Canada-United States-Ontario-Michigan
Border Transportation Partnership

Detroit River International Crossing Environmental Assessment Study

Practical Alternatives Evaluation

Constructability Report for Plaza and Crossing Alternatives

Draft

URS

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Preface

The Detroit River International Crossing (DRIC) Environmental Assessment Study is being conducted by a partnership of the federal, state and provincial governments in Canada and the United States in accordance with the requirements of the Canadian Environmental Assessment Act (CEAA), the Ontario Environmental Assessment Act (OEAA), and the U.S. National Environmental Policy Act (NEPA). In 2006, the Canadian and U.S. Study Teams completed an assessment of illustrative crossing, plaza and access road alternatives. This assessment is documented in two reports: Generation and Assessment of Illustrative Alternatives Report - Draft November 2006) (Canadian side) and Evaluation of Illustrative Alternatives Report (December 2006) (U.S. side). The results of this assessment led to the identification of an Area of Continued Analysis (ACA) as shown in Figure 1.

Within the ACA, practical alternatives were developed for the crossings, plazas and access routes alternatives. The evaluation of practical crossing, plaza and access road alternatives is based on the following seven factors:

- Changes to Air Quality
- Protection of Community and Neighbourhood Characteristics
- Consistency with Existing and Planned Land Use
- Protection of Cultural Resources
- Protection of the Natural Environment
- Improvements to Regional Mobility
- Cost and Constructability

This report pertains to the Constructability portion of the Cost and Constructability factor and is one of several reports that will be used in support of the evaluation of practical alternatives and the selection of the technically and environmentally preferred alternative. This report will form a part of the environmental assessment documentation for this study.

Additional documentation pertaining to the evaluation of practical alternatives is available for viewing/downloading at the study website (www.partnershipborderstudy.com).

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1. Summary

Overall, construction staging and constructability reviews completed by the study team confirm that all the alternatives are constructible. Factors significantly influencing constructability include utilities, poor soil conditions, schedule, drainage and a bedrock anomaly in the vicinity of the approach to Crossing C. Although construction staging for the new plaza/crossing will include a requirement to maintain traffic on the existing local road network during construction, this is not anticipated to significantly affect the comparative constructability of the alternatives.

Based on the study completed to date, it is clear that construction of the plazas may be complicated by the high water table and relatively poor ground conditions in the study area. In the event that the plaza is constructed on fill to facilitate positive drainage and facilitate connections to the roadways entering and exiting the plaza, consideration for staged placement of fill to allow for preconsolidation of the earth platform and underlying soils may be necessary.

The foundations investigation and geophysics program initiated by the study team in 2005 has confirmed the presence of a bedrock anomaly associated with an area of inactive brine wells that poses a significant risk to the approach to Crossing C.

Utility crossings and relocation will need special consideration. Existing utilities crossing the corridor or traversing the plaza area may require extensive relocation depending on the alternative. In this regard, the Hydro One Keith Transformer Station is by far the largest utility. Plaza C requires that this facility be relocated in its entirety which will result in significant additional construction cost ($180 million – 2011 CAD) and a significant impact to construction duration. Plaza B results in the need for minor reconfigurations to the Keith Transformer Station which are anticipated to cause some constructability concern related to scheduling. Crossing B results only in fringe impacts to the facility, which are not anticipated to have a significant impact on constructability.

Additional construction staging and constructability issues for the international bridge alternatives related directly to the main span are addressed in the *Bridge Type Study Report (July 2007)* and in the *Bridge Conceptual Engineering Report (February 2008)*, both reports jointly prepared by URS and Parsons.

2. Background

2.1. Project Overview

The Detroit River International Crossing (DRIC) Study is an Environmental Assessment Study undertaken by a joint partnership between the Ministry of Transportation Ontario (MTO), Transport Canada (TC), the Michigan Department of Transportation (MDOT) and the U.S. Federal Highway Administration (FHWA). This report has been prepared to document constructability associated with implementing four practical plaza alternatives and three practical crossing alternatives (including approaches) which were developed for this project in 2006. Documentation of the construction costs is provided in the *Preliminary Construction Cost Estimate Report for Practical Alternatives, May 2008.*

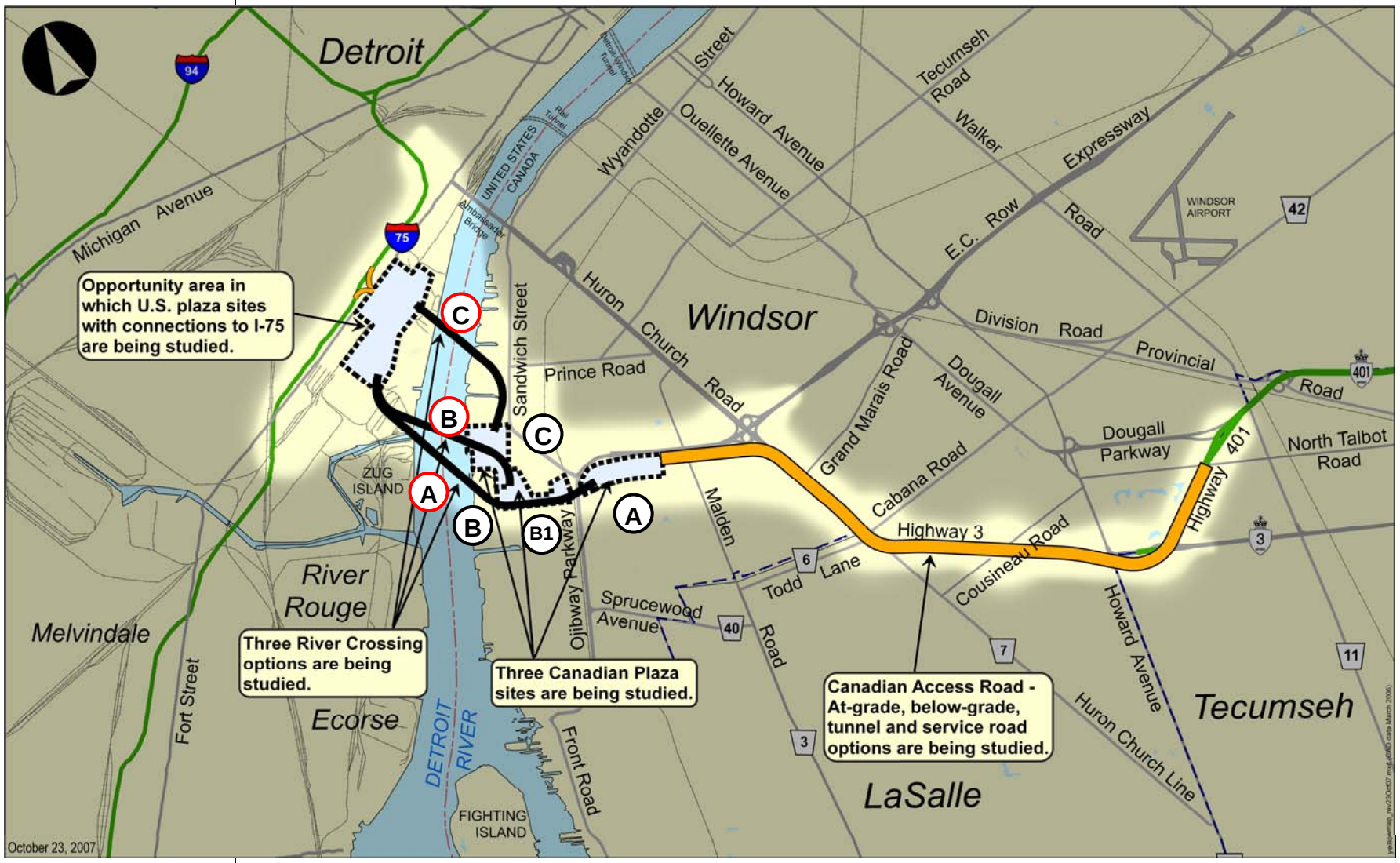
2.2. Project Limits

The project limits for this phase of the study are defined by the Area of Continued Analysis (ACA), which begins near the western terminus of Highway 401, and generally follows the alignments of Highway 3, Huron Church Road, E.C. Row Expressway. Within the ACA, four customs plaza practical alternatives and three international bridge crossing practical alternatives were identified. The ACA traverses through the Town of Tecumseh, the Town of LaSalle and the City of Windsor. A key plan which identifies the ACA is presented in Figure 1.

2.3. Project Schedule

Given the importance of this corridor and the projected traffic, the completion of construction by 2013 is highly desirable. The complexity of construction of the access road, plaza and crossing will influence the assessment of risk to completing the project within the target timeframe.

FIGURE 1 – AREA OF CONTINUED ANALYSIS - PRACTICAL CROSSING, PLAZA AND ROUTE ALTERNATIVES



3. Existing Conditions

The following sections outline those aspects of existing conditions which are relevant to constructability.

3.1. Soil/Bedrock Conditions and Groundwater

The existing soils within the ACA generally consist of soft silty clay. West of the Huron Church Road and E.C. Row Expressway interchange, the soil conditions become progressively softer, and less favourable for conventional construction methods. A majority of the bedrock is comprised of limestone, ranging in depths of 20 m (65 ft) below ground surface at the Detroit River, to 25 m (82 ft) at Ojibway Parkway and E.C. Row Expressway to 35 m (114 ft) at the existing terminus of Highway 401. The existing topography is flat, with a gradual decline in elevation towards the Detroit River. The profile of soil conditions between the Detroit River and the existing terminus of Highway 401 is presented in Figure 2.

High groundwater conditions exist within the study limits, particularly near the Detroit River. Groundwater elevations range between 0.5 m to 6.0 m (1.6 to 19 ft) below the ground surface. Groundwater within the study limits contains dissolved hydrogen sulphide gas. The gas is released when groundwater is exposed to atmospheric pressure. Strategies for groundwater control will be required for all methods of construction.

For additional information regarding existing soil and groundwater conditions, please refer to the *Preliminary Foundation Investigation and Design Report Detroit River International Crossing Bridge Approach Corridor, October 2007* by *Golder Associates Ltd*.

In the area of the approach to Crossings B and C, the primary geotechnical concern to date has related to the historical solution mining of salt deposits in the area. The DRIC study team carried out an extensive foundations investigation and geophysics program to ascertain the quality of the bedrock in the area. The findings have been reviewed and accepted by an independent Geotechnical Advisory Group and are documented in the *Preliminary Foundation Investigation and Design Report Detroit River International Crossing Evaluation of Alternative Bridge Sites, February 2008*.

In summary, the report entitled *Preliminary Foundation Investigation and Design Report Detroit River International Crossing Evaluation of Alternative Bridge Sites, February 2008* identifies limits of primary and secondary solution mining influence, which are generally defined as the zones where salt was directly removed by solution mining and the zones where the rock mass outside the area of primary influence experienced a degree of displacement or disturbance, respectively. The conclusions of this report indicate that Crossings A and B are outside the limits of primary and secondary solution mining influence and that the rock mass performance for these crossings is expected to be no different than in other areas of west Windsor that have been unaffected by solution mining. However, the report indicates that the proposed approach structure to Crossing C passes directly over the eastern end of the identified zones of primary and secondary solution mining influence. Implications of these findings to constructability are discussed further in Section 5.4. Figure 3 illustrates the areas of primary and secondary solution mining influence in relation to the crossing alternative alignments.

FIGURE 2 – PROFILE OF SOIL CONDITIONS WITHIN THE AREA OF CONTINUED ANALYSIS (ACA)

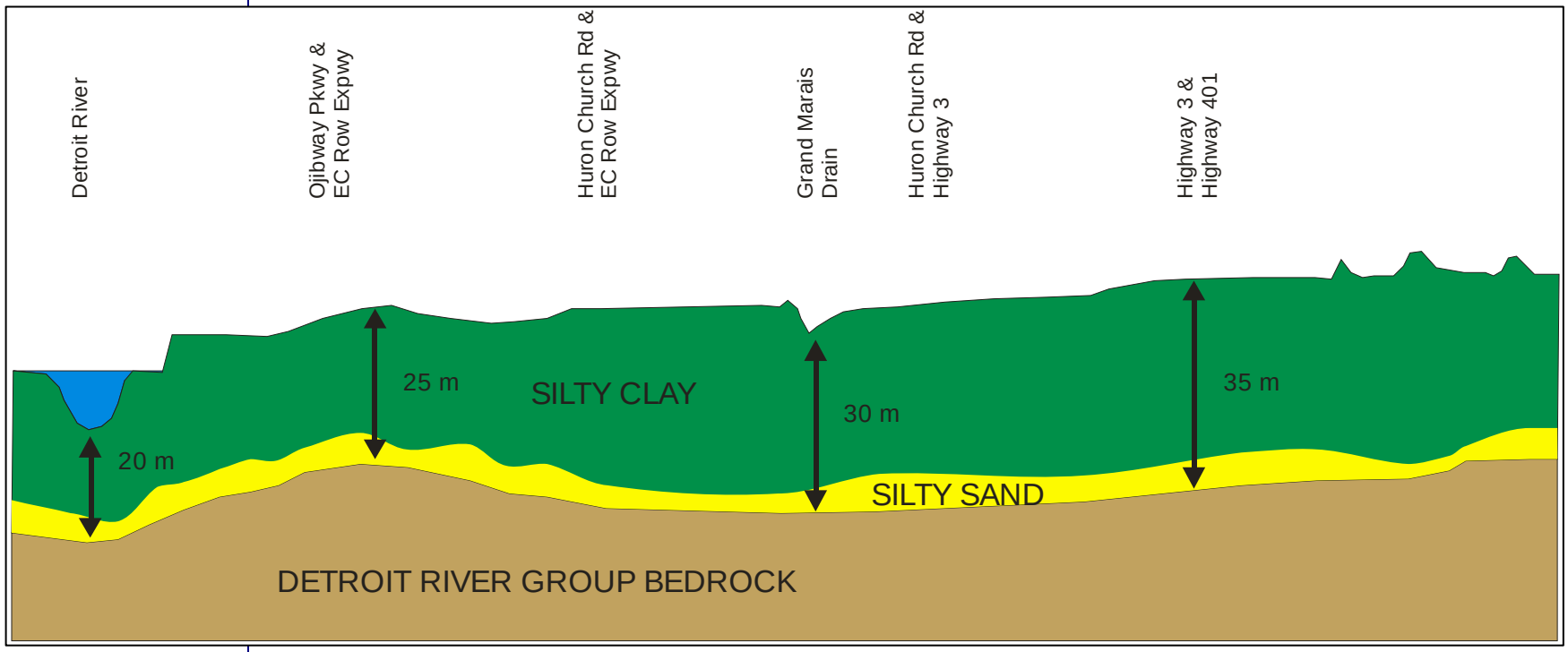
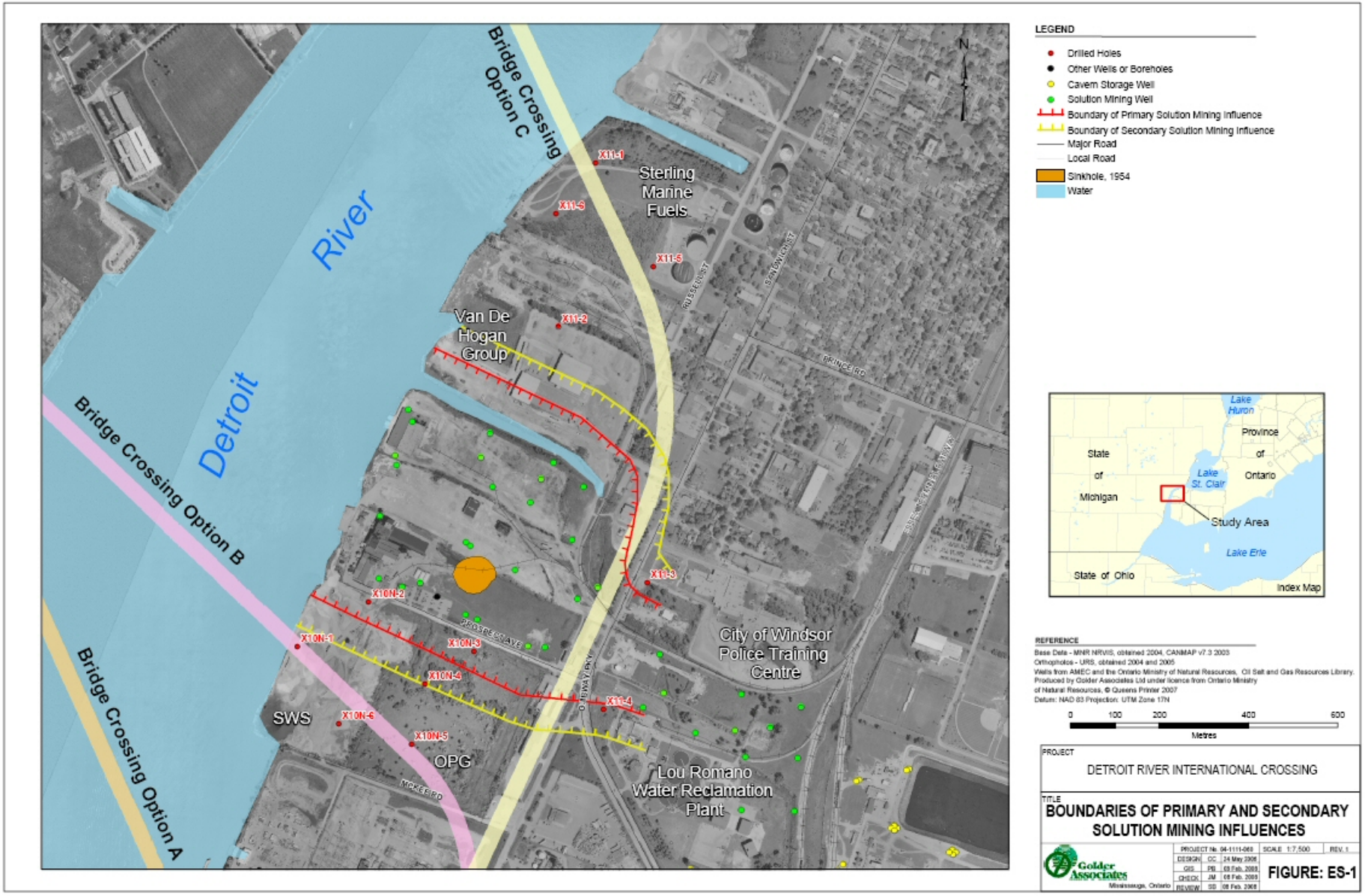


FIGURE 3 – BOUNDARIES OF PRIMARY AND SECONDARY SOLUTION MINING INFLUENCES



3.2. Municipal Drains

All of the existing drainage systems within the ACA are part of the Turkey Creek watershed, which outlets to the Detroit River. Within the vicinity of plaza and crossing alternatives being considered (west of Malden Road), there are two primary municipal drains. These are the McKee Drain and the Titcombe Drain. Both of these drainage systems have been impacted by urbanization.

For additional information regarding municipal drains within the ACA, please refer to *Draft Stormwater Management Plan, March 2008* by *URS Canada*.

3.3. Utilities

There are numerous utilities located within the ACA in the vicinity of plaza and crossing alternatives being considered. These include communications (Bell Canada and MaXess Networks), gas (Union Gas and BP), hydro (Hydro One and EnWin) and Municipal (storm sewer, sanitary sewer, and watermain) as well as major facilities such as the Ontario Power Generation (OPG) Brighton Beach Power Station shore facilities, Hydro One Keith Transformer Station, West Windsor Power Plant and Sterling Marine Fuels fuelling depot. The hydro utilities are predominantly overhead with some underground sections.

The OPG Brighton Beach Power Station, Hydro One Keith Transformer Station and Sterling Marine Fuels are all located on the shores of the Detroit River in the Sandwich Portlands and Brighton Beach Industrial Area. With the exception of the Hydro One transmission line and the BP high pressure gas line, other utilities in the vicinity of plaza and crossing alternatives are predominantly located within municipal road rights-of-way.

4. Practical Alternatives

Three crossing alternatives (including approach and main span structures) and four plaza alternatives have been identified as practical alternatives. All alternatives are located in the west Windsor area. The location of the plaza and crossing alternatives are shown in Figure 1. Seven plaza/crossing combinations have been analyzed. These plaza/crossing combinations are described briefly below and detailed illustrations are provided in Appendix A.

Crossing A-Plaza A consists of a bridge crossing south of the OPG Brighton Beach Power Generation Station and a plaza located south of E.C. Row Expressway between Ojibway Parkway and Malden Road. The approach roadway between the plaza and crossing is generally aligned adjacent to Broadway Street.

Crossing B-Plaza A consists of a bridge crossing north of the OPG Brighton Beach Power Generation Station and a plaza located south of E.C. Row Expressway between Ojibway Parkway and Malden Road. The approach roadway between the plaza and crossing is generally aligned adjacent to Sandwich and Broadway Streets.

Crossing C-Plaza A (2 options) consists of a bridge crossing in the Sandwich Portlands near Russell Street/Sandwich Street and a plaza located south of E.C. Row Expressway between Ojibway Parkway and Malden Road. There are two options for the alignment of the approach roadway between the plaza and crossing (options C1 and C2). Option C1 is generally aligned adjacent to Sandwich and Broadway Streets, while option C2 is generally aligned adjacent to Sandwich Street and the western extension of Ojibway Parkway.

Crossing B-Plaza B1 consists of a bridge crossing north of the OPG Brighton Beach Power Generation Station and a plaza located at the southern end of Sandwich Street. The approach roadway between the plaza and crossing is generally aligned adjacent to Sandwich Street.

Crossing C-Plaza B consists of a bridge crossing in the Sandwich Portlands near Russell Street/Sandwich Street and plaza located at the southern end of Sandwich Street, north of Broadway Street. The approach roadway between the plaza and crossing is generally aligned adjacent to Sandwich Street.

Crossing C-Plaza C consists of a bridge crossing in the Sandwich Portlands near Russell Street and Sandwich Street and plaza located west of Sandwich Street, south of Prospect Avenue. The approach roadway between the plaza and crossing is generally aligned west of Sandwich Street.

5. Factors Influencing Constructability

5.1. Construction Methods

Plaza Alternatives

Construction of the plaza platform will primarily involve relocation of utilities, topsoil stripping, placement of fill, construction of drainage components (i.e. sewers, catchbasins and stormwater management facilities) and other utilities, construction of foundations for various plaza structures, and paving. It is anticipated that each of these components can be constructed using normal construction methods for all plaza alternatives.

It should be noted that it may be beneficial to elevate portions of the plaza alternatives to facilitate positive drainage (thereby reducing or possibly eliminating any requirement for pumping stormwater from the plaza) and facilitate connections to the elevated roadways entering and exiting the plazas. However, due to the soft nature of the soils in the Study Area, particularly in the vicinity of the Detroit River, large embankments may incur considerable settlement. In these cases, consideration may be given to construct the earth platform in stages to allow for settlement/preconsolidation prior to proceeding with subsequent construction stages. The need for elevating the plaza and consideration of staged embankment construction should be assessed further as part of preliminary design of the preferred plaza alternative.

Approach Alternatives

It is also anticipated that all approach roadways and structures between the plazas and main-span bridge alternatives can be constructed using typical bridge construction and highway construction methods.

Main-span Bridge Alternatives

As stated in the *Bridge Type Study Report (July 2007)* prepared by URS and Parsons, none of the main-span crossing alternatives pose difficulties that would require specialized construction methods. Detailed descriptions of construction methods to be employed for construction of the main-span bridge alternatives of Crossings B and C are described in detail within the *Detroit River International Crossing Bridge Conceptual Engineering Report, February 2008* prepared by Parsons and URS.

5.2. Schedule

At the outset of the planning process, the Partnership established year 2013 as the targeted completion date for addressing the stated problems in the Detroit-Windsor transportation corridor. Alternatives that pose serious risks to this completion timeframe are least preferred. It is anticipated that all Practical Plaza Alternatives will require a similar amount of time to construct. The main span of Practical Crossing Alternative C has the shortest span of all Practical Alternatives and is therefore anticipated to have the shortest construction duration. Crossing B, with the second shortest span, is expected to require a 2.5% to 12% longer construction duration than the Crossing C main span.

Crossing A, with the longest span, is expected to result in a 41% to 52% longer construction duration than the Crossing C main span. Other risks to schedule associated with utility impacts and geotechnical conditions are discussed in the following sections.

5.3. Utilities

There are numerous utilities located within the ACA in the vicinity of plaza and crossing alternatives being considered. These include communications (Bell Canada and MaXess Networks), gas (Union Gas and BP), hydro (Hydro One and EnWin) and Municipal (storm sewer, sanitary sewer, and watermain) as well as major facilities such as the OPG Brighton Beach Power Station shore facilities, Hydro One Keith Transformer Station, West Windsor Power Plant and Sterling Marine Fuels fuelling depot. Relocation of, or approval to cross, utilities will be required for all plaza/crossing alternatives. These relocations/approvals should take place in early design stages to minimize risk to construction schedules. A detailed listing of existing utilities potentially impacted by the plaza/crossing alternatives is presented in **Appendix B**.

The most significant utility feature in the vicinity of plaza/crossing alternatives is the Hydro One Keith Transformer Station located between Sandwich Street and the Detroit River south of McKee Road. Crossings B and C (option C1 only) result in fringe impacts to the Keith Transformer Station. These impacts are not anticipated to result in significant constructability concerns for these alternatives. Plaza B results in the need for minor reconfigurations to the Keith Transformer Station which are anticipated to cause some constructability concern related to scheduling. Plaza C, however, results in the full displacement of the Keith Transformer Station. As such, selection of Plaza C would require that the Keith Transformer Station be relocated in its entirety to another suitable site. As part of this study, the project team met with representatives from Hydro One to discuss this potential impact where it was concluded that relocation of Keith Transformer Station would likely cost on the order of $180 million (2011 CAD) and add several years to the construction schedule. The Keith Transformer Station serves a wide area in Windsor/Essex. Approvals, design, construction and commissioning of a new transformer station would all have to be completed prior to decommissioning and demolition of the existing station and construction of the new plaza. Further work is necessary to determine implications for obtaining environmental clearances to relocate the transformer station.

All practical plaza/crossing alternatives require crossings of Hydro One transmission lines. The Crossing A – Plaza A combination results in two (2) crossings of Hydro One transmission lines which are the fewest of all practical plaza/crossing alternatives. The remainder of the practical alternatives result in between six (6) and eleven (11) crossings of Hydro One transmission lines, with the Crossing B – Plaza B1 combination resulting in the highest number of crossings. Coordination with Hydro One will be required to relocate hydro towers as necessary for all practical alternatives.

In summary, with the exception of Plazas B and C, utility impacts associated with plaza/crossing alternatives do not significantly affect overall constructability. There are significant constructability implications associated with displacement of Keith Transformer Station by Plaza C. Additionally, there are some constructability implications associated with the minor reconfiguration of the Keith Transformer Station required by Plaza B.

5.4. Soils/Bedrock

Crossings

As discussed in Section 3.1, due to the known presence of brine wells, the DRIC study team has carried out an extensive foundations investigation and geophysics program to ascertain the quality of the bedrock in the vicinity of Crossings B and C.

Findings of this program indicate that Crossing B is outside the limits of primary and secondary solution mining influence and that the rock mass performance for this crossing is expected to be no different than in other areas of western Windsor that have been unaffected by solution mining.

Findings of the program also indicate that Crossing C main-span bridge foundations are outside the limits of primary and secondary solution mining influence and that the rock mass performance for these foundations is expected to be no different than in other areas of western Windsor that have been unaffected by solution mining. However, findings of the program indicate that the proposed approach structure to Crossing C passes directly over the eastern end of the identified zones of primary and secondary solution mining influence. Additional study would be required to refine the range of risks and orders of magnitude of settlement that should be accommodated by the design of Crossing C. The level of effort that may be required to further refine these issues is extensive and, if undertaken, may still be insufficient to consider supporting structures on the rock in these zones within an acceptable degree of risk. In order to mitigate these concerns to a reasonable degree, the study team has assumed that an additional cable-stayed or suspension bridge will be required to span the anomaly and zones of primary and secondary solution mining influence. However, risks of subsurface settlement in this area would remain, posing indirect constructability concerns associated with construction and maintenance of the spanning structure. In addition, construction of this additional structure will result in a significant increase in construction duration and cost.

Plazas

As discussed in Section 5.1, due to the relatively flat terrain in the study area, it may be beneficial to elevate portions of the plaza alternatives to facilitate positive drainage (thereby reducing or possibly eliminating any requirement for pumping stormwater from the plaza) and facilitate connections to the elevated roadways entering and exiting the plazas. However, due to the soft nature of the soils in the Study Area, particularly in the vicinity of the Detroit River, large embankments may incur settlement. In these cases, consideration may be given to construct the earth platform in stages to allow for settlement/preconsolidation prior to proceeding with subsequent construction stages. This would result in additional construction duration and should be considered when developing construction scheduling/staging. The need for elevating the plaza and consideration of staged embankment construction should be assessed further as part of preliminary design of the preferred plaza alternative.

6. Evaluation of Alternatives

Cost and Constructability is one of seven factors used to evaluate the practical plaza/crossing alternatives. A summary of the assessment of constructability is presented in Figure 4. The construction costs for plazas and segments of access roads between Malden Road and the plazas included in this table were obtained from the *Preliminary Construction Cost Estimate Report for Practical Alternatives (Access Road and Inspection Plaza), May 2008* prepared by *URS Canada*. Construction costs for crossings (main-span bridges) were obtained from the *Bridge Conceptual Engineering Report, February 2008* and the *Bridge Type Study Report, January 2007* prepared by *Parsons* and *URS*. All costs, which are expressed in Canadian currency ($1 CAD = $1 USD), include engineering fees estimates of 10% and inflation to the year 2011 at 3% per annum.

In summary, construction staging and constructability reviews completed by the study team confirm that all of the alternatives are constructible.

The factors that significantly influence the comparative constructability of the various Practical Plaza/Crossing Alternatives include utilities, schedule and a bedrock anomaly in the vicinity of the approach to Crossing C.

The foundations investigation and geophysics program initiated by the study team in 2005 has confirmed the presence of a bedrock anomaly associated with an area of inactive brine wells that poses a significant risk to the approach to Crossing C. This results in significant schedule implications as well as high construction costs and risks associated with constructing an additional long-span bridge over this area of uncertain bedrock integrity for all Practical Plaza/Crossing Alternatives that include Crossing C.

Utility crossings and relocation will need special consideration. Existing utilities crossing the corridor or traversing the plaza area may require extensive relocation depending on the alternative. In this regard, the Hydro One Keith Transformer Station is by far the largest utility. Plaza C requires that this facility be relocated in its entirety which will result in significant additional construction cost ($180 million – 2011 CAD) and a significant impact to construction duration. Plaza B results in the need for minor reconfigurations to the Keith Transformer Station which are anticipated to cause some constructability concern related to scheduling. Crossing B results only in fringe impacts to the facility, which are not anticipated to have a significant effect on constructability.

Conclusion

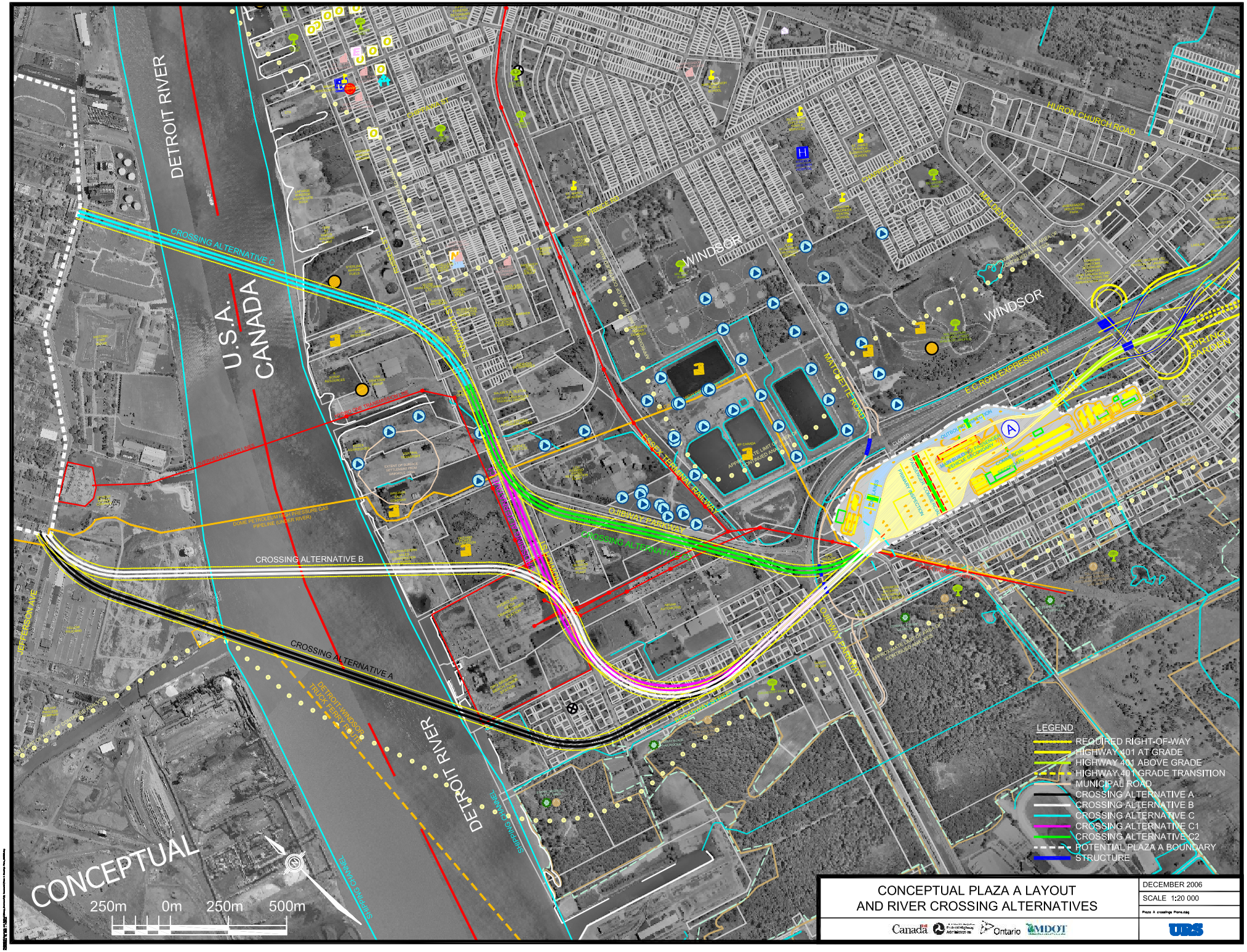
From a constructability perspective, Practical Alternatives that include Crossing C are not desirable due to the risk and schedule implications associated with spanning an identified bedrock anomaly. Additionally, Plaza C is not a desirable alternative due to its requirement for the relocation of the Hydro One Keith Transformer Station. Due to the length of the main span of Crossing A and associated high construction duration, this alternative is also not desirable from a constructability perspective. As such, when considering constructability, the Crossing B – Plaza A and Crossing B – Plaza B1 Practical Alternatives are the most desirable Practical Plaza/Crossing Alternatives.

FIGURE 4 – COST AND CONSTRUCTABILITY ASSESSMENT TABLE

PRACTICAL ALTERNATIVES EVALUATION	Factor: Cost and Constructability

			Segments-Crossings to Malden Road						
			Plaza A				Plaza B	Plaza B1	Plaza C
Performance Measure	**Criteria/Indicator**	**Measurement/Units**	**From Crossing A**	**From Crossing B**	**From Crossing C via Brighton Beach (C1)**	**From Crossing C via Ojibway Parkway (C2)**	**From Crossing C**	**From Crossing B**	**From Crossing C**
Preliminary Construction Costs, Assessment of Constructability	Length of Alternative	Distance in km measured from Malden Road to int'l border	4.0	4.3	5.4	4.7	5.5	4.2	5.5
	Length of Crossing	Distance in metres measured from int'l border to furthest inland anchorage location of bridge type study options	900	750	750	750	750	750	750
	Length of Approach Structure/Roadway	Distance in metres measured from furthest inland anchorage location of bridge type study options to plaza inbound apron at plaza property limit	1700	2150	3150	2500	1550	600	900
	Area of Plaza	Area in ha/acres	37/91	37/91	37/91	37/91	35/86	33/82	43/106
	Length of Access Road	Distance in metres measured from plaza outbound apron at plaza property limit to Malden Road	0	0	0	0	2400	1850	2950
	Preliminary Construction Costs (See Notes 1 through 3) (cs = Cable Stayed Bridge) (s = Suspension Bridge)	1/2 bridge cost $ millions CAD (2011)	395 (s)	311 (s), 282 (cs)	278 (s), 241 (cs)	278 (s), 241 (cs)	278 (s), 241 (cs)	311 (s), 282 (cs)	278 (s), 241 (cs)
		Canadian approach structure/roadway $ millions CAD (2011)	255 (s)	260 (s), 225 (cs)	597 (s), 564 (cs)	591 (s), 558 (cs)	542 (s), 509 (cs)	136 (s), 101 (cs)	474 (s), 441 (cs)
		Plaza $ millions CAD (2011)	180	180	180	180	180	180	360 (Includes additional $180M to relocate Keith Transformer Station)
		Access Road $ millions CAD (2011) Malden Road to Plaza	0	0	0	0	65	65	100
		Total $millions CAD (2011) [% of lowest cost]	830 (s) [117% (s)]	751 (s), 687 (cs) [105% (s), 106% (cs)]	1055 (s), 985 (cs) [148% (s), 152% (cs)]	1049 (s), 979 (cs) [147% (s), 151% (cs)]	1085 (s), 1015 (cs) [152% (s), 157% (cs)]	712 (s), 648 (cs) [Lowest Cost]	1212 (s), 1142 (cs) [170% (s), 176% (cs)]
	Site constraints (eg. utilities)	Qualitative assessment	Lower degree of utility impacts, including 2 crossings of hydro transmission lines. All relocations can be completed using typical construction practices. 1 watercourse A sewer system to convey flows would be required.	Moderate degree of utility impacts, including 8 crossings of hydro transmission lines. All relocations can be completed using typical construction practices. 1 watercourse A sewer system to convey flows would be required.	Moderate degree of utility impacts, including 6 crossings of hydro transmission lines and direct impact to Sterling Marine Fuels fueling depot. All relocations can be completed using typical construction practices. 1 watercourse A sewer system to convey flows would be required.	Moderate degree of utility impacts, including 6 crossings of hydro transmission lines and direct impact to Sterling Marine Fuels fueling depot. All relocations can be completed using typical construction practices. 1 watercourse A sewer system to convey flows would be required.	Moderate to high degree of utility impacts, including 7 crossings of hydro transmission lines and minor reconfiguration of Keith Transformer Station. Direct impact to Sterling Marine Fuels fueling depot. All relocations can be completed using typical construction practices.	Moderate degree of utility impacts, including 11 crossings of hydro transmission lines. All relocations can be completed using typical construction practices.	High degree of utility impacts, including 9 crossings of hydro transmission lines and relocation of Keith Transformer Station. Direct impact to Sterling Marine Fuels fueling depot. All relocations can be completed using typical construction practices.
	Geotechnical considerations eg. soils, brine wells)	Qualitative assessment of subsurface conditions	Plaza and crossing avoid areas of known brine wells on Canadian side of Detroit River.	Plaza avoids area of known brine wells. Crossing is outside of zone of influence associated with known brine wells on Canadian side of Detroit River.	Plaza avoids area of known brine wells. Crossing traverses area of known brine wells on Canadian side of Detroit River. The approach passes directly through the zones of primary and secondary solution mining influence where there is potential to result in significant settlement of overlying bedrock. Approach roadway concept to include additional bridge to span entire zone of solution mining influence to lower risk of settlement impacts to new crossing. However, some risk associated with constructing crossing over this zone remains.	Plaza avoids area of known brine wells. Crossing traverses area of known brine wells on Canadian side of Detroit River. The approach passes directly through the zones of primary and secondary solution mining influence where there is potential to result in significant settlement of overlying bedrock. Approach roadway concept to include additional bridge to span entire zone of solution mining influence to lower risk of settlement impacts to new crossing. However, some risk associated with constructing crossing over this zone remains.	Plaza avoids areas of known brine wells. Crossing traverses area of known brine wells on Canadian side of Detroit River. The approach passes directly through the zones of primary and secondary solution mining influence where there is potential to result in significant settlement of overlying bedrock. Approach roadway concept to include additional bridge to span entire zone of solution mining influence to lower risk of settlement impacts to new crossing. However, some risk associated with constructing crossing over this zone remains.	Plaza avoids area of known brine wells. Crossing is outside of zone of influence associated with known brine wells on Canadian side of Detroit River.	Portion of plaza is in proximity to known brine wells. Crossing traverses area of known brine wells on Canadian side of Detroit River. The approach passes directly through the zones of primary and secondary solution mining influence where there is potential to result in significant settlement of overlying bedrock. Approach roadway concept to include additional bridge to span entire zone of solution mining influence to lower risk of settlement impacts to new crossing. However, some risk associated with constructing crossing over this zone remains.
	Construction staging/duration	Qualitiative assessment of staging duration for plaza and crossing	All plazas are of similar duration to construct. Crossing A requires the longest duration to construct (41-52% longer than Crossing C). Access to local residences/businesses to be maintained during construction.	All plazas are of similar duration to construct. Crossing B requires a longer duration to construct (2.5%-12% longer than Crossing C). Access to local residences/businesses to be maintained during construction.	All plazas are of similar duration to construct. Crossing C requires the shortest duration to construct. Access to local residences/businesses to be maintained during construction.	All plazas are of similar duration to construct. Crossing C requires the shortest duration to construct. Access to local residences/businesses to be maintained during construction.	All plazas are of similar duration to construct. Crossing C requires the shortest duration to construct. Access to local residences/businesses to be maintained during construction.	All plazas are of similar duration to construct. Crossing B requires a longer duration to construct (2.5%-12% longer than Crossing C). Access to local residences/businesses to be maintained during construction.	All plazas are of similar duration to construct. Crossing C requires the shortest duration to construct. Plaza C requires complete relocation of Keith Transformer Station prior to beginning plaza construction which results in several years of delay in construction. Access to local residences/businesses to be maintained during construction.
	Assessment of construction risks	Qualitative assessment of effects of traffic management, utility relocations, subsurface conditions on completion of construction within project timeframe (2013)	The construction risk for completing Crossing A from Plaza A within the project timeframe is high due to the magnitude of required construction and the longer main-span.	The construction risk for completing Crossing B from Plaza A within the project timeframe is moderate due to the magnitude of required construction.	The construction risk for completing Crossing C from Plaza A via Brighton Beach within the project timeframe is high due to the magnitude of required construction, utility relocations and the requirement for significant additional study to traverse the brine well area.	The construction risk for completing Crossing C from Plaza A via Ojibway Parkway within the project timeframe is high due to the magnitude of required construction, utility relocations and the requirement for significant additional study to traverse the brine well area.	The construction risk for completing Crossing C from Plaza B within the project timeframe is high due to the magnitude of required construction, the requirement for reconfiguration of Keith Transformer Station, other utility relocations, and the requirement for significant additional study to traverse the brine well area.	The construction risk for constructing Crossing B from Plaza B1 within the project timeframe is moderate due to the magnitude of required construction and utility relocations.	The construction risk for completing Crossing C from Plaza C within the project timeframe is very high due to the magnitude of required construction, the requirement for relocating the Keith Transformer Station, other utility relocations, and the requirement for significant additional study to traverse the brine well area.
	Degree of impact on traffic during construction	Qualitative assessment of ability to maintain local access during construction	Local access can be maintained for all plaza and crossing alternatives.						
	Maintenance requirements	Qualitative assessment of costs and disruption due to maintenance operations	Operation and maintenance requirements are the same for all plazas. However, operation and maintenance requirements for Crossing C alternatives are higher than those of Crossing A and B alternatives due to the need for an additional main-span structure over the brine well area.						

Appendix A
Plaza/Crossing Alternatives



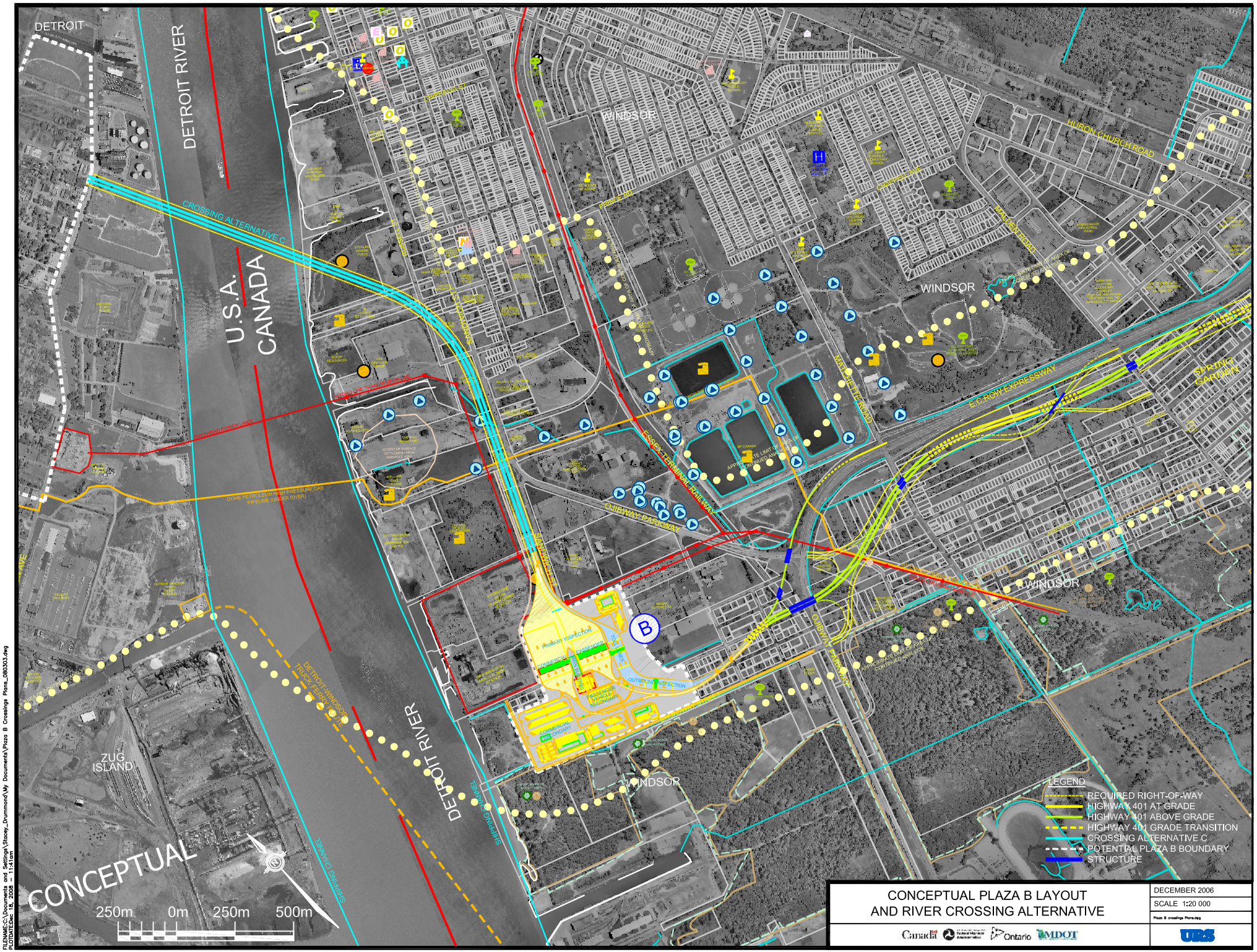
CONCEPTUAL PLAZA A LAYOUT
AND RIVER CROSSING ALTERNATIVES

DECEMBER 2006

SCALE 1:20 000

Plaza A crossings Plans.dwg

Canada Ontario MDOT UBS



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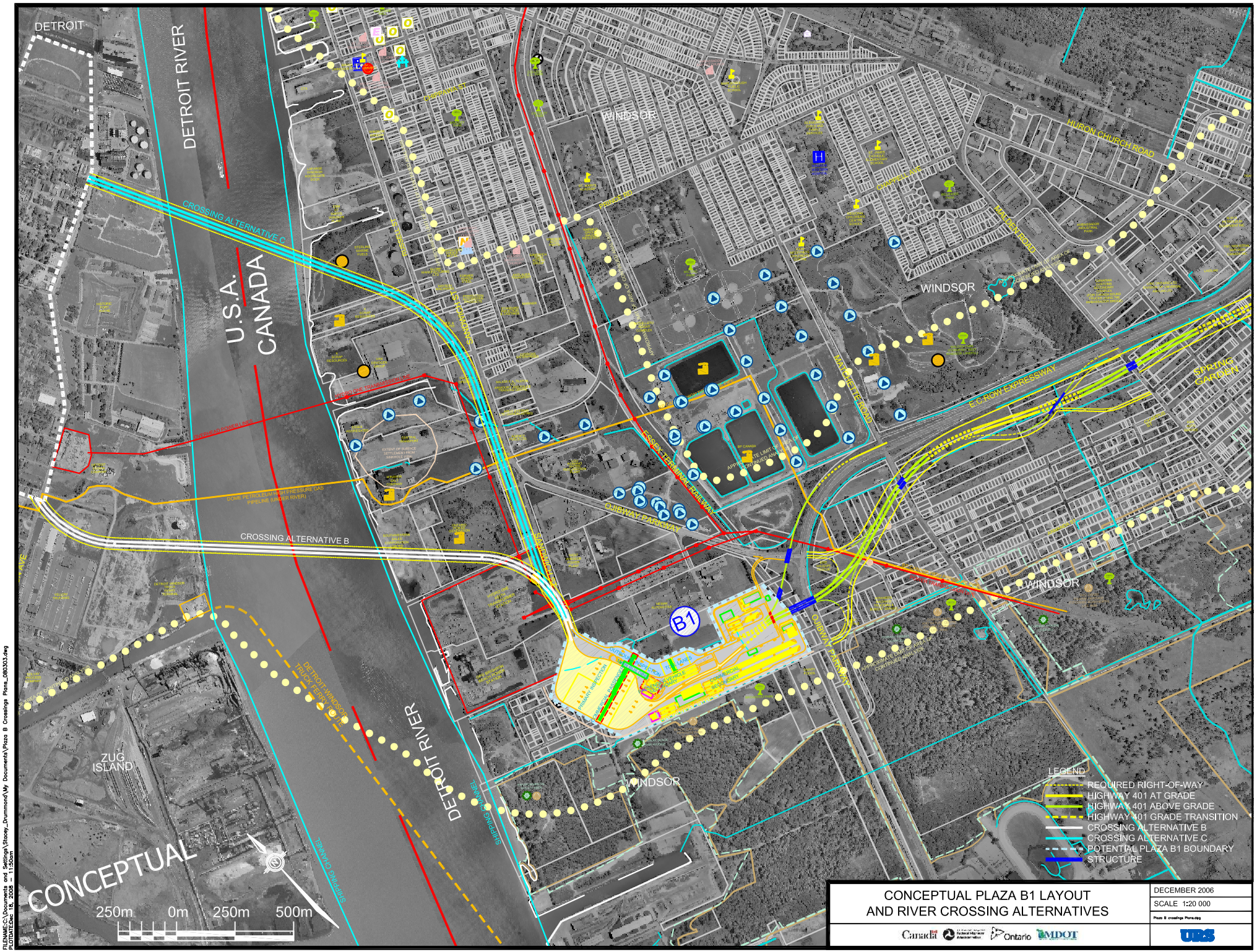

CONCEPTUAL PLAZA B1 LAYOUT
AND RIVER CROSSING ALTERNATIVES

DECEMBER 2006

SCALE 1:20 000

Plaza B crossings Plans.dwg

Canada Ontario MDOT

IBI

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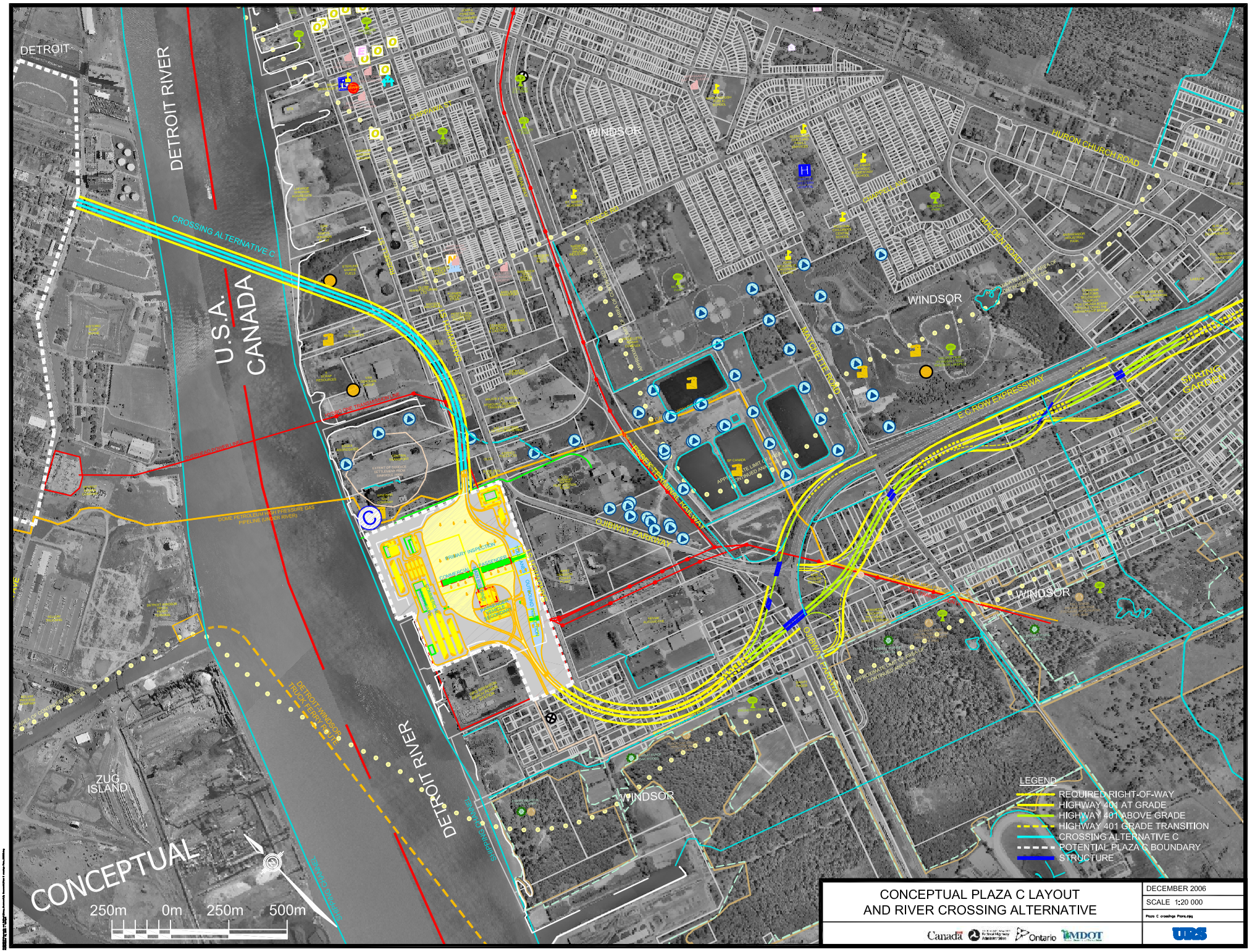

CONCEPTUAL PLAZA C LAYOUT
AND RIVER CROSSING ALTERNATIVE

DECEMBER 2006

SCALE 1:20 000

Plaza C crossings Plans.dgn

Canada Ontario MDOT UDS

Appendix B
Existing Utilities Potentially Impacted

Summary of Existing Utilities

Utilities potentially impacted by Plaza/Crossing alternatives	PLAZA A				PLAZA B	PLAZA B1	PLAZA C
	From Crossing A	From Crossing B	From Crossing C via Brighton Beach (Alternative C1)	From Crossing C via Ojibway Parkway (Alternative C2)	From Crossing C	From Crossing B	From Crossing C
	Length (m)				*Length (m)*	*Length (m)*	*Length (m)*
TELECOM							
Bell Canada - Overhead	1025	785	865	815	1635	2085	2015
Bell Canada - Underground	1500	2205	2250	2190	2955	2840	2100
GAS							
Union Gas	3850	4130	4055	3875	6425	8570	6380
BP	200	200	255	255	315	265	315
SEWERS							
Storm	240	240	360	360	205	85	370
Storm - Proposed 2005	670	670	670	670	0	0	0
Sanitary	945	1020	1225	1500	1580	2050	1260
Sanitary - Proposed 2005	640	640	640	640	195	125	190
Combined	0	0	85	85	85	0	115
WATERMAINS							
All Pipe Diameters	3730	4480	4370	4035	6045	7635	6265
HYDRO							
OPG - Brighton Beach Power Generation Facilities	Impact to shore facility	Minor reconfiguration of Keith Transformer Station	Fringe property impact to transformer station	No impact	Minor reconfiguration of Keith Transformer Station	Minor reconfiguration of Keith Transformer Station	Displacement of Keith Transformer Station
Hydro One - Transmission	165	560	360	670	1060	600	1355
Enwin- Overhead	1645	2400	2280	2105	3730	3985	3725
Enwin - Underground	0	110	195	0	230	110	410
OTHERS							
Sterling Marine Fuels	No impact	No impact	Impact to marine fueling depot	Impact to marine fueling depot	Impact to marine fueling depot	No impact	Impact to marine fueling depot
MaXess Networks - Fibre Optics	610	1465	1105	780	1810	2460	1660
Total Length of Utility moved (km)	*15.2*	*18.9*	*18.7*	*18.0*	*26.3*	*30.8*	*26.2*

Notes: Utilities counted inside of Plaza footprint, rights-of-way for Crossing, Access Road and service roads regardless of profile.
Access Road assumed to be Parkway.
Union Gas count does not include service lines to individual properties.
Count includes utilities on Malden Road.