HIGHWAY 401 PLANNING, PRELIMINARY DESIGN AND CLASS ENVIRONMENTAL ASSESSMENT, BROCKVILLE

GWP 4003-19-00
November 2023

Eastern Region
Ministry of Transportation Ontario

Transportation Environmental Study Report

TRANSPORTATION ENVIRONMENTAL STUDY REPORT

Highway 401 Planning, Preliminary Design and Class Environmental Assessment, Brockville

November 2023

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THE PUBLIC RECORD
ONTARIO MINISTRY OF TRANSPORTATION
HIGHWAY 401 PLANNING, PRELIMINARY DESIGN AND CLASS ENVIRONMENTAL ASSESSMENT, BROCKVILLE (GWP 4003-19-00)
TRANSPORTATION ENVIRONMENTAL STUDY REPORT

This Transportation Environmental Study Report (TESR) is available for review from November 22, 2023, to December 22, 2023, on the study website (www.highway401brockville.ca) and at the following locations:

City of Brockville - City Hall
1 King Street West
Brockville, ON K6V 7A5
Tel: 613-342-8772
Mon - Fri: 8 AM to 4 PM

Brockville Public Library
23 Buell Street
Brockville, ON K6V 5T7
Tel: 613-342-3936
Tues – Thurs : 10 AM to 7 PM
Fri – Sat : 10 AM to 5 PM

This project was carried out in accordance with the requirements of the 2000 Class Environmental Assessment (Class EA) process for Provincial Transportation Facilities, which is approved under Ontario's Environmental Assessment Act. This project is classified as a Group 'B' project, which includes major improvements to existing transportation facilities including highway improvements over land or water that provide a significant increase in traffic capacity or cause a significant widening of the "footprint" beyond the roadbed of an existing highway. The Class EA process is for projects of a defined scope and magnitude, where the impact can be effectively determined and mitigated. This TESR fulfills the documentation requirements of the Class EA. In accordance with the requirements of the Class EA, this report is being submitted for a 30-day comment period from November 22, 2023, to December 22, 2023.

Interested persons are encouraged to review this TESR and provide written comments to the study team by December 22, 2023. All comments and concerns should be sent directly to:

Mr. David Brake
Senior Project Manager
Ministry of Transportation
Capital Planning and Program Development East
1355 John Counter Boulevard, Postal Bag 4000
Kingston, ON K7L 5A3
comments@highway401brockville.ca

In addition, a request may be made to the Ministry of the Environment, Conservation and Parks (MECP) for an order requiring a higher level of study (i.e., requiring an individual/ comprehensive environmental assessment approval before being able to proceed), or that conditions be imposed (e.g., requiring further studies), only on the grounds that the requested order may prevent, mitigate or remedy adverse impacts on constitutionally protected Aboriginal and treaty rights. Requests on other grounds will not be considered.

Requests should include the requester's contact information, full name, and specify what kind of order is being requested (request for conditions or a request for an individual/ comprehensive environmental assessment), how an order may prevent, mitigate or remedy potential adverse impacts on Aboriginal and treaty rights, and any information in support of the statements in the request. This will ensure that the MECP is able to efficiently begin reviewing the request.

The request should be sent in writing or by email to the below MECP contacts, as well as copied to the Ministry of Transportation (MTO):

Minister of the Environment, Conservation and Parks
Ministry of Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto, ON M7A 2J3
Minister.mecp@ontario.ca

Director, Environment Assessment Branch
Ministry of Environment, Conservation and Parks
135 St. Clair Ave. W, 1st Floor
Toronto, ON M4V 1P5
EABDirector@ontario.ca

Upon reviewing comments received from the public, the Minister of Environment, Conservation and Parks may make a Section 16 Order on their own initiative within 30 days from the end of the comment period set out in the Notice of Completion. If no concerns or issues are outstanding within 30 days from the end of the comment period set out in the Notice of Completion, the project is considered to have met the requirements of the Class EA, and MTO may proceed to design stage, subject to the commitments documented in the TESR, and obtain any outstanding environmental approvals.

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EXECUTIVE SUMMARY

GENERAL DESCRIPTION OF PROJECT

The Ontario Ministry of Transportation (MTO) retained Stantec Consulting Ltd. to undertake the Planning, Preliminary Design, and Class Environmental Assessment (Class EA) Study for Highway 401, from 2 km west of Stewart Boulevard to 750 m east of North Augusta Road (about 4.5 km), within the City of Brockville.

The purpose of this study is to develop a plan for the rehabilitation and/or replacement of five (5) structures; determine the long-term plans for the Stewart Boulevard and North Augusta Road interchanges and establish the footprint for interim six-lanes and ultimate eight-lanes of Highway 401 within the City of Brockville. The study area is shown in Figure 1.

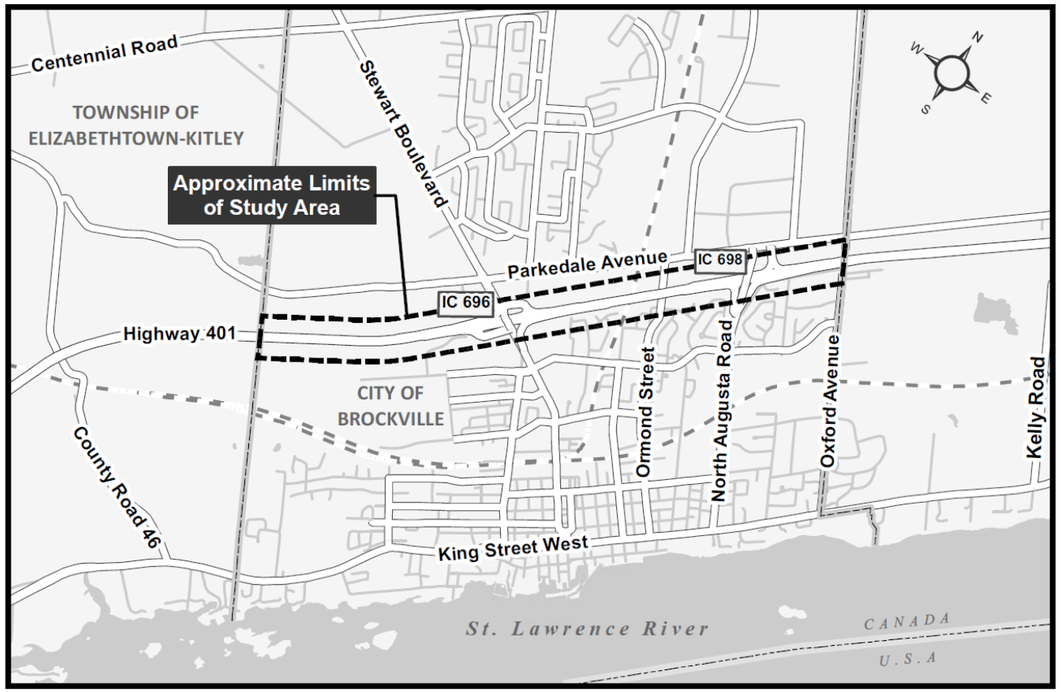

Figure 1: Study area

This Transportation Environmental Study Report (TESR) documents the decision-making process, and includes a description of the project purpose; the existing technical, natural, social, economic, and cultural environmental factors; identification and evaluation of alternatives that were considered; consultation activities, including a record of the comments received and how they were considered; the Recommended Plan; anticipated environmental effects and proposed mitigation measures; and, commitments to future work and monitoring.

ENVIRONMENTAL ASSESSMENT PROCESS

This Preliminary Design and Class EA Study was carried out under the requirements of the 2000 MTO Class EA document. This study has been carried out following the requirements of the Class EA as a “Group ‘B” undertaking, which includes major improvements to existing transportation facilities including highway improvements over land or water that provide a significant increase in traffic capacity or cause a significant widening of the “footprint” beyond the roadbed of an existing highway.

This TESR fulfills the documentation requirements of the Class EA and is filed for a 30-day comment period. If you have any questions and/or concerns regarding this study, please contact the following individual:

Mr. David Brake
Senior Project Manager
Ministry of Transportation
Capital Planning and Program Development East
1355 John Counter Boulevard, Postal Bag 4000
Kingston, ON K7L 5A3
comments@highway401brockville.ca

In addition, a request may be made to the Ministry of the Environment, Conservation and Parks (MECP) for an order requiring a higher level of study (i.e., requiring an individual/comprehensive environmental assessment approval before being able to proceed), or that conditions be imposed (e.g., requiring further studies), only on the grounds that the requested order may prevent, mitigate, or remedy adverse impacts on constitutionally protected Aboriginal and treaty rights. Requests on other grounds will not be considered.

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TRANSPORTATION NEEDS ASSESSMENT

The Transportation Needs Assessment process is part of the ongoing management and administration of the transportation systems by the province. Assessment of needs can result in a number of recommendations, including initiating a study, initiating major or minor improvements, initiating routine maintenance, monitoring a situation, or doing nothing. Given the range of potential outcomes, the transportation needs assessment process includes the following:

- Identifying transportation problems and opportunities
- Evaluating and selecting reasonable alternatives, including ‘do nothing’
- Developing potential transportation study objectives
- Initiating the study process

PROBLEMS AND OPPORTUNITIES

The purpose of this study was to identify a Recommended Plan that addresses current and future transportation needs in the study area, as part of the Ministry’s ongoing review of safety and operational needs for the provincial highway network. The study was initiated to address the following problems and opportunities:

Problems

- Many of the structures in the study area are nearing the end of their service life and require rehabilitation or replacement.

Opportunities

- The study will develop appropriate rehabilitation or replacement strategies to maintain the safe operation of the highway corridor for the current and future planning horizons.
- Identify the ultimate interchange configurations at Stewart Boulevard and North Augusta Road; and the ultimate footprint for the Highway 401 corridor to address current and future transportation needs.

EVALUATION OF ALTERNATIVES

The Environmental Assessment Act requires that ‘reasonable alternatives’ be considered in addressing identified problems and/or opportunities. This involves two levels of analysis. The Alternatives to the Undertaking considers a broad range of alternatives that could address the project needs. Once the best alternative is selected, Alternative Methods of Carrying out the Undertaking are studied in greater detail.

ALTERNATIVES TO THE UNDERTAKING

The Alternatives to the Undertaking considered as part of this assignment consisted of: “Do Nothing”; Transportation Demand Management (TDM); Improve Adjacent Road Systems; Improved Provincial Transportation Facilities. Based on the findings of the assessment; the Improved Provincial Transportation Facilities alternative was carried forward as it addresses the identified transportation problems.

ALTERNATIVE METHODS OF CARRYING OUT THE UNDERTAKING

A range of potential bridge, interchange and highway improvement alternatives that correspond to the Preferred Transportation Undertaking were developed and subjected to evaluation based on their potential to address the structural replacement needs and accommodate the future footprint of Highway 401, while minimizing environmental and community related impacts.

The future footprints for the Highway 401 corridor will include widening for interim 6-lanes and ultimate 8-lanes cross-sections. Interim (6-lane) and ultimate (8-lane) alternatives were considered for the CNR (VIA) Overhead, Ormond Street Overpass, Buells Creek Culvert. The Highway 401 footprint was developed to consider the Interim (6-lane) and Ultimate (8-lane) scenarios.

Six interchange alternatives were developed for the Long List of Interchange Alternatives for the Stewart Boulevard Interchange. Three of the alternatives were carried forward to the Short List of Interchange Alternatives for the Stewart Boulevard Interchange. Seven interchange alternatives were developed for the Long List of Interchange Alternatives for the North Augusta Road Interchange with Highway 401. Six of the alternatives were carried forward to the Short List of Interchange Alternatives for the North Augusta Road.

A detailed evaluation (Short List of Interchange Alternatives) was carried out to identify an improvement plan that is cost-effective, addresses structural needs, provides safe operations, and accommodates the interim and ultimate Highway 401 footprints, while minimizing effects on the natural, social, and cultural environments.

A Technically Preferred Plan was identified following the evaluation of alternatives. Following consultation with the public, Indigenous Communities, agencies and community stakeholders, a Recommended Plan was confirmed.

RECOMMENDED PLAN

The Recommended Plan, as displayed in Figure 2, includes the following proposed work:

- Reconfiguration of the Stewart Boulevard interchange to a Single-Point Urban Interchange design
- Replacement of the Ormond Street Overpass and Buells Creek culvert with a new bridge spanning both Ormond Street and Buells Creek
- Replacement of the existing CNR (VIA) Overhead structure
- Reconfiguration of the North Augusta Road interchange to a Parclo A2/Diamond interchange design
- Future expansion of Highway 401 to an interim six lane and ultimate eight lane cross-section
- Drainage improvements and three new stormwater management ponds

HIGHWAY 401 PLANNING STUDY

Brockville
Preliminary Design &
Class Environmental Assessment
GWP 4003-19-00

Stantec

Existing MTO Right-of-Way
New Roadway - Interim (Future 6-lanes)
New Roadway - Ultimate (Future 8-lanes)
Property Required - Ultimate (Future 8-lanes)
Property Fabric (Approximate based on Assessment Mapping)
Existing Noise Wall to Remain
Proposed Noise Wall

Proposed Retaining Wall
Sidewalk/Multi-Use Path
Ramp Closed
Existing Culvert
New Culvert or Culvert Extension
Potential Stormwater Management Facility
SWM

Recommended Plan

Highway 401

Scale 1:6000

City of Brockville

Figure 2

PUBLIC CONSULTATION

The main objective of consultation in the Class EA process is to ensure that project information is shared in a meaningful way, and that consideration is given to all aspects of the environment from the earliest stages of planning. To achieve this, a variety of communication strategies were used to engage the public, agencies, interest groups, property owners and community members. Opportunities for input were provided at key points during the study process including two online Public Information Centres (PICs) and impacted property owner meetings. In addition, direct contact with the Project Team via mail, email and phone was encouraged throughout the study.

A project website (www.highway401brockville.com) was developed at the onset of the study to provide public with access to project information. The project website was maintained throughout the study process, including project updates, notifications of public events, project team member contact information, PIC materials and links to project specific information, PIC materials and links to project-specific documentation.

INDIGENOUS CONSULTATION

Indigenous Communities and/or organizations were notified of the study commencement, Public Information Centres 1 and 2, and the study completion.

POTENTIAL ENVIRONMENTAL EFFECTS, PROPOSED MITIGATION AND COMMITMENTS TO FUTURE WORK

A summary of environmental effects and proposed mitigation measures, as identified during the course of this study, is provided in Section 10.0, and forms a comprehensive list of commitments to be adhered to during the subsequent design phase of the project.

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1.0 Overview of the Undertaking

1.1 Introduction

The Ontario Ministry of Transportation (MTO) retained Stantec Consulting Ltd. to undertake a Planning, Preliminary Design, and Class Environmental Assessment (Class EA) Study for Highway 401, from 2 km west of Stewart Boulevard to 750 m east of North Augusta Road (about 4.5 km), within the City of Brockville, as shown within Figure 3**.** The purpose of this study is to develop a plan for the rehabilitation and/or replacement of five (5) structures; determine the long-term plans for the Stewart Boulevard and North Augusta Road interchanges, and establish the footprint for interim six-lanes and ultimate eight-lanes of Highway 401 within the City of Brockville.

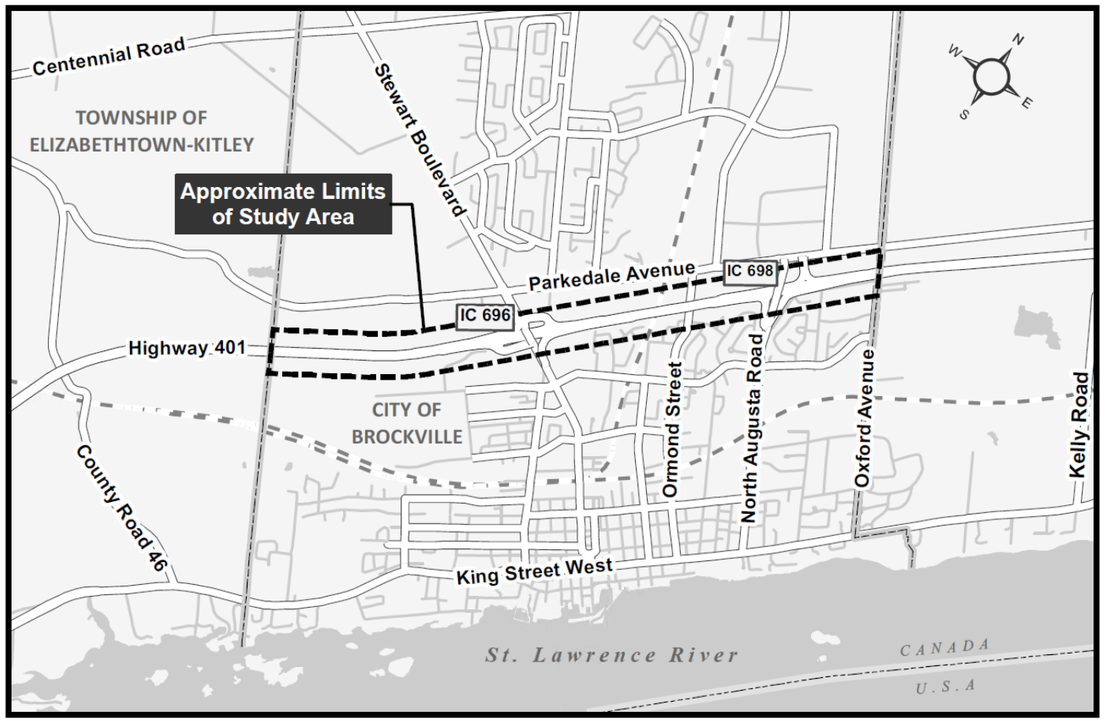

Figure 3: Study area

1.2 General Description of the Project

The goal of projects or activities covered under this Class EA is to provide a safe and effective transportation system while avoiding or minimizing negative environmental effects.

This study was carried out as a 'Group B' project under the MTO Class Environmental Assessment (EA) for Provincial Transportation Facilities (2000). As part of this Class EA, the study team has undertaken a review of existing conditions, environmental and engineering field investigations, reviewed existing conditions, and developed and evaluated a range of reasonable alternatives to determine the most appropriate improvement plan, and has sought input from the public, local municipalities, external ministries/agencies, Indigenous Communities, and businesses. A Recommended Plan was selected and will be designated (protected) at the completion of the study.

The Ministry of Transportation will continue to monitor the facility and may implement certain components of the plan when needed to meet provincial transportation needs.

1.3 Project Background

A Feasibility Study was completed 2020 to assess the potential future modifications of Highway 401 through the City of Brockville. The purpose of the study was to:

- Determine the feasibility of widening Highway 401 to an 8-lane cross-section (initially widening to 6-lanes and ultimately to 8-lanes), including identification of potential impacts
- Develop interchange alternatives to improve the interchange configurations at the Stewart Boulevard Interchange and North Augusta Road Interchange
- Review the replacement and rehabilitation of existing structures along Highway 401 through Brockville
- Identify potential stormwater management facilities
- Review traffic operations

The findings of the feasibility study determined that the future footprint of Highway 401 through the City of Brockville is feasible by adding two additional lanes in each travel direction on the outside of the existing traffic lanes and maintaining the existing median. Six interchange alternatives were also developed and preliminarily assessed for the Stewart Boulevard Interchange, and the North Augusta Road Interchange. The study recommended that MTO proceed with a Class EA and Preliminary Design study to further evaluate the interchange alternatives, and determine a Recommended Plan for improvements within the study area, in consultation with the public, agencies, stakeholders and Indigenous Communities.

1.4 Purpose of the Transportation Environmental Study Report

This *Transportation Environmental Study Report* (TESR) documents the decision-making process, and includes a description of the project purpose; the existing technical, natural, social, economic, and cultural environmental factors; identification and evaluation of alternatives that were considered; consultation activities, including a record of the comments received and how they were considered; the Recommended Plan; anticipated environmental effects and proposed mitigation measures; and, commitments to future work and monitoring.

The TESR fulfills the documentation requirements of the Class EA process for a "Group B" project. The TESR is filed for a 30-day comment period. If you have any questions and/or concerns regarding this study, please contact either one of the following individuals:

Gregg Cooke, P.Eng.
Project Manager
Stantec Consulting Ltd.
200 – 835 Paramount Drive
Stoney Creek ON L8J 0B4
Phone: (289) 439-9630
comments@highway401brockville.ca

David Brake
Senior Project Manager
Ministry of Transportation
Capital Planning and Program Development East
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The request should be sent in writing or by email to the following MECP contacts, as well as copied to the Ministry of Transportation (MTO):

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The potential exists for final design plans completed during the next stage of planning and design to identify design modifications or refinements that may result in environmental benefits or impacts that were not anticipated or identified in this TESR. Any changes that result in design modifications will be discussed with affected external agencies, interested stakeholders and property owners during the next study phase and documented in a *Design and Construction Report* (DCR) that will be made available for public review. If significant changes are made to the project following the completion of the TESR and eligibility for Environmental Clearance, a TESR Addendum may be required to document the project changes.

1.4.1 Environmental Clearance

If there are no significant concerns following the Public Comment Period, or once the Minister of the Environment, Conservation and Parks has reviewed and considered any Order Requests, the project may be eligible for Environmental Clearance and continue to move forward. This will permit MTO to:

- Negotiate temporary and permanent property acquisition, consistent with the project needs (including ROW designation)
- Relocate utilities
- Initiate subsequent study stages (i.e., design and contract preparation) for the Recommended Plan

Although the timeline for implementing the results of this study is not confirmed, this planning will assist MTO, municipalities, Indigenous Communities, business owners, and private landowners with future planning and development within the study area. The implementation of the identified improvements is dependent on regional and provincial priorities and available funding.

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2.0 Class Environmental Assessment Process

2.1 Classification of Project

This Preliminary Design and Class EA Study was carried out under the requirements of the 2000 MTO Class EA document. Based on the nature and extent of the project, the MTO Class EA document specifies different groups under which projects may be planned, and the assessment process required for each. Provided that this process is followed, and its requirements are met for a project, the requirements of the Ontario *Environmental Assessment Act* are considered to be met. This project is being carried out following the requirements of the Class EA as a Group 'B' project. Group 'B' projects include major improvements to existing transportation facilities including highway improvements over land or water that provide a significant increase in traffic capacity or cause a significant widening of the "footprint" beyond the roadbed of an existing highway.

For additional information on the MTO Class EA process, the public may contact the MTO (contact information provided in Section 1.4). In addition, the following documents are available to assist with understanding the process:

- Class Environmental Assessment for Provincial Transportation Facilities, MTO, July 2000
- Environmental Reference for Highway Design, MTO, 2006, updated in June 2013
- Code of Practice for Preparing, Reviewing, and using Class Environmental Assessments in Ontario, MOE, January 2014

These publications are available from the MTO Research Library Online Catalogue (library.mto.gov.on.ca/) and from Publications Ontario (publications.gov.on.ca).

The study process for a Group "B" undertaking, as applicable to this project, is illustrated in Figure 4.

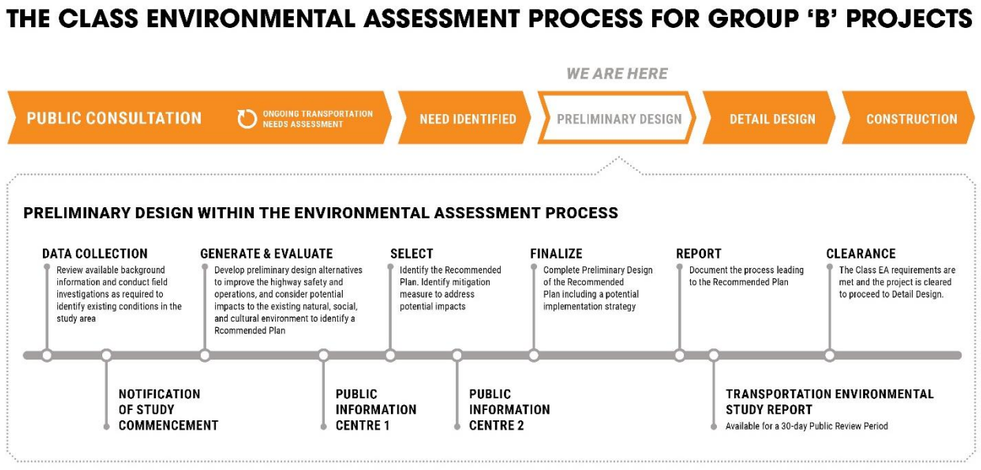

Figure 4: Class Environmental Assessment Process for Group 'B' Projects

2.2 Environmental Assessment Approval Regulations

A Preliminary Design and Class EA Study of this type must be carried out in accordance with applicable environmental legislation and the current government policies and procedures. The policies and legislation that apply to this study are described below.

2.2.1 Ontario Environmental Assessment Act

The Ontario *Environmental Assessment Act* (EAA) governs the conduct of planning studies in the province of Ontario. The purpose of the EAA is to make sure that:

- A reasonable and traceable planning process is followed
- The need for the project is demonstrated
- The public has input into the process and investigations
- The study includes a review of a full range of alternatives
- The selected alternative minimizes any environmental impacts or provides mitigation strategies to minimize impacts resulting from the improvements

2.2.2 Canadian Impact Assessment Act

The *Canadian Impact Assessment Act*, 2019 (IAA 2019) and its regulations establish the legislative basis for the federal environmental assessment process. Under IAA 2019, an environmental assessment is only required for projects included in the list of "designated projects". These types of projects are likely to have significant adverse environmental effects and therefore may be subject to a federal EA.

A proponent is not required to complete the federal EA process if a project is not on this list. This project does not fall under the list of designated projects.

2.2.3 Permits and Approvals

Undertaking an EA also requires consideration of other approvals and review agencies, as outlined below.

Federal Review Agencies

- Department of Fisheries and Oceans (DFO) – MTO/DFO/MNRF Fisheries Protocol, Fisheries Act (FAA)
- Environment and Climate Change Canada (ECCC) – Species at Risk Act (SARA), Migratory Birds Convention Act (MBCA)
- Transport Canada – Notice of Railway Works

Provincial Review/Policy Requirements

- Provincial Policy Statement (2020)
- Ministry of the Environment, Conservation and Parks (MECP) – EAA, Environmental Protection Act, Ontario Water Resources Act, Permits to Take Water
- Ontario Access and Privacy Office – Freedom of Information and Protection of Privacy Act and Accessibility for Ontarians with Disabilities Act
- Ministry of Natural Resources and Forestry (MNRF) MTO Fisheries Protocol, Ontario Wetlands Policy, Endangered Species Act (ESA)
- Ministry of Citizenship and Multiculturalism (MCM) – OHA

Municipal Policy

While MTO is not required to obtain approvals or exemptions for municipal Official Plans, bylaw exemptions and/or or policies, municipal policies and plans are considered as part of the Class EA study process.

2.2.4 Indigenous Rights

Indigenous peoples asserting rights must be consulted and accommodated prior to any decision-making, conduct or activities that may have an impact on those rights.

3.0 Transportation Needs Assessment

The Transportation Needs Assessment process is part of the ongoing management and administration of the transportation systems by the province. Assessment of needs can result in a number of recommendations, including initiating a study, initiating major or minor improvements, initiating routine maintenance, monitoring a situation, or doing nothing. Given the range of potential outcomes, the transportation needs assessment process includes the following:

- Identifying transportation problems and opportunities
- Evaluating and selecting reasonable alternatives, including 'do nothing'
- Developing potential transportation study objectives
- Initiating the study process

This section of the report provides an overview of the transportation problem and opportunity and assessment of Alternatives to the Undertaking that led to the initiation of this study.

3.1 Provincial Responsibilities

The Ontario Ministry of Transportation (MTO) has a mandate to provide transportation services for the people of Ontario. This mandate is to:

- Preserve the safety and efficiency of Ontario's provincial highway network and the Ontario government's investment in highway infrastructure
- Provide a safe and efficient transportation system that is critical to Ontario's quality of life, a strong economy, and a clean and healthy environment

The Ministry's actions are guided by the transportation policies found under both the Transportation Systems and Transportation and Infrastructure Corridors sections of the Ontario *Provincial Policy Statement, 2020* (PPS). These policies include, but are not limited to:

- Providing transportation systems that are safe, energy efficient, facilitate the movement of people and goods, and are appropriate to address projected needs
- Making efficient use of existing and planned infrastructure
- Maintain connectivity within and among transportation systems
- Minimize the length and number of vehicle trips and support current and future use of transit and active transportation
- Planning for and protecting corridors and rights-of-way for transportation, transit, and infrastructure facilities to meet current and projected needs
- Protect major goods movement facilities and corridors

The Transportation Needs Assessment for this study was carried out within the context of the MTO responsibilities and requirements of the PPS, and to meet the requirements of the Class EA process.

3.2 Problems and Opportunities

The purpose of this study was to identify a recommended plan that addresses current and future transportation needs in the study area, as part of the Ministry's ongoing review of safety and operational needs for the provincial highway network. The study was initiated to address the following problems and opportunities:

Problems

- Many of the structures in the study area are nearing the end of their service life and require rehabilitation or replacement

Opportunities

- The study will develop appropriate rehabilitation or replacement strategies to maintain the safe operation of the highway corridor for the current and future planning horizons
- Identify the ultimate interchange configurations at Stewart Boulevard and North Augusta Road; and the ultimate footprint for the Highway 401 corridor to address current and future transportation needs

3.3 Alternatives to the Undertaking

The Class EA process requires that 'reasonable alternatives' be considered in addressing the identified problems and/or opportunities. This involves two levels of analysis. The Alternatives to the Undertaking considers a broad range of alternatives that could address the project needs. Once the best alternative is selected, the Alternative Methods of Carrying out the Undertaking are studied in greater detail.

The Alternatives to the Undertaking identified for this study are outlined below.

3.3.1 Do Nothing

Rehabilitate existing bridges and culverts or replace existing structures with no accommodation for the Highway 401 footprints for interim six and ultimate eight lanes. The configuration of the existing interchanges would be maintained.

3.3.2 Transportation Demand Management (TDM)

TDM shifts demands on the highway network by shifting demands to the time periods outside of the critical congestion periods and shift demands to alternative modes of transportation.

3.3.3 Improve Adjacent Road Systems

Expansion of existing municipal and regional road networks.

3.3.4 Improved Provincial Transportation Facilities

Replace existing bridges and culverts to accommodate the Highway 401 footprints of interim six and ultimate eight lanes. Modify configuration of existing interchanges.

3.4 Preliminary Assessment of Alternatives to the Undertaking

A preliminary assessment of the alternatives to the undertaking was completed to identify the alternatives that best address the transportation problem and opportunity, as described in Section 3.2.

The alternatives are screened to select only the most reasonable alternatives to be carried forward for more detailed study. This process allows for the elimination of alternatives which do not meet the transportation problem and opportunity in advance of the detailed evaluation stage.

The preliminary assessment of the alternatives to the undertaking uses the following screening criteria:

- Does the option realistically address all the problems and opportunities?
- Does the option make a significant contribution towards realistically addressing all of the problems and opportunities?

Only those alternatives that satisfy at least one of the above criteria were carried forward for further study.

3.4.1 Preferred Transportation Undertaking

Based on the findings of the screening assessment indicated that improving the provincial transportation facility alternative is preferred. The results of the screening assessment of Alternatives to the Undertaking are summarized in Table 1.

Table 1: Screening Assessment of Alternatives to the Undertaking

Alternatives to the Undertaking	Does it address the Transportation Problems?	Carried Forward?
Do Nothing Maintains the status quo of transportation infrastructure and services. No changes to Highway 401, its bridges, structural culverts and/ interchanges within the study area.	• Bridges and structural culverts require rehabilitation and/or replacement • Does not establish future Highway 401 footprints for six and eight lanes	No The "Do Nothing" alternative does not address the identified transportation problems.
Transportation Demand Management (TDM) Shift demands on the highway network by shifting demands to the time periods outside of the critical congestion periods and shift demands to alternative modes of transportation.	• Bridges and structural culverts require rehabilitation and/or replacement • Does not establish future Highway 401 footprints for six and eight lanes	No TDM alternative does not address the identified transportation problems.
Improve Adjacent Road Systems Expansion of existing municipal and regional road networks.	• Bridges and structural culverts require rehabilitation and/or replacement • Increases traffic volume on adjacent road systems • Provides less direct route for travelers • Does not establish future Highway 401 footprints for six and eight lanes	No Improving Adjacent Road Systems does not address the identified transportation problems.
Improved Provincial Transportation Facility Expansion, operational and safety improvements including establishing the footprint of future six and eight lanes on the highway to address current and future transportation needs of Highway 401, interchange improvements, and structure replacements to optimize the movement of people and goods.	• Rehabilitates/Replaces bridges and structural culverts • Establishes future Highway 401 footprints for six and eight lanes	Yes Improving the Provincial Transportation Facility addresses the identified transportation problems.

Based on the findings of the assessment of the Alternatives to the Undertaking, the Improved Provincial Transportation Facility alternative is preferred because it addresses the structural replacement needs and the anticipated growth needs.

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4.0 Existing Conditions

Background studies and site-specific field investigations were carried out to help to identify and assess existing environmental conditions, including traffic analyses, land use, cultural heritage, archaeology, contamination, fish and fish habitat, terrestrial ecology, and stormwater management. All work was carried out in accordance with the requirements of the *Environmental Reference for Highway Design* (2006), which provides standards for scope of work, evaluation of potential impacts and proposed mitigation measures for MTO undertakings.

The background reviews to identify existing conditions were carried out between spring 2020 and fall 2021. Significant environmental features and/or constraints identified as a result of the background studies were documented and considered during the development and evaluation of alternatives.

4.1 Natural Environment

An inventory of natural environment features within the study area was undertaken based on a review of previous and relevant studies, field investigations and information received from external agencies and the public during the course of this study.

4.1.1 Physiography, Geology and Soils

The study area is located within the Smith Falls Limestone Plain physiographic region, which is characterized by shallow soil overlying limestone or dolostone bedrock. Deeper soils are present in some areas as a result of old beach deposits, isolated drumlins, and clay deposits that have infilled depressions in the bedrock surface.

The study area is generally underlain by fine textured glaciolacustrine massive to well laminated deposits of silt and clay with minor sand and gravel. Bedrock in the west portion of the study area generally consists of stone-poor, carbonate-derived silty to sandy till and near areas of Paleozoic bedrock drift-complex, which is underlain by Paleozoic bedrock comprising interbedded sandstones and dolostones followed by Precambrian bedrock, which is exposed at surface in the west portion of the study area.

Regional topography generally slopes southwestward toward the St. Lawrence River. Ground surface topography across the study area is relatively flat, generally ranging from approximately 95 m above mean sea level (AMSL) to approximately 105 m AMSL.

4.1.2 Drainage, Surface Water and Groundwater, and Source Water

Drainage

Existing drainage issues have been identified in the vicinity of Highway 401, including in the northwest corner of the Stewart Boulevard and Highway 401 interchange, along the south side of Highway 401 and west of the rail crossing, and along the north side of Highway 401 generally between Ormond Street and North Augusta Road.

Surface Water

The study area is within the Cataraqui Source Protection Area (CSPA) and spans across the Buells Creek subwatershed which is located within the jurisdiction of the Cataraqui Region Conservation Authority. Buells Creek is located approximately 50 m east of the Ormond Street Overpass, and the existing Buells Creek Culvert conveys water from the creek beneath Highway 401. Buells Creek flows southerly towards Butlers Creek which drains into the St. Lawrence River (Lake of the Isles), located approximately 2 km southeast of Highway 401.

Groundwater

A review of existing groundwater conditions was prepared as part of this study to determine existing groundwater levels, uses and any policies that may be applicable to this project. The findings of this review are described herein.

Aquifers within the CSPA have primarily been identified in the bedrock. The bedrock aquifers consist of permeable materials, including Paleozoic limestones, dolostones, sandstones, and Precambrian rock.

Some areas with thicker soil cover can act as a protective barrier to the bedrock aquifers, especially where mainly clay is present and that areas with less soil cover tend to be highly susceptible to surface contamination, as fractures in bedrock can act as a pathway for contaminants to reach groundwater.

Based on MECP water well records (WWRs) for water wells located with within 500 m of the study area, static water levels range from 0.9 m BGS to 9.1 m below ground surface (bgs) in the study area.

Source Water

Municipal and Private Water Supply

The majority of the developed areas within the City of Brockville are serviced with municipal water obtained from St. Lawrence River surface water. The nearest surface water intake is for the City of Brockville's Water Treatment Plant, located approximately 2.4 km south of the Stewart Boulevard Interchange.

It is expected that the majority of the study area is supplied by municipal water, with the exception of along the western extent of Parkedale Avenue, to the west of the Stewart Boulevard Interchange where there does not appear to be municipal water servicing. A review of the MECP WWRs identified 193 historical WWRs within 500 m of the study area, 95 of which are domestic supply wells.

Based on the WWR review, private wells in the study area are reported to be installed in bedrock. It is recommended that as part of final design, the location of below ground excavation be reviewed to determine the need for and extent of private well monitoring in select areas.

Source Water Protection

The CSPA Source Protection Plan identifies vulnerable areas in the region, and the applicable "drinking water threats", which are subject to regulation. Based on a review of the CSPA Source Protection Plan, there are no Wellhead Protection Areas (WHPAs), Issue Contributing Areas (ICAs), and Intake Protection Zones (IPZs) for surface water supply sources within the study area. However, the study area lies within a HVA area with an assigned vulnerability score of 6.

Significant Groundwater Recharge Areas (SGRAs) for groundwater supply sources appear to be located near the west and east portions of the study area.

A copy of the Groundwater Assessment is provided in Appendix A.

4.1.3 Designated Areas

Designated Areas have special or unique value and are defined by government authorities and/or the public, and through legislation, policies, or approved management plans. These areas may have a variety of ecological, recreational, or aesthetic features and functions that are highly valued. Designated Areas include but are not limited to: Provincially Significant Areas of Natural and Scientific Interest (ANSI), Provincially Significant Wetlands (PSW), heritage rivers and national and provincial parks.

The study area does not intersect any Provincially Significant Wetlands (PSWs) or Areas of Natural and Scientific Interest (ANSIs). There are mapped unevaluated wetland areas located approximately 30 m north of the Buells Creek Culvert, 50 m north of the Ormond Street Overpass, and 50 m southeast of the CNR Overhead.

4.1.4 Terrestrial and Aquatic Ecosystems

Terrestrial and aquatic ecosystem conditions were assessed as part of this study based on a review of existing/available information and field investigations undertaken in spring/summer and fall of 2020 and 2021, including supplemental terrestrial ecosystem conditions field assessment undertaken in summer 2020. All field investigations were conducted according to the MTO *Environmental Reference for Highway Desig*n (2013) and the MTO *Environmental Guide for Fish and Fish Habitat* (2009), which were applicable at the time of the field investigations.

Background information was also obtained from the MNRF and published resources.

The findings of these investigations are documented within the Terrestrial Ecosystems Existing Conditions and Preliminary Impact Assessment Report, provided in Appendix B, and Fish and Fish Habitat Existing Conditions and Preliminary Impact Assessment Report, provided in Appendix C.

Fish and Fish Habitat

Buells Creek and a tributary to Grants Creek are the only mapped watercourses within the study area. There are no constructed drains within the study area. Buells Creek has a warmwater thermal regime and a permanent flow regime. The tributary to Grants Creek has a permanent flow regime and there is no assigned thermal regime. There are no historical fish community data for Buells Creek or Grants Creek, in proximity to Highway 401, and there are no records of provincially or federally regulated aquatic SAR in the study area.

Field Investigations

The purpose of the field investigations was to document aquatic ecological conditions in watercourses in the study area at Highway 401. Fish habitat characterization and fish community sampling were conducted in August 2020, May 2021, and September 2021 at seven sites with the potential to support fish habitat and/or that were indicative of flow conveyance based on air photo interpretation, proximity to mapped surface water features, and culvert inspections completed by Stantec.

Based on the findings of the 2020 and 2021 field investigations, the following locations provide direct fish habitat in the study area:

- Tributary to Grants Creek (parallel to the north side of Highway 401, within the Highway 401 ROW) (seasonal)
- Two culverts provide located between the Stewart Boulevard and the existing VIA (CNR) rail corridor (seasonal)
- Buells Creek (MTO Site 16X-0237/C0)
- One culvert located between Ormond Street and North Augusta Road (seasonal)

Based on the assessment results, the features that connect some of the sites listed above also support seasonal fish habitat:

- Ditch located on the north side of Highway 401 and between Stewart Boulevard and the existing VIA (CNR) rail corridor
- Tributary to Buells Creek (ditch) located on the north side of Highway 401, between Ormond Street and North Augusta Road

Indirect fish habitat was also identified at the culvert crossing Highway 401 at the west end of the study area limits.

Significant Fish Habitat means habitat that meets one or more of the following criteria (MTO 2020b):

- Rare or uncommonly found habitat that may (but may not) be one of the limiting factors to the fish population
- Specialized habitat that fish populations are highly dependent on to support critical life functions
- Areas contributing to fisheries productivity that are exceptionally productive, likely to be limiting and are rare or relatively uncommon

None of the sites identified provide Significant Fish Habitat.

Terrestrial Ecosystems

The terrestrial ecosystem is defined as the interaction of land, air, water, and biotic components functioning as an ecological unit over space and time, and includes vegetation, wetlands, wildlife, and wildlife habitat.

The study area is within the Great Lakes St. Lawrence Forest Region and Ecoregion 6E-11 (Smith Falls Ecodistrict). Forest communities in the Great Lakes St. Lawrence Forest Region are dominated by hardwood trees such as maple, oak, birch, and basswood but also commonly include white pine, red pine, hemlock and white cedar. Forested habitat in this ecodistrict is the dominant land cover with deciduous forest occupying 30%, mixed forest 20%, and coniferous forest 6% of the landscape. Agriculture (pasture/cropland) occupies 35% of the landscape with urban habitat at 1%.

The Frontenac Arch Biosphere Reserve, a Significant Ecological Area, has been designated as an international biosphere region that spans 2700 square kilometers (km^2) from Gananoque to Brockville, and Sydenham to Westport and Rideau Lakes. It is an area that contains unique geology, diverse forest communities, and biodiversity in Ontario. The entire study area is within the reserve.

A significant woodland was identified at the southwest end of the study area. A significant woodland is defined in the City of Brockville Official Plan (2012) as “areas which are ecologically important in terms of species composition, age of trees and stand history. . . [and] functionally important due to their contribution to the broader landscape”.

No other designated natural areas or provincially significant natural heritage features such as Provincially Significant Wetlands, Areas of Natural or Scientific Interest, Conservation Reserves, provincial parks, or significant wildlife habitat (SWH) occurred in the study area. There are mapped unevaluated wetland areas located approximately 30 m north of the Buells Creek Culvert (16-237/C), 50 m north of the Ormond Street Overpass (16-123), and 50 m southeast of the CNR Overhead (16-122).

Species of Conservation Concern

Significant species are considered at a number of levels, including globally, nationally and provincially. In Ontario, significant species include species that are provincially rare (with a Provincial S rank of S1 to S3) or listed as Endangered, Threatened, or Special Concern on the Species at Risk in Ontario list (SARO) and/or Schedule 1 of the federal *Species at Risk Act* (SARA).

The Ontario *Endangered Species Act, 2007* prohibits harm or harassment to Threatened or Endangered species, and damage or disturbance to their habitat. The ESA applies on all private and Crown owned lands in Ontario. Habitat protection under the ESA typically includes all habitats that directly or indirectly support SAR.

Federally protected Endangered, Threatened and Special Concern species are listed in Schedule 1 of the *Species at Risk Act, 2002* and apply only to federally owned lands. Fish species are protected under the *Fisheries Act* and migratory bird species are protected under the *Migratory Bird Convention Act*, both of which are afforded protection on all lands.

Provincial ranks (S-ranks) are used by the NHIC to set protection priorities for rare species and vegetation communities. They are based on the number of occurrences in Ontario and are not legal designations. By comparing the global and provincial ranks, the status, rarity, and the urgency of conservation needs can be determined. Species with provincial ranks of S1 to S3, and those tracked by the MNRF, are considered species of conservation concern. Provincial S-ranks are defined as follows:

- S1: Critically imperiled-usually fewer than 5 occurrences
- S2: Imperiled- usually fewer than 20 occurrences
- S3: Vulnerable- usually fewer than 100 occurrences
- S4: Apparently secure- uncommon but not rare, usually more than 100 occurrences
- S5: Secure- common, widespread, and abundant
- S-rank followed by a “?” indicates that the rank is uncertain

The probability that a Significant Species may be present within the study area was assessed by comparing preferred habitat types to existing conditions documented within the background review and during the August 2020 and June 2021 field investigations. Significant Species with preferred habitat in the study area were considered likely to be present. Significant Species with no preferred habitat in the study area were assumed to be absent.

Significant Species

Based on a review of background databases, there were records of 12 significant species for the study area:

- **Birds** - Bobolink (*Dolichonyx oryzivorus*), Chimney Swift (*Chaetura pelagica*), Eastern Meadowlark (*Sturnella magna*), Wood Thrush (*Hylocichla mustelina*)
- **Reptiles** – Blanding's Turtle (*Emydoidea blandingi*), Snapping turtle (*Chelydra serpentina*), Midland Painted Turtle (*Chrysemys picta marginata*), Eastern Milksnake (*Lampropeltis triangulum*)
- **Insects** – Yellow Banded Bumble-bee (*Bombus terricola*), Transvers Lady Beetle (*Coccinella transversoguttata*)
- **Plants** – Butternut (Juglans cinerea), Olney's Grimmia (*Grimmia olneyi*)

An additional 31 significant species with potential to occur within the study area were identified in wildlife atlases and other background data sources, and includes 18 SAR and 25 SOCC. Field investigations confirmed that one of these species are present and habitat assessments determined there is suitable habitat in the study area for an additional 14 species.

Vegetation Communities

Vegetation community mapping followed the Ecological Land Classification (ELC) system for southern Ontario and, where appropriate, the updated ELC Catalogue (2008). Vegetation communities were delineated on satellite photographs and verified in the field. Provincial significance of vegetation communities was based on the rankings assigned by the NHIC (MNRF 2021c).

Land cover in the study area includes constructed, meadow, thicket, woodland and wetland ELC community types. Constructed land use types include transportation and utility corridors, light industry and businesses, residential development, parkland, and golf courses. The vegetation communities observed in the study area were common in southern Ontario, and typical of the Great Lakes St. Lawrence Forest Region and Ecoregion 6E.

Based on the findings of the background review and field investigations undertaken as part of this study, natural areas are predominately woodland and successional communities (meadows and thicket). Woodlands are predominantly deciduous communities comprising sugar maple, red maple, Norway maple, red oak, ash, and elm. Mixed and coniferous forests also include white pine, red pine, Scots pine, and spruce. Thicket communities contain sumac, juniper, Manitoba maple, buckthorn, and young aspen. Wetlands in the study area include cattail meadow marsh, Buells Creek, and water hazards in golf courses.

Areas within the ROW including lands adjacent to the shoulder and areas around interchanges are dominated by meadow communities. These meadows are comprised of common roadside meadow species such as wild carrot, wild parsnip, Canada thistle, Canada goldenrod, aster species, purple crown-vetch, clover species, smooth brome, European reed, and other common old field weeds.

A summary of the ELC communities in the study area is provided in Table 2. The complete list of community types in provided in Appendix B**.**

Table 2: Summary of ELC Communities in the Study area

Type	Area (ha)	Percent of Total Area
Aquatic	0.38	0.20%
Constructed	114.91	61.38%
Deciduous Thicket	10.27	5.48%
Meadow	23.92	12.77%
Rock Barren	0.36	0.19%
Wetland	1.96	1.05%
Woodland - Coniferous	1.24	0.66%
Woodland – Deciduous	33.55	17.92%
Woodland – Mixed	0.34	0.18%
Woodland – Plantation	0.30	0.16%
Total	**187.22**	**100%**

Vascular Plants

Ninety (90) vascular plant species were recorded within and adjacent to the ROW, 48) of which are native to Ontario, while the remaining are either not native to Ontario or their origin is unknown.

- All but one native species have a provincial rank of S5 or S4.
- One SAR (butternut) was observed, which is ranked as S2? and considered rare of very rare in Ontario.

European reed is associated with meadow and marsh habitat along ditches in areas that had been previously disturbed (i.e., grading, construction) in the study area. European reed (invasive Phragmites) was observed within the Highway 401 ROW at the Augusta Road interchange area.

Significant Wildlife Habitat

Significant Wildlife Habitat (SWH) is defined as habitat that is ecologically important in terms of features, functions, representation or amount of contribution to the quality and diversity of an identifiable geographic area or Natural Heritage System, and is protected under the *Provincial Policy Statement*, 2020. Habitats within the Study area were assessed for candidate SWH using the *Ecoregion 6E Criterion Schedule* (MNRF 2015), as described herein

Seasonal Concentration Areas

Seasonal concentration areas are those sites where large numbers of a species gather at one time of the year, or where several species congregate. Such areas include, but are not limited to deer yards, snake and bat hibernacula, waterfowl staging and moulting areas, raptor roosts, bird nesting colonies, shorebird staging areas, and passerine migration concentrations. Only the best examples of these concentration areas are usually designated as SWH. Areas that support a SAR, or areas where a large proportion of the population may be lost if the habitat is destroyed, are examples of seasonal concentration areas which should be designated as significant.

The following candidate habitat for seasonal concentration areas was identified within the study area during field investigations:

- Raptor Wintering Areas (Candidate) – combination of fields and woodlands
- Bat Maternity Colonies (Candidate) – mixed and deciduous forests and swamps with large diameter dead or dying trees with cavities
- Reptile Hibernacula (Candidate) – rock piles or spokes, stone fences, crumbling foundations

Rare or Specialized Habitat

Rare or Specialized habitats are two separate components. Rare habitats are those with vegetation communities that are considered rare in the province. Specialized habitats are microhabitats that are critical to some wildlife species. The SWH Criteria Schedules for Ecoregion 6E identifies a number of habitats that could be considered specialized habitats, such as habitat for area-sensitive species, forests providing a high diversity of habitats, amphibian woodland breeding ponds, turtle nesting habitat, highly diverse sites, seeps and springs. No rare vegetation communities were present within the study area. The following candidate habitats for specialized habitat were identified within the study area:

- Woodland Raptor Nesting Habitat (Candidate): stick nested in forested ELC communities >30 ha with 10 ha of interior habitat
- Seeps and Springs (Undetermined): any forested area with groundwater at surface within the headwater of a stream or river system
- Amphibian Breeding Habitat (Woodland and Wetland) (Candidate): Treed uplands with vernal pools, and wetland ecosites

Habitat for Species of Conservation Concern (SOCC)

Habitat for SOCC is a category of SWH, however these results are presented alongside habitat assessments for SAR. In addition to candidate habitat for SOCC, broad habitat types with the potential to support multiple SOCC may be considered SWF (i.e., marsh bird breeding habitat, open country bird breeding habitat). Candidate habitats found in the study area are:

- Terrestrial Crayfish (Undetermined): wet meadows and edges of shallow marshes with burrows or chimneys

Animal Movement Corridors

Migration corridors are areas that are traditionally used by wildlife to move to one habitat from another. This is usually in response to different seasonal habitat requirements. The following candidate animal movement corridors were identified within the study area:

- Amphibian Movement Corridors (Undetermined): associated with confirmed amphibian breeding habitat

Nest Surveys

Migratory birds and their nests are protected under the *Migratory Bird Convention Act, 1994* (MBCA). Suitable drainage structures, interchange structures and overpasses in the ROW were searched for the presence of migratory bird nests. These structures have the potential to provide nesting habitat for Barn Swallow, which is protected by the ESA and MBCA, and other species that are protected by the MBCA, such as American Robin and Eastern Phoebe. Field staff also recorded the dimensions and physical characteristics of the structures and whether potential nesting ledges were present where access was possible. .

No bird nests were observed during field investigations. One culvert (Buells Creek) and four overpass/bridge structures were surveyed. For structures with limited visibility due traffic and/or rail hazards, a 25-minute survey was conducted at the base of the structure from a safe location to assess if migratory birds and/or Barn Swallow were accessing the structure. For the Augusta Road and Stewart Boulevard interchanges the survey was conducted twice, once from the eastbound land and once from the westbound lane. No nests or birds were observed accessing any structures or the culvert.

Nest searches were conducted on June 14, 2021, to correspond with the active breeding season (i.e., late May through early July); therefore, the lack of bird observations and/or nests indicated that the structures in the study area are not currently being used as nesting habitat.

Incidental Observations

Wildlife observations and evidence of wildlife (e.g., tracks, burrows, vocalizations) were recorded during all field visits. The following species were recorded incidentally during field observations:

- Insects: monarch
- Birds: American Crow, American Goldfinch, American Robin, Black-capped Chickadee, Blue Jay, Common Grackle, European Starling, House Finch, House Sparrow, Rock Pigeon, Red-eyed Vireo, Ring-billed Gull, Song Sparrow
- Mammals: gray squirrel, red squirrel

4.2 Socio-Economic Environment

4.2.1 Connecting the East

Connecting the East: a draft transportation plan for eastern Ontario developed by MTO contains actions to help build a safe, reliable, and connected transportation system that keeps people and goods moving within and across the region. It includes investments to rehabilitate and expand highways, improve transit and intercommunity bus options, support economic development opportunities and ensure that the region's transportation system is ready for the future. The transportation plan identifies the need for rehabilitation or replacement of highway structures in the area of Brockville, including planning for six to eight lanes along Highway 401 in Brockville.

4.2.2 Existing Land Use

The study area is located within the urban boundary of the City of Brockville and the County of Leeds and Grenville. The study area includes many commercial retail stores and industrial facilities, predominately near the Highway 401 interchanges. Notable commercial uses in the study area include the 1000 Islands Mall, hotels, grocery stores, and retail services along Parkedale Avenue.

Two institutional land uses are located in proximity to Highway 401. St. Lawrence College is located north of Parkedale Avenue, and the Thousand Islands Secondary School is located north of Highway 401, northeast of Stewart Boulevard and Parkedale Avenue.

The Brockville Landfill site is located on Old Red Road, north of Highway 401 and beyond the limits of the study area.

4.2.3 Municipal Policies

United Counties of Leeds and Grenville Official Plan

The United Counties of Leeds and Grenville Official Plan (OP) was approved in February 2016. The City of Brockville is geographically but not administratively part of the United Counties of Leeds and Greenville (the Counties).

According to the OP, the Counties and its local municipalities are planning for a total population of 75,960 people and 16,760 jobs by 2031. In addition, the Counties has experienced out-community of its residents to job opportunities in other municipalities, including the City of Brockville. This travel trend is anticipated to continue beyond 2031.

According to "Schedule A – Community Structure and Land Use" of the OP, land uses bordering the City of Brockville generally consist of designated Rural Lands. Lands under this designation are *intended to protect the natural amenities and rural character of the Counties while providing opportunities for agricultural uses, resource-based activities, recreation and tourism and other rural land uses*.

City of Brockville Official Plan

The City of Brockville Official Plan (OP) was completed in 2012 and amended in September 2019. The OP provides strategic land use direction to guide growth and development in the city up to 2031.The OP requires that planning considers the impact of decision making with respect to land use and infrastructure, including transportation networks and transit. The OP also encourages the integration of transportation planning with the existing natural and built environments, trails, active transportation networks, and to ensure that the City's transportation network "meets the short- and long-term needs of all users to ensure that transportation options are flexible, safe, efficient, comfortable, affordable, and convenient."

A range of land uses bound Highway 401 and have been designated by the City of Brockville with the strategy to create a complete community and accommodate development opportunities associated with the Highway 401 exposure Within the study area limits, these land use designations include Employment, Highway Commercial and Major Institutional, Mixed Use and Neighbourhood and Open Space. Designated Parks and Open Spaces and a former golf course are located at the west end of the study area, which has been identified as Rural Lands. The study area land uses generally consist of Open Space, Rural Lands, Business Park, General Employment, General Commercial, Mixed Use Corridor, Residential Zones, Power Centre Zone, and Environmental Protection.

Stewart Boulevard and Parkedale Avenue are identified as "Linking Corridors". These areas are encouraged to be developed in accordance with transit-oriented development design and mixed use.

Lands located on the north side of Highway 401, between the existing VIA (CNR) rail corridor and North Augusta Road are designated Corridor Commercial and Site Specific Policy Areas. These lands are intended to accommodate uses that serve the travelling public while optimizing the City's existing infrastructure and transit corridors.

The OP identifies the Stewart Boulevard/Highway 401 Gateway as a "Secondary Mixed-Use Node" intended to accommodate mixed employment, retail commercial, hotel/motel accommodations, community uses, and mixed density residential uses. The OP recommends that the streetscape design at this location celebrates the importance of the area as the "doorstep" to the City from Highway 401.

Section 5.2.2.1 of the OP recognizes the future improvements to the Highway 401 interchange with North Augusta Road, and notes that the interchange configuration is being protected for the long term upgrades to help meet future travel demands of the provincial and local traffic. Specifically, policy direction related to this future interchange indicates the following:

- The Ministry of Transportation shall have jurisdiction and control over access to Highway 401, and development within the Ministry's permit control area.
- The Ministry of Transportation shall determine the right-of-way width for the Provincial Highways.
- All development in proximity and adjacent to a Provincial Highway shall be subject to the safety and geometric requirements and permits of the Ministry of Transportation. The Ministry of Transportation may require a site specific transportation impact study to be submitted for review and approval in order to determine the impact of development on a Provincial Highway.

In addition, Schedule 1 (City Structure) of the OP illustrates potential conceptual future road and highway interchange configurations at this location.

The City of Brockville identified that businesses and companies evaluating land in Brockville have noted that the current interchanges do not support the use of Large Commercial Vehicles (LCVs).

An active railway is located south of Highway 401 which forms part of the busy Windsor to Quebec City railway corridor and is an important link for freight and VIA Rail passenger rail service. The VIA Rail station in Brockville is located on Perth Street between Highway 401 and the Brockville Downtown.

There is a North-South railway corridor (CPR Rail) located between North Augusta and Stewart Boulevard.

Future Development

An extension of Centre Street is included in the City of Brockville Official plan, consisting of a grade separation crossing of Highway 401. The extension would connect the existing Centre Street to Parkedale Avenue. The City has noted that it is included in the long-term planning (50-100 years), and that it would necessitate a new overpass of Highway 401. A new overpass of Highway 401 is outside the scope of this study, therefore, not considered.

Active Transportation and Trails

Schedule 5 of the City of Brockville OP identifies Parkedale Avenue, Ormond Street, Stewart Avenue, Oxford Avenue as "potential Spine Cycling Network" routes. These potential routes are part of a broader active transportation network that is being planned to connect to Potential Neighbourhood Cycling Routes, that are located along sections of the City's local road network, and the Brock Trail.

The City of Brockville completed its Active Transportation Plan in September 2019 to identify a set of short-, mid- and long-term improvements that will support active transportation over the next approximately 20 years. As part of the long-term improvements to the City's active transportation network, active transportation facilities are envisaged along Stewart Boulevard and North Augusta Road across Highway 401.

In addition, the Brock Trail is a multi-use trail system that runs north-south through the City along linear parks and roadways between the waterfront and the north limit of the City. This trail crosses Highway 401 in the vicinity of the Ormond Street.

The Brocktel or 'Black and Decker' Trail recreation trail system is located immediately south of Highway 401, and generally located 2 km west of Stewart Boulevard, between Central Avenue West and Lyn Road (i.e., beyond the west limit of the study area), north of the rail corridor. This trail system is privately owned and operated, and serves a variety of users, including hikers, cyclists and Off-Road Vehicles (ORVs).

4.2.4 Emergency Services

Emergency Services consist of police, fire, and medical response providers. The following is the summary of emergency service providers within the study area:

- The Brockville Police Services headquarters is located on Parkedale Avenue between Stewart Boulevard and Ormond Street.
- Brockville Fire Department Stations are located on Laurier Boulevard and Perth Street outside of the study area.
- Ontario Provincial Police – Brockville Detachment located on County Road 29, outside of the study area.

4.2.5 Student Transportation/Education Facilities

There are three school districts in the City of Brockville, including the following:

- Upper Canada District School Board
- Catholic District School Board of Eastern Ontario
- Conseil des écoles catholiques du Centre-Est

The Student Transportation of Eastern Ontario and Consortium de transport scolaire d'Ottawa are the transportation services within the study area.

4.2.6 Agriculture

There are no active agricultural lands or operations located directly within the study area.

4.2.7 Potentially Contaminated Property

A Contamination Overview Study (COS) was completed as part of this study to assess the potential for subsurface soil and/or groundwater contamination concern within the study area. Based on the findings of a desktop review and a windshield survey conducted for the study area, approximately 22 potential sources of contamination (PSOC) were identified within the study area, including but not limited to fuel storage, vehicle maintenance and fuelling operations, manufacturing or dry cleaning facilities, and historical records of spills of potentially contaminated material.

Each potential source was ranked high, moderate, or low potential, depending on the distance of the potential contamination source from the study area limits, and the activity associated with the potential contamination source.

A copy of the COS is provided in Appendix D.

4.2.8 Designated Substances and Hazardous Materials

A designated substances and hazardous materials assessment was completed to identify areas that may require attention and/or specific handling considerations prior to any construction activities. A visual survey was completed, and identified the potential presence of the substances listed in Table 3 and designated under the Ontario Occupational Health and Safety Act.

Table 3: Designated Substances and Hazardous Materials

Materials	Comments
Arsenic	Arsenic may be present in paints and adhesives, but at concentrations that are not expected to be a concern.
Asbestos	Presumed asbestos-containing materials (PACMs) may be present in: • Electrical conduit • Drainpipes • Asphalt – North Augusta Road, Ormond Street, Stewart Boulevard • Road patch – North Augusta Road • Expansion joint caulking
Lead	Paint applications were observed in the form of road paint Lead may also be present in the following materials: • Older electrical wiring materials and sheathing • Solder used in bell fittings for cast iron pipes • Solder used in electrical equipment • Vent and pipe flashings.
Silica	Silica may be present in materials such as asphalt, cement and concrete.
Benzene	None identified. May be present in paints, adhesives and asphalt.
Other Designated Substances	Acrylonitrile, coke oven emissions, ethylene oxides, isocyanates, and vinyl chloride are not typically a concern in materials, and therefore these substances were not investigated
Mercury	Equipment suspected to contain mercury was not observed. Mercury may be present in paints and adhesives.
Polychlorinated Biphenyls (PCBs)	Four high intensity streetlights suspected to contain PCBs were observed at the Highway 401/Ormond Street Overpass (Site 16-123). PCBs may be also present in other items in limited amounts (e.g. plastics, molded rubber parts, applied dried paints, coatings or sealants, caulking, adhesives, paper, sound-deadening materials, insulation, or felt and fabric products such as gaskets).

Recommendations pertaining to the handling, removal, disposal and management of identified designated substances and hazardous materials are provided in Section 7.2.3.

A copy of the Designated Substances and Hazardous Materials Assessment Report is provided in Appendix E.

4.2.9 Utilities

Utility companies with plant within the study area were requested to provide information on the location and type of existing utility plant. The following companies have existing utility infrastructure/stations within the study area:

- Bell Canada
- Cogeco Cable
- Enbridge Gas
- Hydro One
- Trans Northern Pipelines

4.3 Cultural Heritage Environment

4.3.1 Archaeological Resources

A Stage 1 archaeological assessment was completed in 2021 to determine the potential for archaeological resources to be present within the study area.

Archaeological potential is established by determining the likelihood that archaeological resources may be present on a subject property. Archaeological potential criteria include proximity to previously identified archaeological sites, distance to various types of water sources, soil texture and drainage, glacial geomorphology, elevated topography and the general topographic variability of the area. Distance to modern or ancient water sources is generally accepted as the most important determinant of past human settlement patterns and considered alone, may result in a determination of archaeological potential. However, any combination of two or more other criteria, such as well-drained soils or topographic variability, may also indicate archaeological potential. Extensive land disturbance can eradicate archaeological potential.

Soil texture can be an important determinant of past settlement, usually in combination with other factors such as topography. Of the soils identified, Farmington loam is suitable for agriculture. The other soils, Hinchinbrooke loam and Napanee clay are poorly drained and are not suitable for agriculture. A total of eight registered archaeological sites are located within one km of the study area. Of these, seven are Euro-Canadian and one is pre-contact Indigenous.

For Euro-Canadian sites, archaeological potential can be extended to areas of early Euro-Canadian settlement, including places of military or pioneer settlements; early transportation routes; properties listed on the municipal register or designated under the *Ontario Heritage Act*; and properties that local histories or informants have identified with possible historical events, activities or occupations. Historic mapping from 1861 shows that much of the land in the township had been settled and most lots are depicted as having an owner and containing a structure.

The property visit demonstrated that approximately 31% of the study area, beyond the existing Highway 401 ROW, retains archaeological potential and consists of undeveloped wood lot, manicured lawn, or scrubland. The balance of the study area (i.e., existing roadways and buildings, low and permanently wet areas, steep slopes and exposed bedrock) has low potential for the recovery of archaeological resources.

The Stage 1 Archaeological Assessment Report was entered into the Ontario Public Register of Archaeological Reports on January 14, 2021. Additional details on the findings of the Stage 1 Archaeological Assessment are provided in Section 7.3.1.

A copy of the report is provided in Appendix F of this report.

4.3.2 Built Heritage Resources and Cultural Heritage Landscapes

A Cultural Heritage Resources Assessment (CHRA) Report was undertaken in 2021 to identify any heritage resources, including built heritage and cultural heritage landscapes, present within, and adjacent to the study area. A land use history was completed to provide a cultural context for the study area, and to inform the evaluation of each property. In addition, the MCM, the Ontario Heritage Trust, and City of Brockville were consulted.

A vehicular windshield survey was also undertaken to confirm existing study area conditions, identify potential heritage resources within, and adjacent to, the study area, and to confirm the presence of previously identified heritage properties.

Potential heritage resources were identified, inventoried and evaluated according to Ontario Regulation (O. Reg.) 9/06, the criteria for determining cultural heritage value or interest (CHVI) (Government of Ontario 2006a).

Based on the findings of the evaluation, one built heritage resource was identified within a 50 m buffer of the study area.

Additional details are provided in Section 7.3.2, and documented within the CHRA provided in Appendix G of this report.

4.4 Transportation Conditions

The existing transportation conditions along Highway 401 within the study are described herein.

4.4.1 Highway Classification

Highway 401 within the project limits spans in an east-west direction and is classified as a four-lane, divided freeway.

4.4.2 Posted and Design Speed

The posted speed limit on Highway 401 is 100 km/h and the design speed is 120 km/h.

4.4.3 Horizontal Alignment

The horizontal alignment of Highway 401 was reviewed to identify geometric deficiencies. Independent alignments for the eastbound and westbound lanes were also reviewed as part of this study.

Horizontal Curves

Within the study area, there are two existing horizontal curves on the eastbound and westbound lanes of Highway 401. All existing curves exceed the minimum design standard radius. All curves satisfy the requirements to achieve standard superelevation. There are two deflections present on the horizontal alignment of Highway 401 in both the eastbound and westbound lanes; however, this is considered acceptable.

Sight Distance of Horizontal Curves

The minimum clearance from the centerline of the inside lane to an obstruction is an important consideration to ensure that adequate sight distance on a horizontal curve is available.

All existing horizontal curves meet the lateral clearance required to achieve stopping sight distance for the design speed of the highway.

4.4.4 Vertical Alignment

There are 11 vertical curves on Highway 401 within the project limits, including six crest and five sag curves. Four of the curves in the eastbound lanes and 5 of the 11 curves in the westbound lane do not meet the minimum K-value for the design speed of the highway (120 km/h). However, all vertical curves exceed the minimum K-value for the posted speed of the highway (100 km/h).

Historical road user collision data for the years 2013 to 2018 indicate there were no collisions reported at two of the four deficient vertical curves in the eastbound lane, and three of the five deficient vertical curves in the westbound lane. Curves located approximately 1 km west of Stewart Boulevard indicate a potential pattern in which the curve deficiencies may be exacerbated by winter related surface conditions, although the overall collision frequencies at these curves are relatively low.

The maximum profile grade for a freeway with a design speed of 120 km/h is 3%. The existing profile of Highway 401 within the study area is generally flat to rolling, and grades range from 0.1% to a maximum grade of 2.6%.

4.4.5 Cross Section

The cross-section characteristics of Highway 401 within the study limits are summarized in Table 4.

Table 4: Summary of Cross-Section Elements

Cross-Section Element	Width (m)
Lane Width	4 x 3.75 (2 EBL, 2 WBL)
Median Width	5.3 – 8.5
Median Shoulder Width	Varies (Typically 2.1 – 3.8)
Outside Shoulder Width	Varies (Typically 2.00 – 3.25)
ROW Width	Varies (Approximately 91.5)

The existing Highway 401 median has a deficient width (less than 7.5 m) between the highway median. Collision data for the years 2013 to 2018 indicate that there were 13 collisions within the study area that involved the concrete barrier.

There are existing shallow rock cuts through the Stewart Boulevard interchange and westerly to the west study area limit.

4.4.6 Interchanges

There are two interchanges on Highway 401 in the study area that provide access to the local road network within the City of Brockville, as described herein.

Stewart Boulevard Interchange

The existing interchange at Stewart Boulevard is a non-standard Parclo A4 configuration. The loops ramps are elongated more than a traditional Parclo A4 and have radii that are below standard values. Long Combination Vehicles (LCVs) cannot be easily accommodated at the interchange given the tight turning radii at the ramp terminal intersections.

The interchange provides access to commercial land uses located directly north and south of Highway 401, as well as to residential land uses situated within north Brockville, and direct access south of Highway 401 to downtown Brockville.

North Augusta Road Interchange

The existing interchange at North Augusta Road is a non-standard Parclo A4 configuration on the south side of Highway 401, and a buttonhook configuration on the north side of Highway 401. Because of constraints with residential properties in the southwest quadrant of the interchange, the ramps are located close to North Augusta Road with less than standard radii. Long Combination Vehicles (LCVs) cannot be easily accommodated at the interchange given the tight turning radii at the ramp terminal intersections.

The interchange provides direct access to commercial land uses located north of Highway 401 and residential land uses located on the south side of Highway 401.

4.4.7 Crossing Roads

There are three municipal roadways that cross Highway 401 within the study area, including two underpasses (crossing road over highway) and one overpass (crossing road under highway).

Posted and Design Speed

The posted speed limit and design speed on each crossing road are listed in Table 5. It has been assumed that the design speed is 20 km/h above the posted speed limit.

Table 5: Crossing Road Posted and Design Speed

Crossing Road	Structure Type	Posted Speed (km/h)	Design Speed (km/h)
Stewart Boulevard (County Road 29)	Underpass (Interchange)	50	70
Ormond Street	Overpass	50	70
North Augusta Road	Underpass (Interchange)	50	70

Horizontal Alignment

The horizontal alignment of each crossing road within the study area was reviewed to identify geometric deficiencies. Based on the findings of this review, it was noted that the Stewart Boulevard alignment does not have any horizontal curves but includes a deflection, which is considered acceptable. In addition, Ormond Street has a tangent alignment within the study area.

The North Augusta Road alignment includes a 200 m radius horizontal curve, which satisfies the requirements for a design speed of 70 km/h.

Vertical Alignment

The vertical alignment of each crossing road within the study area was reviewed to identify geometric deficiencies. Based on the findings of this review, it was noted that one of the four vertical curves on North Augusta Road does not meet the minimum K-value for the design speed of 70 km/h. Improvements to the deficient vertical curve on this road should be considered when investigating bridge replacement options at this location.

Profile Grades

The maximum profile design grade for all crossing roads within the study area is 6-8%. Each crossing road has a maximum profile grade which satisfies the design requirements.

Cross-Section

The cross-section characteristics of each crossing road within the study limits are summarized in Table 6.

Table 6: Summary of Crossing Road Cross-Section Elements

Crossing Road	Approx. Lane Width (m)	Concrete Curb & Gutter (m)	Sidewalk (m)
Stewart Boulevard (County Road 29)	3.4 & 3.65 (northbound) 3.4 & 3.9 (southbound)	0.6	1.5 (east & west sides)
Ormond Street	two, 4.6	0.15 (curb only)	3.0-3.5 (west side only)
North Augusta Road	four, 3.25	0.6	1.5 (west side only)

4.4.8 Existing Structures

There is a total of five structures within the study limits (two underpasses, one overpass, one overhead, and a structural culvert) that are summarized in Table 7.

Table 7: Summary of Existing Structures

Structure Name	Highway Station	Site Number	Type	Year Built	Year Last Rehabilitated
Stewart Boulevard I/C Underpass	21+374 Elizabethtown Twp	16X-0121/B0	Rigid Frame T-Beam	1958	1992
CNR Overhead	22+309 Elizabethtown Twp	16X-0122/B0	Rigid Frame	1958	2009
Buells Creek Culvert	22+503 Elizabethtown Twp	16X-0237/C0	CSP Ellipse	N/A	-
Ormond Street Overpass	22+551 Elizabethtown Twp	16X-0123/B0	Rigid Frame Slab	1958	1994
North Augusta Road I/C Underpass	23+195 Elizabethtown Twp	16X-0124/B0	Rigid Frame Box Girder	1957	1999

4.4.9 Traffic

A *Calibration and Validation of Microsimulation Model Report* and *Road Safety Report* have been prepared as part of this study to detail the existing traffic operations and collision statistics within the study area.

Traffic Operations

Traffic data volume for the Highway 401 mainline and ramp terminals and turning movement counts and signal timing plans for key intersections for the study area were reviewed. Based on historical Annual Average Daily Traffic (AADT) volumes, a growth rate of 2.1% was assumed for the traffic analysis. A commercial vehicle percentage of 27% was considered based on previous studies.

The Highway 401 traffic data is summarized in Table 8.

Table 8: Highway 401 AADT Volume Projections

Segment	Existing Conditions (2020)	Growth Rate	Future AADT Volume			
			2024	2029	2034	2044
Stewart Boulevard Interchange	33,687	2.1%	36,607	40,616	45,064	55,473
North Augusta Road Interchange	36,513	2.1%	39,678	44,022	48,843	60,126

The Level of Service (LOS) is a way to measure the free flow of traffic on a roadway, and is used to determine how well a transportation facility is operating from a traveller's perspective. LOS is expressed in terms of traffic delays and is represented by letters A through F, whereby a LOS of A represents free-flow traffic conditions, and a Level of Service of F represents a breakdown in traffic flow with stop-and-go traffic conditions.

The preliminary LOS along Highway 401 near Stewart Boulevard and North Augusta Road was assessed in consideration of the existing 4-lane, and future interim 6-lane and ultimate 8-lane configuration for the 2029, 2034, and 2044 horizon years.

Highway 401 between Stewart Boulevard and North Augusta Road is expected to operate at LOS D or better until 2035. Under this existing lane configuration, the highway segment is expected to perform at LOS E starting in 2036 and is expected to perform at LOS F by 2042

In consideration of a future interim 6-lane cross-section, Highway 401 between Stewart Boulevard and North Augusta Road is expected to operate at LOS C or better until 2044. Considering a future ultimate 8-lane cross-section, Highway 401 between Stewart Boulevard and North Augusta Road is expected to operate at LOS B or better until 2044.

Road Safety

Based on a review of collision history along Highway 401 within the study area, 76% of collisions have reportedly been single motor vehicle collisions. The section of Highway 401 between Stewart Boulevard and 400 m west of the North Augusta Road interchange was noted to have the highest collision frequency, with 28 of the 45 total collisions (i.e., 62%) reported within this section. A potential contributing factor to these reported incidences may be related to winter road surface conditions, 40% of collisions occurred on ice/snow/slush, which is higher than the provincial average of 14%.

Based on a field investigation undertaken as part of the traffic analysis, deficiencies that could be directly associated with collision history were not noted. However, general deficiencies such as missing warning signs (Lane Ends, Chevron Alignment and Checkerboard), Ramp Speed Signs

mounted on the wrong side of the road, and deficient guide rail systems were identified during field investigation.

4.5 Drainage

A Drainage Report was completed as part of this study to assess existing drainage conditions and to develop a strategy for the Recommended Plan based on a desktop review of relevant information and field visit conducted during this study, as described herein.

4.5.1 Existing Conditions

Centreline Culverts

Within the study area limits, there are a total of seven centreline culverts. Based on the existing condition of the culverts (i.e., limited hydraulic capacity), it is recommended that three of the culverts be lined or replaced and the remaining four be retained with minor maintenance and rehabilitation work.

Median Drainage

A median storm sewer is present throughout the study area. This storm sewer collects runoff from the passing lanes and median, and discharges directly to centerline culverts or to the roadside ditch. This median storm sewer was not inspected as part of this study and would require a CCTV inspection to assess the existing condition of the pipes. Most of the existing median storm sewers outlet to channels associated with the centreline culverts.

Interchange Culverts

At the Stewart Boulevard and North Augusta Road interchanges, ramp culverts provide conveyance for roadway runoff.

A series of storm sewers provide drainage through both Stewart Boulevard and North Augusta Road interchanges, the majority of which have buried outlets and/or are in poor material condition. As part of future improvements at the interchanges, it is recommended that the storm sewer outlets be considered for replacement.

Ditch Drainage

Ditches are present on the north and south sides of Highway 401 within the study area. These ditches are generally in fair condition. Some areas of ditching were found to have an excess build-up of sediment which has caused the outlets of some pipes to become buried. The ditches around areas of buried pipes, excessive ponding/sedimentation, excessive vegetation growth, ponded water and shallow ditching are proposed to be lowered to promote positive drainage.

4.5.2 Drainage Concerns

It was confirmed through consultation with MTO maintenance and its maintenance contractor that the ditch at the north-west end of the existing Stewart Boulevard Underpass often fills with garbage and weeds, and floods following large rain-storm events. As a result, the MTO maintenance group regularly cleans out the ditch. Lowering of the ditch in this vicinity is recommended to address this maintenance issue.

Previous Relevant Stormwater Management Reports

An assessment of flooding in the vicinity of the study area was completed and documented in the report entitled, “Preliminary Stormwater Management Report Brockville Drainage Concern”, completed by Ainley and June 2011. This report outlined drainage concerns on residential properties located south of the Highway 401, between Stewart Boulevard Interchange and Ormond Street. Based on a review of this report, the following drainage concerns were noted:

- Some properties on Ferguson Drive, south of the Highway 401, are currently experiencing flooding following rainfall events;
- Flooding is caused by back-up of water in a ditch running parallel to Highway 401;
- An overflow spill path was previously designed and constructed south of Highway 401, but is likely currently filled-in and non-functional;
- The elevations of the rear yards south of the Highway 401 are lower than the MTO culvert obverts, leading to flooding when the MTO culvert is flowing full;
- Poor ditch capacity has contributed to flooding.

City of Brockville

Feedback received from City of Brockville staff indicated that drainage issues are present at Ormond Street, east of the Stewart Boulevard interchange and at the residential yards located on the north side of Ferguson Drive and Brookview Crescent. In response to the City’s feedback, the following was noted by the study team:

- Residential lots on the south side of the Highway 401 and immediately east of the Stewart Boulevard Interchange exhibited ponding after storm events (i.e., approximately 200 mm of ponded water after typical spring rainfall events). This issue results from a lack of a proper drainage ditch along the south side of the sound barrier wall to capture and convey stormwater runoff.
- Ponding water is observed east of Ormond Street towards North Augusta Road, immediately south of the commercial properties. It is recommended that ditching be options be investigated and potentially improved to ensure proper surface water conveyance.

4.6 Existing Utilities

Utility companies with plants in the study area were requested to provide existing utility information, including the location and type of existing utility plant. Bell Canada, Cogeco Cable, Enbridge Gas, and MTO all have utilities within the study area.

5.0 Generation and Evaluation of Alternatives

A range of potential bridge, interchange and highway improvement alternatives that correspond to the Preferred Transportation Undertaking were developed and subjected to an evaluation based on their potential to address the structural replacement needs and accommodate the future footprint of Highway 401, while minimizing environmental and community related impacts. The evaluation of alternatives is summarized below.

5.1 Highway 401

The future footprints for the Highway 401 corridor will include widening for interim 6-lanes and ultimate 8-lanes cross-sections.

Due to concrete barriers and narrow median widths throughout the study area, widening the existing footprint to the outside was the only option, and widening the median is not possible.

The existing median width will be maintained throughout the study area by adding additional lanes to the outside of the existing platform.

5.2 Structure Alternatives

The CNR (VIA) Overhead, Buells Creek Culvert, and the Ormond Street Overpass within the study area are approaching the end of their service life and need to be rehabilitated or replaced. The structures will also need to accommodate the future Highway 401 footprints for interim six and ultimate eight lanes.

5.2.1 Evaluation Process

A range of reasonable improvement alternatives for each structure were initially developed and subjected to an evaluation process to assess the advantages and disadvantages of each alternative and identify a preferred alternative. A summary of the evaluation of structural improvement alternatives is outlined below. It should be noted that the ‘Do Nothing’ alternative for each bridge was screened out during the preliminary screening of the bridge alternatives as it did not accommodate the short-term or long-term structure needs.

5.2.2 Evaluation of CNR (VIA) Overhead Alternatives

The structure is approximately 65 years old and is generally in good condition. Based on the current bridge condition, and with future regular maintenance, the useful remaining life of the overpass is estimated to be 15 to 25 years. The existing structure will require widening or replacement to accommodate the future Highway 401 footprint.

Three bridge alternatives (Table 9) were developed and evaluated for the future Highway 401 footprint.

Table 9: Bridge Alternatives

Alternative	Description	Assessment
1	• Rehabilitate the existing structure • Widen to accommodate the 6-laning configuration at the interim stage • Replace the structure in conjunction with 8-laning at the ultimate stage.	• Lowest initial cost • Structure will be 105 years old at the time of 8-laning and would have significantly exceeded its intended design life as well as its expected remaining life
2	• Build a new bridge to accommodate the 8-lane configuration at the interim stage • Rehabilitate at the ultimate stage.	• The 8-lane deck width accommodates staged construction to maintain four lanes in each direction • Highest initial cost
3	• Build new substructures for the 8-lane configuration • Construct a deck to accommodate the 6-lane configuration • Rehabilitate and widen the structure in conjunction with 8-laning at the ultimate stage.	• Lower initial cost compared to Alternative 2 • The 6-lane deck width does not accommodate staged construction to maintain four lanes in each direction

Alternative 2, a new structure built to the ultimate 8-lane configuration at the interim stage, is the preferred strategy for accommodating the future Highway 401 footprint at the CNR (VIA) Overhead because it can best accommodate Highway 401 traffic during construction.

5.2.3 Evaluation of Buells Creek and Ormond Street Structure Alternatives

The Buells Creek Culvert and the Ormond Street Overpass are located approximately 50 metres apart on Highway 401 in the study area. In addition to considering several alternatives for each site, opportunities to combine these structures to minimize traffic impacts and simplify construction were also considered. The alternatives for each site and the combination alternatives are discussed in the following section.

Evaluation of Buells Creek Culvert Alternatives

The culvert is approximately 65 years old and is generally in fair condition. Based on the current culvert condition and with future regular maintenance, the remaining life of the culvert is estimated to be 15 to 20 years. The existing structure will require extensions or replacement to accommodate the future Highway 401 footprint.

Structure rehabilitation or replacement is recommended to be undertaken at the time of the interim 6-lane highway widening and will be constructed to the ultimate 8-lane width. The following rehabilitation and replacement alternatives (Table 10) were considered.

Table 10: Rehabilitation and Replacement Alternatives

Alternative	Description	Assessment
1	• Line and extend existing culvert	• Maintains exiting hydraulic opening • Requires overflow culvert • Requires temporary property for jack and bore operations • Requires additional study to confirm feasibility of trenchless installation • Lowest cost
2	• Replace the culvert with a bridge	• Can be constructed using top-down construction, which simplifies construction staging • Requires minimal roadway protection • Does not impact existing water course • The 8-lane deck width accommodates staged construction to maintain four lanes in each direction • Highest initial cost
3	• Replace the culvert with a box culvert on the existing alignment	• Requires cut-and-cover construction, which complicates construction staging • Requires temporary culvert to maintain flow • Requires median cross-over to maintain traffic
4	• Replace the culvert with a box culvert west of the existing alignment and perpendicular to Highway 401	• Requires cut-and-cover construction, which complicates construction staging • Requires temporary culvert to maintain flow • Requires median cross-over to maintain traffic • Requires watercourse realignment • Lower cost than Alternative 3
5	• Replace the culvert with a box culvert west of the existing alignment and skewed to Highway 401	• Requires cut-and-cover construction, which complicates construction staging • Requires temporary culvert to maintain flow • Requires median cross-over to maintain traffic • Requires watercourse realignment than Alternative 4 • Higher cost than Alternative 4
6	• Replace the culvert using a trenchless method of culvert installation, west of the existing alignment	• Minimizes traffic impacts during construction • Requires watercourse realignment • Highest cost • Requires additional study to confirm feasibility of trenchless installation

Alternative 2, replace the culvert with a bridge to the 8-lane configuration at the interim stage, is the preferred strategy for accommodating the future Highway 401 footprint at Buells Creek because it can best accommodate Highway 401 traffic during construction.

Evaluation of Ormond Street Overpass Alternatives

The structure is approximately 65 years old and is generally in good condition. Based on the current bridge condition, and with future regular maintenance, the useful remaining life of the overpass is estimated to be 15 to 25 years. The existing structure will require widening or replacement to accommodate the future Highway 401 footprint.

Three bridge alternatives were developed and evaluated for the future Highway 401 footprint (Table 11).

Table 11: Highway 401 Bridge Alternatives

Alternative	Description	Assessment
1	• Rehabilitate the existing structure • Widen to accommodate the 6-laning configuration at the interim stage • Replace the structure in conjunction with 8-laning at the ultimate stage.	• Lowest initial cost • Structure will be 105 years old at the time of 8-laning and would have significantly exceeded its intended design life as well as its expected remaining life
2	• Build a new bridge to accommodate the 8-lane configuration at the interim stage • Rehabilitate at the ultimate stage.	• The 8-lane deck width accommodates staged construction to maintain four lanes in each direction • Highest initial cost

Alternative	Description	Assessment
3	• Build new substructures for the 8-lane configuration • Construct a deck to accommodate the 6-lane configuration • Rehabilitate and widen the structure in conjunction with 8-laning at the ultimate stage.	• Lower initial cost compared to Alternative 2 • The 6-lane deck width does not accommodate staged construction to maintain four lanes in each direction

Alternative 2, a new structure built to the ultimate 8-lane configuration at the interim stage, is the preferred strategy for accommodating the future Highway 401 footprint at the Ormond Street Overpass because it can best accommodate Highway 401 traffic during construction.

Buells Creek and Ormond Street Bridge Combination Alternatives

The preferred alternative for the Buells Creek and Ormond Street sites is to replace both structures with single-span structures. Given the proximity of these similar structures on Highway 401, opportunities to combine the Buells Creek and Ormond Street structures was also considered to minimize traffic impacts on Highway 401 and to simplify construction. The following combination alternatives were developed and evaluated for the future Highway 401 footprint (Table 12).

Table 12: Highway 401 Combination Alternatives

Alternative	Description	Assessment
1	• Replace Ormond Street Overpass and Buells Creek Culvert Individually	• Separation between structures is reduced to 10 m • Requires 29.0 m span structure for Buells Creek • Requires 23.1m span structure for Ormond Street • Minimal impacts to Buells Creek
2	• Replace Ormond Street Overpass and Buells Creek Culvert with Combined Bridge • Maintain the Buells Creek Alignment	• Requires a two span structure with a total length of 85.4 m • Minimal impacts to Buells Creek • Highest initial cost
3	• Replace Ormond Street Overpass and Buells Creek Culvert with Combined Bridge • Realign Buells Creek	• Requires a two-span structure with a total length of 45.0 m • Requires realignment of Buells Creek • Potential impacts to aquatic species
		• Lowest initial cost

Alternative 3, replace the Ormond Street Overpass and the Buells Creek Culvert with a combined 8-lane bridge at the interim stage is the preferred strategy for accommodating the future Highway 401 footprint because it simplifies construction and minimizes the total structure length and cost.

5.3 Interchange Alternatives

The existing interchanges at Stewart Boulevard and North Augusta Road will need to be reconfigured to accommodate the Highway 401 future footprints for interim six and ultimate eight lanes. A detailed evaluation approach was undertaken for the Stewart Boulevard and North Augusta Road interchanges to help identify a Recommended Plan that addresses current and future transportation needs in the study area.

5.3.1 Evaluation Process

A staged evaluation process was used to identify a preferred interchange design that can accommodate the future footprint of Highway 401 while minimizing environmental and community related impacts. The evaluation process consisted of the following stages.

Develop and Assess a Long List of Interchange Design Alternatives: Develop and assess new interchange design concepts for Stewart Boulevard and North Augusta Road and identify a Short List of Interchange Design Alternatives to carry forward for more detailed evaluation. The preliminary assessment of the Long List of Stewart Boulevard and North Augusta Road Interchange Alternatives are provided in Table 13 and Table 14.

Evaluation Criteria: Evaluation criteria were developed grouped into highway engineering, community, and natural environment categories. The criteria are independent variables, each of which may contribute a positive or negative influence on the overall suitability of an Interchange Design Alternative based on the factors considered within each criterion and the scoring methodology. Table 15 to Table 18 set out the evaluation criteria for the Interchange Design Alternatives including the factors considered for each criterion, and the methodology and measurement for the scoring of each factor.

Evaluate a Short List of Interchange Design Alternatives: Subject the Short List of Interchange Design Alternatives to a comparative evaluation process in consideration of transportation benefits and environmental effects for each alternative. The process includes: a) identifying evaluation criteria through input received during this study, the project team's experience in projects of this nature, provincial guidelines and existing study area conditions; b) applying a weight percentage to each factor/criterion, which was based on the project team and stakeholder assessment of the importance of the factor; c) applying a reasoned argument approach to the evaluation in

consideration of the net environmental effects of each alternative (qualitative assessment) and evaluating the Short List of Interchange Design Alternatives based on the total calculated scores (quantitative assessment); and, d) identifying a Preliminary Preferred Interchange Design.

5.3.2 Develop and Assess a Long List of Interchange Alternatives

The evaluation of the Long List of Stewart Boulevard Interchange Alternatives is provided in Table 13. The evaluation of the Long List of North Augusta Road Interchange Alternatives is provided in Table 14.

Development and Assessment of the Long List of Stewart Boulevard Interchange Alternatives

A Long List of six interchange alternatives for Stewart Boulevard was initially developed and assessed. The potential configuration of each interchange alternative is presented in Figure 5 to Figure 10. Table 13 presents the assessment of the Long List of Stewart Boulevard Interchange Alternatives.

A copy of the interchange alternative design concepts is provided in Appendix H.

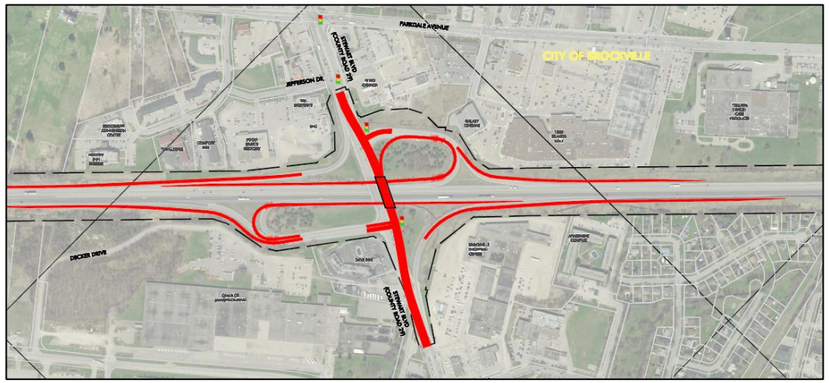

Figure 5: Alternative 1 - Minor Improvements

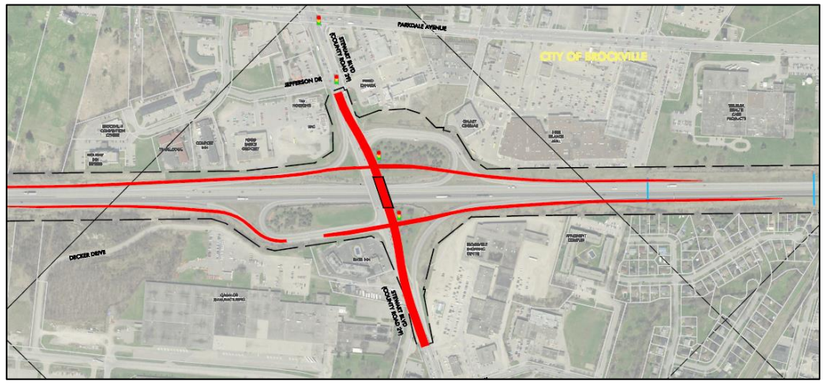

Figure 6: Alternative 2 - Diamond

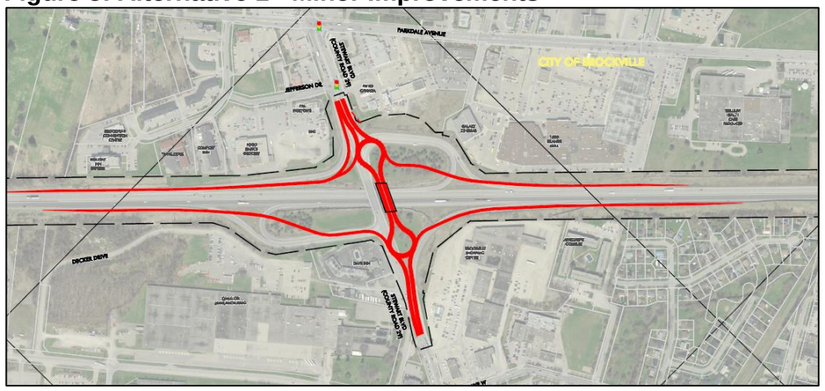

Figure 7: Alternative 3 - Diamond with Roundabouts

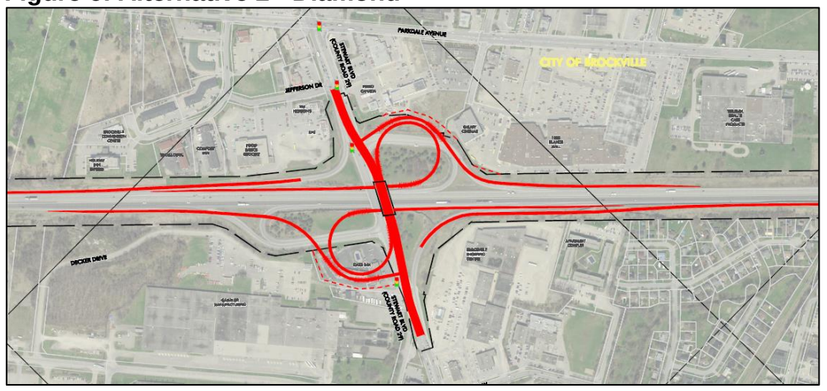

Figure 8: Alternative 4 - Parclo A4

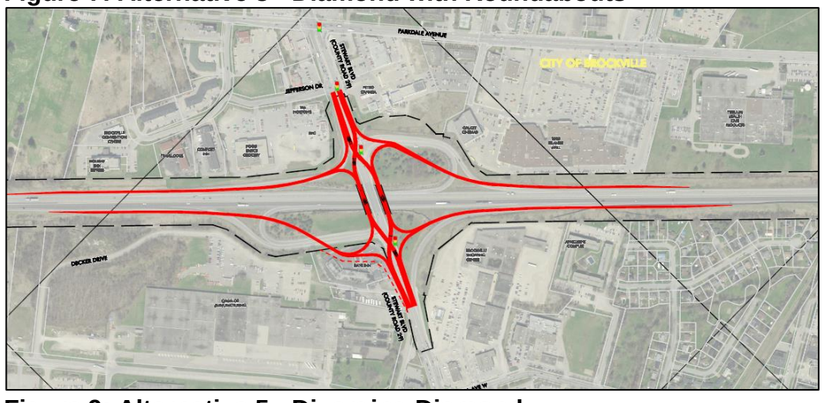

Figure 9: Alternative 5 - Diverging Diamond

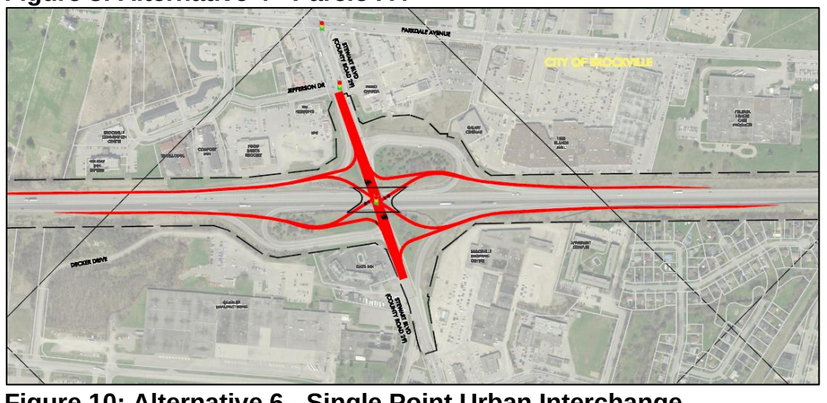

Figure 10: Alternative 6 - Single Point Urban Interchange

Table 13: Assessment of the Long List of Stewart Boulevard Interchange Alternatives

Interchange Alternative	Advantages	Disadvantages	Preliminary Assessment Results
Alternative 1 **Minor Improvements**	• Similar traffic capacity to Parclo A4 configuration • Smaller footprint than standard Parclo A4 configuration • No anticipated property impacts • Suitable where the through movements on crossing road are high • Lowest construction costs compared to other alternatives • Typical construction staging is anticipated	• Non-standard interchange configuration in Ontario • Ramp radii do not meet current MTO standards • Ramp terminals require signalization • Potential for left-turn conflicts and potential for higher collision severity • Does not work well in locations where the left-turn movements on the crossing road are high	Carried forward for further evaluation
Alternative 2 **Diamond**	• Standard interchange configuration in Ontario • Smaller footprint than Parclo A4 configuration • No anticipated property impacts • Suitable where the through movements on crossing road are high • Lower cost compared to Parclo A4 configuration • Typical construction staging is anticipated	• Lower traffic capacity than a Parclo A4 configuration • Ramps terminals require signalization • Potential for left-turn conflicts and potential for higher collision severity • Does not work well in locations where the left-turn movements on the crossing road are high	Screened-out from further consideration because the interchange cannot accommodate the anticipated 2044 traffic volumes.
Alternative 3 **Diamond with Roundabouts**	• Higher traffic capacity compared to Diamond configuration • Smaller footprint than Parclo A4 configuration • No anticipated property impacts • Ramps terminals do not require signalization • Roundabouts eliminate left-turn conflicts and potentially reduce collision severity • Suitable where the through movements on crossing road are high	• Non-standard interchange configuration in Ontario • Does not work well in locations where the left-turn movements on the crossing road are high • Higher cost compared to Diamond configuration • Requires complex construction staging	Screened-out from further consideration because the interchange cannot accommodate the anticipated 2044 traffic volumes.
Alternative 4 **Parclo A4**	• Higher traffic capacity compared to Diamond configuration • Standard interchange configuration in Ontario • Direct ramps eliminate left-turn conflicts and potentially reduce collision severity • Suitable where the through movements on crossing road are high • Works well in locations where the left-turn movement on the crossing road are high volume • Typical construction staging is anticipated	• Larger footprint than Diamond interchange • Requires acquisition of the Days Inn property • Ramps terminals require signalization • Higher cost compared to Diamond configuration	Carried forward for further evaluation

Interchange Alternative	Advantages	Disadvantages	Preliminary Assessment Results
Alternative 5 **Diverging Diamond**	• Potential for higher traffic capacity compared to standard Diamond configuration • Smaller footprint than Parclo A4 configuration • Intersection configuration eliminates left-turn conflicts and potentially reduces collision severity • Works well in locations where the left-turn movements on the crossing road are high	• Non-standard interchange configuration in Ontario • Significant impacts to the Days Inn property • Ramp terminals require signalization • Not suitable where the through movements on crossing road are high • Higher cost compared to Parclo A4 configuration • Requires complex construction staging	Carried forward for further evaluation
Alternative 6 **Single Point Urban Interchange (SPUI)**	• Higher traffic capacity compared to standard Diamond configuration • Smaller footprint than Parclo A4 configuration • Minimal property impacts • Single intersection with traffic signals to control all traffic • Increased intersection spacing between Parkedale Road and ramp terminal intersection • Suitable where the through movements on crossing road are high • Works well in locations where the left-turn movements on the crossing road are high	• Non-standard interchange configuration in Ontario • Potential for left-turn conflicts and potential for higher collision severity • Higher cost compared to Parclo A4 configuration • Requires complex construction staging	Carried forward for further evaluation

Based on further assessment of the Long List of Interchange Alternatives, it was noted that Alternative 1 (Minor Improvements) would not accommodate Long Combination Vehicles (LCVs). As such, it was also screened out from further evaluation, in addition to Alternative 2 (Diamond), and Alternative 3 (Diamond with Roundabouts). The following alternatives were carried forward for further evaluation:

- Parclo A4
- Diverging Diamond
- Single Point Urban Interchange (SPUI)

The evaluation of the Short List of Stewart Boulevard Interchange Alternatives is provided in Section 5.3.4.

Development and Assessment of the Long List of North Augusta Road Interchange Alternatives

A Long List of six interchange alternatives for North Augusta Road was initially developed and assessed. The potential configuration of each interchange alternative is presented in Figure 11 to Figure 16. Table 14 presents the assessment of the Long List of North Augusta Road Interchange Alternatives. A copy of the interchange alternative design concepts is provided in Appendix I.

Figure 11: Alternative 1- Minor Improvements

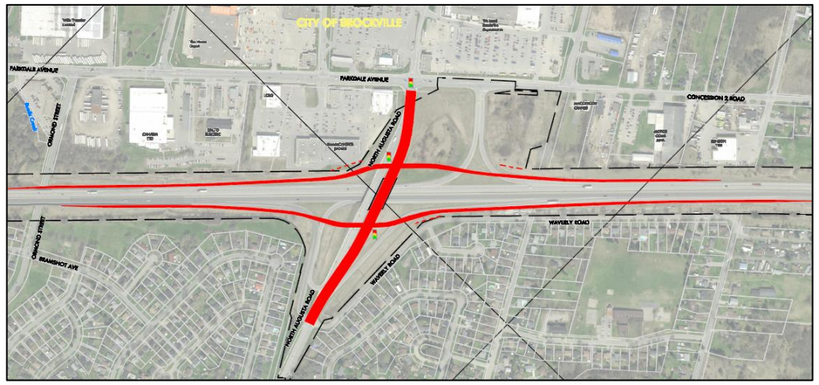

Figure 12: Alternative 2- Diamond

Figure 13: Alternative 3- Diamond with Roundabouts

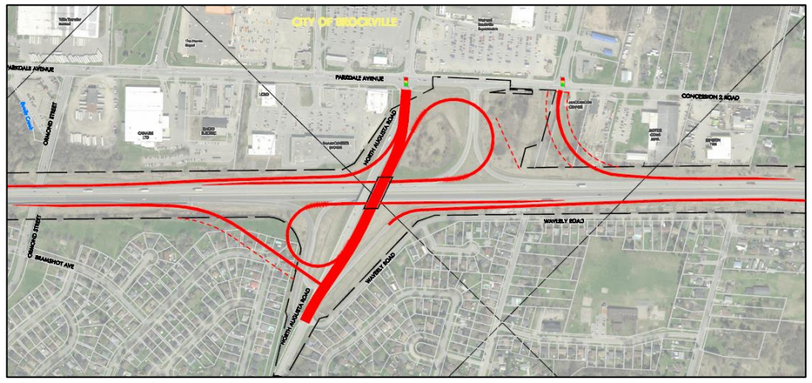

Figure 14: Alternative 4 - Parclo A4

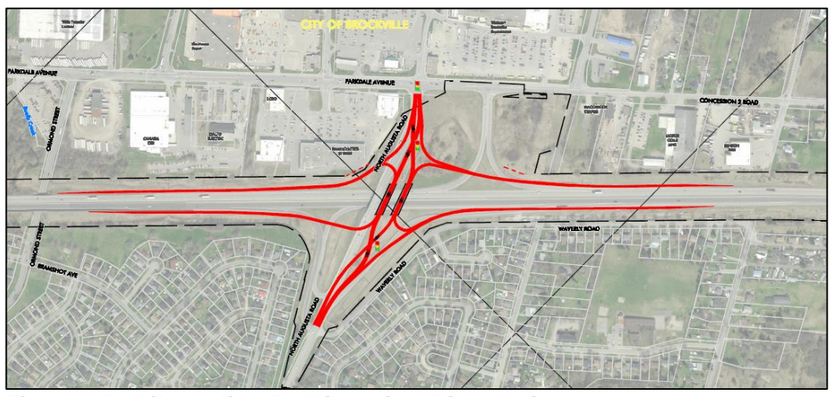

Figure 15: Alternative 5 - Diverging Diamond

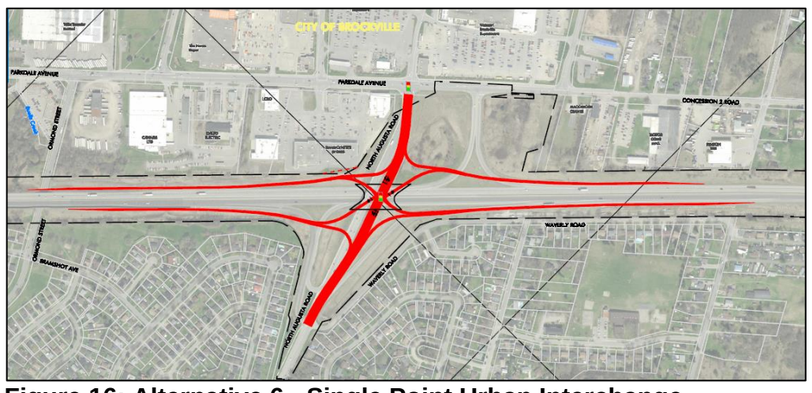

Figure 16: Alternative 6 - Single Point Urban Interchange

Table 14: Assessment of the Long List of North Augusta Road Interchange Alternatives

Interchange Alternative	Advantages	Disadvantages	Preliminary Assessment Results
Alternative 1 **Minor Improvements**	• Similar traffic capacity to Parclo A4 configuration • Smaller footprint than standard Parclo A4 configuration • No anticipated property impacts • Suitable where the through movements on crossing road are high • Lowest construction costs compared to other alternatives • Typical construction staging is anticipated	• Non-standard interchange configuration in Ontario • Contradicts driver expectation to enter and exit highway at Parkedale Road • Ramp radii do not meet current MTO standards • Ramps terminals require signalization • Reduced intersection spacing between Parkedale Road and ramp terminal intersection compared to SPUI • Potential for left-turn conflicts and potential for higher collision severity • Does not work well in locations where the left-turn movements on the crossing road are high	Carried forward for further evaluation
Alternative 2 **Diamond**	• Standard interchange configuration in Ontario • Smaller footprint than Parclo A4 configuration • No anticipated property impacts • Suitable where the through movements on crossing road are high • Lower cost when compared to Parclo A4 configuration • Typical construction staging is anticipated	• Lower traffic capacity than a Parclo A4 configuration • Ramps terminals require signalization • Reduced intersection spacing between Parkedale Road and ramp terminal intersection compared to SPUI • Potential for left-turn conflicts and potential for higher collision severity • Does not work well in locations where the left-turn movements on the crossing road are high	Carried forward for further evaluation
Alternative 3 **Diamond with Roundabouts**	• Higher traffic capacity compared to Diamond configuration • Smaller footprint than Parclo A4 configuration • No anticipated property impacts • Ramps terminals do not require signalization • Roundabouts eliminate left-turn conflicts and potentially reduce collision severity • Suitable where the through movements on crossing road are high	• Non-standard interchange configuration in Ontario • Reduced intersection spacing between Parkedale Road and ramp terminal intersection compared to SPUI • Does not work well in locations where the left-turn movements on the crossing road are high • Highway cost compared to Diamond configuration • Requires complex construction staging	Carried forward for further evaluation
Alternative 4 **Parclo A4**	• Higher traffic capacity compared to Diamond configuration • Standard interchange configuration in Ontario • Direct ramps eliminate left-turn conflicts and potentially reduce collision severity • Suitable where the through movements on crossing road are high • Works well in locations where the left-turn movement on the crossing road are high volume • Typical construction staging is anticipated	• Contradicts driver expectation to exit highway at Parkedale Road • Larger footprint than Diamond interchange • Minor property impacts • Ramp terminals require signalization • Reduced intersection spacing between Parkedale Road and ramp terminal intersection compared to SPUI • Higher cost compared to Diamond configuration	Carried forward for further evaluation

Interchange Alternative	Advantages	Disadvantages	Preliminary Assessment Results
Alternative 5 **Diverging Diamond**	• Potential for higher traffic capacity compared to standard Diamond configuration • Smaller footprint than Parclo A4 configuration • Intersection configuration eliminates left-turn conflicts and potentially reduces collision severity • Works well in locations where the left-turn movements on the crossing road are high	• Non-standard interchange configuration in Ontario • Ramp terminals require signalization • Reduced intersection spacing between Parkedale Road and ramp terminal intersection compared to SPUI • Not suitable where the through movements on crossing road are high • Higher cost compared to Parclo A4 configuration • Requires complex construction staging	Carried forward for further evaluation
Alternative 6 **Single Point Urban Interchange (SPUI)**	• Higher traffic capacity compared to standard Diamond configuration • Smaller footprint than Parclo A4 configuration • Minimal property impacts • Single intersection with traffic signals to control all traffic • Increased intersection spacing between Parkedale Road and ramp terminal intersection • Suitable where the through movements on crossing road are high • Works well in locations where the left-turn movements on the crossing road are high	• Non-standard interchange configuration in Ontario • Potential for left-turn conflicts and potential for higher collision severity • Higher cost compared to Parclo A4 configuration • Requires complex construction staging	Carried forward for further evaluation

Following PIC 1, a hybrid Interchange Alternative (Parclo A2/Diamond) was developed for North Augusta Road to help address traffic capacity deficiencies, and to reduce potential property and environmental impacts (please refer to Figure 17). As such, this alternative was carried forward for more detailed evaluation.

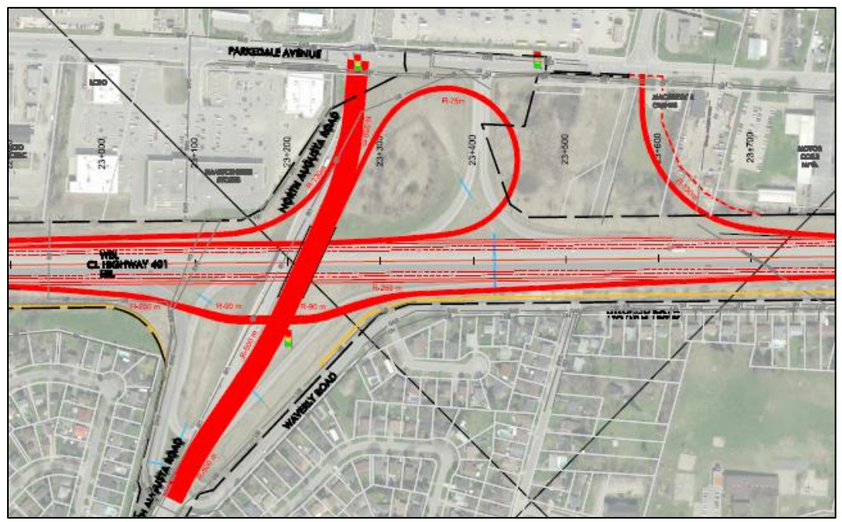

Figure 17: Parclo A2/Diamond

Based on the assessment of the Long List of North Augusta Road Interchange Alternatives, the following alternatives were carried forward for further evaluation:

- Minor Improvements
- Diamond
- Diamond with Roundabouts
- Parclo A4
- Diverging Diamond
- Single Point Urban Interchange (SPUI)
- Parclo A2/Diamond

The evaluation of Short List of North Augusta Road Interchange Alternatives is provided in Section 5.3.4.

5.3.3 Evaluation Criteria

Following the assessment of the Long List of Interchange Alternatives, a Short List of Interchange Alternatives was carried forward for more detailed evaluation.

The evaluation process includes identifying evaluation criteria through the input received during this study, the project team's experience in projects of this nature, provincial guidelines and existing study area conditions. This process includes:

- Reviewing the results of the analysis and evaluation based on specialist work and input received during the study
- Determining which criteria have the most influence on the outcome of the evaluation process
- Considering the sensitivity of the weightings
- Confirming the rankings of the alternatives
- Considering public/stakeholder response to the evaluation process and Technically Preferred Plan

Evaluation Category and Weighting

Preliminary criteria were developed to evaluate the Short List of Interchange Alternatives in consideration of engineering, social and cultural environment, and natural environment factors. The criteria are independent variables, each of which may contribute a positive or negative influence on the overall suitability of an alternative based on the factors considered within each criterion and the scoring methodology. Table 15 presents the weighting for each evaluation category.

Table 15: Weighting for Each Evaluation Category

Category	Weight
Engineering	65.0%
Social and Cultural Environment	27.5%
Natural Environment	7.5%

Table 16 to Table 18 set out the evaluation criteria for the Highway 401 Widening Alternatives including the factors considered for each criterion, and the methodology and measurement for the scoring of each factor.

Table 16: Engineering Evaluation Criteria

Engineering Factors	Criteria
Traffic Operations	• Level of Service (LOS) on Highway 401, ramp terminals and adjacent municipal intersections
Geometrics & Safety	• Collision severity • Accommodation of Long Combination Vehicles • Active Transportation • Intersection Spacing • Ramp Radii • Crossing Road Grade
Constructability	• Complexity of staging and detours
Utilities	• Length of impacts to utilities

Table 17: Social and Cultural Environment Evaluation Criteria

Social and Cultural Environment Factors	Criteria
Property	• Appropriate area of impact to designated land uses • Appropriate number of private properties potentially impacted
Business Operations / Viability	• Number of businesses directly impacted
Air	• Potential to affect air quality by reducing emissions
Noise	• Potential change in traffic noise levels on surrounding residential dwellings
Cultural Heritage	• Potential to affect cultural heritage resources; existing and potential built heritage and cultural heritage landscapes
Archaeology	• Possible impacts to areas having archaeological potential
Contamination	• Potential to encounter contaminated soils/groundwater
Stormwater	• Potential to increase impervious surface area

Table 18: Natural Environment Evaluation Criteria

Natural Environment Factors	Criteria
Terrestrial Ecosystem	• Area of impact to wildlife habitat • Area of impact to vegetated areas due to construction
Fish & Fish Habitat	• Number of water crossings impacted • Potential to impact fish/fish habitat
Species of Conservation Concern	• Potential to impact Species at Risk habitat

5.3.4 Evaluate the Short List of Interchange Alternatives

Evaluation of the Short List of Stewart Boulevard Interchange Alternatives

As noted in Section 5.3.2, based on the findings of the assessment of the Long List of Stewart Boulevard Interchange Alternatives, the following Short List of Interchange Alternatives were identified and subjected to more detailed evaluation:

- Parclo A4
- Diverging Diamond
- Single Point Urban Intersection

Each alternative was evaluated against the criteria outlined in Table 16 to Table 18, and received a ranking from least preferred to most preferred. The evaluation of the Short List of Stewart Boulevard Interchange Alternatives is provided in Table 19.

Table 19: Evaluation of the Short List of Stewart Boulevard Interchange Alternatives

Category	Criteria	Factors	Alternative		
			4 – Parclo A4	**5 – Diverging Diamond**	**6 – SPUI**
Highway Engineering (65.0%)	**Traffic Operations**	Level of Service (LOS) Highway 401	• Highway 401 operates at an anticipated Level of Service (LOS) B in 2044	• Highway 401 operates at an anticipated Level of Service (LOS) B in 2044	• Highway 401 operates at an anticipated Level of Service (LOS) B in 2044
		Level of Service (LOS) Ramp Terminal	• The north and south ramp terminals operate at an anticipated LOS B in the 2041	• The north and south ramp terminals operate at an anticipated LOS B in the 2041	• The ramp terminal operates at an anticipated LOS C in the 2041
		Level of Service (LOS) Municipal Intersection	• The adjacent municipal intersections (Central Avenue, Jefferson Drive and Parkedale Avenue) operate at an anticipated LOS D in the 2041	• The adjacent municipal intersections (Central Avenue, Jefferson Drive and Parkedale Avenue) operate at an anticipated LOS D in the 2041	• The adjacent municipal intersections (Central Avenue, Jefferson Drive and Parkedale Avenue) operate at an anticipated LOS D in the 2041
	Geometrics & Safety	Collisions	• Estimated 86 severe collisions 20-year period	• Estimated 72 severe collisions 20-year period	• Estimated 72 severe collisions 20-year period
		Accommodates Long Combination Vehicles (LCVs) to and from the north	• LCVs track on the shoulders on the following ramps – N-E – N-W	• LCVs require wider than standard shoulders on the following ramps – N-E ramp • LCVs track on the shoulders on the following ramps – W-N – E-N – N-W	• LCVs track on the shoulders on the following ramps – W-N – N-W – N-E – E-N
		Facilitates active transportation	• N-S access requires three crossings which include two signalized intersections and one entrance ramp	• N-S access requires a minimum of four crossings two entrance/exit ramps and two signalized intersections	• N-S access requires a minimum of three crossings which include two entrance/ exit ramps and one crossing at a signalized intersection
		Intersection spacing	• North Ramp terminal to Jefferson Drive – 117 m < 400 m MTO min. • South Ramp terminal to Central Avenue – 250 m < 400 m MTO min. • S-E Ramp taper to Central Avenue – 120 m < 400 m MTO min. • S-E Ramp taper to Brockville Shopping Centre access – 0 m < 125 m MTO min.	• North Ramp terminal to Jefferson Drive – 117 m < 400 m MTO min. • South Ramp terminal to Central Avenue – 298 m < 400 m MTO min. • S-E Ramp taper to Central Avenue – 230 m < 400 m MTO min. • S-E Ramp taper to Brockville Shopping Centre access – 143 m > 125 m MTO min.	• SPUI intersection to Jefferson Drive – 228 m < 400 m MTO min. • SPUI intersection to Central Avenue – 407 m > 400 m MTO min. • S-E Ramp taper to Central Avenue – 195 m < 400 m MTO min. • W-S Ramp taper to The Days Inn commercial access – 0 m < 125 m MTO min.

Category	Criteria	Factors	Alternative		
			4 – Parclo A4	**5 – Diverging Diamond**	**6 – SPUI**
					• S-E Ramp taper to Brockville Shopping Centre access – 90 m < 125 m MTO min.
		Ramp Radii	• 1 of 6 ramps have lower than desirable standards for ramp radii – N-W ramp radii (55 m) does not meet minimum standard of 90 m	• 2 of 4 ramps have lower than desirable standards for ramp radii – N-W ramp radii (45 m) does not meet minimum standard of 90 m – S-E ramp radii (45 m) does not meet minimum standard of 90 m	• 2 of 6 ramps have lower than desirable standards for ramp radii • N-W ramp radii (45 m) does not meet minimum standard of 90 m • S-E ramp radii (45 m) does not meet minimum standard of 90 m
		Crossing Road Alignment	• Introduces two horizontal curves	• Introduces two horizontal curves	• Maintains existing alignment on tangent
		Crossing road grade at ramp terminal	• Crossing road grade below maximum limits (i.e., between 6-8%)		
	Constructability	Complexity of staging and detours	• Medium Complexity of Traffic Staging because: – Stewart Boulevard bridge can be constructed in one stage – Stewart Boulevard road construction will not require a temporary alignment and will have minimal disruption to traffic – Several portions of new ramps can be constructed without traffic disruption – 4 short-term ramp closures (<15 days) – 2 long-term ramp closures (>15 days) (Ramp N-W & Ramp S-E)	• High Complexity of Traffic Staging because: – 2 Stewart Boulevard bridges; each constructed separately, with demolition of existing bridge between stages – Stewart Boulevard road construction will require temporary alignments and multiple traffic stages – Construction of new intersections on existing alignment – 4 short-term ramp closures (<15 days) – 2 long-term ramp closures (>15 days) (Ramp N-W & Ramp S-E)	• High Complexity of Traffic Staging because: – Stewart Boulevard bridge will require staged construction – Stewart Boulevard road construction will require temporary alignments and multiple traffic stages – 4 short-term ramp closures (<15 days) – 2 long-term ramp closures (>15 days) (Ramp N-W & Ramp S-E)
	Utilities	Length of impacts to utilities	• Approximate utility impacts: – Hydro One: 150 m – Bell Canada: 730 m – Enbridge Gas: 535 m	• Approximate utility impacts: – Hydro One: 40 m – Bell Canada: 780 m – Enbridge Gas: 270 m	• Approximate utility impacts: – Hydro One: 40 m – Bell Canada: 780 m – Enbridge Gas: 270 m

Category	Criteria	Factors	Alternative		
			4 – Parclo A4	**5 – Diverging Diamond**	**6 – SPUI**
		Highway Engineering Summary	**Moderately Preferred**	**Least Preferred**	**Most Preferred**
Social & Cultural Environment (27.5%)	**Property**	Approximate area of impact to designated land uses (City of Brockville Official Plan - Future Roads, Mixed Use/ Commercial/ Employment, Neighborhoods, Parks, and Open Space)	• Anticipated to require approximately 1.28 ha of property designated as Mixed Use/ Commercial/ Employment • Some impacts may be mitigated during detail design	• Anticipated to require approximately 0.47 ha of property designated as Mixed Use/ Commercial/ Employment • Some impacts may be mitigated during detail design	• Anticipated to require approximately 0.05 ha of property designated as Mixed Use/ Commercial/ Employment • Some impacts may be mitigated during detail design
		Approximate number of private properties potentially impacted by construction activities (residential)	• No impacts to residential properties		
	Business Operations/ Viability	Number of businesses directly impacted (i.e., access to/from commercial property or landscaped areas) or displaced	• 1 commercial property (2 parcels) anticipated to displaced – Access to/from approximately 1 commercial property may be impacted – Parking lot located on 1 commercial property may be impacted – 1 planned commercial property (currently vacant) north-east quadrant of interchange may be impacted – Landscaped areas located on approximately 1 commercial property may be impacted	• Large portion of parking lot located on 1 commercial property may be impacted – Access to/from approximately 2 commercial properties may be impacted – Landscaped areas located on approximately 3 commercial properties may be impacted • Impacts may be mitigated by reconfiguration and design of landscaped features	• Access to/from 2 commercial properties may be impacted – Landscaped areas located on approximately 2 commercial properties may be impacted • Impacts may be mitigated by reconfiguration and design of landscaped features
	Air	Relative potential to affect air quality by reducing emissions (based on the total network delay model)	• Lower potential to impact local air quality due to idling vehicles at interchange when compared to the other alternatives • Impacts may be mitigated by landscape design (additional tree plantings at interchange)	• Lower potential to impact local air quality due to idling vehicles at interchange when compared to the other alternatives • Impacts may be mitigated by landscape design (additional tree plantings at interchange)	• Moderate potential to impact local air quality due to idling vehicles at interchange when compared to the other alternatives • Impacts may be mitigated by landscape design (additional tree plantings at interchange)

Category	Criteria	Factors	Alternative		
			4 – Parclo A4	**5 – Diverging Diamond**	**6 – SPUI**
	Noise	Relative potential change in traffic noise levels on surrounding residential dwellings (based on ramp speeds and Level Of Service (LOS))	• Closer to nearby sensitive receptors • Highest speeds along ramps due to configuration • The north and south ramp terminals operate on average LOS A • Some impacts may be mitigated by noise barrier design, if warranted and feasible	• Closer to nearby sensitive receptors • Higher speeds along ramps due to configuration • The north and south ramp terminals operate on average LOS A • Some impacts may be mitigated by noise barrier design, if warranted and feasible	• Greatest distance to nearby sensitive receptors • Lower speeds along ramps due to configuration • The ramp terminal operates on average LOS D
	Cultural Heritage	Potential to affect cultural heritage resources. Existing and potential built heritage resources; existing and potential cultural heritage landscapes.	• No significant difference between alternatives. • No properties and/or structures having potential cultural heritage value and/or interest identified in proximity to interchange alternatives		
	Archaeology	Possible impacts to areas having archaeological potential	• Potential to impact an approximately 1.69 ha area of land having archaeological potential • Additional archaeological assessment activities required to confirm impacts, if any	• Potential to impact an approximately 1.41 ha area of land having archaeological potential • Additional archaeological assessment activities required to confirm impacts, if any	• Potential to impact an approximately 1.92 ha area of land having archaeological potential • Additional archaeological assessment activities required to confirm impacts, if any
	Contamination	Potential to encounter contaminated soils/groundwater	• Traverses portion of 2 properties identified as having high potential for contamination – 325 Stewart Blvd, Petro-Canada gas station (UST and waste generation) – 154 Stewart Blvd, Imperial Oil listed between 1999 to 2012 (Waste generation, USTs) • Additional environmental site assessment activities required to confirm on-site soil/groundwater contamination if any • All excess materials generated during construction will be managed in accordance with MECP regulations	• Encroaches onto 2 properties identified as having high potential for contamination – 325 Stewart Blvd, Petro-Canada gas station (UST and waste generation) – 154 Stewart Blvd, Imperial Oil listed between 1999 to 2012 (Waste generation, USTs) • Additional environmental site assessment activities required to confirm on-site soil/groundwater contamination if any • All excess materials generated during construction will be managed in accordance with MECP regulations	• Encroaches onto 1 property identified as having high potential for contamination – 154 Stewart Blvd, Imperial Oil listed between 1999 to 2012 (Waste generation, USTs) • Additional environmental site assessment activities required to confirm on-site soil/groundwater contamination if any • All excess materials generated during construction will be managed in accordance with MECP regulations

Category	Criteria	Factors	Alternative		
			4 – Parclo A4	**5 – Diverging Diamond**	**6 – SPUI**
	Stormwater	Total impervious area requiring stormwater management strategies/facilities	• Potential to create approximately 3.27 ha of impervious surface • Impacts can be mitigated through stormwater quality and quantity control measures	• Potential to create approximately 2.29 ha of impervious surface • Impacts can be mitigated through stormwater quality and quantity control measures	• Potential to create approximately 2.56 ha of impervious surface • Impacts can be mitigated through stormwater quality and quantity control measures
Social & Cultural Environment Summary			**Least Preferred**	**Moderately Preferred**	**Most Preferred**
Natural Environment (7.5%)	**Terrestrial Ecosystem**	Area of impact to wildlife habitat	• No significance between alternatives – Each alternative has potential to impact treed area, and areas identified as potentially suitable snake hibernacula – Some impacts may be mitigated through restoration/design		
		Area of impact to vegetated areas due to construction	• Potential for construction to impact 6.61 ha of vegetated areas/ open spaces	• Potential for construction to impact 5.09 ha of vegetated areas/ open spaces	• Potential for construction to impact 5.50 ha of vegetated areas/ open spaces
	Species of Conservation Concern	Area impacts to potential SAR habitat	• No significant difference between alternatives • No SAR species and/or suitable habitat identified within the study area		
	Fish & Fish Habitat	Number of watercourse crossings Impacts to fish habitat	• No significant difference between alternatives – No watercourse crossing required Potential to impact seasonal habitat for tolerant warmwater baitfish community. Fish habitat to be determined in spring field investigations. – Impacts can be mitigated through restoration/design		
Natural Environment Summary			**Least Preferred**	**Most Preferred**	**Moderately Preferred**
Overall Assessment			**Least Preferred**	**Moderately Preferred**	**Most Preferred**

Based on the findings of the evaluation, the **Single Point Urban Interchange (or SPUI)** is most preferred at the Stewart Boulevard Interchange because:

- It provides a high level of service on Highway 401 and at the ramp terminals
- It minimizes the potential for severe collisions by minimizing potential traffic conflict points
- It provides greatest separation between adjacent intersections, when compared to other alternatives
- It accommodates Long Combination Vehicles (LCVs)
- There are minimal impacts to property and the natural environment, when compared to other alternatives

Evaluation of the Short List of North Augusta Road Interchange Alternatives

As noted in Section 5.3.2, based on the findings of the Assessment of the Long List of North Augusta Road Interchange Alternatives, the following Short List of Interchange Alternatives were identified and subjected to more detailed evaluation:

- Minor Improvements
- Diamond
- Diamond with Roundabouts
- Parclo A4
- Diverging Diamond
- Single Point Urban Intersection
- Parclo A2/Diamond

Each alternative was evaluated against the criteria outlined in Table 16 to Table 18, and received a ranking from least preferred to most preferred. The evaluation of the Short List of North Augusta Road Interchange Alternatives is provided in Table 20.

Table 20: Evaluation of North Augusta Road Short List of Alternatives

Category	Criteria	Factors	Alternative						
			1 – Minor Improvements	**2 – Diamond**	**3 – Diamond with Roundabouts**	**4 – Parclo A4**	**5 – Diverging Diamond**	**6 – SPUI**	**7 – Parclo A2/Diamond**
Highway Engineering (65.0%)	**Traffic Operations**	Level of Service (LOS) Highway 401	• Highway 401 operates at an anticipated Level of Service (LOS) B in 2044	• Highway 401 operates at an anticipated Level of Service (LOS) C in 2044	• Highway 401 operates at an anticipated Level of Service (LOS) C in 2044	• Highway 401 operates at an anticipated Level of Service (LOS) C in 2044	• Highway 401 operates at an anticipated Level of Service (LOS) C in 2044	• Highway 401 operates at an anticipated Level of Service (LOS) C in 2044	• Highway 401 operates at an anticipated Level of Service (LOS) C in 2044
		Level of Service (LOS) Ramp Terminal	• The north and south ramp terminals operate at an anticipated LOS C in the 2041	• The north and south ramp terminals operate at an anticipated LOS B in the 2041	• The north and south ramp terminals operate at an anticipated LOS A in the 2041	• The north and south ramp terminals operate at an anticipated LOS B in the 2041	• The north and south ramp terminals operate at an anticipated LOS B in the 2041	• The ramp terminal operates at an anticipated LOS B in the 2041	• The north and south ramp terminals operate at an anticipated LOS C in the 2041
		Level of Service (LOS) Municipal Intersection	• The adjacent municipal intersections (Parkedale Avenue and Reynolds Drive) operate at an anticipated of LOS C	• The adjacent municipal intersections (Parkedale Avenue and Reynolds Drive) operate at an anticipated of LOS C	• The adjacent municipal intersections (Parkedale Avenue and Reynolds Drive) operate at an anticipated of LOS C	• The adjacent municipal intersections (Parkedale Avenue and Reynolds Drive) operate at an anticipated of LOS C	• The adjacent municipal intersections (Parkedale Avenue and Reynolds Drive) operate at an anticipated LOS C in the 2041	• The adjacent municipal intersections (Parkedale Avenue and Reynolds Drive) operate at an anticipated LOS C in the 2041	• The adjacent municipal intersections (Parkedale Avenue and Reynolds Drive) operate at an anticipated LOS C in the 2041
	Geometrics & Safety	Collisions	• Estimated 79 severe collisions in a 20-year period	• Estimated 69 severe collisions in a 20-year period	• Estimated 76 severe collisions in a 20-year period	• Estimated 79 severe collisions in a 20-year period	• Estimated 66 severe collisions in a 20-year period	• Estimated 66 severe collisions in a 20-year period	• Estimated 73 severe collisions in a 20-year period
		Accommodates Long Combination Vehicles (LCVs) to and from the north	• LCVs require wider than standard shoulders on the following ramps – N-E – W-N • LCVs track on the shoulders	• LCVs require wider than standard shoulders on the following ramps – N-E – E-N – S-W	• LCVs track on the shoulders on the following ramps – N-W – N-E – W-N – E-N • W-N movement requires	• LCVs track on the shoulders on the following ramps – N-E	• LCVs require wider than standard shoulders on the following ramps – N-E ramp • LCVs track on the shoulders	• LCVs track on the shoulders on the following ramps – E-N – N-W – W-N • N-E	• LCVs require wider than standard shoulders on the following ramps • N-E

Category	Criteria	Factors	Alternative						
			1 – Minor Improvements	**2 – Diamond**	**3 – Diamond with Roundabouts**	**4 – Parclo A4**	**5 – Diverging Diamond**	**6 – SPUI**	**7 – Parclo A2/Diamond**
			on the following ramps – N-W – E-N		tracking within 2 lanes and truck apron • N-W movement required tracking within 2 lanes • LCVs track on roundabout truck aprons		on the following ramps – W-N • E-N		
		Accommodates active transportation	• N-S travel requires two crossings which include two entrance/exit ramps	• N-S travel requires two crossings which include two signalized intersections	• N-S travel requires two crossings which include two roundabout entrance/exit arms • Roundabouts are less bicycle and pedestrian friendly	• N-S travel requires three crossings which include three entrance/exit ramps	• N-S travel requires a minimum of four crossings which include two entrance/exit ramps and two signalized intersection	• N-S travel requires a minimum of three crossings which include two entrance/exit ramps and one crossing at signalized intersections	• N-S travel requires two crossings which include one unsignalized intersection and one entrance ramp
		Intersection spacing	• N/S-W & E-N/S Ramp terminal Int. to N. Augusta Road/Parkedale Avenue – 135 m < 400 m MTO min. • S-E Ramp taper to Waverly Road – 20 m < 400 m MTO min.	• North Ramp terminal to Parkedale Avenue – 165 m < 400 m MTO min. • South Ramp terminal to Waverly Road – 217 m < 400 m MTO min.	• North Roundabout to Parkedale Avenue – 133 m < 400 m MTO min. • South Roundabout to Waverly Road – 190 m < 400 m MTO min.	• E-N/S Ramp terminal Int. to N. Augusta Road/Parkedale Avenue – 195 m < 400 m MTO min. • N-W Ramp taper to Parkedale Avenue – 55 m < 400 MTO min. • South Ramp terminal to Waverly Road – 73 m < 400 m MTO min.	• North Ramp terminal to Parkedale Avenue – 110 m < 400 m MTO min. • N-W Ramp taper to Parkedale Avenue – 30 m < 400 m MTO min. • South Ramp terminal to Waverly Road – 195 m < 400 m MTO min.	• New SPUI intersection to Parkedale Avenue – 225 m < 400 m MTO min. • E-N Ramp taper to Parkedale Avenue – 100 m < 400 m MTO min. • New SPUI intersection to Waverly Road – 285 m < 400 m MTO min.	• E-N/S Ramp terminal Int. to N. Augusta Road/Parkedale Avenue intersection – 195 m from < 400 m MTO min. • N-W Ramp taper to Parkedale Avenue – 55 m < 400 MTO min.

Category	Criteria	Factors	Alternative						
			1 – Minor Improvements	**2 – Diamond**	**3 – Diamond with Roundabouts**	**4 – Parclo A4**	**5 – Diverging Diamond**	**6 – SPUI**	**7 – Parclo A2/Diamond**
						• S-E Ramp taper to Waverly Road – 20 m < 400 m MTO min.	• S-E Ramp taper to Waverly Road • 125 m < 400 m MTO min.	• W-S Ramp taper to Waverly Road • 125 m < 400 m MTO min.	• South Ramp terminal to Waverly Road • 217 m < 400 m MTO min.
		Ramp Radii	• 2 of 5 ramps have lower than desirable standards for ramp radii – E-N/S ramp radii (50 m) does not meet minimum standard of 250 m – W-N/S ramp radii (75 m) does not meet minimum standard of 250 m	• All ramps meet standard	• All ramps meet standard	• 1 of 6 ramps have lower than desirable standards for ramp radii – E-N/S ramp radii (130 m) does not meet minimum standard of 250 m	• All ramps meet standard	• All ramps meet standard	• 1 of 5 ramps have lower than desirable standards for ramp radii • E-N/S ramp radii (130 m) does not meet minimum standard of 250 m
		Crossing Road Alignment	• Introduces two horizontal curves	• Introduces two horizontal curves	• Introduces two horizontal curves	• Introduces two horizontal curves	• Introduces two horizontal curves	• Introduces two horizontal curves	• Introduces two horizontal curves
		Crossing road grade at ramp terminal	• Crossing road grade below maximum limits (i.e., between 6-8%)	• Crossing road grade below maximum limits (i.e., between 6-8%)	• Crossing road grade within maximum limits (i.e., between 6-8%)	• Crossing road grade below maximum limits (i.e., between 6-8%)	• Crossing road grade below maximum limits (i.e., between 6-8%)	• Crossing road grade below maximum limits (i.e., between 6-8%)	• Crossing road grade below maximum limits (i.e., between 6-8%)
	Constructability	Complexity of staging and detours	• Medium Complexity of Traffic Staging because: – North Augusta	• Medium Complexity of Traffic Staging because: – North Augusta	• High Complexity of Traffic Staging because: – North Augusta	• Low Complexity of Traffic Staging because: – North Augusta Road bridge	• High Complexity of Traffic Staging because:	• High Complexity of Traffic Staging because:	• Low Complexity of Traffic Staging because:

Category	Criteria	Factors	Alternative						
			1 – Minor Improvements	**2 – Diamond**	**3 – Diamond with Roundabouts**	**4 – Parclo A4**	**5 – Diverging Diamond**	**6 – SPUI**	**7 – Parclo A2/Diamond**
			Road bridge can be constructed in one stage – North Augusta Road construction will not require a temporary alignment and will have minimal disruption to traffic – 4 short-term ramp closures (<15 days) – 1 long-term ramp closure (>15 days) (Ramp S-E)	Road bridge can be constructed in one stage – North Augusta Road construction will not require a temporary alignment and will have minimal disruption to traffic – 4 short-term ramp closures (<15 days) – 1 long-term ramp closure (>15 days) (Ramp S-E)	Road bridge can be constructed in one stage – Roundabouts on North Augusta Road will require several construction stages and multiple traffic stages – 4 short-term ramp closures (<15 days) – 1 long-term ramp closure (>15 days) (Ramp S-E)	can be constructed in one stage – North Augusta Road construction will not require a temporary alignment and will have minimal disruption to traffic – 3 short-term ramp closures (<15 days) – 1 long-term ramp closure (>15 days) (Ramp S-E)	– North Augusta Road bridge can be constructed in one stage – North Augusta Road construction of the two new intersections must be completed while maintaining existing traffic – 4 short-term ramp closures (<15 days) • 1 long-term ramp closure (>15 days) (Ramp S-E)	– North Augusta Road bridge will require staged construction – North Augusta Road construction will require temporary alignments and multiple traffic stages – 4 short-term ramp closures (<15 days) • 1 long-term ramp closures (>15 days) (Ramp S-E)	– North Augusta Road bridge can be constructed in one stage – North Augusta Road construction will not require a temporary alignment and will have minimal disruption to traffic – 3 short-term ramp closures (<15 days) • 1 long-term ramp closure (>15 days) (Ramp S-E)
	Utilities	Length of impacts to utilities	• Approximate utility impacts: – Hydro One: 50 m – Bell Canada: 540 m – Enbridge Gas: 70 m – Trans-Northern	• Approximate utility impacts: – Hydro One: 100 m – Bell Canada: 540 m – Enbridge Gas: 70 m – Trans-Northern	• Approximate utility impacts: – Hydro One: 100 m – Bell Canada: 540 m – Enbridge Gas: 70 m – Trans-Northern	• Approximate utility impacts: – Hydro One: 150 m – Bell Canada: 670 m – Enbridge Gas: 130 m – Trans-Northern	• Approximate utility impacts: – Hydro One: 100 m – Bell Canada: 540 m – Enbridge Gas: 70 m • Trans-Northern Pipeline: 100 m	• Approximate utility impacts: – Hydro One: 100 m – Bell Canada: 540 m – Enbridge Gas: 70 m • Trans-Northern Pipeline: 100 m	• Approximate utility impacts: – Hydro One: 100 m – Bell Canada: 540 m – Enbridge Gas: 70 m • Trans-Northern Pipeline: 100 m

Category	Criteria	Factors	Alternative						
			1 – Minor Improvements	**2 – Diamond**	**3 – Diamond with Roundabouts**	**4 – Parclo A4**	**5 – Diverging Diamond**	**6 – SPUI**	**7 – Parclo A2/Diamond**
			Pipeline: 100 m	Pipeline: 100 m	Pipeline: 100 m	Pipeline: 100 m – Cogeco Cable: 150 m			
Highway Engineering Summary			**Least Preferred**	**Moderately Preferred**	**Least Preferred**	**Moderately Preferred**	**Moderately Preferred**	**Least Preferred**	**Most Preferred**
Social & Cultural Environment (27.5%)	**Property**	Approximate area of impact to designated land uses (City of Brockville Official Plan - Future Roads, Mixed Use, Commercial, Employment, Neighbourhoods, Parks and Open Space)	• Anticipated to require 0.03 ha in total – 0.03 ha of Future Roads • All land designated Future Roads	• Anticipated to require 0.05 ha of property in total – 0.01 ha of Future Roads – 0.04 ha of Mixed Use/ Commercial /Employment • Impacts may be mitigated during detail design	• Anticipated to require 0.03 ha of property in total – 0.03 ha of Mixed Use/ Commercial /Employment • Impacts may be mitigated during detail design	• Anticipated to require 2.13 ha of property in total – 1.08 ha of Future Roads – 0.05 ha of Mixed Use/ Commercial/ Employment – 0.42 ha of Neighbour-hoods – 0.58 ha of Parks and Open Space • Majority of land designated Future Roads • Impacts may be mitigated during detail design	• Anticipated to require approximately 0.03 ha of property in total – 0.01 ha of Future Roads – 0.02 ha of Mixed Use/ Commercial/ Employment • Impacts may be mitigated during detail design	• Anticipated to require approximately 0.03 ha of property – 0.03 ha of Mixed Use/ Commercial/ Employment • Impacts may be mitigated during detail design	• Anticipated to require approximately 2.68 ha of property in total – 1.87 ha of Future Roads – 0.81 ha of Mixed Use/ Commercial/ Employment • Majority of land designated Future Roads • Impacts may be mitigated during detail design
		Approximate number of private properties potentially impacted by construction activities	• No residential property impacts • Portion of approximately 1 property potentially impacted by new ROW	• No residential property impacts	• No residential property impacts	• Approximately 11 private properties potentially impacted by new ROW in total • Anticipated to displace approximately 6	• No residential property impacts	• No residential property impacts	• No residential property impacts

Category	Criteria	Factors	Alternative						
			1 – Minor Improvements	**2 – Diamond**	**3 – Diamond with Roundabouts**	**4 – Parclo A4**	**5 – Diverging Diamond**	**6 – SPUI**	**7 – Parclo A2/Diamond**
		(residential impacts)	(owned by the Ministry of Public Works Ontario)			private residences • Some impacts may be mitigated during detail design			
	Business Operations/ Viability	Number of businesses directly impacted (i.e., access to/ from commercial property or landscaped areas) or displaced	• No commercial properties expected to be impacted by construction activities	• Landscaped areas located on approximately 1 commercial property may be impacted • Impacts may be mitigated by reconfiguration and design of landscaped features	• Landscaped areas located on approximately 1 commercial property may be impacted • Impacts may be mitigated by reconfiguration and design of landscaped features	• Landscaped areas located on approximately 1 commercial property may be impacted • Impacts may be mitigated by reconfiguration and design of landscaped features	• Landscaped areas located on approximately 1 commercial property may be impacted • Impacts may be mitigated by reconfiguration and design of landscaped features	• Landscaped areas located on approximately 1 commercial property may be impacted • Impacts may be mitigated by reconfiguration and design of landscaped features	• Potential to displace approximately 1 business operation • Landscaped areas located on approximately 3 commercial properties may be impacted • Access to/from and parking lot of approximately 1 commercial property may be impacted • Impacts may be mitigated by reconfiguration and design of landscaped features and commercial property access
	Air	Relative potential to affect air quality by reducing emissions (based on the	• Lower potential to impact local air quality due to idling vehicles at	• Lower potential to impact local air quality due to idling vehicles at	• Lower potential to impact local air quality due to idling vehicles at	• Lower potential to impact local air quality due to idling vehicles at interchange	• Lower potential to impact local air quality due to idling vehicles at interchange	• Moderate potential to impact local air quality due to idling vehicles at	• Higher potential to impact local air quality due to idling vehicles at interchange

Category	Criteria	Factors	Alternative						
			1 – Minor Improvements	**2 – Diamond**	**3 – Diamond with Roundabouts**	**4 – Parclo A4**	**5 – Diverging Diamond**	**6 – SPUI**	**7 – Parclo A2/Diamond**
		total network delay model)	interchange when compared to the other alternatives • Impacts may be mitigated by landscape design (additional tree plantings at interchange)	interchange when compared to the other alternatives • Impacts may be mitigated by landscape design (additional tree plantings at interchange)	interchange when compared to the other alternatives • Impacts may be mitigated by landscape design (additional tree plantings at interchange)	when compared to the other alternatives • Impacts may be mitigated by landscape design (additional tree plantings at interchange)	when compared to the other alternatives • Impacts may be mitigated by landscape design (additional tree plantings at interchange)	interchange when compared to the other alternatives • Impacts may be mitigated by landscape design (additional tree plantings at interchange)	when compared to the other alternatives • Impacts may be mitigated by landscape design (additional tree plantings at interchange)
	Noise	Relative potential change in traffic noise levels on surrounding residential dwellings (based on ramp speeds and level of service (LOS))	• Generally same distance to nearby sensitive receptors as existing condition • Higher speeds along ramps due to configuration • The north and south ramp terminals operate on average LOS B – Some impacts may be mitigated by noise barrier design, if warranted and feasible	• Greater distance to nearby sensitive receptors • Higher speeds along ramps due to configuration • The north and south ramp terminals operate on average LOS B – Some impacts may be mitigated by noise barrier design, if warranted and feasible	• Greater distance to nearby sensitive receptors • Lower speeds along ramps due to roundabout configuration • The north and south ramp terminals operate on average LOS A • Some impacts may be mitigated by noise barrier design, if warranted and feasible	• Closer to nearby sensitive receptors • Higher speeds along ramps due to configuration • The north and south ramp terminals operate on average LOS B – Some impacts may be mitigated by noise barrier design, if warranted and feasible	• Larger distance to nearby sensitive receptors • Lower speeds along ramps due to configuration • The north and south ramp terminals operate on average LOS B • Impacts may be mitigated by noise barrier design, if warranted and feasible	• Larger distance to nearby sensitive receptors • Lower speeds along ramps due to configuration • The north and south ramp terminals operate on average LOS B • Impacts may be mitigated by noise barrier design, if warranted and feasible	• Medium distance to nearby sensitive receptors • Lower speeds along ramps due to configuration • The north and south ramp terminals operate on average LOS C • Impacts may be mitigated by noise barrier design, if warranted and feasible

Category	Criteria	Factors	Alternative						
			1 – Minor Improvements	**2 – Diamond**	**3 – Diamond with Roundabouts**	**4 – Parclo A4**	**5 – Diverging Diamond**	**6 – SPUI**	**7 – Parclo A2/Diamond**
	Cultural Heritage	Potential to affect existing and potential built heritage resources; existing and potential cultural heritage landscapes.	• No significant difference between interchange alternatives • No properties or structures having cultural heritage value or interest anticipated to be impacted						
	Archaeology	Possible impacts to areas having archaeological potential	• Potential to impact an approximately 0.43 ha area of land having archaeological potential • Additional archaeological assessment (AA) activities required to confirm impacts if any	• Potential to impact an approximately 0.65 ha area of land having archaeological potential • Additional archaeological assessment activities required to confirm impacts if any	• Potential to impact an approximately 0.56 ha area of land having archaeological potential • Additional archaeological assessment activities required to confirm impacts if any	• Potential to impact an approximately 1.60 ha area of land having archaeological potential • Additional AA activities required to confirm impacts if any	• Potential to impact an approximately 0.69 ha area of land having archaeological potential • Additional archaeological assessment (AA) activities required to confirm impacts, if any	• Potential to impact an approximately 0.59 ha area of land having archaeological potential • Additional AA activities required to confirm impacts, if any	• Potential to impact an approximately 1.02 ha area of land having archaeological potential • Additional AA activities required to confirm impacts, if any
	Contamination	Potential to encounter contaminated soils/ groundwater	• No significant difference between alternatives • Avoids properties identified as having moderate and/or high potential for contamination • Additional environmental site assessment activities required to confirm on-site soil/groundwater contamination if any • All excess materials generated during construction will be managed in accordance with MECP regulations			• Traverses small area of property identified as having high potential for contamination • Additional environmental site assessment activities required to confirm on-site soil/groundwater contamination if any	• Avoids properties identified as having moderate and/or high potential for contamination • Additional environmental site assessment activities required to confirm on-site soil/groundwater	• Avoids properties identified as having moderate and/or high potential for contamination • Additional environmental site assessment activities required to confirm on-site soil/groundwater	• Traverses small area of property identified as having high potential for contamination • Additional environmental site assessment activities required to confirm on-site soil/groundwater contamination if any

Category	Criteria	Factors	Alternative						
			1 – Minor Improvements	**2 – Diamond**	**3 – Diamond with Roundabouts**	**4 – Parclo A4**	**5 – Diverging Diamond**	**6 – SPUI**	**7 – Parclo A2/Diamond**
						– All excess materials generated during construction will be managed in accordance with MECP regulations	contamination if any • All excess materials generated during construction will be managed in accordance with MECP regulations	contamination if any • All excess materials generated during construction will be managed in accordance with MECP regulations	• All excess materials generated during construction will be managed in accordance with MECP regulations
	Stormwater	Total additional impervious area requiring stormwater management strategies/facilities	• Potential to create approximately 2.02 ha of impervious surface • Impacts can be mitigated through stormwater quality and quantity control measures	• Potential to create approximately 2.35 ha of impervious surface • Impacts can be mitigated through stormwater quality and quantity control measures	• Potential to create approximately 2.05 ha of impervious surface • Impacts can be mitigated through stormwater quality and quantity control measures	• Potential to create approximately 2.71 ha of impervious surface • Impacts can be mitigated through stormwater quality and quantity control measures	• Potential to create approximately 1.9 ha of impervious surface • Impacts can be mitigated through stormwater quality and quantity control measure	• Potential to create approximately 2.1 ha of impervious surface • Impacts can be mitigated through stormwater quality and quantity control measure	• Potential to create approximately 2.71 ha of impervious surface • Impacts can be mitigated through stormwater quality and quantity control measures
Social & Cultural Environment Summary			**Moderately Preferred**	**Moderately Preferred**	**Most Preferred**	**Least Preferred**	**Moderately Preferred**	**Moderately Preferred**	**Moderately Preferred**
Natural Environment (7.5%)	**Terrestrial Ecosystem**	Area of impact to wildlife habitat	• No significant difference between alternatives • Potential to impact treed areas • Impacts may be mitigated through restoration design				• No significant difference between alternatives – Potential to impact treed areas, and areas containing Phragmites • Some impacts may be mitigated through restoration/design		
		Area of impacts to vegetated areas due to construction	• Potential for construction to impact 4.54 ha of vegetated areas/open spaces	• Potential for construction to impact 4.70 ha of vegetated areas/open spaces	• Potential for construction to impact 4.33 ha of vegetated areas/open spaces	• Potential for construction to impact 6.89 ha of vegetated areas/open spaces	• Potential for construction to impact 4.60 ha of vegetated areas/open spaces	• Potential for construction to impact 4.33 ha of vegetated areas/open spaces	• Potential for construction to impact 6.55 ha of vegetated areas/open spaces

Category	Criteria	Factors	Alternative						
			1 – Minor Improvements	**2 – Diamond**	**3 – Diamond with Roundabouts**	**4 – Parclo A4**	**5 – Diverging Diamond**	**6 – SPUI**	**7 – Parclo A2/Diamond**
			• Small portion contains invasive species • Impacts can be mitigated through restoration design	• Small portion contains invasive reed species • Impacts can be mitigated through restoration design	• Portions of areas contain invasive reed species • Impacts can be mitigated through restoration design	• Large portion of area contains invasive reed species • Impacts can be mitigated through restoration design	• Portions of areas contain invasive reed species • Impacts can be mitigated through restoration design	• Portions of areas contain invasive reed species • Impacts can be mitigated through restoration design	• Large portion of area contains invasive reed species • Impacts can be mitigated through restoration design
	Species of Conservation Concern	Area impacts to potential SAR habitat	• No significant difference between alternatives • No SAR species and/or habitat identified within the study area						
	Fish & Fish Habitat	Number of watercourse crossings Impacts to fish habitat	• No significant difference between alternatives • No watercourse crossing required – Potential to impact seasonal habitat for tolerant warmwater baitfish community associated with roadside swale. – Fish habitat to be determined in Spring field investigations. – Impacts can be mitigated through restoration/design						
Natural Environment Summary			**Moderately Preferred**	**Moderately Preferred**	**Moderately Preferred**	**Moderately Preferred**	**Moderately Preferred**	**Moderately Preferred**	**Moderately Preferred**
Overall Assessment			**Moderately Preferred**	**Moderately Preferred**	**Moderately Preferred**	**Least Preferred**	**Moderately Preferred**	**Moderately Preferred**	**Most Preferred**

Based on the findings of the evaluation, the **Parclo A2/Diamond** interchange is the most preferred for the North Augusta Road Interchange because:

- It provides a high level of service on Highway 401 and at ramp terminals
- It minimizes the potential for severe collisions by minimizing potential traffic conflict points
- It accommodates LCVs
- It provides greatest separation between adjacent intersections, when compared to other alternatives
- It provides the best opportunity to accommodate active transportation, when compared to other alternatives
- There are moderate impacts to property and the natural environment, when compared to other alternatives.

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6.0 Recommended Plan

Based on the findings of the evaluation process, a Technically Preferred Plan was identified and shared with the public, agencies and Indigenous Communities for review and feedback, prior to confirming the Recommenced Plan.

The Recommended Plan is presented in Figure 19 and includes the following:

- Reconfiguration of the Stewart Boulevard interchange to a Single-Point Urban Interchange design
- Replacement of the Ormond Street Overpass and Buells Creek culvert with a new bridge spanning both Ormond Street and Buells Creek
- Replacement of the existing CNR (VIA) Overhead structure
- Reconfiguration of the North Augusta Road interchange to a Parclo A2/Diamond interchange design
- Future expansion of Highway 401 to an interim six lane and ultimate eight lane cross-section
- Drainage improvements and three new stormwater management ponds

The Recommended Plan is provided in Appendix J.

6.1 Highway 401 Design Speed

The design of new highway infrastructure is required to meet a 130 km/h design speed. The change in design speed was identified by MTO after the selection of the Technically Preferred Plan (as presented to the public at PIC 2), but prior to completion of the Preliminary Design for the Recommended Plan. As such, Stantec undertook a review and evaluation of the existing and proposed geometric features within the study area in consideration of the design criteria for a 130 km/h design speed. The additional work was documented in a *Mainline Design Speed Review 130km/h Report*, a copy of which is on file with MTO. Based on the findings of the review, design modifications were recommended and were incorporated into the Recommended Plan, as described herein.

6.2 Design Criteria

Highway 401 within the project limits is classified as a four-lane Rural Freeway Divided (RFD) highway. The Recommended Plan has been designed for a design speed of 130 km/h, with some exceptions.

There are three roads that cross Highway 401 within the project limits. The functional classification of each crossing road along with its posted speed and design speed is outlined in Table 21.

Table 21: Crossing Road Posted and Design Speed

Crossing Road	Structure Type	Functional Highway Classification	Posted Speed (km/h)	Design Speed (km/h)
Stewart Boulevard	Underpass (Interchange)	UAU70	50	70
Ormond Street	Overpass	ULU60	50	60
North Augusta Road	Underpass (Interchange)	UAU70	50	70

6.3 Highway 401

6.3.1 Horizontal Alignment

The existing horizontal alignment for Highway 401 will be maintained with the exception of a modification of the horizontal curve to increase the curve radius within the west portion of the study area to satisfy the requirements for a design speed of 130 km/h. The curve will maintain the existing median shoulder widths through the curve (i.e., 3.6 m at the west end of the curve and transition to 2.4 m at the east end of the curve). Increasing the curve radius and maintaining the existing median width provides the required 305 m of sight distance through the curve for eastbound traffic.

The new curve will result in a centreline median shift of approximately 2.6 m to the north and requires approximately 550 m of full Highway 401 reconstruction.

6.3.2 Vertical Alignment

The minimum requirements for vertical curves with a design speed of 130 km/h are K-150 for the crest curves and K-80 for the sag curves. Additionally, the maximum profile grade for a freeway with a design speed of 130 km/h is 3%.

There six crest curves and five sag curves on independent eastbound and westbound alignments on Highway 401 within the project limits. All vertical curves exceed the minimum K-value for the posted speed of the highway (100 km/h) and an equivalent design speed of 110 km/h.

Historical road user collision data provided by MTO for the years 2013 through 2018, indicate there were no collisions reported at two of the four deficient vertical curves in the eastbound lane and three of the five deficient vertical curves in the westbound lane.

With no correlation between collisions and vertical curve deficiencies, and existing right-of-way width limitations, all existing vertical curves will be retained within the project limits.

6.3.3 Cross-Section

The Highway 401 cross-section within the study limits includes increasing the highway footprint to 6-lanes in the interim, and to 8-lanes ultimately. The existing median width will be maintained throughout the study area by adding additional lanes to the outside of the existing platform.

The cross-section elements of Highway 401 within the project limits are summarized in Table 22, and displayed in Figure 18.

Table 22: Summary of Recommended Cross-Section Elements on Highway 401

Cross-Section Element	Width (m)
Pavement Width	6 x 3.75 m (3 EBL, 3 WBL) [Interim] 8 x 3.75 m (4 EBL, 4 WBL) [Ultimate]
Shoulder Width	2.1 m – 3.8 m (Lt) 3.0 m (Rt)
Shoulder Rounding	1.5 m
Median Width	5.3 m – 8.5 m (varies)
ROW Width	Varies (91.5 m – 115 m)

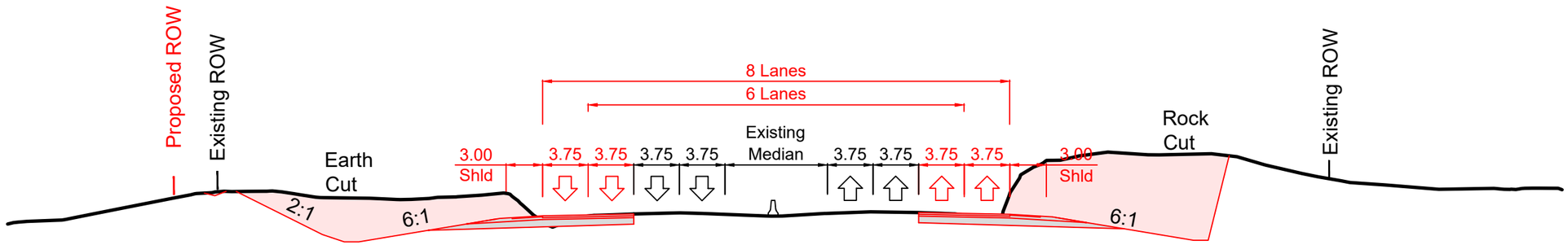
A retaining wall is also required on the south side of Highway 401 from west of the CNR (VIA) corridor to just west of Ormond Street, and on the south side of North Augusta Road and Waverly Road, to avoid highway widening grading impacts to existing residential properties in this area.

6.3.4 Traffic Operations

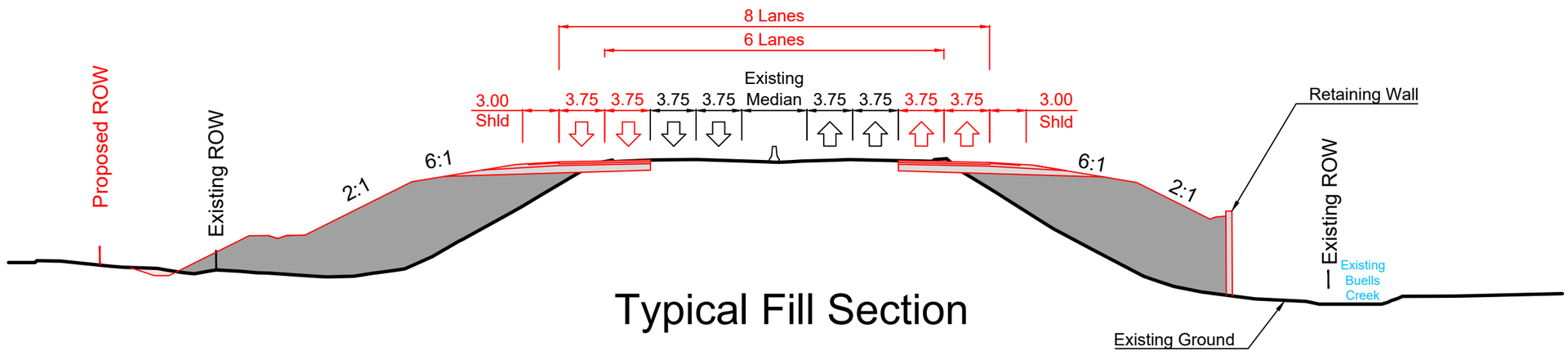
The Level of Service (LOS) is a way to measure the free flow of traffic on a roadway, and is used to determine how well a transportation facility is operating from a traveller's perspective. LOS is expressed in terms of traffic delays and is represented by letters A through F. Level of Service of 'A' represents free-flow traffic conditions, while Level of Service of 'F' represents breakdown flow with stop-and-go traffic conditions.

Based on traffic analysis conducted as part of this study, an as documented in an Interchange Design Alternative Analysis Report (please refer to Appendix K), the following conclusions is noted:

- Based on the existing 4-lane cross-section, Highway 401 is expected to operate at LOS D until approximately 2035, and LOS F during the peak period by 2044
- Highway 401, with a 6-lane cross-section, is expected to perform at LOS C until 2044
- Highway 401, with an 8-lane cross-section, is expected to perform at LOS B until 2044



Typical Cut Section



Typical Fill Section

Stantec

HIGHWAY 401 PLANNING STUDY
Brockville
Preliminary Design & Class Environmental Assessment
GWP 4003-19-00

SCALE 1:400

Typical Cross-Sections
Highway 401

Figure 18

HIGHWAY 401 PLANNING STUDY

Brockville
Preliminary Design &
Class Environmental Assessment
GWP 4003-19-00

Stantec

Existing MTO Right-of-Way
New Roadway - Interim (Future 6-lanes)
New Roadway - Ultimate (Future 8-lanes)
Property Required - Ultimate (Future 8-lanes)
Property Fabric (Approximate based on Assessment Mapping)
Existing Noise Wall to Remain
Proposed Noise Wall

Proposed Retaining Wall
Sidewalk/Multi-Use Path
Ramp Closed
Existing Culvert
New Culvert or Culvert Extension
Potential Stormwater Management Facility
SWM

Recommended Plan

Highway 401

Scale 1:6000

City of Brockville

Figure 19

CITY OF BROCKVILLE

JEFFERSON DR

STEWART BLVD (COUNTY ROAD 29)

9+766

9+800

9+900

10+000

10+100

10+200

10+300

20+800

20+900

21+000

21+100

21+200

21+300

21+400

21+500

21+600

21+700

BROCKVILLE CONVENTION CENTRE

HOLIDAY INN EXPRESS

TRAVELODGE

COMFORT INN

FOOD BASICS GROCERY

TIM HORTON'S

KFC

PETRO CANADA

GALAXY CINEMAS

1000 ISLANDS MALL

Ramp N-W

Ramp E-N

Ramp E-S

Ramp S-W

WBL CL HIGHWAY 401 EBL

WBL CL HIGHWAY 401 EBL

SWM

Ramp W-N

Ramp N-E

Ramp W-S

Ramp S-E

DECKER DRIVE

DAYS INN

STEWART BLVD (COUNTY ROAD 29)

BROCKVILLE SHOPPING CENTRE

APARTMENT COMPLEX

CAMALOR MANUFACTURING

Stantec

HIGHWAY 401 PLANNING STUDY

Brockville
Preliminary Design &
Class Environmental Assessment
GWP 4003-19-00

- Existing MTO Right-of-Way
- New Roadway - Interim (Future 6-lanes)
- New Roadway - Ultimate (Future 8-lanes)
- Property Required - Ultimate (Future 8-lanes)
- Property Fabric (Approximate based on Assessment Mapping)
- Existing Noise Wall to Remain
- Proposed Noise Wall
- Proposed Retaining Wall
- Sidewalk/Multi-Use Path
- Ramp Closed
- Existing Culvert
- New Culvert or Culvert Extension
- SWM Potential Stormwater Management Facility

Recommended Plan

Stewart Boulevard Interchange

Scale 1:2500

City of Brockville

Figure 20

PARKEDALE AVENUE

The Home Depot

22+000

TRILLIUM HEALTH CARE PRODUCTS

22+100

22+200

22+300

BROCKVILLE POLICE

CP (VIA) RAILWAY

22+400

COMMUNITY PRIMARY HEALTH CARE

22+500

Buells Creek

ORMOND STREET

22+600

22+700

CANARM LTD

22+800

DALTO ELECTRIC

22+900

SWM

WBL
CL HIGHWAY 401
EBL

SWM

CP (VIA) RAILWAY

Buells Creek

ORMOND STREET

BRAMSHOT AVE

Stantec

HIGHWAY 401 PLANNING STUDY

Brockville
Preliminary Design &
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- Existing MTO Right-of-Way
- New Roadway - Interim (Future 6-lanes)
- New Roadway - Ultimate (Future 8-lanes)
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- Proposed Retaining Wall
- Sidewalk/Multi-Use Path
- Ramp Closed
- Existing Culvert
- New Culvert or Culvert Extension
- SWM Potential Stormwater Management Facility

Recommended Plan

Station 22+000 to 22+900

Figure 21

Scale 1:2500

City of Brockville

Depot

LCBO

DALTO ELECTRIC

SMARTCENTRES STORES

22+800

22+900

23+000

23+100

23+200

23+300

23+400

23+500

23+600

23+700

9+772

PARKEDALE AVENUE

9+800

Ramp S-W

SWM

9+900

Ramp N-W

Ramp E-N/S

MACGREGOR CRANES

TRANS-NORTHERN PIPELINE

MOTOR COILS MFG.

WBL
CL HIGHWAY 401
EBL

10+000

Ramp N/S-E

Ramp W-N/S

WAVERLY ROAD

WAVERLY ROAD

WAVERLY ROAD

SWM

NORTH AUGUSTA ROAD

10+100

10+200

10

Existing MTO Right-of-Way
New Roadway - Interim (Future 6-lanes)
New Roadway - Ultimate (Future 8-lanes)
Property Required - Ultimate (Future 8-lanes)
Property Fabric (Approximate based on Assessment Mapping)
Existing Noise Wall to Remain
Proposed Noise Wall

Proposed Retaining Wall
Sidewalk/Multi-Use Path
Ramp Closed
Existing Culvert
New Culvert or Culvert Extension
Potential Stormwater Management Facility

Stantec

HIGHWAY 401 PLANNING STUDY

Brockville
Preliminary Design &
Class Environmental Assessment
GWP 4003-19-00

Recommended Plan

North Augusta Road Interchange

Scale 1:2500

City of Brockville

Figure 22

6.4 Interchanges

To accommodate the future footprint of Highway 401, and the projected future traffic volumes, modifications to the Stewart Boulevard and North Augusta Road interchanges have been identified as part of the Recommended Plan, as described herein. It is important to note that the interchange modifications proposed as part of the Recommended Plan will accommodate Long Combination Vehicles (LCVs) for all movements. Additional improvements, to be undertaken by the City of Brockville, may be required to accommodate LCVs at other intersections.

6.4.1 Stewart Boulevard Interchange

A Single-Point Urban Interchange (SPUI) configuration is recommended at Stewart Boulevard. The SPUI configuration at Stewart Boulevard is presented in Figure 20. For this configuration, ramps from all four quadrants on the interchange merge into one signalized intersection on the structure above Highway 401.

Stewart Boulevard will be reconstructed between Jefferson Drive to the north and to approximately 100 m north of Central Avenue West to the south (i.e., just north of the existing Brockville Shopping Centre entrance). The Recommended Plan will tie into the existing cross-section on Stewart Boulevard at these locations.

Commercial entrances along Stewart Boulevard in the southwest quadrant of the interchange will be maintained as part of the Recommended Plan. Modifications to the entrances will be required to accommodate the upgraded cross-section and sidewalk on the west side of Stewart Boulevard.

Stewart Boulevard will maintain the urban cross-section through the improved section with two 3.5 m through lanes in each direction, opposing centre left-turn lane (3.0 m) with centre divisional island (2.0 m), and 1.5 m shoulders adjacent to curb on the bridge. The west side of Stewart Boulevard will have a 1.5 m sidewalk and the east side will have a 3.6 m multi-use path (MUP) The ROW is minimum 30.5 m in width. Details of the recommended cross-section are provided in Table 23.

Table 23: Stewart Boulevard Cross-Section

Crossing Road	Lane Width (m)	Shoulder Width (m)	Curb (m)	ROW Width (m)
Stewart Boulevard	4 x 3.5 (thru) 1 x 3.0 (left-turn) 2.0 centre island	1.5	0.6	Varies 30.5-55.0

As noted, a 1.5 m wide sidewalk will be provided on west side of the new bridge, and a 3.6 m wide Multi-Use Path (MUP) will be provided on the east side of the new bridge. The need for pedestrian signals at MUP crossings will be reviewed during detail design and construction.

The horizontal alignment of Stewart Boulevard will follow the existing tangent alignment through the interchange.

The vertical alignment for Stewart Boulevard generally matches the existing profile, although will be raised by approximately 1 m to provide the required clearances on Highway 401 beneath the new structures. The grades on both sides of the bridge will be adjusted to tie into the existing roadway prior to the intersections on Stewart Boulevard with Jefferson Drive and Central Avenue West. All of the curves will exceed the minimum design speed requirements for a design speed of 70 km/h.

Four new ramps will be required to accommodate all of the movements for the new SPUI interchange at Stewart Boulevard. All ramps are single lane with a 4.75 m width, 1.0 left shoulder and 2.5 m right shoulder. All rounding on the ramps and speed change lanes are 1.0 m.

The new ramps at the Stewart Boulevard interchange will meet MTO design standards. The proposed ramp speed change lane lengths will satisfy requirements to meet minimum design standards for a design speed of 130 km/h on Highway 401.

Traffic Operations

Based on the findings of the traffic analysis, all approaches at the interchange ramp terminals are expected to perform at LOS C or better in all of the periods in 2044 for both the 6-lane and 8-lane configuration of the Highway 401 mainline

The traffic operations at the adjacent intersections to the ramp terminals (i.e., intersections along Stewart Boulevard at Central Avenue West, Jefferson Drive, and Parkedale Avenue) are expected to perform at LOS D or better in each of the different Highway 401 mainline configurations scenarios for all peak periods in 2044.

6.4.2 North Augusta Road Interchange

A modified Parclo A (north side)/Diamond (south side) configuration interchange is recommended at North Augusta Road. The Parclo A/Diamond configuration at North Augusta Road is presented in Figure 22. The crossing road will be shifted to the east to facilitate construction and allow traffic to remain on North Augusta Road during a significant portion of construction.

North Augusta Road will be reconstructed between Parkedale Avenue to the north and Waverly Road to the south.

North Augusta Road will maintain the urban cross-section through the improved section with two 3.5 m through lanes in each direction, a 3.5 m centre left-turn lane and 1.5 m shoulders adjacent to curb on the bridge. The west side of North Augusta Road will have a 3.6 m MUP. There will be no sidewalk on the east side. The ROW is minimum 22.4 m in width. Details of the recommended cross-section are provided in Table 24.

Table 24: North Augusta Road Cross-Section

Crossing Road	Lane Width (m)	Shoulder Width (m)	Curb (m)	ROW Width (m)
North Augusta Road	4 x 3.5 (thru) 1 x 3.5 centre left-turn lane	1.5	0.6	Minimum 22.5

As noted, a 3.6 m wide MUP will be provided on the west side of the new bridge. The need for pedestrian signals at MUP crossings will be reviewed during detail design and construction.

On the north side of the interchange, rather than intersecting with the crossing road (i.e., North Augusta Road) the exit ramp from the east will intersect with Parkedale Avenue (similar to a buttonhook) at a signalized intersection. This configuration was chosen since the ramp will also align with Broome Road to the north of Parkedale Avenue and provide an opportunity for a loop ramp (Ramp S-W) at North Augusta Road. As part of this change, the existing ramps that terminate at Parkedale Road will be removed along with the existing signalized intersection.

On the south side of the interchange, a diamond configuration is recommended to replace the current non-standard Parclo A4 configuration. The ramp terminal intersection at North Augusta Road is anticipated to be unsignalized. As part of the future detail design phase, traffic volumes will be reviewed to confirm the need for traffic signals.

The new alignment for North Augusta Road will closely match the existing profile of the road, but will be raised slightly to accommodate the structure over Highway 401. The grades on both sides of the bridge will be adjusted to tie into the existing roadway prior to the intersections on North Augusta Road with Parkedale Avenue and Waverly Road.

Five new ramps will be required to accommodate all of the movements for the new Parclo A/Diamond interchange at North Augusta Road. The new ramps at the North Augusta Road interchange all meet MTO design standards. All ramps will consist of a single 4.75 m wide lane, 1.0 m left paved shoulder and 2.5 m right paved shoulder. All rounding on the ramps and speed change lanes are 1.0 m.

Traffic Operations

All approaches at the north and south ramp terminals are expected to perform at LOS C or better in all of the periods in 2044 for both the 6-lane and 8-lane configuration of the Highway 401 mainline.

The traffic operations at the adjacent intersections to the ramp terminals (i.e., intersections along North Augusta Road at Reynolds Drive and Parkedale Avenue) are not expected to be adversely impacted, and are expected to perform at an overall LOS D or better in each of the different Highway 401 mainline configurations scenarios for all peak periods in 2044.

6.5 Ormond Street

With the exception of Stewart Boulevard and North Augusta Road, Ormond Street is the only road that crosses Highway 401 within the study area. This municipal roadway passes beneath Highway 401 approximately 600 m west of North Augusta Road.

Changes to the existing horizontal or vertical alignments on Ormond Street are not proposed as part of the Recommended Plan.

A 3.0 m MUP is currently present along the west side of Ormond Street, and will be accommodated as part of the Recommended Plan. A 2.1 m wide boulevard will be included beneath the structure to provide separation between active transportation and vehicle travel lanes, as per current City of Brockville design standards.

6.6 Active Transportation

As noted, new active transportation facilities will be provided along the new Stewart Boulevard and North Augusta Road structures. These new facilities are subject to cost sharing agreements with the City of Brockville.

6.7 Bridge Engineering

The Recommended Plan includes the replacement of three existing roadway structures, one railway overhead, and the removal of one structural culvert, as described herein. It is anticipated that the bridges will be replaced in advance of, or in conjunction with the interim 6-lane highway widening.

6.7.1 Stewart Boulevard Underpass

As described in Section 6.4.1, the existing Stewart Boulevard Underpass will be replaced with a new structure to accommodate the single point urban interchange. The new structure will have a span and width of approximately 47 m and 55 m, respectively. The new bridge is designed to accommodate the ultimate 8-lane Highway 401 cross-section.

6.7.2 CNR (VIA) Overhead

The existing CNR (VIA) Overhead will be replaced with a single-span structure. The proposed span of the structure is 21.0 m, and its width is 46.46 m. The bridge is designed to accommodate the ultimate 8-lane Highway 401 cross-section and two sets of railway tracks crossing under Highway 401 (one existing, one future).

These improvements are anticipated to be completed in conjunction with the replacement of the Buells Creek and Ormond Street structures.

6.7.3 Ormond Street/Buells Creek Structure

The existing Ormond Street Overpass will be replaced with a new structure that spans over both Ormond Street and Buells Creek. Buells Creek will be realigned at this location to minimize the length of the new bridge. The bridge will be a two-span structure. The proposed spans of 22.5 m each provide a total bridge length of 45.0 m, with substructures skewed approximately 15.1° to match the alignment of Ormond Street. The proposed width of the new bridge is 46.46 m. The new bridge is designed to accommodate the ultimate 8-lane Highway 401 cross-section.

As part of the construction activities, the existing Ormond Street Overpass will be removed and the existing Buells Creek culvert will be removed or filled with low-strength concrete.

6.7.4 North Augusta Road Underpass

The existing North Augusta Road Underpass will be replaced with a new structure with two equal spans of 33.5 m. The structure will be situated on a new alignment immediately east of the existing bridge. The new bridge is designed to accommodate the ultimate 8-lane Highway 401 cross-section.

6.8 Drainage Engineering

The proposed drainage conditions are summarized in the sections below.

6.8.1 Culvert Recommendations

In general, specific maintenance work is recommended for the existing Highway 401 centreline culverts. Specific recommendations for culvert replacement have been made in the instance of MTO standard exceedance, and to help mitigate identified areas of flooding concern. In instances where the culvert was in fair – good material condition, and MTO Design Criteria were met, the culvert is recommended to be replaced.

There are two (2) circular culverts and four (4) box culverts within the study area. As part of the Recommended Plan, the circular culverts that are currently in poor condition will be replaced. In addition, one box culvert will be abandoned, one will be replaced and upsized to mitigate flooding, and two (2) will be retained.

6.8.2 Stormwater Management Strategy

The proposed stormwater management (SWM) strategy was designed to meet SWM design guidelines and policies as outlined in the MTO *Drainage Management Manual* (1997), the Ministry of the Environment *Stormwater Management Planning and Design Manual* (2003), and the MTO *Highway Drainage Design Standards* (HDSS) (2008).

Preliminary estimates of the proposed highway improvements include increasing the highway footprint from 4 to 8 lanes, including interchange improvements, which will significantly increase impervious area and surface water runoff. As such, SWM controls are warranted.

In general, where there is existing or potential flooding to downstream properties, SWM controls are proposed to maintain peak flows and water levels. The SWM controls have been designed, as either Linear Dry Detention Swales or Wet Ponds, as described below.

- **Linear Dry Detention Swale** – provide a shallow storage area (typically 1 m) for water quantity control (flow attenuation) and some water quality benefits by reducing pollutant and sediment loading downstream. They generally consist of a wide swale with a small berm at the downstream end to storage water. No water is stored between rainfall events

- **Wet Pond SWM Facility** – provide an active storage volume for water quantity control, and an additional permanent pool volume for water quality control (total suspended solids reduction in outflow)

Generally, wet ponds require a larger footprint, and have only been proposed at the Highway 401 and North Augusta Road Interchange where space is available. An assessment of available area within the Highway 401 right-of-way has been completed, such that the proposed SWM controls are accommodated. During detail design, grading of the recommended SWM Facilities and design of outlet structures will be completed.

The preliminary SWM strategy is provided in Appendix L.

6.8.3 Ferguson Drive Flooding

The primary cause of flooding in the vicinity of Ferguson Drive is the low elevation difference between the culvert invert and the property line (i.e., approximately 0.3 m to 0.5 m), where low headwater levels result in property flooding.

The proposed ultimate improvements to this area include:

- Abandon the existing culvert
- Outlet the median storm sewer west and east of the existing to the north ditch
- Capture the area between Highway 401, Stewart Boulevard, and the southeast ramp in the median storm sewer instead of the current outlet to the south ditch and existing culvert
- All four quadrants of the Highway 401 and Stewart Boulevard interchange will outlet to the north ditch
- Lower the ditch along the south side of Highway 401

The proposed ultimate improvements include significant changes to the drainage pattern around the interchange and are not suitable for short term improvements. Significant interim improvements are not possible due to the elevation differences between the culvert invert and property line. Possible interim improvements include:

- Ditching improvements, as sediment build up was evident in the ditch and the barrel and continued (annual) inspection and cleanout would reduce water levels somewhat
- Ditching along the south side of Highway 401 from in line with the ultimate improvements. This would require significant vegetation (mature tree) removal
- Reconfiguration of median sewer so that it outlets to the north ditch and not the culvert barrel, which maybe possible under interim conditions using trenchless technology.

6.9 Foundations Engineering

A foundation investigation was undertaken and generally identified surficial layers of fill underlain by clay to sand. Each structure location is underlain by very strong layer of dolostone (bedrock). Foundations for the bridges range from shallow or deep foundations and piles driving to bedrock. Additional field investigations and testing will be completed during detail design to confirm the site-specific soil conditions.

6.10 Pavement Design

A preliminary pavement analysis was completed for the Highway 401 mainline and interchange ramps. The proposed pavement design will be confirmed during detail design.

6.11 Illumination

The Recommended Plan includes partial illumination at both the Stewart Boulevard and North Augusta Road interchanges. The partial illumination will, at a minimum, match the level of lighting that is currently provided at the interchanges by providing illumination at key decisions points (i.e. Highway 401 entry and exit ramps) for the new interchange configurations. Illumination will be provided by conventional light poles and will include LED lighting. The need for light trespass mitigation measures (e.g. alternative lighting sources, shields) will be reviewed in Detail Design, if required. The need for full illumination of the interchanges and the areas on Highway 401 adjacent to the interchanges was reviewed but was not warranted based on traffic volumes and proposed conditions.

Illumination of the crossing roads will be reviewed further in Detail Design, based on additional consultation with the City of Brockville. At a minimum, it is expected that the existing illumination will be maintained. This includes the full illumination of Stewart Boulevard across Highway 401, and the partial illumination of North Augusta Road and Ormond Street across Highway 401. Additional illumination along North August Road and Ormond Street should be considered based on the sidewalks/multi-use paths that are recommended. The cost of these improvements will be subject to a cost-sharing agreement with the City of Brockville.

6.12 Utilities

Utility relocations will be required to accommodate the Recommended Plan. Utility crossings and potential conflicts have been identified in Table 25; however, relocation plans for utilities will be confirmed during detail design. It is recommended that all utility relocations occur as part of the Interim Strategy.

No impacts to municipal services are anticipated as a result of the Recommended Plan.

Table 25: Summary of Utility Conflicts

Utility Company	Conflict Location	Potential Impacts
Bell Canada	Underground Bell crossing Highway 401 approximately 500 m east of west project limit	Highway 401 widening; Consult Bell Canada for vertical clearances
Hydro One	Overhead hydro and poles along south side Highway 401 right-of-way west of Stewart Boulevard	Relocate poles prior to widening to accommodate 8-lane ultimate design; Consult with Hydro One
Bell Canada	Underground Bell on south side of Highway 401 west of Stewart Boulevard	Highway 401 widening; Consult Bell Canada for vertical clearances
Hydro One	Overhead hydro crossing Highway 401 approximately 500 m west of Stewart Boulevard	Highway 401 widening; To confirm in Detail Design
Bell Canada	Underground Bell within existing Stewart Boulevard bridge and roadway	Replacement of existing bridge will require existing plant relocation; Consult Bell Canada for relocation of plant from existing bridge and roadway
Enbridge Gas Hydro One Bell Canada	Underground plant crossing Stewart Boulevard approximately 250 m south of Highway 401	Stewart Boulevard reconstruction; Consult Enbridge Gas, Hydro One & Bell Canada for vertical clearances
Enbridge Gas Bell Canada	Underground plant on east side of Stewart Boulevard approximately 200 m north of Highway 401	Stewart Boulevard reconstruction; Consult Enbridge Gas & Bell Canada for vertical clearances
Bell Canada	Underground Bell crossing Highway 401 and new ramps approximately 100 m east of Stewart Boulevard	Highway 401 widening and new Stewart Boulevard Ramp E-N/S & new Ramp N/S-E; Consult Bell Canada for vertical clearances
Enbridge Gas	Underground gas line crossing Highway 401 and new ramps approximately 250 m east of Stewart Boulevard	Highway 401 widening and new Ramp E-N/S & new Ramp N/S-E; Consult Enbridge Gas for vertical clearances
Hydro One Cogeco Cable	Underground plant on the west side of Ormond Street at Highway 401 bridge	New Highway 401 bridge over Buells Creek and Ormond Street; Consult Hydro One & Cogeco Cable prior to new bridge construction
Bell Canada	Underground Bell crossing Highway 401 and new Ramp W/N/S (south side) and new Ramp N-W (north side) approximately 260 m west of North Augusta Road	Highway 401 widening and new North Augusta Road Ramp W/N/S and new Ramp N-W; Consult Bell Canada for vertical clearances
Enbridge Gas	Underground gas line crossing Highway 401 approximately 100 m west of North Augusta Road	Highway widening and new North Augusta Road Ramp W/N/S and new Ramp N-W; Consult Enbridge Gas for vertical clearances
Hydro One	Overhead hydro crossing Highway 401 approximately 100 m west of North Augusta Road	Pole relocation required to accommodate new Ramp W-N/S (south side)
Bell Canada	Underground Bell within existing North Augusta Road bridge and road	Replacement of existing bridge will require existing plant relocation; Consult Bell Canada for relocation of plant from existing bridge and roadway
Bell Canada	Underground Bell north side of new North Augusta Ramp S-W)	New North Augusta Ramp S-W; Consult Bell Canada for relocation of plant
Bell Canada	Underground Bell south side of new North Augusta Ramp N/S-E (along right-of-way)	New North Augusta Ramp N/S-E; Consult Bell Canada for relocation of plant
Hydro One	Parkedale Avenue (south side at new intersection with new ramp E-N/S)	New North Augusta Ramp E-N/S intersection at Parkedale; Consult Hydro One for vertical clearances and pole relocation
Trans-Northern Pipeline	Underground pipeline crossing Highway 401 and new North Augusta Ramp N/S-E and new Ramp E-N/S	Highway widening and new North Augusta Ramp N/S-E & Ramp E-N/S; Consult Trans-Northern Pipeline for vertical clearances and mitigation
Hydro One	Overhead hydro crossing Highway 401 approximately 740 m east of North Augusta Road	Highway 401 widening; To confirm in Detail Design

6.13 Implementation Plan

A preliminary strategy to implement the Recommended Plan has been prepared as part of this study. However, depending on MTO funding priorities and future operations, there may be changes to the proposed construction strategy (implementation plan). MTO will continue to monitor study area operations and may implement certain components of the plan as needed to meet provincial transportation needs.

6.13.1 Interim Strategy

The structures will be replaced in advance of, or in conjunction with, the widening of the Highway 401 mainline, as described herein.

Underpasses

Stewart Boulevard

Two possible construction staging alternatives have been developed for the Stewart Boulevard underpass:

- The first concept involves constructing a portion of the new structure to the east of the existing bridge in Stage 1 and then shifting the traffic to this deck in Stage 2 to allow removal of the existing bridge and construction of the remainder of the new structure.
- The second concept involves building portions of the new structure to both sides of the existing bridge in Stage 1 and then diverging the northbound and southbound traffic to these decks in Stage 2.

The two proposed concepts will be further assessed and confirmed during detail design.

North Augusta Road

The North Augusta Road underpass is on a new alignment and can be constructed while maintaining traffic on the existing bridge.

Overpasses

The replacement of the CNR (VIA) overhead and the Buells Creek/Ormond Street overpass will be completed through lane shifts of the highway on the existing platform. Initially, traffic will be shifted towards the median with two lanes provided in each direction while the new structure is constructed on the outside edges. In the second stage, two lanes of traffic will be provided on the new structures while the existing structure is demolished, and the central section of the new structure is constructed.

Ormond Street

Ormond Street may be closed for the duration of construction of the overpass structure. While it may be feasible to maintain traffic through the work zone, height/clearance restrictions (as a result of formwork for the new bridge), could be in place. Additional consultation during detail design will be required.

Highway 401 Mainline

After the structures have been replaced, Highway 401 can be widened to six lanes. Expansion will occur to the outside of the existing platform. The existing outside shoulder can be removed and the new lane and shoulder constructed. During this phase, the overpass structures (i.e., rail bridge and Ormond Street/Buell's Creek) will be wider than required as they are being constructed to accommodate the ultimate 8-lane Highway 401 cross-section. During this interim phase, Highway 401 will have a 6-lane cross-section across the structures, and the area of the bridge for the future 8-lane cross-section will be closed to traffic.

6.13.2 Ultimate Phase

All of the structures will be constructed to their ultimate design during the interim phase of construction. Therefore, no structure widening or lengthening is required when Highway 401 is expanded to eight lanes. However, the structures may be approximately 25 years old may require structure rehabilitation.

During the expansion of the highway to the 8-lane cross-section it is assumed that three lanes of traffic will need to be maintained and traffic will be shifted to the median during construction. Once the traffic has been shifted the shoulder removal can be completed and the new lanes added to the outside of the pavement structure.

6.13.3 Interchange Replacement Prioritization

Depending on available funding or needs, it is possible that the implementation of the interchange improvements could be completed at different times. Based on a high-level review of traffic operations to determine which interchange should be constructed first, if both cannot be completed within a similar timeframe, it was noted that prioritizing the construction of the Stewart Boulevard interchange is preferred to accommodate traffic operations during construction (i.e., diverted traffic as a result of ramp closures at the North Augusta interchange).

It should also be noted that, based on the proposed configuration of the North Augusta Road interchange and the proximity to the Ormond Street structure, the North Augusta Road interchange N-W and S-W ramps cannot be constructed until the new overpass structure at Ormond Street is completed.

6.14 Construction Closures and Detours

To facilitate construction of the Recommended Plan, several closures of municipal roads, ramps, of Highway 401 will be required. It should be noted that a traffic analysis was conducted for each of the detour types for the applicable scenario. The anticipated overnight closure requirements are summarized in Table 26.

Table 26: Potential Road Closure Durations

Category	Approximate Duration	Typical Scenario
Overnight closure	12-18 hours	Highway 401 closures related to bridge demolitions and girder placements for new bridges
Short-term closure	1-30 days	Interchange ramp closures
Long-term closure	1-4 months	Municipal road closure for bridge construction

The number and durations closures will be confirmed during detail design.

6.14.1 Overnight Closures and Detours

Overnight closures of Highway 401 will be required for the demolition of the underpasses at Stewart Boulevard and North Augusta Road. An overnight closure may be required for girder placements for new underpass structures, although this activity can typically be completed through the use of rolling closures.

Closures of Highway 401 will be required to accommodate the demolition of the existing Stewart Boulevard bridge and the North Augusta Road bridge. These closures will require overnight detours using local municipal roads.

The Highway 401 eastbound closure at Stewart Boulevard will direct the detour traffic to exit the highway at the County Road 2 interchange, to travel easterly along King Street East, then northerly at North Augusta Road. Traffic will be able to continue onto Highway 401 using the North Augusta Road interchange.

The Highway 401 westbound closure at Stewart Boulevard will direct the detour traffic to exit the highway at the North Augusta Road interchange to travel westerly along Parkedale Avenue. From Parkedale Avenue, traffic will travel southerly on Stewart Boulevard to continue onto Highway 401 using the Stewart Boulevard interchange.

The Highway 401 eastbound closure at North Augusta Road will direct the detour traffic to exit the highway at the North Augusta Road interchange, and travel southerly towards County Road 2. Traffic will travel easterly on County Road 2, then northerly on Maitland Road to continue onto Highway 401 using the Maitland Road interchange.

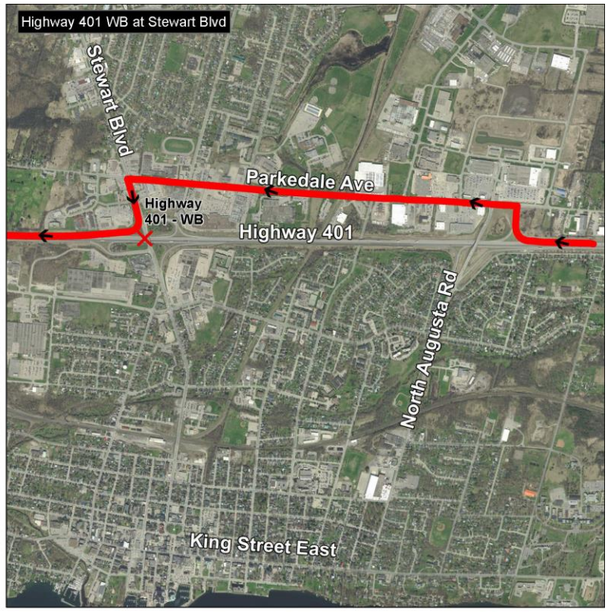
The Highway 401 westbound closure at North Augusta Road will direct the detour traffic to exit the highway onto North Augusta Road to travel westerly along Parkedale Avenue. From Parkedale Avenue, traffic will travel southerly on Stewart Boulevard to continue onto Highway 401 using the Stewart Boulevard interchange.

The anticipated overnight closures are summarized in Table 27.

Table 27: Overnight Closures

Structure Replacement	Closure Requirement	Construction Activity
Stewart Boulevard Underpass	Highway 401 EB between County Road 2 and North Augusta Road	Existing Stewart Boulevard underpass demolition and potential girder placement for new bridge
	Highway 401 WB between North Augusta Road and Stewart Boulevard	
North Augusta Road Underpass	Highway 401 EB between North Augusta Road and Maitland Road	Existing North Augusta Road underpass demolition and potential girder placement for new bridge
	Highway 401 WB between North Augusta Road and Stewart Boulevard	

Each overnight closure of Highway 401 will require a detour route along the existing municipal road network to maintain traffic along Highway 401. The anticipated detour routes are shown in Figure 23.



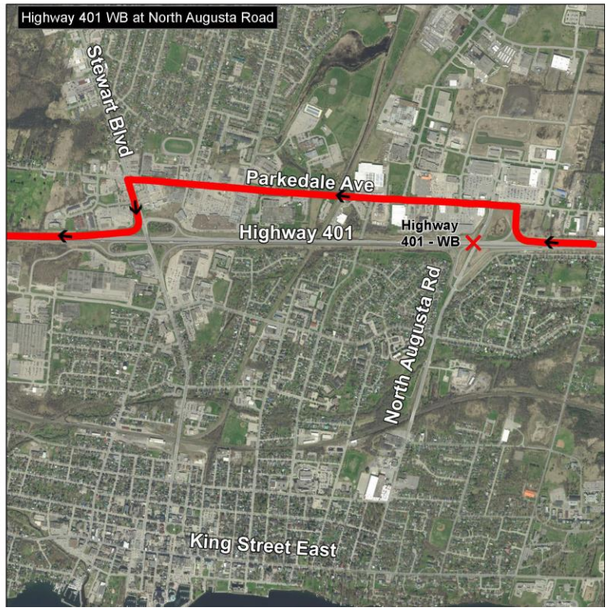


Figure 23: Overnight Closure Detour Routes

The overnight closure and detour traffic analysis shows some significant queueing and delay along the Highway 401 mainline. A no-flag-person scenario and a flag-person scenario were modelled for each closure along Highway 401. Based on the comparison made between the Highway 401 closure scenarios and the base-case scenarios, travel delays and traffic queuing is anticipated.

Adding paid duty officers at key intersections and ramp terminals will significantly reduce delay and queueing for all the Highway 401 closure scenarios. It should be noted that the results are based on the summer weekend peak demand where the traffic operations are at their worst conditions, therefore, the delay and queueing results could potentially be improved if the closure happens during off-peak seasons when traffic demand is expected to be lower.

6.14.2 Short-Term Closures and Detours

Ramp closures will be required to accommodate the construction of the new Stewart Boulevard and North Augusta Road Interchange ramps. These ramps closures will require short-term detours using local municipal roads. However, the closures of Stewart Boulevard and North Augusta Road ramps will not occur simultaneously.

The duration of the closure is dependent on the construction work required and will generally range between 1 to 30 days.

Each ramp closure will require a detour route along the existing municipal road network to maintain access to Highway 401. Closures of ramps at the Stewart Boulevard interchange will direct the detour traffic to North Augusta Road interchange. Closure of ramps at the North Augusta Road interchange will direct the detour traffic to Stewart Boulevard interchange.

It is proposed that Parkedale Avenue between the two interchanges be used as the detour route for all ramp closures. A plan illustrating the proposed detour route is shown in Figure 24.

Figure 24: Short-Term Closure Detour Route

The short-term closure detour traffic analysis concluded the following:

- There are no major impacts on the traffic operations within the network during the different ramp closure scenarios
- Impacted ramp terminals and intersections due to the different closure(s) are expected to perform at an overall LOS C or better, with the exception of the Stewart Boulevard and Central Avenue intersection which is expected to perform at LOS D during the Stewart Boulevard interchange E-N/S and S-W ramp closures
- Traffic at the following locations is expected to operate at a LOS E:
    - Stewart Boulevard W-N/S and N-E Ramp Closures: EB movement at North Augusta Road ramp terminal, and SB Left movement at Stewart Boulevard and Parkedale Avenue
    - Stewart Boulevard E-N/S and S-W Ramp Closures: WB Left movement at North Augusta Road and Parkedale Avenue
    - North Augusta Road E-N/S Ramp Closure: SB Left movement at Stewart Boulevard and Central Avenue
- Some movements may have occasional queues exceeding the available storage; however, average queues can still be accommodated.
- Adjusting signal timing plans would help in reducing delay and queueing impacts

6.14.3 Long-Term Closure and Detour

It is recommended that Ormond Street be closed for the duration of the overpass structure. The closure will require long-term detours using local municipal roads. Traffic seeking to travel northbound or southbound on Ormond Street will be directed to travel on North Augusta Road.

While it is feasible to maintain traffic through the work zone, the contractor's access and operations will be greatly restricted. This long-term closure would have a duration of approximately one to four months. A plan of the proposed detour along North Augusta Road is shown in Figure 25.

The City of Brockville has expressed their general support for this closure during construction. No major traffic impacts are expected along local roads due to the relatively low traffic volumes. Additional consultation with the United Counties of Leeds and Grenville and the City of Brockville will be required during detail design to confirm closure details.

Figure 25: Long-Term Closure Detour Route

7.0 Environmental Impacts and Mitigation

In accordance with the MTO *Class EA for Provincial Transportation Facilities* (2000) and the *Environmental Reference for Highway Design* (2006), a description of the anticipated impacts associated with the Recommended Plan, and appropriate mitigation at a Preliminary Design level of detail, is described herein. The details of the Recommended Plan will be refined and finalized during the next stage of the design process (i.e., detail design), subsequent to the Class EA.

7.1 Natural Environment

Based on the Recommended Plan, it is assumed that natural areas will be partially removed to accommodate construction activities. The precise limits of impacts to the natural environment will be confirmed during detail design.

7.1.1 Surface Water, Groundwater, and Source Water

The study area lies within HVA areas with a vulnerability score of 6, and highly vulnerable SGRAs are located in the vicinity of the Stewart Boulevard and North Augusta Road interchange areas.

It is anticipated that a groundwater Permit to Take Water (PTTW) or registration with the Environmental Activity Sector Registry (EASR) will be required for this project. The need for an EASR or a PTTW in select areas will be determined as part of the detail design, including additional geotechnical investigation.

Potential private groundwater supply wells are located within 500 m of the Stewart Boulevard Interchange (16-121) and are installed within bedrock. Based on the reported location and typical depth of private wells, it is not anticipated that a well monitoring program will be required for general excavation activities. The need for and extent of private well monitoring in areas of excavation should be confirmed as part of the supporting documentation for any PTTW application/EASR registration.

Various mitigation techniques will be employed during construction to reduce the risk of impacts to natural features. During construction, the primary concern regarding groundwater quality would be the potential for a contaminant spill. To address this concern, the following mitigation measures are proposed:

- Refuelling of equipment shall be completed away from SGRAs and HVAs, whenever possible, to minimize potential impacts to groundwater quality in the event that an accidental spill occurs
- To minimize the impact of potential contaminant spills, the Contractor should implement best management protocols such as secondary containment of any temporary fuel storage and preparation of a spill response plan and proper facility management during operation and maintenance.
- Materials for spill response such as drip pans and spill contingency kits must be maintained on site.

7.1.2 Erosion and Sediment Overview Risk Assessment

An Erosion and Sediment Overview Risk Assessment (ESORA) was completed as part of this study in accordance with the MTO Erosion and Sediment Control Guide to determine which Erosion and Sediment Control (ESC) approach is best suited for the anticipated construction works. It is recommended that the control measures consider the study area to have a moderate-high erosion and sediment risk, and that Approach 3: Two Part Erosion and Sediment Control Plan (ESCP) – Main and Supplemental be implemented during detail design, in accordance with MTO Guidelines. This approach provides the contractor with the ability to adapt the ESCP without having to go through the change control process for a supplemental plan, should the site conditions found during construction differ than conditions assumed during design, as part of a Best Management Practice.

A copy of the ESORA is provided in Appendix M.

7.1.3 Fisheries and Aquatic Resources

A Fish and Fish Habitat Existing Conditions and Preliminary Impact Assessment Report was completed as part of this study, a copy of which is provided in Appendix C. As noted in Section,4.1.4, Buells Creek provides direct fish and fish habitat. In addition, direct seasonal fish habitat was identified at other locations within the study area. In addition, the features that connect some of these sites also support seasonal fish habitat, including a ditch situated along the north side of Highway 401, and a tributary to Buells Creek. Indirect fish habitat was also identified within the west end of the study area.

Potential Impacts

The following proposed construction activities have the potential to affect fish and fish habitat:

- Expansion of Highway 401 to an interim 6-lane and ultimate 8-lane cross-section
- Improvements to the management of stormwater (e.g. ditching)
- Culvert improvements (replace or line)
- Removal of the Buells Creek culvert beneath Highway 401
- Realignment of Buells Creek (closer to Ormond Street)

- Removal and replacement of the existing Ormond Street structure with a new structure that will span both Buells Creek and Ormond Street

The potential effects of the more common activities that may occur at or within 30 m of surface water features that provide fish habitat and culverts that convey watercourses that provide fish habitat are listed herein.

Channel Realignment/Bridge Construction

- Loss of existing habitat
- Net loss of habitat if new channel length is shorter than existing conditions
- Infilling floodplain fish habitat with temporary construction access ramps and/or abutments
- Removal of riparian vegetation and cover along the banks of a waterbody
- Removal of edge habitat (e.g., undercut bank, shallower areas with lower velocity, aquatic vegetation)
- Creation of barriers to fish movement (e.g., velocity barriers, alteration of the natural stream gradient)
- Introduction of sediments, concrete and other deleterious substances (e.g., salt, paint, solvents, oil and grease) into waterbodies
- Operation of machinery may impact habitat on the waterbody banks and bed and result in erosion and sedimentation
- Death of fish

Culvert Replacement/Extension

- Loss of habitat due to additional culvert length
- Changes to (or loss of) habitat if channel realignment is required for a culvert extension
- Infilling floodplain fish habitat with temporary construction access ramps
- Removal of riparian vegetation and cover along the banks of a waterbody
- Removal of edge habitat (e.g., undercut bank, shallower areas with lower velocity, aquatic vegetation)
- Creation of barriers to fish movement (e.g., perched crossings, velocity barriers, alteration of the natural stream gradient)
- Introduction of sediments, concrete and other deleterious substances (e.g., salt, paint, solvents, oil and grease) into waterbodies
- Operation of machinery may impact habitat on the waterbody banks and bed and result in erosion and sedimentation
- Death of fish

Culvert Maintenance

- Removal of woody debris that is important for cover and food production
- Flooding and excessive waterbody scouring if blockages are removed too quickly
- Excessive erosion and sedimentation from the use of equipment along the waterbody bank
- Disruption of critical fish life stages
- Replacement of eroded rock armouring can alter flows and fish movement patterns if done excessively
- Removal of riparian vegetation and cover along the banks or shoreline of a waterbody
- Removal of edge habitat (e.g., undercut bank, shallower areas with lower velocity, aquatic vegetation)
- Introduction of sediments, concrete and other deleterious substances (e.g., salt, paint, solvents, oil and grease) into waterbodies

Mitigation Measures

Detail Design

Direct and/or seasonal and indirect fish habitat was identified at several locations in the study area (please refer to Section 4.1.4). The spatial extent of fish habitat directly affected by the project will need to be determined once the following information is confirmed:

- Culvert dimensions
- The need for rock protection in the creek bed
- The need for channel realignments
- Details of other activities that may affect fish and fish habitat

Opportunities for habitat enhancement in the study area include repairs to the gabion baskets at Buells Creek (MTO Site 16X-0237/C0) and other bank stabilization measures on the south side of Highway 401. The addition of instream structure would enhance habitat in Buells Creek on the

north side of Highway 401. Seasonal barriers to fish passage (i.e., isolated pools) were observed in the tributary to Buells Creek but the pools provide summer refuge and should be maintained or replaced, as appropriate.

Opportunities for habitat enhancement through the addition of riparian vegetation should be considered on a site-specific basis during detail design.

Rock protection (waterbody material) is often added to the bed and/or banks of watercourses at both ends of culverts where extensions and replacements are proposed to reduce the risk of scour and erosion of the bed and banks of watercourses. The area of rock protection should be determined using the *Drainage Management Manual* (MTO 1997). The extent (area) of rock protection to be added and the area that will directly affect fish habitat should be determined during detail design and documented in a fisheries assessment.

If rock protection (waterbody material) is proposed within the bankfull channel, the extent (area) of rock protection to be added and the area that will directly affect fish habitat should be determined during detail design and documented in the aquatic effects assessment. The rock protection (waterbody material) particle size should be determined using expected water velocities and selected from Table 3 or Table 4 of Ontario Provincial Standard Specification (OPSS) 1005. The addition of Granular B to the waterbody material should be considered to maintain wetted habitat to the extent possible by reducing water loss among the interstitial spaces in the rock protection.

As part of the fisheries assessments recommended during detail design, Pathways of Effects (POEs) for land-based and in-water activities will need to be applied to determine the likelihood of the death of fish and/or HADD of fish habitat.

Fluvial geomorphology field studies are recommended during detail design to support channel realignment design for Buells Creek, the fisheries assessment, and DFO review of the channel realignment.

The following measures should be also considered during detail design to reduce the risk of impacts to fish and fish habitat:

- Design the replacement channel for Buells Creek using natural channel design principles such that it continues to provide habitat and fish passage
- If applicable, design other channel relocations using natural channel design principles
- Design drainage system to reduce changes in drainage to watercourses that provide fish habitat
- Design and plan activities and works such that loss of fish habitat or disturbance to fish habitat is reduced to the extent possible
- Design stormwater management measures to reduce effects on watercourses that provide fish habitat to the extent possible
- Design a rehabilitation/re-vegetation plan for long-term stability of the areas disturbed during construction
- For rock reinforcement below the normal high water level, use appropriately-sized material and install at a similar slope to the existing, maintain a uniform bank/shoreline and maintain a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile.

Construction Timing

The in-water construction window for watercourses in the study area where fish habitat was identified is July 1 to March 14 inclusive (i.e., in-water work is not permitted from March 15 to June 30) (MNRF 2020). The timing window does not apply to work above the high-water level. Additional timing considerations are as follows:

- Reduce the duration of in-water work to the extent possible
- Conduct in-water work during periods of low flow to allow work in water to be isolated from flows
- Schedule work to avoid wet, windy, and rainy periods that may increase erosion and sedimentation
- Allow time for re-stabilization and re-vegetation as appropriate prior to winter

See OPSS.PROV 182 for fish protection measures regarding fish transfers and fish screens.

General

The following general measures are applicable to the project and should be designed and implemented following the OPSSs listed further below:

- Limit access to banks or areas adjacent to watercourses to the extent required for construction activities
- Watercourse crossing (fording) is not permitted
- Manage and treat dewatering (or other) discharge water to reduce the risk of erosion and/or release of sediment-laden or contaminated water to surface water features
- Operate machinery on land above the high water level
- Operate, store, and maintain (e.g., refuel) equipment, vehicles, and materials in a manner that reduces the risk of the entry of deleterious substances to surface water features
- Equipment operating within 30 m of surface water features will be free of fluid leaks, invasive species, and noxious weeds

- Design and implement erosion and sediment controls (ESC) to contain/isolate the construction zone, manage site drainage/runoff and reduce the risk of erosion of exposed soils and migration of sediment to surface water features during construction and site restoration
- ESC measures should be maintained until disturbed ground has been permanently stabilized. The plan should include the following items:
    - Install effective ESC measures before starting work to reduce the risk of sediment entering surface water features
    - Regularly inspect, maintain and repair ESC measures during construction
    - Remove non-biodegradable ESC materials once the site is stable
- Develop a Spill Management Plan and have it on site for implementation in the event of an accidental spill
- Stabilize and re-vegetate areas of disturbed/exposed soil, as per the rehabilitation/re-vegetation plan.

Ontario Provincial Standard Specifications

The following OPSSs are applicable to the project:

- OPSS.PROV 180 - General Specification for the Management of Excess Materials
- OPSS.PROV 182 - General Specification for Environmental Protection for Construction In and Around Waterbodies and on Waterbody Banks
- OPSS.PROV 517 - Construction Specification for Dewatering
- OPSS.PROV 803 - Construction Specification for Vegetative Cover (issued in November 2020 to replace former OPSS.PROV 804)
- OPSS.PROV 804 - Construction Specification for Temporary Erosion Control (issued in April 2021 to replace the erosion control components of former OPSS 805)
- OPSS.PROV 805 - Construction Specification for Temporary Sediment Control (issued in November 2020 to replace the sediment control components of former OPSS 805)
- OPSS.PROV 825 - Construction Specification for Placement of Aggregates in Waterbodies
- OPSS.PROV 1005 - Material Specification for Aggregates - Waterbody

The OPSSs are applicable to the following general activities:

- **Equipment Use** - Use of equipment shall be in accordance with OPSS.PROV 182.
- **Dewatering and Temporary Flow Passage** - Dewatering and/or temporary flow passage shall be according to OPSS.PROV 517 and OPSS.PROV 182.
- **Fish Salvage** - Fish salvage operations shall be conducted in accordance with OPSS.PROV 182.
- **Preservation of Riparian Vegetation** - Removal of riparian vegetation shall be in accordance with OPSS.PROV 182
- **Erosion and Sediment Control** - Installation, monitoring, maintenance, and removal of temporary erosion and sediment control measures shall be according to OPSS.PROV 182, OPSS.PROV 804 and OPSS.PROV 805.
- **Placement of Aggregates in Waterbodies** - Use of aggregate in waterbodies shall be according to OPSS.PROV 825 and OPSS.PROV 1005.
- **Restoration of Disturbed Areas** - Vegetation protection and rehabilitation shall be in accordance with OPSS.PROV 182, OPSS.PROV 803 (Vegetative Cover, Non-Standard Special Provision - Amendment to OPSS.PROV 803) and OPSS.PROV 804.
- **Management of Excess Materials** - All excess material shall be managed in accordance with OPSS.PROV 180.

In consultation with DFO, MTO has developed the *Best Management Practices Manual* (MTO 2020c). The Best Management Practices (BMPs) and Table 2 of the Protocol were developed for routine activities in or near water with minimal to no impacts to fish and fish habitat. If a project is located within 30 m of the high water level of a waterbody and the activity is listed in Table 2 of the Protocol, it can proceed without a fisheries assessment (Step 1 of the Protocol). Mitigation measures must be implemented to reduce the risk of the death of fish or the harmful alteration, disruption or destruction (HADD) of fish habitat.

The BMPs streamline the regulatory review process for routine highway activities and provide mitigation measures to reduce the risk of the death of fish and HADD of fish habitat. A project can proceed without DFO review if the conditions and mitigation measures outlined in a BMP can be met (Step 3 of the Protocol). Where a BMP is used, an MTO Project Notification Form is completed and filed by MTO (Step 5).

If a project cannot meet the conditions of a BMP at Step 3 of the Protocol (MTO 2020a), a fisheries assessment is conducted to determine the likelihood of the death of fish and HADD of fish habitat (Step 4). Projects proceed to Step 5 (MTO Notification) when there are no federally listed SAR and it is determined that the death of fish and HADD of fish habitat is not likely. Where HADD is likely and/or where federally listed SAR are present, the project proceeds to step 6 of the Protocol where an MTO Request for Review Application Form is submitted to DFO for review under the *Fisheries Act.*

The applicability of Table 2 of the Protocol and/or BMPs will be determined during the detail design phase of the project.

Likelihood of the Death of Fish or HADD of Fish Habitat

Additional field data are required to document potential habitat use at the proposed bridge location. Design details, construction methods and additional mitigation measures (if required) are also necessary to update the Preliminary Fisheries Assessment and to determine if the project may result in the death of fish or HADD of fish habitat.

Recommendations and Next Steps

Design details, construction methods and additional mitigation measures (if required) will be necessary to update the impact assessment completed as part of this study.

The design details will be used to determine if BMPs (MTO 2020c) are applicable at Step 3 of the Protocol and/or to conduct a Fisheries Assessment at Step 4 of the Protocol to determine if the project may result in the death of fish or HADD of fish habitat. As part of the Fisheries Assessment at Step 4 of the Protocol, the following items must be completed:

- MTO Template D3 - Aquatic Effect Summary Table
- MTO Template D4 - Fish and Fish Habitat Impact Documentation

The MTO Project Notification Form(s) cannot be completed based on the Recommended Plan, since the form documents applicable BMPs or summarizes and provides supporting documentation of a Fisheries Assessment. The Project Notification Form(s) will need to be completed at Step 5 of the Protocol for the sites where work will occur at or within 30 m of fish habitat.

As noted above, a geomorphological assessment is recommended during detail design to support the design of the channel realignment of Buells Creek, as well as the fisheries assessment and DFO review.

7.1.4 Terrestrial Habitat

A Terrestrial Ecosystems Existing Conditions and Preliminary Impact Assessment Report was completed as part of this study, and is provided in Appendix B.

Potential Impacts

The Recommended Plan will require vegetation removal, earth clearing, and grading, and will result in the loss of approximately 23.6 ha of terrestrial habitat within the study area. Most of the proposed works will occur within the ROW and require little disturbance to natural vegetation cover and terrestrial habitat to accommodate construction activities. However, construction activities in some areas will extend beyond the current ROW to accommodate the highway's future footprint. Therefore, vegetation removal and earth grading will be required, which will result in a loss of natural vegetation communities, including meadows, forested communities.

Potential Disturbance to Wetlands

Approximately 1.12 ha of swamp and marsh communities are anticipated to be impacted by construction activities. These small wetland features are low quality and are unlikely to support wildlife habitat.

Potential Disturbance to Vegetation and Terrestrial Habitat

It is anticipated that the proposed works will disturb approximately 23.6 ha of vegetation cover and terrestrial habitat during construction. There will be temporary and permanent loss or disturbance to native vegetation communities because of the clearing required to accommodate construction activities (i.e., excavation, demolition, staging). These impacts are anticipated to be minor in nature.

The following impacts may also occur as a result of construction:

- accidental damage or loss of trees and other vegetation features because of site alteration or construction activities
- indirect temporary disturbance of noise, vibration, and vegetation removal to terrestrial wildlife habitat
- erosion and sedimentation into adjacent vegetation communities
- permanent loss of native vegetation due to the spread of non-native and invasive vegetation species into disturbed areas after construction

Potential Disturbance to Sensitive Features

Buells Creek will be impacted by the project. Buells Creek and its associated riparian corridor are classified by CRCA as a Flood Hazard/Screening Area within the regulatory floodplain. Lands within this area may be subject to O. Reg 148/06.

Approximately 1.95 ha of Significant Woodland, may also be impacted by construction activities.

Given that the study area is part of the Frontenac Arch Biosphere Reserve, this will be impacted by the project.

Potential impacts to sensitive features include the following:

- discharge/spills of contaminants/pollutants into Buells Creek
- sedimentation and erosion impacts, including transport of sediment into Buells Creek

- accidental damage or loss of trees and other vegetation features because of site alternation or construction activities
- indirect temporary disturbance of terrestrial wildlife habitat
- erosion and sedimentation into adjacent vegetation communities
- permanent loss of native vegetation due to the spread of non-native and invasive vegetation species into disturbed areas after construction

Potential Interference with Migratory Birds

Although not present during field investigations, there is potential for Barn Swallow, Cliff Swallow, Eastern Phoebe, and other migratory birds to nest under the structures within the study area.

Vegetation throughout the study area may also support nesting birds. Any work near active bird nests has the potential to disturb nesting behaviour or damage/destroy the nests, particularly if vegetation clearing occurs during the active breeding bird window (i.e., April 1 – August 31).

Potential Disturbance to Significant Wildlife Habitat

Five candidate SWH features were identified within the study area and were associated with deciduous woodlands, wetlands, and open meadow communities:

- raptor wintering area
- bat maternity colonies
- reptile hibernacula
- woodland raptor nesting
- habitat for SOCC

The best habitat for these features generally occurs within interior areas of habitats where disturbance levels are low. Although portions of the proposed area of impact are forested and contain trees, the likelihood of impacts of impacts to candidate SWH are low for this reason.

Potential Disturbance to Species at Risk and Species of Conservation Concern

Suitable habitat for SAR and SOCC in the study area is primarily associated with deciduous forests, open meadow, and wetland communities. Although portions of the proposed area of impact are forested and contain trees, the likelihood of impacts to SAR and SOCC are low as best habitats occur beyond the ROW.

Species at Risk

The following eight SAR have potential to be directly impacted during construction activities due to their behaviour, habitat preferences, or movement patterns:

- **Butternut** – one butternut tree was observed during field investigation, but is not anticipated to be impacted by construction activities. Other suitable habitats including forest edges, open areas, and riparian corridor may support this species.
- **Blanding's Turtle** – interaction with Blanding's Turtle during construction activities could result in direct mortality. The riparian corridor and wetlands in the study area may provide suitable habitat for Blanding's Turtles and individuals may also travel through work zones. They are particularly vulnerable during peak activity periods (April 1 to October 31), including movement between wintering and nesting sites, nesting in the road shoulder and basking or foraging in the ROW.
- **Gray Ratsnake** – construction activity can result in direct mortality to snakes. Snakes may be vulnerable during emergence from a hibernaculum, re-entrance, and basking periods, and may preferentially seek out construction materials to bask under. Peak activity for snakes is typically between late April and late June. Roadside meadows and ditches may provide habitat for the Gray Ratsnake. With implementation of site-specific mitigation measures (please refer to 0), no direct impacts are expected.
- **Bat SAR (Little Brown Myotis, Northern Myotis, Eastern Small-footed Myotis, and Tri-coloured Bat)** - bat maternity roost habitat is present within deciduous forests in the study area and may be impacted by construction activities. Tree removal can result in direct mortality to bat SAR and loss of habitat.

Species of Conservation Concern (SOCC)

Nine SOCC have potential to be directly impacted during construction activities due to their behaviour, habitat preferences, or movement patterns.

Disturbance to habitat of Common Nighthawk, Eastern Wood-Pewee, Wood Thrush, Canada Warbler, and Evening Grosbeak is not anticipated because this species' habitat is either outside the ROW or unlikely to be occupied near Highway 401 where tree removals are proposed. Potential impacts to species that are more tolerant of disturbed habitats, such as those found in the ROW, or which may be encountered in work zones due to their behaviour or movement patters, are identified below:

- **Monarch** - primarily found in areas containing milkweed and wildflowers (including goldenrods, asters, and purple loosestrife). The larvae occur only where milkweed exists, whereas adults are more generalized, feeding on a variety of wildflower nectar. Monarch and its habitat were observed in roadside meadows, which will experience temporary and permanent disturbance during construction.

- **Yellow-banded Bumble Bee** - – Meadow habitats that contain flowering plants are present in the ROW, which will experience temporary and permanent disturbance during construction. Approximately 11.22 ha of mixed meadow are expected to be impacted by construction activities.
- **Western Chorus Frog** - Construction activities can result in direct mortality to amphibians as this species may be present within drains and wetlands in the ROW and may be present in work zones. These wetland habitats will experience temporary and/or permanent disturbance during construction.
- **Eastern Milksnake** - Construction activities can result in direct mortality to snakes. Snakes may be vulnerable during emergence from a hibernaculum, re-entrance, and basking periods, and may preferentially seek out construction materials to bask under. Peak activity for Eastern Milksnake is typically between late April and late June.
- **Turtle SOCC (Snapping Turtle, Eastern Musk Turtle, and Midland Painted Turtle) -** Interaction with turtle SOCC during construction activities could result in direct mortality. The Buells Creek and wetlands in the ROW may provide suitable habitat for SOCC turtles and individuals may also travel though work zones when seeking nesting sites, such as the sand/gravel highway shoulders.
- **Barn Swallow** - although not present during the 2021 field investigations, structures in the proposed area of impact may provide suitable habitat (i.e., vertical walls, ledges) and Barn Swallows may establish nests at new locations in future nesting seasons.

Mitigation Measures

The standard measures described herein are recommended for the protection and reduction of impacts to natural features, general wildlife and wildlife habitat, and to reduce the risk of potential impacts to SAR and SOCC.

Site-specific mitigation recommendations for natural features, SWH, or habitat of SAR/SOCC confirmed in the study area or assumed to be present, are discussed below.

Standard Environmental Protection Measures

Mitigation measures for sedimentation, erosion, and dust control should be implemented to prevent sediment and dust from entering sensitive natural features. The primary principles associated with sedimentation and erosion protection measures are to:

- Reduce the duration of soil exposure
- Retain existing vegetation, where feasible
- Encourage re-vegetation
- Divert runoff away from exposed soils
- Keep runoff velocities low
- Trap sediment as close to the source as possible

To address these principles, the following mitigation measures are recommended:

- Silt fencing and/or barriers are recommended along the work zone where there is potential for sedimentation of watercourses or wetlands, or inadvertent encroachment of construction vehicles into natural areas of Significant Woodlands, wetlands, and watercourses.
- Avoid entering any natural areas beyond the barrier fencing with equipment and avoid excess vegetation removal.
- Stabilize exposed soil areas (native seed mixes; sourced locally if possible) and re-vegetate through the placement of seed and mulching or seed and an erosion control blanket, promptly upon completion of construction activities. All disturbed substrates are recommended to be re-vegetated using seed mixes of species that are native to the site and suitable for site conditions. Introduce seed to disturbed substrates as soon as feasible following construction, and sediment fencing is recommended to remain in place until vegetation cover is re-established.
- Re-fuel equipment 30 m away from watercourses to reduce potential impacts if an accidental spill occurs.
- In addition to any specified requirements, make additional silt fence available on site, prior to grading operations, to provide a contingency supply in the event of an emergency.
- Monitor all erosion and sedimentation controls regularly and properly maintain, as required. Remove controls only after the soils of the construction area have been stabilized and adequately protected or until cover is re-established.
- Monitor limits of construction adjacent to natural features during construction (along with erosion and sedimentation control measures) to ensure that the limits are maintained with respect to vehicular traffic and soil or equipment stockpiling.
- Avoid stockpiling excess materials on site within proximity of Significant Woodlands, wetlands, and watercourses.
- Restore any disturbed natural areas to pre-construction conditions.

Vegetation Protection

Precise limits of vegetation removal will be confirmed during detail design. Vegetation removal should be limited to the extent possible and undertaken outside the migratory bird nesting period (April 1 to August 31).

Sediment fencing will reduce the likelihood of release of sediments and other deleterious substances into adjacent areas of natural vegetation and should be used to clearly mark and separate work areas from sensitive natural features (e.g., significant woodlands, wetlands, and watercourses).

Topsoil and organic matter should be salvaged and reused in areas disturbed during construction, as appropriate. Replaced soils will contain native seed bank, which will help facilitate successful revegetation. Post-construction seeding of the disturbed ROW should be done with a suitable native seed mix and in consideration of Monarch and Yellow-banded Bumble Bee habitat. Seed mixes should include fast-growing, short-lived perennial cover crop to stabilize soil and reduce competition from weedy exotics. Native cover crops are preferred. New seed should be introduced to disturbed substrates as soon as feasible following construction (within 15 days for areas less than 200 m from a watercourse, and 45 days for other areas), and sediment fencing should remain in place until vegetation cover is re-established. Seeded areas shall receive water either through precipitation or irrigation after every seven successive days without rainfall for the first two months after seeding.

A detailed landscape restoration plan should be developed for all areas disturbed during construction, as well as any proposed compensation areas, and incorporated into the detail design package. The plan would include recommendations for use of native species in restoration planting as well as methods for management of invasive species.

Invasive Phragmites Management

The invasive Common Reed (Phragmites) is a ‘restricted’ plant species regulated by the Ontario Invasive Species Act (2015), and under the Act, it is illegal to import, deposit, release, grow, buy, sell, lease, or trade this species. Phragmites was identified throughout the study area, typically in in roadside ditches and other drainage features and low-lying areas. If work will occur in or near features with Phragmites, equipment will be cleaned before leaving the site to avoid transport of soil containing Phragmites to other sites.

Protection of Migratory Birds

Although no nests were observed under any of the five structures at the time of field investigations, there is potential for such structures to support nests of migratory birds in subsequent seasons.

The MBCA protects nests of migratory birds from damage while they are active, including nests in vegetation and on structures. For all migratory birds, the core nesting period is identified as April 1 to August 31. Vegetation clearing during nesting periods in migratory bird breeding habitat can destroy active nests and contravene the MBCA. Vegetation clearing is recommended to occur outside the core nesting period to eliminate the need for migratory bird nest searches. If work must take place during the core nesting period and the area is small enough to be effectively searched for nesting birds (e.g., isolated trees or hedgerows), then a breeding bird survey can be completed by a Qualified Biologist.

The pre-construction breeding bird survey is recommended to occur at structures proposed for rehabilitation/removal within the work zone. The area where bird nests may be impacted must be searched within five days prior to the work commencing. If breeding pairs are located, then they will be protected with a buffer until the nest is no longer active.

If an active nest is observed during construction, a designated buffer will be delineated within which no activity will be allowed to occur while the nest is active (i.e., with eggs or young). The radius of the buffer will also be determined by a Qualified Biologist. Once the nest is determined to be inactive (e.g., the young have fledged the nest), clearing and other activities in the area may proceed.

Wildlife Protection

The following environmental mitigation and protective measures for wildlife and wildlife habitat are recommended:

- construction equipment and vehicles are to yield to wildlife
- inform construction personnel not to threaten, harass or injure wildlife
- If wildlife is encountered during construction, personnel are required to move away from the animal and wait for the animal to move off the construction site. If slow-moving wildlife (e.g., turtles, snakes) are observed on the road and are in danger, and if safe to do so, they should be moved off the road by gently guiding the individual in the direction it was traveling. Handling of SAR is not permitted without an ESA authorization.

Site-specific Protection Measures

Site-specific protection measures are required for sensitive species or habitats that may be present within the study area and where standard mitigation measures alone do not provide sufficient protection.

Wetlands

Standard Sediment and Erosion Control measures are recommended where work will occur within 30 m of wetland communities.

Woodlands

Newly created edges that are cut along existing woodlands and significant woodlands should be addressed with restoration plantings to protect and mitigate for potential negative effects, such as increased sunlight penetration, susceptibility to windthrow, desiccation, and spread of invasive species. Restoration plans should use native species that are tolerant of the site conditions, including roadside stresses such as salt, pollution, and soil compaction. Restoration should include broadcast seeding to replace seed banks that are lost, as well as planting of woody shrubs and trees to create vertical structure. Monitoring plans should track survivorship and effectiveness of restoration plans and include recommendations to adapt management as appropriate.

Species at Risk and Species of Conservation Concern

The mitigation measures presented below follow general guidance for the protection of SAR/SOCC and are consistent with approved measures implemented on similar projects in Ontario. Species-specific measures are provided for species commonly encountered along roadways or in construction zones, however these are not project or site-specific. Further field investigations, including targeted surveys, shall be undertaken at detail design to confirm the presence of SAR or SOCC and their habitat. Authorization requirements, if any, for SAR will be determined at detail design.

The following mitigation provides recommendations to reduce the risk to SAR and SOCC through avoidance of habitat features, timing windows and observations of potential refuges.

General mitigation to reduce impacts to SAR or SOCC and their habitats include:

- Inform on-site personnel of the potential presence of the SAR/SOCC identified in the study area, obligations under the ESA (2007), and recommended actions in the event of an encounter.
- Species listed as endangered or threatened on the SARO list that are present in the study area must be protected from harm and harassment.
- Any SAR that is incidentally encountered in the study area must be allowed to leave of its own accord. Activities within 20 m should cease until the individual disperses. Construction machinery/equipment must maintain a minimum operating distance of 20 m from the individual until it disperses from the work zone of its own accord.
- Should on-site personnel be unable to allow an incidentally encountered SAR to disperse from the active construction area under its own ability, MECP must be contacted immediately for additional guidance.
- Any SAR that is encountered in the work zone should be reported to the MECP staff within 48 hours of the observation or the next working day, whichever comes first.
- Handling of SAR is not permitted without an ESA authorization.
- If an injured or deceased SAR is found, the specimen must be placed in a non-airtight container that is maintained at an appropriate temperature and MECP must be contacted immediately for additional guidance.
- Temporary alterations to SAR habitat must be limited to the duration and spatial extent possible and be remediated upon completion of activity and monitored as necessary

Butternut

Treed habitats are present within the proposed area of impact and will experience permanent disturbance where tree removals are proposed. There is potential that Butternut trees are present within the treed habitats. The following measures are recommended to mitigate potential impacts to Butternut.

To identify Butternut trees within the work zone, a follow-up survey is recommended during detail design, and during leaf-on conditions within, and 50 m adjacent to, the work zones. If a butternut health assessment is required, guidance within the *Butternut Assessment Guidelines: Assessment of Butternut Tree Health for the Purposes of the Endangered Species Act*, 2007 will be followed.

Monarch

Construction activities with the potential to harm Monarch eggs, caterpillar or pupae (e.g., vegetation clearing in meadow areas) should not be undertaken during the larval period which is approximately May 1 to September 30 (Mission-Monarch 2020).

If vegetation clearing will proceed when Monarch larvae may be present (May 1 to September 30), inspection of milkweed plants is recommended to locate Monarch larvae. If larvae are present, they may be moved to a location that is suitable and safe under the direction of a qualified professional. Monarch caterpillars may be moved to other milkweed plants; for other larval stages (i.e., eggs and chrysalis), entire milkweed plants should be transplanted.

Milkweed and nectar producing plants should be included in seed mixes for areas restored to meadow to provide habitat for Monarch. Planting should follow mitigation recommendations from Section 7.1.4.

Reptiles and Amphibians

General mitigation measures may not provide sufficient protection for reptiles and amphibian. As such, avoidance of sensitive wildlife periods and temporary wildlife exclusion are recommended s.

The peak active season for reptiles and amphibians is from approximately April 1 to October 31. Installation of wildlife exclusion fencing is recommended before May 15 or after September 15 (i.e., outside of key breeding period) to define work zones and restrict the movement of reptiles and amphibians into the working area. If construction must be initiated during the turtle nesting or snake gestation season (approximately June 1 to September 1), a qualified biologist will visually inspect the site for evidence of nesting or individual reptiles and direct installation of construction barrier fencing to avoid nests. If it is not possible to isolate a nest from construction, work will be delayed until it is determined that the nest no longer includes viable eggs (hatchlings have emerged, or eggs were predated).

Potential snake hibernation sites (rock outcroppings or stumps extending below-grade, or animal burrows) should not be disturbed during the hibernation period (November 1 to March 31). If removal of above-ground habitat features (rock slabs or piles, brush) is needed, these features will be retained outside the active work zone during construction and returned post-construction to the same or a nearby location.

During ditching and grading activities undertaken between April 1 and October 31, disturbance will be limited to the greatest extent possible to protect reptiles or amphibians that may be present. A spotter could be used to identify individuals present in the work area.

Bat Species at Risk

Trees > 10 cm DBH are present and may be impacted by construction activities. These trees may be used by bat SAR as maternity habitat.

Trees that have the potential to be used as maternity habitat by bat SAR may be present within the areas proposed for vegetation removal. To identify potentially suitable bat SAR trees, follow-up surveys (during detail design) are recommended during leaf-off in areas where vegetation removal is proposed. Trees will be surveyed to identify trees that are >10 cm DBH, with cavities or loose, peeling bark and will be completed following the guidance outlined in MECP's survey protocol: *Treed Habitats – Maternity Roost Surveys* (2022), which references the *Bats and Bat Habitats: Guidelines for Wind Power Projects*. If potential bat trees are identified within the area proposed for removal, acoustic surveys or maternity exit surveys may be needed prior to tree removals.

Additionally, to further reduce the likelihood of harm to bats, removal of trees > 10 cm DBH is recommended to take place outside the period when bats use trees for maternity roosts. Myotis species typically give birth in late-May to early-June, and females fly with newborn young until they become too heavy. Young begin to fly in mid-to late-June, at age three to four weeks. Rearing is completed in August when the bats move to hibernacula. Therefore, tree removal should not occur between May 1 to August 31. If tree clearing is required within this window, maternity exit surveys may be conducted prior to the tree removals, as mentioned above. Maternity exit surveys are conducted during the evening and should include visual and acoustic surveys using accepted protocols.

Consultation with MECP is recommended prior to any tree removals in order to receive up-to-date guidance on appropriate surveys and mitigation measures to remain compliant under the ESA.

7.2 Socio-Economic Environment

7.2.1 Land Use

Land use designations in the study area are not expected to change as a result of the Recommended Plan.

The Recommended Plan supports the transportation infrastructure required to maintain a high level of service on the provincial highway system for the movement of people and goods.

Property

The Recommended Plan, for the ultimate 8-lane expansion, will result in impacts to a total of 29 properties. One property will require full acquisition. Table 28 summarizes the property impacts associated with the Recommended Plan.

Table 28: Summary of Property Impacts

Property Type	Number	Area (ha)
Business	16	2.70
Private	3	0.31
Public	10	0.63
Total	29	3.64

A preliminary Property Request Plan has been prepared for this study and is on file with MTO.

Traffic Operations

As described in Section 6.14.1, closures of Highway 401 will be required to accommodate the demolition of the existing Stewart Boulevard bridge and the North Augusta Road bridge. These closures will require overnight detours using local municipal roads. Replacement of the Ormond Road structure will also impact travel on the municipal road system. Preliminary detour plans have been prepared as part of this study, in consultation with the City of Brockville and local emergency service providers. The preliminary detour plans will be confirmed during detail design.

Emergency Services

The study team prepared preliminary detour plans in consultation with emergency service providers. These plans will be confirmed during detail design. MTO will continue to consult with emergency service providers during this phase of project planning.

Student Transportation

There may be temporary minor delays to student transportation services during construction. Delays are expected to be minor during construction, but construction staging plans will be confirmed during detail design, in consultation with affected student transportation services.

Active Transportation

The MTO is committed to sustainable transportation and active transportation as outlined in the MTO *Statement of Environmental Values* (2008). The technically preferred plan will improve active transportation facilities along Stewart Boulevard and North Augusta Road, as well as reinstate the existing facilities on Ormond Street described in Section 6.7. The recommended improvements to

the active transportation facilities (i.e., MUPs) are subject to cost sharing agreements with the City of Brockville.

Impacts to the Brocktel or 'Black and Decker' Trail recreational trail system have been identified as part of the Recommended Plan (as part of the ultimate 8-lane Highway 401 footprint). The impacts are anticipated to be minor; however, will be confirmed during detail design.

7.2.2 Potentially Contaminated Property

Twenty-two (22) properties were identified as having, high, moderate or low potential for environmental concern or contamination. As part of the Recommended Plan, acquisition of approximately eight potentially contaminated properties may be required, three of which have a high potential for concern, four have moderate potential for concern, and one has low potential for concern. Additional site screening will be required, in accordance with the requirements of the MTO documents *Environmental Guide for Contaminated Property Identification and Management* (MTO, 2006) and *Environmental Reference for Highway Design* (MTO, 2013).

If building demolition will be required as part of the Recommended Plan, designated substance surveys should be completed for buildings or structures prior to demolition.

Soil and groundwater that will be disturbed during construction should be sampled and analyzed for metals and inorganics (including electrical conductivity and SAR), polycyclic aromatic hydrocarbons (PAH) and petroleum hydrocarbons (PHC). In addition, areas within or adjacent to PSOC should be analyzed for the specific contaminants of concern. The selection of soil for analysis should take into consideration the presence of anthropogenic substances such as debris/waste and, evidence of PHCs, solvents, or other unusual odours or staining.

Ontario Regulation (O.Reg.) 406/19 (*On-Site and Excess Soil Management*) and the associated document *Rules for Soil Management and Excess Soil Quality Standards* referenced by O.Reg. 406/19 should be followed for soil that is excavated and managed on-site or off-site during construction. In addition, it is understood that salt-related parameters, such as electrical conductivity (EC) and sodium adsorption ratio may not be considered to be contaminants when related to the application of a substance to surfaces for the safety of vehicular or pedestrian traffic under snow or ice conditions (O.Reg. 153/04 s.49.1.1); however, soil or water impacted by salt should be managed according to O.Reg. 406/19 if it is to be removed from the right-of-way.

Should excess water be generated during future construction activities, water quality analyses should be conducted to determine appropriate management methods. This work should be done in coordination with a QP_{ESA} as defined by O.Reg. 153/04, to maintain data quality and provide an appropriate assessment of water quality.

Should evidence of soil or water impacts be identified during construction (e.g., staining, odours, petroleum hydrocarbon sheen) samples should be collected for laboratory analyses to confirm concentrations of potential contaminants so as to appropriate manage the material in accordance with O.Reg. 406/19, and protect workers according to health and safety guidelines.

7.2.3 Designated Substances and Hazardous Materials

Based on the findings of the Designated Substances and Hazardous Materials Assessment, the recommendations pertaining to the handling, removal, disposal and management of the identified designated substances and hazardous materials are provided below.

Arsenic/Lead

Work that may disturb any lead-containing materials should following the recommendations in the following documents:

- *Environmental Abatement Council of Ontario (EACO) Lead Guideline for Construction, Maintenance or Repair,* dated October 2014
- *Ministry of Labour (MOL) Lead Guideline for Construction, Renovation Maintenance or Repair*, issued October 2014

Silica

Work that may disturb silica-containing materials, should follow the recommendations provided in the document entitled:

- Guideline: Silica on Construction Projects, issued by the Ministry of Labour (MOL), dated April 2011

Benzene

Benzene as a constituent of hydrocarbon-based mixtures is not expected to be a worker exposure concern.

Mercury

Mercury vapour within light fixtures poses no risk to workers or occupants provided the mercury containers remain intact and undisturbed. Complete removal of mercury-containing equipment is required prior to activities that may disturb the equipment. Prior to work that would disturb the light tubes, they must be removed and stored in a safe, secure location or disposed of following the requirements of *R.R.O. 1990, Regulation 347 General - Waste Management*, as amended (R.R.O. 1990, Reg. 347) under the EPA

The recommendations for handing Arsenic/Lead also apply to the handling of mercury in paints and adhesives.

Polychlorinated Biphenyls

Fluorescent lamp ballasts that may contain PCBs can be managed in place, where these items are operating and in good condition.

When decommissioned, verify the PCB content of fluorescent lamp ballasts as per the Environment Canada publication Identification of Lamp Ballasts Containing PCBs, 1991. Handle, store and dispose of PCB-containing ballasts in accordance with Federal Regulation SOR/2008-273, under CEPA and R.R.O. 1990, Reg. 362.

Should another material suspected to contain PCBs become uncovered during demolition activities (i.e., dielectric fluids, hydraulic fluids), all work in the areas that may disturb the material should be stopped. Samples of the suspect material should be submitted for laboratory analysis to determine if PCBs are present. Confirmed PCBs should be handled in accordance with Federal Regulation SOR/2008-273 and R.R.O. 1990, Reg. 362, under the EPA.

A copy of the Designated Substances and Hazardous Materials Assessment Report is provided in Appendix E.

7.2.4 Air Quality and Greenhouse Gas Assessment

Operational Air Quality

An air quality assessment was completed to characterize existing air pollutant emissions (2022) and predict air quality effects within the study area after implementation of the project, in consideration of the Future Interim Build (2032) and Future Ultimate Build (2042) scenarios. Predicted future emissions and effects with implementation are also compared to predicted future emissions and effects without implementation for five assessment scenarios, including:

- 2022 - Existing Conditions, Highway 401 (4-lanes)
- 2032 – Future Interim No Build, Highway 401 (4-lanes)
- 2032 – Future Interim Build, Highway 401 (6-lanes), replacement of interchanges
- 2042 – Future Ultimate No Build, Highway 401 (6-lanes), replacement of interchanges
- 2042 – Future Ultimate Build, Highway 401 (8-lanes), replacement of interchanges

The horizon years 2032 and 2042 have been selected for the purpose of analysis only and does not represent the actual timing of implementation of the project. The air quality assessment was completed following guidance from the “Ministry of Transportation Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects” (MTO Guide).

The air contaminants of potential concern (CoPCs) selected for this study were based on the most relevant transportation-related contaminants as listed in the MTO Guide and include nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter with diameter less than 10 micrometres (PM_{10}), particulate matter with diameter less than 2.5 micrometres ($PM_{2.5}$), acrolein, benzene, 1,3-butadiene, benzo(a)pyrene (B(a)P), acetaldehyde and formaldehyde. The potential GHG emissions were assessed and quantified as CO_2 equivalents (CO_2e).

Baseline ambient air quality conditions were characterized by using historical data obtained from the National Air Pollution Surveillance Network and MECP for stations located near the study area. The latest version of the US EPA’s Motor Vehicle Emission Simulator (MOVES3) model was used to estimate current and future emission rates from motor vehicle traffic. The US EPA dispersion model, CAL3QHCR (which is an approved model by the MECP) was used to predict the maximum 1-hour, 8-hour, 24-hour and annual average ground level concentrations at special receptors for the five assessment scenarios.

Special receptors are placed to assess data at points where human activity more regularly takes place. The MTO Guide recommends that the local air quality impacts be studied within a distance of 500 m from a project at both sensitive (residences) and critical receptors (hospitals, retirement homes, childcare centres). The special receptors located within the study area include existing residences and potential future residences (to be located north of Parkedale Avenue and west of Stewart Blvd.), places of worship, schools/daycare facilities, retirement homes and hotels. Sixty (60) receptors were identified to be within the study area, nineteen of which are critical. These receptors were considered in the assessment.

Based on the results of the assessment, the following was noted:

The results of the air quality assessment identified that while the project may contribute to CoPC, exceedances are expected to be small, and the incremental increase in GHG emissions are expected to be insignificant. It is expected that with ongoing advancements in on-road vehicles to lower emissions along with transitioning to electric vehicles, the quantities of air contaminants and GHGs released to the atmosphere from transportation sources will be lower in the future. Implementation of the project is expected to improve the future traffic flow on the local road network with less congestion relative to the Future Interim No Build scenario.

Measures to minimize impacts of particulate matter and NOx emissions that could be considered as part of this project includes incorporating vegetation barriers in the landscape design. The effectiveness of trees and plants as physical barriers for particulate matter (dust) or gaseous contaminants control depends on the density and height of the vegetation. In general, a vegetation barrier should be thick (approximately 6-metres or more) and have full leaf and branch coverage from the ground to the top of the canopy with no gaps in-between or underneath the vegetation. Typically, evergreen species are more effective than deciduous for this objective and the barrier should be located close to the emissions sources.

Air Quality During Construction

During construction of the project, particulate matter (dust) will be the primary CoPC. Other CoPCs such as NO_2 and VOCs will also be emitted from equipment used during construction. As the construction activities will be short-term and intermittent, CoPC emissions are expected to be minor provided adequate mitigation measures are implemented. GHGs including CO_2, CH_4 and N_2O are also expected to be emitted from equipment used during construction. The Environment and Climate Change Canada (ECCC) guideline “Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities” provides recommendations for mitigation measures to

reduce construction emissions. These measures include material wetting or use of chemical suppressants to reduce dust, the use of wind barriers to limit exposed areas which may be a source of dust, equipment washing, implementation of anti-idling policies and the use of efficient equipment to reduce the unnecessary release of CoPCs and GHGs. It is recommended that appropriate best management practices be followed during construction. With implementation of mitigation measures, the emissions from the construction phase and resulting changes in local air quality can be controlled and reduced.

A copy of the Air Quality Assessment Report is provided in Appendix N.

7.2.5 Noise Impact Assessment

Operational Noise

A noise impact assessment was prepared to assess the potential changes in traffic noise associated with the proposed reconfiguration of the study area interchanges and future footprint of Highway 401. In addition, the noise assessment determined potential noise impacts at nearby noise sensitive areas (NSAs) associated with the project, and to investigate the feasibility of noise mitigation, as needed, in accordance with the MTO Environmental Guide for Noise.

To determine the project noise impact, a comparison was made for predicted future noise levels with the project (Future Build) and without the project (Future No-build) for both interim and ultimate project footprint scenarios. The following scenarios were considered for the assessment:

- 2022 - Existing Conditions, Highway 401 (4-lanes)
- 2032 – Future Interim No Build, Highway 401 (4-lanes)
- 2032 – Future Interim Build, Highway 401 (6-lanes), replacement of interchanges
- 2042 – Future Ultimate No Build, Highway 401 (6-lanes), replacement of interchanges
- 2042 – Future Ultimate Build, Highway 401 (8-lanes), replacement of interchanges

The horizon years 2032 and 2042 were selected for analysis and do not represent the actual timing of the highway improvements or configuration of the interchanges. Where predicted Future Build noise levels increased more than 5 dB over Future No-build and/or exceed 65 dBA, mitigation was investigated. For the mitigation to be implemented, it must be technically, economically, and administratively feasible.

Thirty-two (32) representative receptors were considered as part of the assessment, including three (3) proposed developments, that were identified as outdoor living areas (OLAs) of the existing and planned NSAs for the project. The NSAs were identified based on a review of aerial imagery, the City of Brockville development information, and the findings of the Air Quality Assessment (please refer to 7.2.4). The receptors identified in the Air Quality Assessment without an OLA are excluded from this assessment.

Existing noise barriers are located on the south side of Highway 401, between Stewart Boulevard and North Augusta Road, and east of North August Road. The existing noise barrier located to the east of Stewart Boulevard will be relocated to accommodate the Highway 401 widening and bridge replacements, as part of the Recommended Plan.

At one receptor (residence), an increase in sound levels of up to 2.6 dB for the interim project footprint and up to 2.9 dB for the ultimate project footprint was predicted, and both levels are within 5 dB. Predicted Future Build noise levels exceeded the absolute limit of 65 dBA at three (3) receptors for future interim project footprint, and threat seven (7) receptors for future ultimate project footprint. It should be noted that noise mitigation was investigated only for the existing receptors.

Noise barriers reduce noise levels at protected receptors by blocking the path of sound waves emanating from the source towards the receiver, and by absorbing or reflecting the incident sough energy away from the receptor. For noise barriers to be considered a viable mitigation measure, the investigated noise barrier should be administratively, technically and economically feasible.

The relocation of the existing noise barrier situated between Stewart Boulevard and Ormond Street will be constructed to current MTO standards (i.e., 5 m in height). The feasibility of two new noise barriers and an upgrade of the existing noise barrier were investigated as part of this study. Although one of the noise barriers considered met the criteria for technical feasibility, it did not meet the criteria for economic feasibility. The remaining noise barriers did not meet technical feasibility criteria. Therefore, new noise barriers were ruled out as mitigation and not recommended for this project.

Construction Noise

Construction noise for the project was assessed in accordance with the applicable MECP Publication NPC-115 (MECP 1977) and NPC-118 (MECP 1982) for construction, and the City of Brockville Noise By-Law (No. 076-2-21). The typical sound levels for most of the construction equipment are within the MECP and City noise limits. However, there is potential for higher sound levels than the permissible limits for some equipment. Once equipment and construction schedules are finalized, the equipment noise data should be reviewed during detail design to confirm that noise emissions are within the limits. If the sound levels are higher than the limits, noise control options may be required. Methods to minimize construction noise impacts should be included in the Construction Code of Practice.

To minimize the potential for construction noise impacts, it is recommended that provisions be written into the contract documentation for the contractor, as outlined below.

- All equipment will be properly maintained to limit noise emissions. As such, all construction equipment will be operated with effective muffling devices that are in good working order

- There should be explicit indication that Contractors are expected to comply with all applicable requirements of the contract and the City of Brockville noise by-law. Enforcement of noise control by-laws is the responsibility of the Municipality for all work done by Contractors.
- The Contract Documents will contain a provision that any initial noise complaint will trigger verification of construction noise and typical noise control measures
- In the presence of persistent noise complaints, all construction equipment will be verified to comply with the City, MECP NPC-115 and NPC-118 limits.
- In the presence of persistent complaints and subject to the results of a field investigation, alternative noise control measures may be required, where reasonably available. In selecting appropriate noise control and mitigation measures, consideration should be given to the technical, administrative, and economic feasibility of the various alternatives.

A copy of the Noise Impact Assessment Report is provided in Appendix O.

7.3 Cultural Heritage Environment

7.3.1 Archaeological Resources

The findings of the Stage 1 archaeological assessment identified portions of the study area that retain potential for the identification and recovery of archaeological resources. In accordance with Section 1.3.1 and Section 7.7.4 of the MCM's 2011 Standards and Guidelines for Consultant Archaeologists (Government of Ontario 2011), Stage 2 archaeological assessment is required for any portion of the project's anticipated construction which impacts an area of archaeological potential. A Stage 2 archaeological assessment is being undertaken for the Recommended Plan in 2023. Additional archaeological assessment activities (i.e., Stage 3/4 mitigation) will be undertaken, if required.

A copy of the Stage 1 Archaeological Assessment report is provided in Appendix F.

7.3.2 Built Heritage Resources and Cultural Heritage Landscapes

The built heritage resource at 2801 Oxford Avenue (BHR-2) is located within approximately 30 metres of proposed project activities. Although the effects of traffic and construction vibrations on historic resources are not fully known, negative effects have been demonstrated on buildings with a setback of less than 40 metres from the curbside. Therefore, mitigation options have been prepared to lessen the potential for indirect impacts to BHR-2.

The preferred option is to avoid BHR-2 by establishing a buffer zone around the heritage attributes of the built heritage resource to avoid construction activity within 50 metres. This should include appropriate preventive measures such as mapping on construction maps or plans and temporary fencing. Staging and laydown areas should also be non-invasive and avoid the BHR-2. Where avoidance is not feasible, the alternative option should be applied.

The alternative option is to retain a qualified person(s) to complete a pre-construction vibration assessment to determine acceptable levels of vibration given the site-specific conditions (including soil conditions, equipment proposed to be used, and building characteristics). Should BHR-2 be determined to be within the zone of influence, additional steps should be taken to secure the building from experiencing negative vibration effects (i.e., adjustment of machinery or establishment of buffer zones). Where BHR-2 is determined to be outside the zone of influence, no additional mitigation strategies are required.

A copy of the Cultural Heritage Resources Assessment Report is provided in Appendix G.

7.4 Landscape Composition Plan

A Landscape Composition Plan was developed for the Recommended Plan to identify areas for potential vegetation retention and renewal.

Five stormwater management areas are proposed to provide for quantity and quality treatment. Planting improvements will meet MNRF Stormwater Management Plan and SWMP Guidelines, and will include a mix of native trees, shrubs and grasses.

Two gateway feature relocations (i.e., City of Brockville signage) are recommended to highlight the presence of the existing feature. The design of the feature and plantings will be coordinated with the City of Brockville, and will provide a mix of deciduous and coniferous species of trees and shrubs. Native, non-invasive species tolerant of drought and salt are preferred in the design of these features.

Eight proposed reforestation planting locations are proposed and recommended to provide a mix of 50-60 mm cal. deciduous trees, and 200 cm high coniferous trees with a diversity of shrub species. Native, non-invasive species tolerant of drought and salt are preferred.

Nine accent planting locations to provide a mix of large deciduous and coniferous species of trees. Native, non-invasive species tolerant of drought and salt are preferred.

Three noise barrier locations are present and provide an opportunity for visual interest by providing context sensitive materials, colours, and shapes. Plantings will be provided along the wall where possible, and will include a mix of native trees, shrubs and grasses.

To enhance fish habitat along Buells Creek, it is recommended that realignment be coordinated with fisheries biologists and fluvial geomorphologists. Creek embankments will be revegetated with a variety of native, non-invasive plant species responding to soil conditions.

Retaining wall locations will provide visual interest and allow for a diversity of native plantings on both sides of the wall. Plantings will include a mix of native trees in a variety of sizes (from 50-60 mm cal. to 100 cm high for deciduous trees, and 200 cm to 100 cm high for coniferous trees). Plantings shall include a variety of native shrubs and grasses.

Two stormwater management pond locations to provide for quantity and quality treatment of stormwater. Planting improvements will meet MNRF Stormwater Management Plan and SWMP Guidelines, and will include a mix of native trees, shrubs, and grasses.

Two landscape buffers to screen highway ramps from commercial properties are proposed. New plantings at these locations shall offer a mix of large coniferous trees. Non-invasive species tolerant of drought and salt are preferred.

A copy of the Landscape Composition Plan is provided in Appendix P.

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8.0 Consultation

Communication with potentially impacted and/or interested parties is key in the planning process and provides a mechanism for the proponent to define and respond to issues prior to key decisions being made. The main objective of consultation in the Class EA process is to ensure that project information is shared in a meaningful way, and that consideration is given to all aspects of the environment from the earliest stages of planning. Recognizing this, the study team initiated a comprehensive program from the onset of the study, as described herein.

All interested parties were offered early and ongoing opportunities to review study information and provide input to the decision-making process. A variety of communication strategies were used to engage the public, agencies, interest groups, property owners and community members. As a first step, a Consultation Plan was developed and described the following elements:

- Study notifications (Notices of Study Commencement, Public Information Centres (PICs) 1 and 2 and TESR)
- Communication with external agencies in order to obtain pertinent technical information and identify the requirement for legislative or regulatory approvals related to the project
- Three (3) meetings with City of Brockville staff
- Two (2) presentations to City of Brockville Planning and Operations/Planning and Development Committee)
- Establishment of a Municipal Technical Advisory Committee (MTAC) comprising municipal staff and local emergency service providers
- Communication with affected property owners where temporary or permanent interest in property is required, including personalized letters and property impact plans, telephone conversations, and organized virtual meetings with members of the project team
- Two Online PICs. PIC 1 was held from December 10, 2020, to January 21, 2021, and PIC 2 was held from January 26, 2023, to February 24, 2023)
- Notice of Study Completion/*Transportation Environmental Study Report* 30-Day Comment Period (November 22, 2023 to December 22, 2023)

A copy of all public notification materials is provided in Appendix Q.

The input received from the public was incorporated into the project findings and recommendations, as appropriate, and responses were provided to all input received, a summary of which is provided in Table 29.

All project correspondence to/from the public was collected in accordance with the *Freedom of Information and Protection of Privacy Act.* Accordingly, with the exception of personal information, all public comments form part of the public record.

8.1 Public Consultation

As noted, four study notifications have been prepared and issued as part of this study, including Ontario Government Notifications (OGNs), to notify the public, federal, provincial, and municipal agencies, Indigenous Communities, local community members and other interested persons of the study at key points in the Class EA process. Notices were posted in the *Brockville Recorder and Times* and the *Brockville This Week* newspapers. Letter notice, along with a copy of the OGN, was also provided to agencies, key stakeholders, and Indigenous Communities, as described in the subsequent sections.

A copy of all OGNs is provided in Appendix Q.1.

8.1.1 Project Website

A project website (highway401brockville.ca) was developed at the onset of the study to provide the public with easy access to project information, which was maintained throughout the study process, including background, project team member contact information, PIC materials links to project-specific documentation (i.e., study notifications, MTO Class EA) and supplementary information.

8.1.2 Project Email Address

A project email address was established for this study (comments@highway401brockville.com) and was provided on all public consultation materials (notifications, PIC displays, and the project website). In addition, the project website allowed interested parties to contact the project team directly through the dedicated project email address, or by using the online comment form (secured with certified encryption).

8.1.3 Notice of Study Commencement

The purpose of the Notice of Study Commencement was to introduce the study to the public, agencies, stakeholders and Indigenous Communities and to gather initial feedback.

The notice provided the purpose of the study, a brief overview of the Class EA process, a map of the study area, and offered project team contact information for members of the public to provide comments and/or questions about the study. The Notice of Study Commencement was communicated via newspaper advertisements in the *Brockville Recorder and Times* and the *Brockville This Week* on Wednesday, August 27, 2020. It was also posted on the project website.

Individual notification letters were also sent to federal, provincial, and municipal agencies and stakeholder groups that were expected to have an interest in the study on August 27, 2020. Letters to agencies requested information on the environmental features of the study area and to seek their input on the project.

A total of 68 comment sheets, letters, emails, and phone calls were received following the Notice of Study Commencement up to, and beyond the requested submission date of September 18, 2020. A copy of the comments received from agencies and public and associated responses are provided in. A copy of the correspondence received following the Notice of Study Commencement is provided in Appendix Q.2**.**

8.1.4 Online Public Information Centre 1

The first PIC was held between December 10, 2020, to January 21, 2021. In light of the COVID-19 pandemic and associated physical distancing requirements, the PIC was held online through the project website (www.highway401brockville.ca) via pre-recorded presentation. The purpose of the PIC was to introduce the project and to outline the process being followed, provide background information on the need for improvements, present preliminary bridge and structural culvert rehabilitation/replacement alternatives, interchange alternative, and future Highway 401 footprints for the interim six and ultimate eight lane configurations. The purpose of the PIC was also to present and gather input on the existing study area conditions.

The PIC was advertised in the *Brockville Recorder and Times,* and the *Brockville This Week* on December 3, 2020. The Notice was also posted on the project website. In addition, notification letters were mailed to external agencies, businesses, stakeholders, property owners and the general public on November 26, 2020. A Canada Post marketing mailing (AdMail) was also used to deliver a hard copy of the notice in flyer format to approximately 4,718 properties within Canada Post's delivery routes in the vicinity of the study area during the week of November 25, 2020.

The online was hosted on the study website. Hardcopies of the presentation and transcript were available for mailout for those unable to access the online PIC 1 materials provided on the study website.

Statistics were gathered during the online PIC period to determine the number of viewers of the online presentations. The website visit statistics were broken down into two categories:

- Unique Visitors – the total number of people that visited the site. The same person visiting the site multiple times during the PIC review period is only counted once.
- Number of Visits – the total number of visits by browsing session. If a visitor viewed another page on the site within 30 minutes of their last pageview, it is counted as the same visit. If a visitor returns to the study website 30 minutes after their last pageview, it is counted as a separate visit.

A total of 598 unique visitors, and 749 visits to the project website were made during the online PIC review period.

During the online PIC review period, 19 comments were received via email or telephone following the online PIC by the requested submission date of January 21, 2021.

A copy of the information displayed at PIC 1, as well as the feedback received at and following online PIC 1 is provided in Appendix Q.3.

8.1.5 Online Public Information Centre 2

The second PIC was held between January 26 and February 24, 2023. The PIC was held online through the project website (www.highway401brockville.ca) via a recorded presentation. The purpose of the PIC was to present and solicit feedback on the evaluation of alternatives, the technically preferred plan, and next steps in the Class EA process.

The PIC was advertised in the *Brockville Recorder and Times,* and the *Brockville This Week* on January 19, 2023. The Notice was also posted on the project website. In addition, notification letters were mailed to external agencies, businesses, stakeholders, property owners and the general public on January 19, 2023. A Canada Post marketing mailing (AdMail) was used to deliver a hard copy of the notice in flyer format to approximately 4,786 properties within Canada Post's delivery routes in the vicinity of the study area during the week of January 16, 2023.

The online PIC was hosted on the study website. Hardcopies of the presentation and transcript were available for mailout for those unable to access the online PIC 2 materials provided on the study website. A total of 1,136 unique visitors, and 1,513 visits to the project website were made during the PIC review period.

During the online PIC review period, 22 letters and/or email responses were received at and/or following the PIC by the requested submission date of February 24, 2023.

A copy of the information displayed at PIC 2, as well as the feedback received at, and following PIC 2 is provided in Appendix Q.4.

8.1.6 Summary of Public Comments

Over the duration of the study, many comments were received from the public, some of which could be categorized into common themes, including active transportation facilities, safety, traffic, property impacts, and the Technically Preferred Plan. Table 29 provides a summary of the main comments and themes and the associated response provided by the project team. With the exception of correspondence carried out as part of the public consultation events completed as part of this study, a copy of all remaining public correspondence is provided within Appendix Q.5.

Table 29: Summary of Public Comments and Responses

Comment	Response Provided and/or Action Taken
Active Transportation	
• Will the reconstruction/replacement of the under/overpass structures accommodate active transportation? • The highway creates a physical barrier between the north and south of the City, and there are only three ways to cross that divide. Active Transportation is needed to connect both sides. • There is a break in the Brock Trail below the CNR (VIA) Overhead. Can this break be connected?	Please note that pedestrian access across Highway 401 at Stewart Boulevard and North Augusta Road will be maintained during construction. Opportunities for accelerated bridge construction techniques will be considered during the next phase of the project (i.e., detail design). In addition, the timing and duration of closures and detours will be confirmed in consultation with the City of Brockville. The Stewart Boulevard structure will include a 1.5 m wide sidewalk on the west side, and a 3.6 m wide multi-use path on the east side. These active transportation facilities will be separated from traffic by a 1.5 m buffer. The North Augusta Road structure will include a 3.6 m wide multi-use path on the west side of the structure, which will be separated from traffic by a barrier wall. The Ormond Street overpass will provide space for a 3.0 m wide multi-use path, separated from traffic with a 2.1 m buffer. These active transportation measures were included after consultation with the City of Brockville. The improvements at the CNR (VIA) rail corridor are for the overhead bridge that carries Highway 401 traffic. The existing bridge has been identified for replacement and will be designed to accommodate the future eight-lane footprint of Highway 401 and two railway tracks crossing under the highway. Improvements to the Brock Trail are not identified in the City of Brockville Active Transportation Plan.
Public Feedback Process	
• Will there be a public meeting to voice opinions?	There is no in-person public meeting currently planned for this study. Online Public Information Centre (PIC) 2 is now available on the study website, www.highway401brockville.ca, for your review and comment. A recorded presentation has been prepared to present and gather feedback on the study, including the evaluation of alternatives, the technically preferred plan, and potential impacts and mitigation measures. Comments and feedback from the public are encouraged and can be provided to the project team through email, phone, mail, as well as through the online comment form (Highway 401 Brockville Survey (surveymonkey.com)), which can also be accessed on the study website and/or on the last slide of the online PIC 2 presentation.
Highway 401 8-Laning	
• This section is the least busy section of the highway. Why is widening planned?	This Preliminary Design and Class Environmental Assessment (EA) study is being undertaken to address the long-term replacement and/or rehabilitation needs for the aging bridges and culvert structure located within the City of Brockville limits. New structures will be designed with a 75-year design life, so it is important to plan for potential future changes to the Highway 401 footprint. As part of this study, MTO will be establishing the footprint for the future interim six lanes and ultimate eight lanes of Highway 401 so that the new structures can be designed appropriately.
Aesthetics	
• Will there be opportunity to provide aesthetic design input? Would like to see decorated red and white maple leaves, and the Ontario Coat of Arms on the new overpass structures.	Following the completion of this Class EA, the project will proceed to detail design, at which time the design of the Recommended Plan will be further refined. Your comments related to the aesthetic design of the structures have been received by the study team and will be considered during detail design of the project.
Property Impacts	

Comment	Response Provided and/or Action Taken
• Will our home be impacted by the widening of the highway? • Will the existing noise wall be moved?	Property owners who have the potential to be directly impacted (i.e., property acquisition required, in whole or in part) by the technically preferred plan have been contacted by letter to discuss the technically preferred plan, the anticipated impacts to their property, and to discuss any questions or concerns they may have. Please note that future design phases could result in refinements to the technically preferred plan with new and/or adjusted property requirements.
Traffic	
• Will the on and off ramps be compatible for LCVs? This will allow Brockville to be in a more competitive business position.	The Stewart Boulevard and North Augusta Road interchange alternatives were evaluated against a set of technical and environmental criteria and measures, including the consideration to accommodate Long Combination Vehicles (LCVs). As a result of the evaluation of interchange alternative, the Recommended Plan will accommodate LCVs.
Noise	
• Concerned about traffic noise	One existing noise wall will be moved approximately 7.5 m south of its existing location to accommodate the future Highway 401 8-lane footprint. A noise assessment was completed, and determined that new noise barriers were ruled out as mitigation and not recommended for this project. The noise analysis will follow the MTO Environmental Guide for Noise protocols which comply with the requirements of the Ontario Environmental Assessment Act.
Black & Decker Trail (Brocktel)	
• Concerned about impacts to the recreational trail system	Based on the technically preferred plan, a portion of the trail system located within and beyond the existing limits of the MTO right-of-way may be impacted by future grading activities. However, impacts will be confirmed during detail design. Please note that future design phases could result in refinements to the technically preferred plan with new and/or adjusted property requirements.
Detours	
• The detours will create traffic on adjacent roadways • What will happen during overnight bridge replacements	Please note that overnight closures of Highway 401 will be required to remove the existing structures at Stewart Boulevard and North Augusta Road. It is anticipated that the overnight closures will be required once for each structure, for a duration of 12-18 hours each. Additional overnight, short-term closures of Highway 401 may be required to place girders for the new bridges at Stewart Boulevard and North Augusta Road. Preliminary traffic modeling has been completed and confirmed that Parkedale Avenue and County Road 2 can accommodate the overnight Highway 401 traffic for these closures. The timing of demolition and construction of the new bridges at Stewart Boulevard, Ormond Street, and North Augusta Road will be coordinated to ensure only one of these crossing roads is fully closed at a time. Please note that pedestrian access across Highway 401 at Stewart Boulevard and North Augusta Road will be maintained during construction. Opportunities for accelerated bridge construction techniques will be considered during the next phase of the project (i.e., detail design). In addition, the timing and duration of closures and detours will be confirmed in consultation with the City of Brockville.

8.2 Property Owner Meetings

Approximately 19 potentially impacted property owners were provided with a tailored letter package notifying them of the potential to be directly impacted by the Technically Preferred Plan. The letter package included a cover letter that provided a summary of the project, the purpose of PIC 2, and reference to an appending property impact plan that outlined the approximate area of their property that may be impacted by the future footprint of Highway 401, and the interchange improvements. Property owners were invited to contact the project team to arrange a virtual meeting to discuss potential impacts to their property and possible mitigation measures. In addition. The property owner letters and appending Notice of PIC 2 were delivered via Canada Post standard mail on January 18, 2023.

In response to the impacted property owner letter package, the project team received a response from 6 property owners, 4 of which requested virtual meetings with members of the project team. Based on the correspondence with potentially impacted property owners, a summary of the concerns raised by property owners and associated response from and/or commitment made by the project team was prepared. For privacy reasons, this correspondence has not been included in this report; however, is summarized within Table 30.

Table 30: Property Owner Consultation

Comment/Concern	Response Provided and/or Action Taken
Timing of construction and property acquisition	Timing of construction is unknown and is dependent on funding and approvals. The property acquisition process may begin once Environmental Clearance is achieved, which is completed at the end of the Class EA Study process. The MTO contacts the property owner once Environmental Clearance is issued, to discuss property impacts and begin negotiations. There is potential that future refinement may result in requiring less property acquisition.
Full property acquisition process and business relocation	If significant impacts to the property are anticipated, the MTO may require a full property buyout and relocation of the business. MTO will work closely with impacted businesses to determine a suitable location for new operations. There is potential that future refinement of the Recommended Plan may result in requiring less property acquisition. MTO will continue to communicate the anticipated property impacts with the property owner during detail design, and provide continued direction and support throughout the property acquisition process.
Impacts to business operations	Additional studies, including Stage 2 AA, may be required on the property. Permission to enter the property will be sought, as required.

8.3 Agency Consultation

As part of the Notice of Study Commencement, issued on August 27, 2020, the following external agencies and stakeholders received an agency comment sheet, requesting appropriate representative contact information and initial input to the study by September 18, 2020:

Provincial Agencies

- Ministry of Natural Resources and Forestry
- Infrastructure Ontario
- Ministry of Municipal Affairs and Housing
- Ministry of Northern Development and Mines
- Ministry of the Environment, Conservation and Parks
- Ministry of Citizenship and Multiculturalism – Heritage Program Unit
- Ministry of Citizenship and Multiculturalism – Archaeology Programs Unit
- Ministry of Indigenous Relations and Reconciliation

Municipal Agencies

- City of Brockville
- United Counties of Leeds and Grenville

Local Elected Representatives

- MPP – Leeds-Grenville-Thousand Islands and Rideau Lakes
- City of Brockville – Mayor

Emergency Services

- Ontario Provincial Police – Leeds County, Rideau Lakes, Thousand Islands
- Brockville Fire Department
- Leeds and 1000 Islands Fire Department
- Brockville Police
- Augusta Fire Department
- Leeds Grenville Paramedic Service

School Boards/ Bus Service

- Upper Canada District School Board
- Conseil des écoles catholique du Centre-Est
- Catholic District School Board of Eastern Ontario
- Student Transportation Services of Eastern Ontario

Other Stakeholders

- Brockville & District Chamber of Commerce
- Ontario Trucking Association
- Ontario Federation of Agriculture
- Brockville Cycling Club
- Cataraqui Region Conservation Authority
- Leeds and Grenville Economic Development
- Coach Canada
- Leeds County Federation of Agriculture
- Grenville Snowmobile Association

A copy of the agency mailing list is provided within Appendix Q.6.

It should be noted that staff from the City of Brockville was kept informed throughout the duration of the study. Meetings with the City of Brockville Planning and Operations/Planning and Development Committee were planned in advance of each PIC. In addition, City of Brockville staff were invited to participate on the Municipal Technical Advisory Committee (MTAC). Where required, additional meetings were held with relevant agencies or municipalities to discuss project specific issues.

8.3.1 Municipal Committee Presentations

The project team made two presentations to local municipal committees to provide an update on study progress, and to solicit feedback at key points in the study process. Each presentation was followed by a question-and-answer period. The study team offered presentations at the following committee meetings:

- City of Brockville Planning and Operations Committee, December 1, 2020
- City of Brockville Planning and Development Committee following PIC 2 on April 4, 2023

A copy of the presentations shared with the municipal committees is provided in Appendix Q.7.

8.3.2 Municipal Technical Advisory Committee

A Municipal Technical Advisory Committee (MTAC) was established at the onset of the study to share information with key municipal staff members and emergency service providers, including obtaining input on existing study area conditions, alternative design concepts, the evaluation and selection of the Technically Preferred, potential detour routes, and to discuss any questions, comments and/or concerns. The following key organizations were invited to participate:

- City of Brockville
- Ontario Provincial Police (Leeds County, Rideau Lakes, Thousand Islands)
- Brockville Police

- Brockville Fire Department
- Leeds and 1000 Islands Fire Department
- Leeds Grenville Paramedic Service

Three MTAC meetings were held during of the study. These meetings were held at key points in the study process, as described herein. A record of external agency representatives in attendance at each meeting, as well as a copy of the meeting notes are provided in Appendix Q.8.

MTAC Meeting 1

The first MTAC meeting was held to introduce the project, seek input on the existing conditions within the study area, present and gather input on the evaluation process, and to identify any initial comments or questions. The first meeting was held on October 7, 2020, via a videoconference (i.e., Microsoft Teams). A slide deck was presented during the meeting. Seven MTAC members attended the meeting.

MTAC Meeting 2

The second MTAC meeting was held to discuss PIC 1, review the evaluation process, existing constraints and opportunities, and to discuss the next steps of the study. The second meeting was held on March 3, 2021, via videoconference (i.e., Microsoft Teams). A slide deck was presented during the meeting. Seven MTAC members attended the meeting.

MTAC Meeting 3

The third MTAC meeting was held to present the evaluation of preliminary design alternatives, the Technically Preferred Plan, and the potential environmental impacts and proposed mitigation measures. The third meeting was held on September 26, 2022, via videoconference (i.e., Microsoft Teams). A slide deck was presented during the meeting. Seven MTAC members attended the meeting.

8.3.3 Agency Correspondence

Review agencies were consulted to verify the existing conditions of the study area, and to solicit feedback throughout the study on the alternative solutions, and requirements of the area. A copy of all agency correspondence is provided in Appendix Q.9.

8.4 Indigenous Community Consultation

Indigenous Communities and/or organizations contacted with respect to this study were identified based on desktop research during the initial stages of the planning process. Through this review, the following Indigenous Communities were identified as having rights within the study area, and were provided formal letter notification about this study in coordination with the Notices of Study Commencement, PICs 1 and 2, and Completion:

- Mohawks of the Akwesasne
- Métis Nation of Ontario

A copy of the draft Stage 1 Archaeological Assessment report was issued via email to the Mohawks of Akwesasne for review and comment on December 8, 2020, prior to issuing the final report to the MCM for review and record.

8.4.1 Notice of Study Commencement

The Notice of Study Commencement and Request to Consult was sent via mail and email to the above noted communities on August 20, 2020. The purpose of this correspondence was to provide information related to the study purpose, the Class EA process, and to invite each Indigenous community to participate in the consultation process.

8.4.2 Public Information Centre 1

The letter Notice of PIC 1 was sent via mail and email to the above noted communities on November 26, 2020. The purpose of this letter was to provide an update regarding the study, including PIC 1, which would present the study background, existing study area conditions, preliminary improvement alternatives, the evaluation process, and next steps in the Class EA process. The letter notice offered an opportunity to meet with ministry staff to discuss the study in more detail.

8.4.3 Public Information Centre 2

The Notice of PIC 2 was sent via mail and email to the above noted communities on January 18, 2023. The purpose of this correspondence was to notify them of PIC 1, which would present and gather feedback on the evaluation of alternatives, the technically preferred plan, and next steps in the Class EA process. Each Indigenous community was provided the opportunity to meet with ministry staff.

No responses from Indigenous Communities were received during the course of this study.

A copy of all outgoing correspondence with Indigenous Communities is provided in Appendix Q.10.

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9.0 Future Consultation

During the subsequent stage of design stage of this undertaking, relevant agencies, authorities, Indigenous Communities, and property owners will continue to be engaged with respect to detail design and commitments to future work as outlined in this document, as appropriate.

9.1 Future Commitments

Future consultation will be required during the next phase of planning and design to address all outstanding issues, including permits and approvals and more detailed environmental and engineering investigations to confirm the final design. A summary of the proposed future consultation activities is provided in Table 31.

Table 31: Future Consultation with External Agencies

External Agency	Subject of Consultation
Fisheries and Oceans Canada	• Request for Review Form
Transport Canada	• Notice of Railway Works
Ministry of Natural Resources and Forestry	• Terrestrial Species and Habitat • Construction timing windows/restrictions
Ministry of Citizenship and Multiculturalism	• Stage 2 Archaeological Assessment
Ministry of the Environment, Conservation and Parks	• Terrestrial and/or aquatic Species at Risk species and/or habitat • Endangered Species Act authorization/permit
Indigenous Communities	• Stage 2 Archaeological Assessment
City of Brockville	• Traffic Management Plan • Construction timing • Utility relocations • Public concerns, as required • Cost sharing agreements
United County of Leeds and Grenville	• Construction timing and detour routes
Canadian National Rail (CNR) and VIA Rail	• Work Permit Application
Emergency service agencies (i.e., OPP, Fire, ambulance, Police Services, etc.)	• Traffic Management Plan • Construction timing • Final Detour Plan
Cataraqui Region Conservation Authority	• Source Water Protection
Utility companies	• Utility relocations • Construction timing

Other issues to be dealt with during subsequent planning and design process include:

- Property concerns and negotiations with individual property owners
- Additional details of the Recommended Plan such as tree clearing requirements

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10.0 Summary of Environmental Effects, Proposed Mitigation and Commitments to Future Work

A summary of environmental effects, proposed mitigation, and commitments to future work, as identified during the course of this study, is provided in Table 32, and forms a comprehensive 'checklist' of outstanding issues identified at the end of Class EA and Preliminary Design and will serve as a starting point for the subsequent planning and design phase of the project.

Table 32: Summary of Environmental Effects, Proposed Mitigation and Commitments for Future Work.

Legend

MTO: Ministry of Transportation
MNRF: Ministry of Natural Resources and Forestry
DFO: Fisheries and Oceans
MUN: Local Municipalities
CRCA: Cataraqui Region Conservation Authority
TC: Transport Canada
CNR: Canadian National Rail
PUB: General Public
EMS: Emergency Medical Services
RES/BUS: Local Residents/Business Owners
MECP: Ministry of Environment, Conservation and Parks
MCM: Ministry of Citizenship and Multiculturalism
STS: Student Transportation Services

I.D. #	Environmental Issues/Concerns and Potential Effects	Concerned Parties	I.D. #	Mitigation/Protection/Monitoring/Commitments to Further Work
Natural Environment				
1.0	Surface Water • Potential impacts to surface water and groundwater from disturbance of contaminated soils, leaks and accidental spills	MTO MECP DFO CRCA	1.1	Equipment refuelling activities shall be undertaken away from SGRAs and HVAs
			1.2	Do not permit refueling within 30 m of a watercourse.
			1.3	At minimum, best management practices shall be applied for fuel management including secondary containment of temporary fuel storage.
			1.4	Prepare and follow spill response plan for construction. All spills shall be cleaned up immediately, and contaminated materials shall be disposed of in an approved manner. The MECP shall be informed immediately of all reportable spills.
			1.5	Materials for spill response such as drip pans and spill contingency kits must be maintained on site.
			1.6	Detailed assessment of site-specific conditions shall be undertaken to further evaluate need for EASR or a PTTW
			1.7	Obtain draft Permit to Take Water (PTTW), if required.
			1.8	Determine extent of private well monitoring in support of PTTW, if required.
2.0	Fish & Fish Habitat • Works adjacent to or within aquatic resources that provide fish habitat, or have the potential to support fish habitat, may present a risk of construction-related impacts to fish during their most sensitive / vulnerable life cycles (i.e., during reproduction and	MTO MECP MNRF DFO CRCA	2.1	The spatial extent of fish habitat directly affect by the project shall be determined once culvert dimensions, the need for rock protection in the creek bed and channel realignments and details of other activities that may affect fish and fish habitat, have been confirmed.
			2.2	Complete update to Preliminary Fisheries Assessment, including additional field data collection, to determine the likelihood of causing the death of fish or HADD of fish habitat (Step 4 of the Protocol). Pathways of Effects (POEs) for land-based and in-water activities shall be applied.
			2.3	Fluvial geomorphology field studies shall be undertaken during detail design to support channel realignment at Buells Creek, the Fisheries Assessment, and DFO review of the channel realignment.
			2.4	Repair the gabion baskets at Buells Creek (Culvert C6; MTO Site 16X-0237/C0) and other bank stabilization measures on the south side of Highway 401.

I.D. #	Environmental Issues/Concerns and Potential Effects	Concerned Parties	I.D. #	Mitigation/Protection/Monitoring/Commitments to Further Work
	early development stages of off-spring)		2.5	Enhance habitat through the addition of riparian vegetation on a site-specific basis.
				Rock protection shall be added to the bed and/or banks of watercourses at both ends of culverts where extensions and replacement are proposed. The area shall be determined using the *Drainage Management Manual* (MTO 1997). The extent of rock protection to be added and the area shall be determined during detail design and documented in a fisheries assessment.
			2.6	If rock protection is proposed within the bankfull channel, the extent to be added and the area that will directly affect fish habitat shall be documented in the aquatic effects assessment. The rock protection particle size shall be determined using expected water velocities and selected from Table 3 or Table 4 of the OPSS 1005. The addition of Granular B to the waterbody material shall be considered to maintain wetted habitat to the extent possible.
			2.7	Design the replacement channel for Buells Creek using natural channel design principles to continue to provide habitat and fish passage.
			2.8	If applicable, design other channel relocations using natural channel design principles.
			2.9	Design drainage system to reduce changes in drainage to watercourses that provide fish habitat.
			2.10	Design and plan activities and work such that loss of fish habitat or disturbance to fish habitat is reduced to the extent possible.
			2.11	Design stormwater management measures to reduce effects on watercourses that provide fish habitat to the extent possible.
			2.12	Design a rehabilitation/re-vegetation plan for long-term stability of the areas disturbed during construction.
			2.13	For rock reinforcement below the normal high water level, use appropriately-sized material and install at a similar slope to the existing, maintain a uniform bank/shoreline and maintain a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile.
			2.14	Applicable in-water work restrictions (i.e., in-water construction activities are permitted from July 1 to March 14 inclusive (i.e., no work from March 15 to June 30 (MNRF 2020). The timing window does not apply to work above the high water level. Additional timing considerations are as follows: • Reduce the duration of in-water work to the extent possible • Conduct in-water work during periods of low flow to allow work in water to be isolated from flows • Schedule work to avoid wet, windy, and rainy periods that may increase erosion and sedimentation • Allow time for re-stabilization and re-vegetation as appropriate prior to winter
			2.15	Adhere to OPSS.PROV 182 for fish protection measures regarding fish transfers and fish screens.
			2.16	Limit access to banks or areas adjacent to watercourses to the extent required for construction activities.
			2.17	Watercourse crossing (fording) is not permitted.
			2.18	Manage and treat dewatering (or other) discharge water to reduce the risk of erosion and/or release of sediment-laden or contaminated water to surface water features.
			2.19	Operate machinery on land above the high water level.

I.D. #	Environmental Issues/Concerns and Potential Effects	Concerned Parties	I.D. #	Mitigation/Protection/Monitoring/Commitments to Further Work
			2.20	Operate, store, and maintain (e.g., refuel) equipment, vehicles, and materials in a manner that reduces the risk of the entry of deleterious substances to surface water features.
			2.21	Equipment operating within 30 m of surface water features shall be free of fluid leaks, invasive species, and noxious weeds.
			2.22	Install effective ESC measures before starting work to reduce the risk of sediment entering surface water features.
			2.23	Regularly inspect, maintain and repair ESC measures during construction.
			2.24	Remove non-biodegradable ESC materials once the site is stable.
			2.25	ESC measures should be maintained until disturbed ground has been permanently stabilized.
			2.26	Develop a Spill Management Plan and have it on site for implementation in the event of an accidental spill.
			2.27	Stabilize and re-vegetate areas of disturbed/exposed soil, as per the rehabilitation plan/re-vegetation plan.
			2.28	An update to MTO's Template Table D4 (Fish and Fish Habitat Impact Documentation) shall be completed prior to completion of a Request for Review form.
			2.29	All activities shall adhere to Best Management Practices Manual for Fisheries and Table 2 of the Protocol.
			2.30	The following OPSSs are applicable to this project: • OPSS.PROV 180 - General Specification for the Management of Excess Materials • OPSS.PROV 182 - General Specification for Environmental Protection for Construction In and Around Waterbodies and on Waterbody Banks • OPSS.PROV 517 - Construction Specification for Dewatering • OPSS.PROV 803 - Construction Specification for Vegetative Cover (issued in November 2020 to replace former OPSS.PROV 804) • OPSS.PROV 804 - Construction Specification for Temporary Erosion Control (issued in April 2021 to replace the erosion control components of former OPSS 805) • OPSS.PROV 805 - Construction Specification for Temporary Sediment Control (issued in November 2020 to replace the sediment control components of former OPSS 805) • OPSS.PROV 825 - Construction Specification for Placement of Aggregates in Waterbodies • OPSS.PROV 1005 - Material Specification for Aggregates - Waterbody
			2.31	The following OPSSs are applicable to the following general activities: • Equipment Use - Use of equipment shall be in accordance with OPSS.PROV 182. • Dewatering and Temporary Flow Passage - Dewatering and/or temporary flow passage shall be according to OPSS.PROV 517 and OPSS.PROV 182. • Fish Salvage - Fish salvage operations shall be conducted in accordance with OPSS.PROV 182. • Preservation of Riparian Vegetation - Removal of riparian vegetation shall be in accordance with OPSS.PROV 182 • Erosion and Sediment Control - Installation, monitoring, maintenance, and removal of temporary erosion and sediment control measures shall be according to OPSS.PROV 182, OPSS.PROV 804 and OPSS.PROV 805. • Placement of Aggregates in Waterbodies - Use of aggregate in waterbodies shall be according to OPSS.PROV 825 and OPSS.PROV 1005.

I.D. #	Environmental Issues/Concerns and Potential Effects	Concerned Parties	I.D. #	Mitigation/Protection/Monitoring/Commitments to Further Work
				• Restoration of Disturbed Areas - Vegetation protection and rehabilitation shall be in accordance with OPSS.PROV 182, OPSS.PROV 803 (Vegetative Cover, Non-Standard Special Provision - Amendment to OPSS.PROV 803) and OPSS.PROV 804. • Management of Excess Materials - All excess material shall be managed in accordance with OPSS.PROV 180.
3.0	Vegetation • Potential for localized impacts to vegetation due to disturbance of common species	MTO MECP MNRF	3.1	Vegetation removal shall be limited to the extent possible and undertaken outside of the migratory bird nesting period (April 1 to August 31). If work must take place during this period, a breeding bird survey can be completed by a Qualified Biologist.
			3.2	Silt barriers shall be implemented along work zone where there is potential for sedimentation of watercourses or wetlands, or encroachment of construction vehicles into natural areas. Additional silt barrier shall be available on-site to provide a contingency supply in the event of an emergency.
			3.3	Erosion and sedimentation controls shall be monitored regularly and properly maintained. Controls shall be removed only after the soils of the construction area have been stabilized, protected or until cover is re-established.
			3.4	Vehicles/equipment shall not enter natural areas beyond the barrier.
			3.5	Monitor limits of construction adjacent to natural features during construction.
			3.6	Stockpiling excess materials within proximity of natural areas shall be avoided.
			3.7	Topsoil and organic matter shall be salvaged and reused in areas disturbed during construction.
			3.8	Replaced soils shall contain native seed bank.
			3.9	Post-construction seeding of the disturbed ROW should be done with a suitable native seed mix and in consideration of Monarch and Yellow-banded Bumble Bee habitat (i.e., milkweed and nectar producing plants for areas restored to meadow).
			3.10	Seed mixes should include fast-growing, short-lived perennial cover crop to stabilize soil and reduce competition from weedy exotics. Native cover crops are preferred.
			3.11	Stabilize exposed soil areas and re-vegetate through the placement of seed and mulching or seed and an erosion control blanket, promptly upon completion of construction activities. New seed should be introduced to disturbed substrates as soon as feasible following construction (within 15 days for areas less than 200 m from a watercourse, and 45 days for other areas), and sediment fencing should remain in place until vegetation cover is re-established.
			3.12	Restore any disturbed natural areas to pre-construction conditions.
			3.13	Seeded areas shall receive water either through precipitation or irrigation after every seven successive days without rainfall for the first two months after seeding.
			3.14	A detailed landscape restoration plan shall be developed during detail design. The plan shall recommend use of native species in restoration planting as well as methods for management of invasive species.
			3.15	If work occurs in or near features with Phragmites, equipment shall be cleaned before leaving the site to avoid transport of soil containing Phragmites to other sites.
			3.16	Restoration planting shall be undertaken for newly created edges along existing woodlands and significant woodlands to protect and mitigate for potential negative effects (e.g., sunlight penetration, susceptibility to windthrow, desiccation, and spread of invasive species).
			3.17	Restoration plans shall use native species that are tolerant of roadside stresses such as salt, pollution, and soil compaction.

I.D. #	Environmental Issues/Concerns and Potential Effects	Concerned Parties	I.D. #	Mitigation/Protection/Monitoring/Commitments to Further Work
			3.18	Monitoring plans should track survivorship and effectiveness of restoration plans and include recommendations to adapt management as appropriate.
			3.18	Vegetation clearing in meadow areas shall not be undertaken during the Monarch larval period (May 1 to September 30). If vegetation clearing shall proceed when Monarch larvae may be present, inspection of milkweed plants for Monarch larvae shall be completed. If larvae present, they may be moved to a suitable location under the direction of a qualified professional. Monarch caterpillars may be moved to other milkweed plants; for other larval stages, entire milkweed plants should be transplanted.
4.0	Wildlife and Species at Risk (SAR) • Potential for species at risk (SAR) habitat within or adjacent to the study area, and potential interactions with wildlife during construction	MTO MNRF MECP CRCA	4.1	Construction equipment and vehicles are to yield to wildlife.
			4.2	Construction personnel shall be advised not to threaten, harass or injure wildlife.
			4.3	If wildlife are encountered during construction, personnel are required to move away from the animal and wait for the animal to move off the construction site. If safe to do so, slow-moving wildlife shall be moved off the road by gently guiding the individual in the direction it was traveling.
			4.4	Once design details are confirmed, additional surveys shall be carried out in potential habitat for SAR to confirm potential impacts to SAR species identified. The following SAR and provincially rare species are present within the study area: Butternut, Monarch.
			4.5	Candidate habitat for SAR for Blanding's Turtle nesting and overwintering habitat, Gray Ratsnake transient use and hibernacula, and bat SAR maternity and roosting habitat (i.e., Little Brown Myotis, Small-footed Myotis, Northern Myotis, and Tri-coloured Bat). Proper mitigation and avoidance shall be determined.
			4.6	Candidate habitat for SOCC includes turtle nesting and overwintering habitat (i.e., Snapping Turtle, Eastern Musk Turtle, and Midland Painted Turtle), and amphibian breeding habitat for Western Chorus Frog.
			4.7	On-site personnel of the potential presence of the SAR/SOCC identified in the study area, obligations under the ESA, and recommended actions in the event of an encounter. Handling of SAR is not permitted without an ESA authorization.
			4.8	Species listed as endangered or threatened on the SARO list that are present within the study area must be protected from harm and harassment.
			4.9	Any SAR that is incidentally encountered in the study area must be allowed to leave of its own accord. Activities within 20 m should cease until the individual disperses. Construction machinery/equipment must maintain a minimum operating distance of 20 m from the individual until it disperses from the work zone of its own accord.
			4.10	Should on-site personnel be unable to allow an incidentally encountered SAR to disperse from the active construction area under its own ability, MECP must be contacted immediately for additional guidance.
			4.11	Any SAR that is encountered in the work zone should be reported to the MECP staff within 48 hours of the observation or the next working day, whichever comes first.
			4.12	If an injured or deceased SAR is found, the specimen must be placed in a non-airtight container that is maintained at an appropriate temperature and MECP must be contacted immediately for additional guidance.
			4.13	Temporary alterations to SAR habitat must be limited to the duration and spatial extent possible and be remediated upon completion of activity and monitored as necessary.
			4.14	To identify Butternut trees within the work zone, a follow-up survey shall be undertaken during leaf-on conditions during detail design within, and 50 m adjacent to, the work zones. If a butternut health assessment is required, guidance within the *Butternut Assessment*

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				Guidelines: Assessment of Butternut Tree Health for the Purposes of Endangered Species Act, 2007 (MECP 2021b) shall be followed.
			4.15	Avoidance of sensitive wildlife periods and temporary wildlife exclusion is recommended for reptiles and amphibians. Peak active season for reptiles and amphibians is from approximately April 1 to October 31. Installation of wildlife exclusion fencing is recommended before May 15 or after September 15 (i.e., outside of key breeding period) to define work zones and restrict the movement of reptiles and amphibians into the working area. If construction must be initiated during the turtle nesting or snake gestation season (June 1 to September 1), a qualified biologist shall inspect the site. If it is not possible to isolate a nest from construction, work shall be delayed until it is determined that the nest no longer includes viable eggs.
			4.16	Potential snake hibernation sites (rock outcroppings or stumps extending below-grade, or animal burrows) should not be disturbed during the hibernation period (November 1 to March 31). If removal of above-ground habitat features (rock slabs or piles, brush) is needed, these features shall be retained outside the active work zone during construction and returned post-construction to the same or a nearby location.
			4.17	During ditch and grading activities undertaken between April 1 and October 31, disturbance shall be limited to the greatest extent possible to protect reptiles or amphibians that may be present. A spotter could be used to identify individuals present in the work area.
			4.18	Leaf-off bat surveys shall be undertaken during detail design in areas where vegetation removal is proposed following the guidance outlined in MECP's survey protocol: *Treed Habitats – Maternity Roost Surveys* (2022). If potential bat trees are identified within the area proposed for removal, acoustic surveys or maternity exit surveys may be needed prior to tree removals.
			4.19	Removal of trees >10 cm DBH shall take place outside the period when bats use trees for maternity roosts (May 1 to August 31). If tree clearing is required within this window, maternity exit surveys shall be conducted prior to the tree removals. Consultation with MECP shall be undertaken prior to tree removals.
5.0	Migratory Birds and Protected Nests • Potential for protected birds to establish nests on existing structures	MTO MNRF CRCA	5.1	Vegetation clearing shall take place outside the core nesting period (April 1 to August 31).
			5.2	If an active breeding bird nest is observed during construction, a designated buffer shall be delineated by a qualified biologist within which no activity shall be allowed to occur while the nest is active. Once the nest is determined to be inactive clearing may proceed.
			5.3	A pre-construction breeding bird survey shall occur at structures proposed for disturbance within the work zone.
6.0	Erosion and Sedimentation • Erosion and sediment generated during construction may surface water/natural features	MTO MNRF	6.1	A comprehensive Erosion and Sediment Control Plan shall be completed during detail design. Control measures shall consider the study area to have a moderate-high erosion and sediment risk. Approach 3: Two Part Erosion and Sediment Control Plan (ESCP) – Main and Supplemental shall be implemented during detail design, in accordance with MTO Guidelines.
Social and Economic Environment				
7.0	Land Use and Property	MTO MUN	7.1	Construction staging and laydown areas shall be confirmed during detail design.
			7.2	A detailed Traffic Management Plan shall be prepared during detail design.

I.D. #	Environmental Issues/Concerns and Potential Effects	Concerned Parties	I.D. #	Mitigation/Protection/Monitoring/Commitments to Further Work
	• Potential direct and indirect impacts to adjacent properties, including disruption during construction • Temporary delay or disruption to student transportation and EMS providers during construction	CNR / VIA EMS STS RES/BUS PUB	7.3	The City of Brockville, public, student transportation service and emergency service providers shall be consulted during detail design, and notified of the start construction staging, construction, etc. to provide opportunities to provide input to the final construction staging and Traffic Management Plans.
			7.4	Impacted property owners shall be engaged during detail design to review, discuss and confirm impacts to property and associated mitigation measures.
			7.5	Access to private entrances and sideroads shall be maintained during construction.
	Management of Excess Materials • Excess materials may be encountered during construction at the sites and require proper management/disposal	MTO MECP	7.6	Additional investigations (e.g., PSS and/or Phase I ESA) shall be completed for any property that will be acquired by MTO in accordance with the requirements of the Environmental Guide for Contaminated Property Identification and Management and Environmental Reference for Highway Design.
			7.7	If building demolition is required, designated substance surveys shall be completed for buildings prior to demolition.
			7.8	Ontario Regulation (O.Reg.) 406/19 (*On-Site and Excess Soil Management*) and the associated document *Rules for Soil Management and Excess Soil Quality Standard*s referenced by O.Reg. 406/19 shall be followed for soil that is excavated and managed on-site or off-site during construction. Soil or water impacted by salt should be managed according to O.Reg. 406/19 if it is to be removed from the right-of-way.
			7.9	Soil and groundwater disturbed during construction shall be sampled and analyzed for metals and inorganics (including electrical conductivity and SAR), polycyclic aromatic hydrocarbons (PAH) and petroleum hydrocarbons (PHC). In addition, areas within or adjacent to PSOC shall be analyzed for the specific contaminants of concern. The selection of soil for analysis shall take into consideration the presence of anthropogenic substances such as debris/waste and, evidence of PHCs, solvents, or other unusual odours or staining.
			7.10	Should excess water be generated at the Site during future construction activities, water quality analyses should be conducted to determine appropriate management methods. This work should be done in coordination with a QP_{ESA} as defined by O.Reg. 153/04, to maintain data quality and provide an appropriate assessment of water quality.
			7.11	Should evidence of soil or water impacts be identified during construction (e.g., staining, odours, petroleum hydrocarbon sheen) samples should be collected for laboratory analyses to confirm concentrations of potential contaminants so as to appropriate manage the material in accordance with O.Reg. 406/19, and protect workers according to health and safety guidelines.
8.0	Designated Substances and Hazardous Materials • Potential to handle, remove, dispose and manage designated substances and hazardous materials	MTO	8.1	Work that may disturb lead containing materials shall follow the recommendations of the *Environmental Abatement Council of Ontario (EACO) Lead Guideline for Construction, Maintenance or Repair,* dated October 2014 and the *Ministry of Labour (MOL) Lead Guideline for Construction, Renovation Maintenance or Repair*, issued October 2014
			8.2	Work that may disturb silica containing materials shall follow the recommendations in the document entitled, “Silica on Construction Projects”, issued by the Ministry of Labour and dated April 2011.
			8.3	Removal of mercury-containing equipment is required prior to activities that may disturb the equipment.
			8.4	Prior to work that would disturb the light tubes, they must be removed and stored in a safe, secure location or disposed of following the requirements of *R.R.O. 1990, Regulation 347 General - Waste Management*, as amended (R.R.O. 1990, Reg. 347) under the EPA.

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			8.5	Should another material suspected to contain PCBs become uncovered during demolition activities (i.e., dielectric fluids, hydraulic fluids), all work in the areas that may disturb the material should be stopped. Samples of the suspect material should be submitted for laboratory analysis to determine if PCBs are present. Confirmed PCBs should be handled in accordance with Federal Regulation SOR/2008-273 and R.R.O. 1990, Reg. 362, under the EPA.
9.0	Construction Noise • Potential noise increase during construction associated with some equipment (e.g., boom trucks, pile drivers, dump trucks and paving machines)	MTO MUN RES/BUS PUB	9.1	Once equipment and construction schedules are finalized, construction equipment sound levels shall be reviewed to confirm that nose emissions are within the permissible limits. If higher than permissible limits, noise control options shall be explored.
			9.2	Contractors shall comply with all applicable requirements of the contract and the City of Brockville noise by-law. Enforcement of noise control by-laws is the responsibility of the Municipality for all work done by contractors.
			9.3	All equipment shall be properly maintained to limit noise emissions. As such, all construction equipment shall be operated with effective muffling devices that are in good working order.
			9.4	The contractor shall be required to adhere to standard noise restrictions.
			9.5	Contract documents shall contain a provision that any initial noise complaint shall trigger verification that the general noise control measures agreed to are in effect.
			9.6	In the presence of persistent noise complaints, all construction equipment shall be verified to comply with MECP NPC-115 and NPC-118 guideline.
			9.7	In the presence of persistent complaints and subject to the results of a field investigation, alternative noise control measured may be required, where reasonably available. In selecting appropriate noise control and mitigation measures, consideration shall be given to the technical, administrative and economic feasibility of the various alternatives.
10.0	Air Quality Potential for dust from construction activities to adversely affect nearby land uses and watercourses	MTO MECP RES/BUS PUB	10.1	The Environment and Climate Change Canada's Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities shall be followed. At minimum, best practices during construction shall include material wetting or use of chemical suppressants to reduce dust, use of wind barriers and limiting exposed areas which may be a source of dust, and equipment washing.
			10.2	Vegetation barriers shall be incorporated to the landscape design. In general, a vegetation barrier shall be thick (approximately 6-metres or more) and have full leaf and branch coverage from the ground to the top of the canopy with no gaps in-between or underneath the vegetation. Typically, evergreen species are more effective than deciduous.
Cultural Heritage				
11.0	Archaeological Resources • Areas having potential for the recovery of archaeological resources within the study area • Previously unknown/deeply buried artifacts/human remains could be uncovered during construction	MTO MCM	11.1	A Stage 2 Archaeological Assessment shall be completed prior to detail design for all areas potentially impacted by the Recommended Plan, including construction grading and laydown areas.
			11.2	Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48(1) of the Ontario Heritage Act (Government of Ontario 1990b). The person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48(1) of the Ontario Heritage Act (Government of Ontario 1990b).
			11.3	The Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33 (Government of Ontario 2002) requires that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Government and Consumer Services.

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	Cultural Heritage Resources • Potential to effect identified built heritage resource during construction	MTO MCM	11.4	A buffer zone shall be established around the heritage attributes of the identified built heritage resource to avoid construction activities within 50 m.
			11.5	Staging and laydown areas shall avoid the identified built heritage resource.
			11.6	If construction activities are to be carried out within 50 m of the identified built heritage resource, a pre-construction vibration assessment shall be completed to determine acceptable levels of vibration. Should it be determined that the resource lies within a zone of influence, the building should be secured from experiencing negative vibration effects (i.e., adjustment of machinery or establishment of buffer zones. No additional mitigation is required should the resource be determined to be beyond the zone of influence.
Technical				
12.0	Utilities • Impacts to existing utilities during construction	MTO UTL	12.1	Utilities shall be contacted during detail design to confirm the location of existing utilities and potential conflicts. A utility relocation plan will be confirmed during detail design, in consultation with impacted utilities.
13.0	Traffic Operations • Impacts to traffic operations during construction • Temporary delay or disruption to EMS providers during construction.	MUN EMS STS	13.1	A detailed Traffic Management Plan will be developed and Detour Routes will be confirmed in consultation with the City of Brockville, school transportation services, and emergency service providers.
14.0	Rail Operations • Impacts to rail operations during removal/replacement of CNR (VIA) structure	MTO TC VIA	14.1	VIA will continue to be engaged with respect to the design of the new structure during detail design.
			14.2	Transport Canada's Standards Respecting Railway Clearances will be adhered to.
			14.3	A Notice of Railway Works shall be given at least 60 days before the proposed date of commencement of the proposed railway works in accordance with the Railway Safety Act for any construction or alteration in a municipality of railway bridges having an overall span greater than 6 m, or structures located above or below a line of railway by a party other than a railway company, any line works that may affect drainage on land adjoining the land on which a line of railway is situated.
			14.4	The Notice of Railway Works shall contain: • a drawing showing the location of the proposed works, • a description of the proposed works with general plans, including elevations of proposed structures, • a description of any impact that the proposed works may have on the safety of persons and property, and • the proposed date of commencement and the projected time for completion of the proposed works

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11.0 Monitoring

The planning and preliminary design phase of this project is now complete. Specific mitigation measures identified in this report will require confirmation during the detail design phase and monitoring during construction.

Monitoring will be conducted by on-site construction supervisory staff to ensure that environmental protection measures, as outlined in this report, confirmed during subsequent design phases, and included in the contract package, are implemented. This includes ensuring that the implementation of mitigating measures and key design features is consistent with commitments made to external agencies prior to construction.

For certain activities, monitoring by a Qualified Environmental Specialist will be required.

In the event that protective measures do not address concerns identified or if major problems develop, the appropriate agency will be contacted to provide additional input.

In the event that the impacts of construction are different than anticipated, or that the method of construction is such that there are greater than anticipated impacts, the Contractor's method of operation will be modified to reduce those impacts.