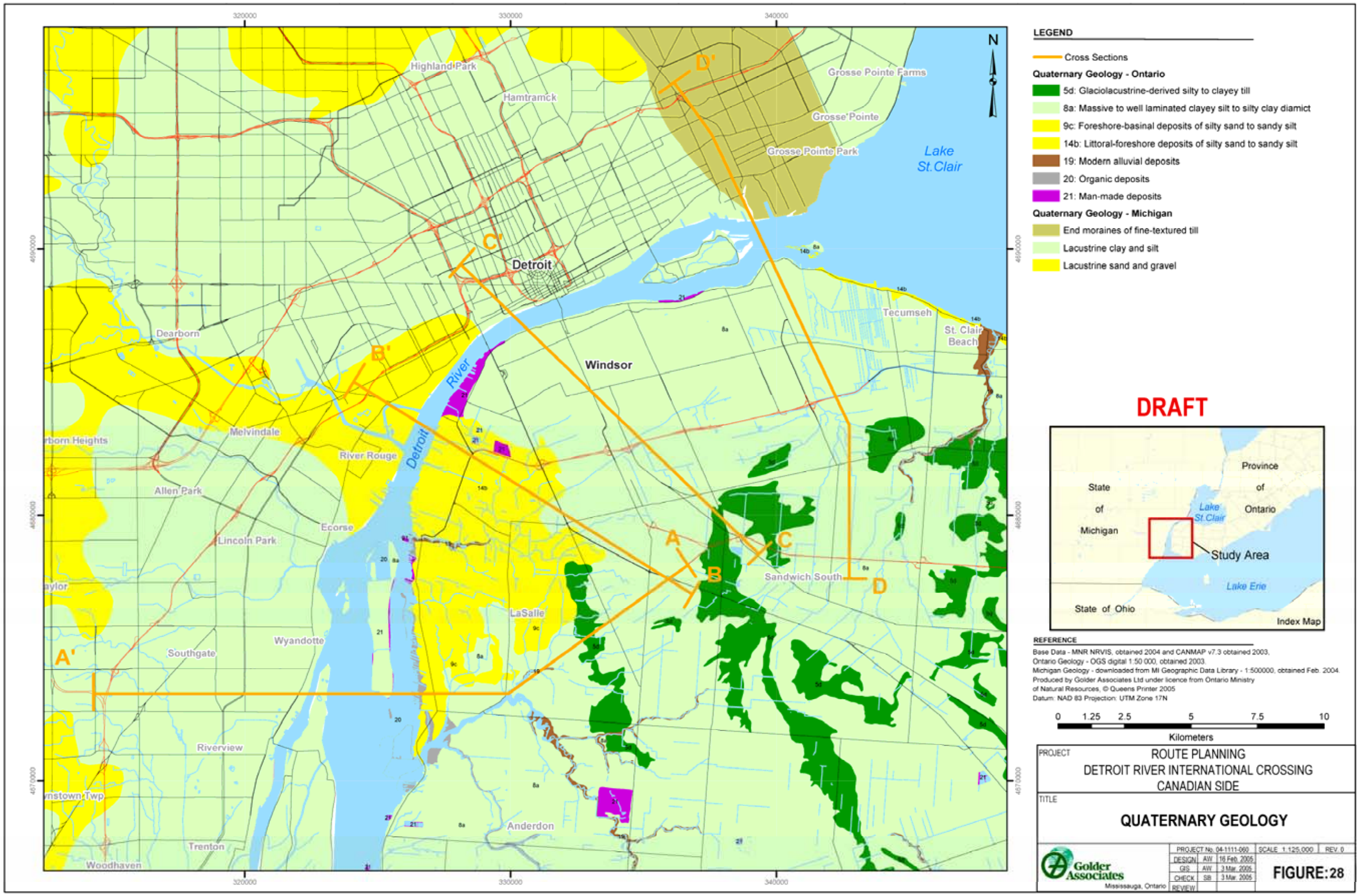


FIGURE 28. QUARTERNARY GEOLOGY

Figure 28 illustrates the general surficial sedimentary geology of the study area based on geologic interpretation of widely-spaced sample locations and an understanding of geomorphologic processes. This figure has been prepared using data and mapping from government agencies in both Ontario and Michigan. Although the surficial sedimentary information is more spatially detailed for Ontario and the nomenclature somewhat different between the two jurisdictions, the general characteristics of the sediments are well known in both areas.

10.9.1 Sedimentary Geology

The study area is located in the physiographic region of Southwestern Ontario known as the St. Clair Clay Plains. Within this region, Essex County and the south-western part of Kent County are normally discussed as a sub-region known as the Essex Clay Plain. The clay plain was deposited during the retreat of the ice sheets (late Pleistocene Era) when a series of glacial lakes inundated the area. In general, the ice sheets deposited till in the area of Windsor and Detroit. Depending on the locations of the glacial ice sheets and depths of water in the ice-contact glacial lakes, the till may have been directly deposited at the contact between the ice sheet and the bedrock or, as the lake levels rose and the ice sheets retreated and floated, the soil and rock debris within and at the base of the ice may have been deposited through the lake water (lacustrine). Glacial till, in its common usage, often indicates a very dense or hard composition resulting from consolidation and densification under the weight of the ice sheet. The mineral soil particles typically have a distribution of grain sizes ranging from cobbles to clay. However, in many areas of Windsor and Detroit, the soils described as “glacial till” were deposited through water and have a softer consistency as a result. A large end moraine of glacial till is mapped in the area of Windsor-Detroit, generally trending northwest to southeast near the outlet of Lake St. Clair as illustrated by the dark-green areas illustrated in Figure 28. Outcrops of this moraine may also be found throughout Essex county near the terminus of Provincial Highway 401. In other areas, the lacustrine deposits overlie the hard glacial till,

The major clay stratum, typically ranging in thickness from about 20 m to 30 m, exhibits a till-like structure exemplified by a random distribution of coarser particles within the primarily fine-grained silt and clay deposit (this type of deposit is also called “diamict”). In most of the eastern and northern parts of the study area below frost depth, the near-surface clay is generally stiff to hard and brown and exhibits undrained shear strengths in the range of 200 kPa or more. This layer is often about 2 to 3 m thick; though in some areas can be up to 10 m thick. Underlying this stiff to hard “crust” the silty clay becomes grey-brown, firm to stiff, and exhibits undrained shear strengths in range of 60 to over 150 kPa. Below the groundwater level, the undrained shear strength of the soil decreases and is typically between 40 and 60 kPa. In the western part of the study area, beneath the sand deposits identified on Figure 28, the undrained shear strength of the silty clay can be as low as 10 to 20 kPa, but is more typically in the range of 25 to 40 kPa.

Surficial layers or pockets of more typical layered lacustrine (lake deposited) silty clay, silt, or sand may be encountered overlying the extensive stratum of “till-like” silty clay. Silt and sand deposits, on the order of 2 to 4 m thick, are often found near the ground surface in areas near the western side of Windsor and the south-western limits of the study area. A relatively thin stratum, on the order of 1 to 6 m thick, of very dense or hard basal glacial till or dense silty sand is found directly overlying the bedrock surface.

10.9.2 Bedrock Geology

Within the Windsor area, the bedrock geology consists of an evaporate-carbonate sequence of rock formations. These include the Silurian Salina formation, the Devonian Bass Islands dolomite, the Detroit River Group, the Dundee Formation, and the Hamilton Group, respectively, with decreasing age and closer proximity to the ground or bedrock surface. The surface of the bedrock, beneath the overlying sediments, is relatively flat except for “a significant depression in the vicinity of the Windsor airport. The depression may represent a dissolution collapse of either the underlying carbonates or the lower Salina salt beds” (Hudec 1998).

Devonian Age bedrock of dolomite, shaly limestone, limestone and sandstone extend from the bedrock surface, found at depths of between 20 and 40 m, to depths of about 160 m below ground level. These bedrock formations are underlain by the Salina Group of formations that include thick salt beds at depths of about 270, 300, and 400 m below the ground surface. It is also known that relatively small volumes of petroleum are found within the limestone and dolomite strata.

Near the eastern limits of the study area, the bedrock encountered beneath the sedimentary deposits is the Hamilton Group of limestone, shaly limestone, and mudstone formations. Near the southwestern tip of Belle Isle, the uppermost bedrock formation is the Dundee limestone formation within the Hamilton Group. Approximately equidistant between Belle Isle and Fighting Island, the uppermost bedrock formation transitions to the Detroit River Group and the Lucas formation of dolomite in particular.

10.9.3 Hydrogeology

Static groundwater levels within the overburden soil deposits are typically at about 1 and 3 m below the ground surface depending on specific locations and ground surface elevations. Groundwater within the underlying glacial till and bedrock in some areas, however, is known to be under artesian pressures (in which groundwater levels will rise above the ground surface for wells that penetrate the soil overburden and connect with groundwater in the bedrock). In these areas, particularly in the western part of the study areas, artesian pressures may be on the order of 2 to 3 m above the river level. In general, groundwater flow will be toward the Detroit River, Lake St. Clair, and Lake Erie. Groundwater from within the bedrock is likely to be corrosive because of the salt deposits found at depth.

10.9.4 Gas

It is also know in some areas that the groundwater contains hydrogen sulphide that will be liberated from solution and become hydrogen sulphide gas at normal atmospheric pressures. Hydrogen sulphide gas is toxic at low concentrations. Methane gas has also been encountered during excavations into both soft ground and bedrock in the Detroit-Windsor area. Methane gas can present an explosion hazard if not adequately controlled during construction.

10.10 Geotechnical - Influence of Subsurface Conditions on Potential Route Selection

The subsurface conditions may influence the selection of proposed transportation corridors in differing ways. Brief discussions of these different potential corridor and route selection influences are provided below.

10.10.1 Salt Extraction Activities

Within the Windsor-Detroit area, salt has been extracted from beneath the ground surface since the mid- to late 1800's. The salt has been extracted using two different methods, solution mining and underground rock salt mining. Salt extraction by solution mining involves pumping water into wells drilled into the salt formations, dissolving the salt with the pumped water, and extracting salt from the saline water (brine) which is returned to surface. Rock salt mining of the salt typically uses the "room and pillar" method, whereby mine shafts are excavated from the ground surface down to the level of the salt beds. At the level of the salt beds rooms are excavated using drilling and blasting, and the "rock" salt is transported back to the surface in large buckets, or "skips". The extraction of salt from deep formations results, in most cases, in subsidence of the ground surface. The methods of salt extraction and their effects on the ground surface are discussed in more detail below.

Solution Mining

Brine production started in the Windsor-Detroit area at the beginning of the 20th century. The Canadian Salt Company Limited was founded in 1893 under the name of Windsor Salt Company. The company owned many brine wells in the Township of Sandwich West. The rest of the brine wells located in this area are or have been owned by Wyandotte Chemicals Corporation, BP Canada Energy Company, Dome Petroleum Limited, Allied General Chemical Canada Limited, and Canadian Steel Corporation. Ownership of some wells has been transferred between several of these companies and their respective subsidiaries or parent companies a number of times over the years since the wells were first installed. The total depth of most wells located in this area varies from about 430 m to 495 m. A minority of wells have total depths of between 230 m and 315 m.

There is extensive salt production in southwestern Ontario and southeastern Michigan accomplished using the brine well, or solution mining, method. The majority of food-grade salt and pure salt used in the chemical industry is produced in this way since it has the advantage of leaving insoluble impurities within the underground cavern. In addition, salt is a useful medium in which to create safe storage space for petrochemical products and extensive industrial activity in the region has resulted in widespread development of salt caverns. Some individual wells in the older brine well fields may not be included within the OGSRL database of known wells. In particular, it is understood, based on collected documents, that there are a relatively large number of abandoned wells on the Canadian Industries Limited (CIL) site in Windsor, one of the oldest brine production facilities in the area. The CIL site was the location of a sinkhole in 1954, as discussed below, and many of the wells were abandoned at that time or in the one or two decades following and little information was available for this report regarding their exact locations.

As a consequence of solution mining activities, large caverns have been formed where the salt was removed. Modern methods of cavern development control the shape and size of caverns quite carefully. However, it was not unusual, for the cavities surrounding older wells (those drilled prior to about 1970), to become accidentally interconnected or for accidental interconnection to adjacent aquifers to occur. Interconnection of caverns may occur either by overlap of gradually enlarging caverns, enlargement of natural solution features or fractures, or intentionally though the use of directed jets of water and air. Modern caverns used for salt production, as opposed to product storage caverns, may also be intentionally interconnected. As caverns were interconnected, it then became possible to pump water down into the salt formation through one well and extract the resulting brine from a nearby well, improving the productivity of the mining operation. Single well caverns have been known to be on the order of 200 to 300 m in diameter or more and more than 50 m in height. Caverns may be interconnected in rows as long as 1,000 m or more. Caverns created by single brine wells can be in the range of 0.2 to 1 million cubic metres in volume and that interconnected brine well caverns are typically on the order of 1 million cubic metres in volume or more.

Several locations in the study area have experienced sinkhole development. One incident occurred in 1954 at the Canadian Industries Limited (CIL) facilities in Windsor. In this instance, an approximately 600 m diameter bowl-shaped depression developed slowly over the course of a number of years with central settlements on the order of about 50 mm, then within a period of a few hours, the ground collapsed into a sinkhole about 9 m deep at the centre and 150 m in diameter. Several buildings and railroad facilities were irreparably damaged during this incident. The sinkhole was later filled and the area has been reused for open storage and rail yards. Several large sinkholes also developed in a similar fashion on Grosse Ile. These sinkholes ranged in diameter between 100 and 300 m and were over 20 m deep. Another suspected sinkhole may have occurred on the property of the Detroit Marine Terminal in the early 1960's, though the details of this report were not well documented and it has been interpreted by others that the event was indicative of causes unrelated to salt extraction. Based on an anectodal report from a site operator, there may have been precursors to a sinkhole in Amherstburg that did not fully develop and remained as a localized but distinct depression over a now-abandoned brine well field, but the details of this report are not well documented.

The presence of brine well mining activities within a possible route could lead to the potential for general subsidence or a sudden collapse directly over these areas. The potential for collapse is generally thought to be greater for wells that were in operation prior to about 1980, but this potential depends to a great (and often indeterminate) extent on the well operational methods, local bedrock conditions, interconnection of cavities between wells, and the methods used to abandon or plug the wells. Further study of specific areas and well and cavern conditions will be required to adequately assess the likelihood, if it exists, and magnitude of such potential subsidence.

"Room and Pillar Mining (Dry Mining)

Salt is also mined in a dry form, mainly for application as a highway de-icing agent. Underground mining of rock salt typically occurs using the "room and pillar" method, whereby mine shafts are sunk from the ground surface down to the level of the salt beds and rooms are then created by horizontal tunnelling. In room and pillar mining the ore is excavated leaving pillars to support the roof. Rooms and pillars are dimensioned depending on the depth of the mine and the strength of the rock in the roof and pillars and it is typical to design pillars to be stable for an indefinite time period. Generally, pillars are arranged in a regular pattern, like a checker board. The salt is mined by drilling and blasting, and it is then crushed and the “rock” salt is transported to the surface in a large box or “skip” suspended from wire hoisting ropes in the shaft.

Subsidence also occurs over room and pillar mines, though it is more easily predicted since the size of pillars can be easily controlled and it is possible to install support in the mine roof if there is any indication of instability. Subsidence may occur in the context of underground mining due to the gradual deformation or, occasionally, the sudden collapse, of the pillars that remain after salt extraction. Since the pillars are generally very large, it is rare for sudden collapse to occur and so the most common type of subsidence is a very slow, widespread sinking of the ground surface across the entire mining area. As ore is mined from the “rooms”, the load carried by the overlying “roof” rock is transferred to the pillars.

The presence of deep salt mining activities within a possible route could lead to the potential for general subsidence. General subsidence of the type observed over room and pillar mines in the Windsor area is unlikely to cause significant concerns for highway pavements or embankments, in that repairs could be made if and when needed, but may be undesirable for bridge structures.

10.10.2 Other Industrial Activities

The general Windsor metropolitan area has been the site of industrial activities since the mid-1800’s. Such activities may have an influenced on both the physical and chemical (environmental) conditions of the route areas. It is not within the scope of this paper to address potential environmental contamination.

10.11 Geotechnical - Foundations

10.11.1 Structures

In some areas, it may be feasible to support relatively lightly loaded structures on shallow spread foundations seated on the surficial sand deposits or the stiffer parts of the silty clay deposits. However, the feasibility of this foundation option will be highly dependent upon local soil conditions, foundation loads, and performance (settlement) requirements. It is understood that some portions of the approach structures for the Ambassador Bridge are supported on shallow foundations.

In the Windsor area, structure foundations often consist of driven steel H-piles. It is likely that such driven pile foundations may be required for highway overpass structures constructed along the potential routes joining Highway 401 with the crossing location.

Drilled shaft foundations may also be used for support of heavily loaded structures. Construction of drilled shaft foundations may be complicated by the presence of artesian groundwater pressures, methane, or hydrogen sulphide gases which are largely dependent on the depth of drilling into bedrock, groundwater inflows, local artesian pressures, and gas concentrations.

Heavily loaded bridge foundations, of the type that may be needed for large-span structures crossing the Detroit River, have often been constructed using deep “caissons”. Although this term is often locally applied to drilled shaft foundations, bridge caissons usually consist of relatively large structures built by:

- constructing a perimeter form, either circular or rectangular, at the ground surface using timbers, steel, or concrete (pre-cast or cast-in-place) that encompasses the final foundation plan shape;
- excavation is then carried out within and immediately beneath the edges of this form and the form is permitted to "sink" to the bottom of the excavation – in some cases, the edge of the form is created to act as a cutting edge;
- the height of the perimeter form is then built up, and the excavation sequence is carried out once again;
- this process is repeated until the final excavation depth and bearing stratum is reached (thus building the support for the excavation as the excavation proceeds); and
- the excavated interior of the form is filled with mass concrete creating a large foundation column to support the superstructure.

This method has been used to construct many of the foundations for major bridge crossings around the world. Often, to counteract groundwater pressures or the tendency of soft soils to squeeze into the caisson at its base during construction, excavation within the caisson is completed under compressed air. Because of health and safety concerns related to working under compressed air, recent work of this type has also been conducted using slurries, with all of the excavation and concrete placement work conducted under water. Similar to drilled shaft foundations, construction of drilled shaft foundations may be complicated by the presence of artesian groundwater pressures, methane, or hydrogen sulphide gases. As with other foundation types discussed above, final design capacities must be based on site-specific explorations and analyses.

10.11.2 Embankments and Earthwork

The relatively soft deeper portions of the extensive deposits of silty clay in the Windsor area will influence embankment design and construction. Most typical highway embankment heights in the eastern study area are in the range of 5 to 10 m and satisfactory stability has been achieved with side slopes of about 2 to 1; however, high embankments, on the order of 10 to 15 m (e.g. high bridge approaches) may be unstable at these side slope configurations. In the western study area, in those locations with soft clay deposits, embankment heights may be limited to between 3 and 5 m. It is anticipated that stability conditions will be more sensitive to local conditions in the western areas of the project. Additional mitigation measures may be required for high embankments in the east and typical highway embankment heights for those sections in the western project areas. These mitigation measures can include slope flattening, by providing counter-balancing mid-height berms along the slope of the embankment, or implementing a ground improvement program. Additional information on such mitigation measures can be provided at a later date should such high embankments be considered.

Although stability may be satisfactory, embankments will experience combined short and long-term settlements of 200 to 400 mm for embankments about 10 m high for those built over the soft to stiff soils in the eastern project areas. Similar settlements may occur under embankments with heights as little as 3 to 5 m for those constructed in the western project areas. It is anticipated that settlement conditions will be more sensitive to local conditions in the western areas of the project.

10.12 Geotechnical - Underground Construction

Apart from the route selection issues associated with historical salt extraction activities, three subsurface conditions will dominate geotechnical-related design decisions, construction methods, and costs for underground construction in the proposed corridors. These conditions of concern include deep and extensive deposits of relatively soft silty clay, bedrock groundwater conditions, and the presence of methane and hydrogen sulphide gas. Hydrogen sulphide gas, dissolved in the groundwater within the bedrock, will be liberated upon exposure to atmospheric pressure. Hydrogen sulphide gas is toxic to human health in relatively small concentrations and may adversely affect any underground construction and must be taken into account for any future construction or planning studies. Explosive methane gas has also been encountered in underground construction in the area. It is anticipated that monitoring and control of such gases will be required for any underground construction.

10.12.1 Excavations for Shallow Foundations and Utilities

Excavations made for utilities and near-surface foundations that are, in general, less than about 5 m deep and at great distances from the Detroit River, may be made using conventional methods. For preliminary planning such excavations will require dewatering and side-support using trench boxes or sheeting or side slopes on the order of 1 horizontal to 1 vertical. Excavations made near watercourses may need special measures to support the sides of the excavation, ensure base stability and maintain dewatered conditions within the excavation.

10.12.2 Cut and Cover Tunnels and Shafts

The relatively soft consistency of the silty clay soils at the site require that special consideration be given to maintaining base stability, ground displacement, and dewatering. Excavation depths of 10 m or more are expected to be unstable or only marginally stable if the extensive deposit of silty clay is found at and below the bottom of the excavation. Additional detail on these techniques will be discussed in future reports as appropriate.

Provided that excavation support is adequately maintained, excavations into the relatively soft and extensive silty clay will require only limited dewatering. However, if the excavation extends to great depths where the excavation depth is larger than the distance between the bottom of the excavation and the underlying glacial till or bedrock surface, artesian groundwater pressures can result in potential base instability. For the shafts constructed for the Ojibway mine, ground freezing was used to allow full penetration of the shaft through the lower reaches of the silty clay, glacial till, and the upper reaches of the bedrock.

10.12.3 Mined Tunnels

Tunnels may be mined in the sedimentary deposits of the Windsor area. In the upper portions of the extensive silty clay deposit, relatively small diameter tunnels, on the order of 2 to 4 m in diameter, have been mined using open-face shields. Within the deeper and softer parts of the silty clay, when tunnelling using open-face shields, the clay may squeeze into the face. For this reason, modern tunnels at depth or of large diameter within the softer zones of the silty clay are most often constructed using closed-face tunnel boring machines. Older tunnels utilized compressed air to counteract the tendency of the soils to squeeze into the face. Tunnels within the bedrock have also encountered difficulties due to groundwater and hydrogen sulphide gas conditions. Some of the tunnels constructed near the Detroit River, or through similar ground between Sarnia (Ontario) and Port Huron (Michigan), are listed below as a historical perspective of tunnelling in the area and the problems that such tunnelling encountered.

- A soft ground tunnel was to be constructed for a railroad crossing in the late 1800s to connect the downtown areas of Detroit and Windsor. After a number of attempts, the tunnel effort was abandoned due to ground water inflows and hydrogen sulphide gas. It is understood that two workers were killed by exposure to toxic hydrogen sulphide gas.
- In 1890, a rail tunnel was constructed between Sarnia, Ontario, and Port Huron, Michigan. Initial construction attempts involved the installation of a lower drainage tunnel. This tunnel was abandoned during construction due to flowing sand and water within the face. Soft clay squeezing into another 2 m diameter test tunnel (at about 27 m below ground surface) was so fast that the test tunnel was abandoned. Methane gas, squeezing clay, and groundwater control problems also resulted in abandonment of a similar test tunnel on the Canadian side of the works. Subsequent work on large diameter shafts for another attempt at a full size tunnel was abandoned due to squeezing clay at between 20 m and 30 m depths. The use of shafts was abandoned as a tunnel construction technique and the approaches were moved further from the shores. The approaches to the tunnel were constructed in open-cut to depths of between 10 m and 15 m. During construction the open-cut side slopes failed on two occasions. The tunnel was finally constructed through the soft clay using an open face shield and compressed air for face support.
- In 1910, the Detroit River Rail Tunnel was completed beneath the Detroit River. The river crossing was completed as an immersed tube tunnel (where the bottom of the river was dredged to allow burial of the tunnel sections). The approaches to the tunnel were constructed through soft ground using an open face tunnel shield and compressed air for face support with the shallower sections constructed using cut and cover methods. It is understood that the top of this tunnel is about 1 to 2 m below the bottom of the river bed.
- Between about 1928 and 1930, the Detroit River Car Tunnel was constructed similarly to the Detroit River Rail Tunnel, using immersed tube, shield and compressed air, and cut and cover methods. This tunnel is covered by about 2 to 3 m of backfill up to the river bed elevations.
- The Belle Isle River Intake Tunnel connects the northern end of Belle Isle with the Michigan mainland for drinking water supplies. This tunnel was constructed in the 1930s within the bedrock. Hydrogen sulphide gas, liquid petroleum, and artesian water inflows all complicated construction of this tunnel.
- The Detroit River Outfall Tunnel No. 1 (DRO-1) was constructed in 1936 from near Jefferson Avenue and the Rouge River through soft clay within an open shield using compressed air at a depth of about 20 m.
- The Southwest Intake Tunnel (Land Section) was constructed in the 1950s from near the intersection of Goddard and interstate highway I-75 through soft silty clay with sand layers with an open shield about 12 m below the ground surface. It is

understood that two workers were also killed during construction of this project by exposure to toxic hydrogen sulphide gas.

- The St. Clair River rail tunnel, constructed between Sarnia and Port Huron in the early 1990s, was built using an approximately 9.5 m diameter earth-pressure-balance (EPB) tunnel boring machine (TBM). At the time, this was the largest soft ground TBM used in North America. At the lowest point of the crossing, the tunnel passes within 5 m of the river bed and about 1 to 2 m of the bedrock surface. The approaches to this tunnel were also constructed in open cut and concrete diaphragm walls with underground struts were used to provide additional stability to the base of the excavation and side slopes. During construction a shaft was built to access the TBM for unexpected repairs. Squeezing clay near the bases of the drilled shafts, used for support of the walls, and near the base of the excavation caused considerable difficulty during shaft construction. After TBM repair, the tunnel was constructed successfully.
- In 1995 the Second Street Sewer was built to cross below the E.C. Row Expressway. This approximately 1.3 metre diameter sewer tunnel was constructed using pipe jacking techniques with an open faced shield at a depth of about 11 metres through mainly stiff to very stiff silty clay till materials. Difficulties were encountered during the work caused by squeezing of the soils into the open face.
- The Detroit River Outfall Tunnel No. 2 (DRO-2), near the location of DRO-1, was started in 2000 using an open rock tunnel boring machine at a depth of about 85 m below the ground surface but abandoned due to difficulties with grouting, water inflows, and hydrogen sulphide gas.
- The approximately 2.1 metre diameter McDougall Avenue Storm Sewer Tunnel was constructed about 11 metres below existing grade and from the Detroit River to Tuscarora Street in the City of Windsor, Ontario. The tunnel was constructed in 1997 using a TBM through the firm to very stiff grey silty clay till.
- The Prince Road Storm Sewer, measuring about 1.8 to 2.3 metre diameter, was constructed in phases between 1980 and 1998 at depths of between 6 and 9 metres below the ground surface. The tunnel was constructed in the soft to firm grey silty clay using pipe jacking techniques and compressed air in some of the deeper sections.
- Boblo Island to Amherstburg underwater utility crossing, a 0.6 metre diameter directional bore, was drilled in the bedrock below the Detroit River in 2004. The bore was carried out in the Dolostone at a depth of about 7.5 metres below the river channel.

Tunnels constructed in soft ground beneath bodies of water run the risk of establishing direct connections between the body of water and the tunnel itself should ground losses occur. Where tunnels are constructed through rock that is close to or contacts the body of water, fractures within the rock mass can provide direct conduits for large inflows of water. This risk is more significant with relatively thin “cover” of either rock or soil above the tunnel. Direct connection of tunnel construction to bodies of water has resulted in flooding of tunnels. Use of full-face, closed and pressurised tunnel boring machines assists in reducing this risk but does not eliminate it entirely (e.g. Storabelt, Denmark and Sweden).

10.12.4 Immersed Tube Tunnels

As noted above, two crossings of the Detroit River have been constructed using immersed tubes. In general, this method of tunnel construction beneath bodies of water involves:

- Construction of pre-fabricated sections of tunnel, using either steel (historically cast iron has also been used) or concrete, in a dry-dock area;
- Dredging the bed of the water body to allow subsequent burial of the tunnel in a trench;
- Floating the pre-fabricated tunnel section to its planned position over the dredged trench and sinking the tunnel section into place;
- Joining of sunken tunnel sections and filling within or around these sections with concrete to fully enclose the tunnel and provide additional weight to the tunnel (in some cases, particularly those in which little cover over the tunnel is provided, permanent ground (rock or soil) anchors may also be necessary to counteract uplift forces);
- Backfilling over the top of the tunnel with rockfill or other materials to re-establish the river, ocean, or lake bed;
- Evacuation of water within the sunken tunnel sections; and
- Connection of the buried tunnel sections to the land areas using either cut and cover methods within a cofferdam or other use of other tunnelling methods (e.g. open face shields).

This construction technique has been used recently for other major transportation corridors including the Ted Williams Tunnel (Boston), Elbe River (Germany), Tama River (Japan), Eastern Harbour (Hong Kong), and Baltimore Harbor (Maryland). Although construction of an immersed tube tunnel may be conceptually feasible for this project, it is anticipated that environmental conditions and regulatory issues may significantly hinder the feasibility of this option. During dredging, the potential exists for disturbing environmentally contaminated sediments that are present in the river bed. The scope of this paper does not include review of the environmental conditions of the river bed, but it is anticipated that, given the long industrial history and our general knowledge of the area, that the potential for environmental contaminants within the river bed will need to be addressed during future planning and design efforts.

10.13 Geotechnical - Summary

The subsurface conditions in the area of the proposed corridors are characterised by: miscellaneous fills to typical depths of 1 to 4 m near the river; surficial sand deposits in the western study areas to depths of about 4 m; overlying stiff to soft silty clay to depths of 20 to 30 m overlying bedrock. In the eastern part of the study area, the ground conditions consist primarily of 20 to 30 m of firm to hard silty clay glacial till overlying bedrock. The bedrock stratigraphy consists of limestone, sandstone, and dolomite to depths of about 300 m with interbeds of salt, dolomite, anhydrite, and gypsum between the depths of about 300 to 500 m. Near-surface groundwater is typically found at depths ranging from about 2 to 5 m; however, groundwater pressures in the bedrock and granular soils are slightly artesian in some areas.

These conditions may influence the proposed transportation corridors in various ways including:

- Moderately to heavily loaded structures (e.g., bridges) will have to be supported on driven pile foundations, drilled shafts, or caissons founded on bedrock;
- The stiff to soft silty clay may limit embankment heights to about 3 to 5 m and 5 to 10 m in the western and eastern parts of the study areas, respectively, unless other settlement and stability mitigation measures are implemented (e.g, wick drains, lightweight fill, preloading, surcharging, ground improvement, or staged construction);
- The stiff to soft silty clay may limit excavation depths for roadways, railways, or deep utilities to about 5 m and 7 m in the western and eastern parts of the study areas, respectively. Deeper excavations may require complex measures for maintaining base stability (e.g., base slabs, buried struts, ground improvement); and
- Salt extraction activities (brine wells, deep mining) have created caverns in the salt deposits beneath some areas of the city. The older caverns have been known to cause surface subsidence, with several incidents having previously occurred in Detroit and Windsor.

11. SUMMARY

11.1 Summary

This Environmental Overview Paper (June 2005) has documented the current social, economic and environmental conditions in the Preliminary Analysis Area in order to identify constraints that may be faced in the development of proposed alternatives or the expansion or conversion of existing corridors

On the Canadian side, the density of protected natural features located along the Detroit River may present particular challenges. Because these natural features are small remnants of the original, they are particularly high in value and accordingly protected by statute, regulation and policy, and international agreement. Any alternatives that impact these features will undergo extensive studies to thoroughly document the current condition of such features and to completely understand the potential affects upon them. These studies may undergo successive review by several different agencies and levels of government.

Cultural features such as historical sites, parks, and cemeteries may, because of their number and density, pose particiluar challenges. Natural features such as wetlands are particularly highly valued because of their scarcity, but given their relative locations, may difficult to avoid fully.

Contaminated sites may present opportunities rather than challenges because the extent of cleanup is now limited to that which is commensurate with the safe re-use of the property. The liabilities for such properties, if acquired for right of way for transportation projects, are very limited if cleanup and use are conducted in accordance with applicable statutes and standards.

The following features are considered to influence the location for transportation corridors:

- commerical and residential areas;
- natural features;
- land uses or areas that are in transition to compatible transportation land uses (an opportunity); and,
- existing transportation infrastructure.

The following features may constrain, but do not preclude transportation facilities:

- parks and recreation areas;
- museums, zoos and aquariums;
- public libraries;
- churches, mosques and synagogues;
- cemeteries;
- archaeological sites and cultural heritage resources; and,
- wetlands, fisheries and wildlife habitat.

11.2 Summary of Environmental Issues

The individual social, economic, and environmental issues, all of which are referenced under the umbrella term "environmental" in this paper, each carry their own intricacies and complexities. The following is a general summary of the nature of the challenges that each type of feature presents.

11.2.1 Social Environment

The demographics and cultural areas within the PAA provide indications that the proposed alternatives will require sensitivity to social issues. These issues can be particularly time consuming and intractable.

11.2.2 Economic Environment

The Windsor Detroit area is one of three major links within a system of highways and trade corridors connecting major urban areas in southwest Ontario to major US centres. A significant amount of trade takes place between Canada and United States, and the transportation system in southern Ontario plays a key role in facilitating this economic activity. Therefore improving the connection between these two areas will have significant implications for the future economic prospects and growth of both Canada and the U.S.

11.2.3 Archaeological Resources

Both Canada and the U.S. place high value on the retention of Archological Resources and therefore place a high priority on the preservation of historical and archeological sites. The importance of these sites is often linked to their location and the context in which they are found. Any proposed alternatives that have the potential to impact such sites may face significant challenges.

11.2.4 Cultural Heritage Resources

Both countries in the PAA place high value on Cultural Heritage Resources and therefore place a high priority on the preservation of historical sites. The importance of these sites is often linked to their location and the context in which they are found. Any proposed alternatives that have the potential to impact such sites may face significant challenges.

11.2.5 Acoustics and Vibration

Noise is a component of the environment. Excessive noise can detrimentally affect residences, businesses and environmental sites. Both the Canadian and Ontario governments have recognized this and have implemented very similar noise mitigation policies and programs. While a very important issue, noise is seldom a determining factor in the location of a transportation project. However, any proposed alternatives will require assessment of the potential noise impacts and possiblemitagation measures that can be considered.

11.2.6 Air Quality

The air quality issue is of national importance both in United States and Canada, especially due to its effect on human health and welfare. The Canadian air quality program is a complex mix of intergovernmental agreements between provinces, national law, and international agreements with the United States. The aim of the program is to regulate the sources of emission, promulgate more stringent standards where it is deemed necessary, and improve all aspects of air quality monitoring programs.

In recent years, there have been increased traffic delays due to heightened security checks at the U.S. – Canada border. This has resulted in concerns regarding the local air quality. As a result, numerous local air quality studies have been (and continue to be) carried out by the MOE, EC and other organizations such as the University of Windsor. . A new or expaned crossing of the Detroit River will require an assessment of possible changes in Air Quality.

11.2.7 Waste and Waste Management

The Preliminary Analysis Area is intensely developed and industrialized and, as such, there are numerous contaminated and/or potentially contaminated sites located within it. The owner of a property is responsible for any contamination on it. However, whether the degree of contamination rises to the actionable level depends upon the context within which it exists. Contaminated properties may be used for transportation projects but the cost-effectiveness and legal entanglements must be carefully evaluated for each specific parcel. While there are a few exceptions, such as landfills, contaminated or potentially contaminated sites do not preclude a route, bridge, or other transportation project. Barring some unusual factor or circumstance, the technical, legal, and economic issues associated with them are usually resolvable.

11.2.8 Technical Considerations

Technical issue tend to be very engineering orientated and empirical based, with intricacies and complexities specific to each. The following is a general highlighting of the nature of three of the technical challenges that the DRIC project presents.

Engineering Considerations –The Engineering/Structural Planning component of the DRIC project will support the Route Planning for Illustrative and Practical Alternatives, Preliminary Concept Design and Environmental Assessment by providing feasible solutions tailored for each alternative, including cost information, construability assessment and aesthetic development.

Traffic Modelling – Changes in travel behavior and trip patterns across the Southeast Michigan/Southwestern Ontario border have occurred during the past five years. A decline in the US economy, 9/11, a SARS outbreak in Toronto, the Iraq war, a rising Canadian dollar and the opening of three casinos in Detroit and other events have all contributed to a large decline in cross-border passenger car traffic and has retarded commercial vehicle growth. None of these events were reflected in the previous 2000 base year data that provided the basis for the thirty-year passenger car and commercial vehicle forecasts prepared for the previous Bi-national Partnership P/N&F Study. The Detroit River International Crossing Study updated Travel Demand Model updates the passenger car and commercial vehicle travel patterns and characteristics to 2004 and the updates the P/N&F Travel Demand Model for the current DRIC Study.

The resulting Travel Demand Model Update provides a comprehensive transportation analysis tool that is based on detailed travel origin-destination data for passenger cars and commercial vehicles, reflects local domestic background traffic in urbanized areas, with assignment to detailed presentations of the road and highway network and international crossings. The model provides a current (2004) and sophisticated tool to assess and evaluate the impact of new/expanded crossings on local and international traffic and related transportation impacts.

Geotechnical Considerations – The scope of the salt mine and brine well foundation issues and the resulting potentially adverse ground conditions, will affect structure options and present construction concerns. There are challenges in determining extend of subsurface and geological features, and developing mitigation methods to deal with these features.