AECOM

Transportation Environmental Study Report

Highway 410 Improvements from South of Queen Street to North of Bovaird Drive – Preliminary Design and Class Environmental Assessment Study (W.O. #17-20005)

City of Brampton, Peel Region

Ontario Ministry of Transportation

60682865

April 2026

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AECOM: 2024-12-21

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Executive Summary

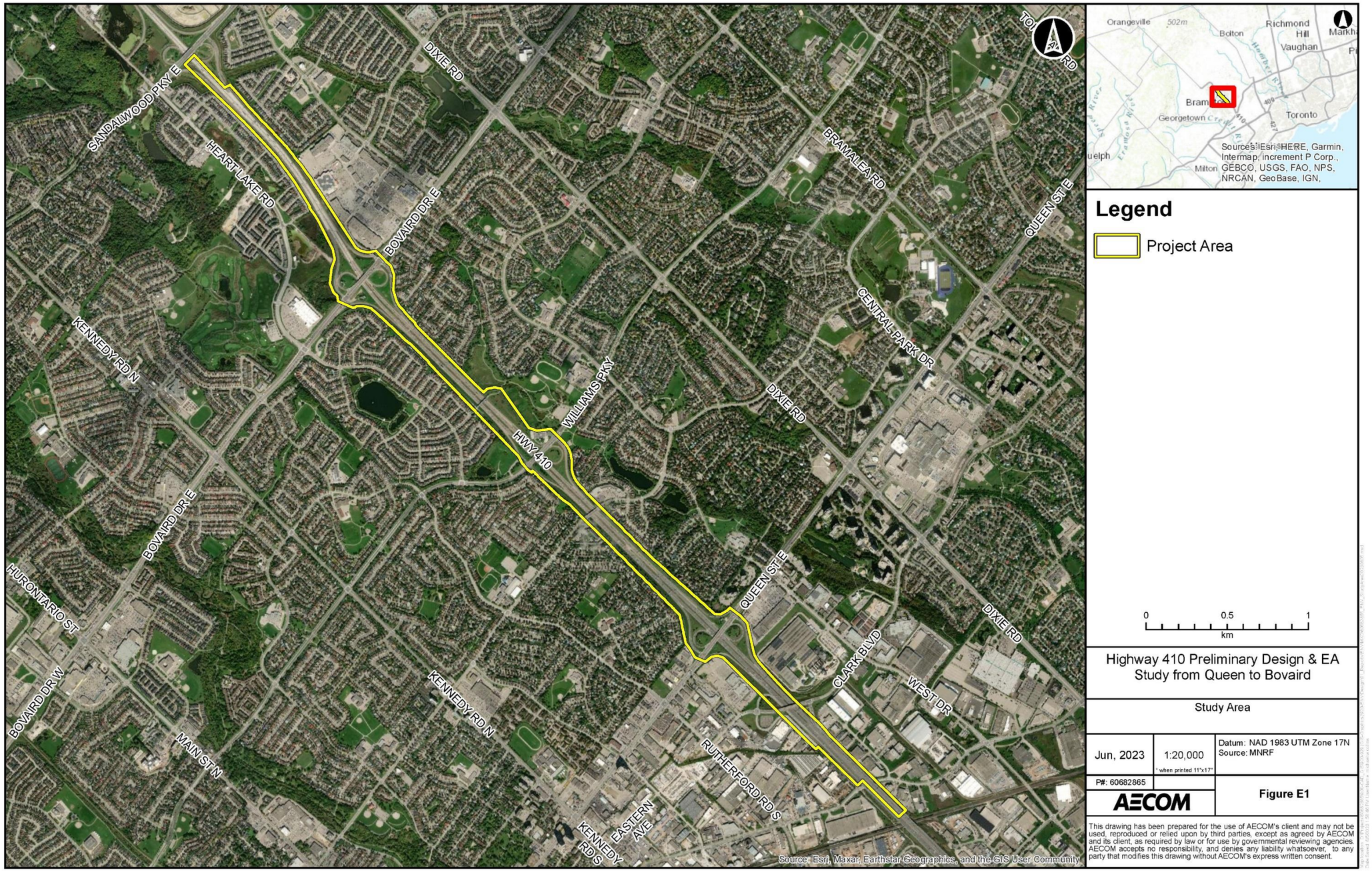
The Ontario Ministry of Transportation has undertaken a Preliminary Design and Class Environmental Assessment Study for improvements to Highway 410. The Study Limits extend from the Canadian National Railway (CNR) Highway 410 overpass (south of Queen Street) at the south, northerly to Sandalwood Parkway (north of Bovaird Drive), within the City of Brampton and Regional Municipality of Peel (refer to **Figure ES-1**).

The purpose of this study was to identify improvements of Highway 410 that will allow the next round of infrastructure rehabilitation and renewal to accommodate future traffic needs of Highway 410 within the study limits. The Recommended Plan (**refer to Section 8 and Appendix A**) includes the following improvements:

- Widening of Highway 410 to include High Occupancy Vehicle (HOV) lanes from south of Clark Boulevard northerly to Bovaird Drive and auxiliary lanes in each direction to address mainline capacity deficiencies.
- Improvements to interchange ramp geometry.
- Extension of tall wall median barrier.
- New noise barrier on the west side of Highway 410 between Vodden Street East and Williams Parkway.
- Implementation of the Stormwater Management Plan (SWM).
- Adjustments to interchange illumination and high-mast lighting.
- Pavement rehabilitation of existing Highway 410 lanes.

Consultation has been ongoing throughout the Study (**Section 3: Consultation**) and has included notifications to government agencies, Indigenous Communities, municipalities, interest groups and utility companies at the beginning of the study by letter in September 2022. The general public was notified via newspaper advertisements and brochures (a copy of the Ontario Government Notice (OGN) distributed by Canada Post Direct Mailing to all routes within 250 metres of the study corridor) informing them of the study initiation and to solicit their comments. One Public Information Centre was held for this study in May 2024 (to present the evaluation of alternatives, the preliminary Recommended Plan and proposed mitigation measures). A website was also created for the public and stakeholders to learn more about the project.

Figure ES-1: Study Area



Meetings were held throughout the study at key milestones with City of Brampton, Region of Peel, and Metrolinx. These meetings focused on collection of existing conditions information and to present and obtain feedback on the generation and evaluation of alternatives, the Preliminary Design details of the preliminary preferred alternative, potential environmental impacts and proposed mitigation measures.

Impacts to the natural, socio-economic and cultural environments as well as impacts to infrastructure associated with the Recommended Plan for improvements to the Highway 410 corridor within the Study Area have been identified (**Section 8** and **Section 9**). Mitigation measures to minimize or avoid potential adverse environmental impacts as well as commitments to future work have been identified for completion during future design stages and/or implementation during construction of the Recommended Plan for highway improvements.

The Public Record

A copy of this document has been submitted to the following office of the Ministry of the Environment, Conservation and Parks (MECP) to be placed in the Public Record:

- **Ministry of the Environment, Conservation and Parks**
  Halton-Peel MECP District Office
  Suite 300, 4145 North Service Road
  Burlington, Ontario L7L 6A3

The Transportation Environmental Study Report will be available for a 30-day public comment period from **Friday, May 15** and ending **Monday, June 15** on the project website.

- **Project Website:** www.hwy410queentobovaird.ca/documents-links

Comments

If you have questions or comments, you can send an email or call or visit the project website.

- **Email:** ProjectTeam@hwy410queentobovaird.ca
- **Telephone:** 1-844-698-9876
- **Project Website:** www.hwy410queentobovaird.ca/

Cette publication hautement spécialisée Transportation Environmental Study Report Highway 410 Improvements – Preliminary Design and Class Environmental Study n'est disponible qu'en anglais conformément au Règlement 671/92, selon lequel il n'est pas obligatoire de la traduire en vertu de la Loi sur les services en français. Pour obtenir des renseignements en français, veuillez communiquer avec Nathalie Dube au ministère des Transports au 613-544-2200 x4049 ou par courriel à nathalie.dube@ontario.ca.

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1. Overview of the Project

1.1 Study Background and Location

AECOM Canada ULC (AECOM) was retained by the Ontario Ministry of Transportation to complete a Class Environmental Assessment and Preliminary Design Study for improvements to Highway 410. The Study Limits extend from the Canadian National Railway (CNR) Highway 410 overpass (south of Queen Street) at the south, northerly to Sandalwood Parkway (north of Bovaird Drive), within the City of Brampton and Regional Municipality of Peel (refer to **Figure 1-1**).

Highway 410 is a major north-south controlled access freeway linking the cities of Mississauga, Brampton and the Town of Caledon. This project's Study Area includes the Highway 410 from south of Queen Street to north of Bovaird Drive. The existing lane arrangement varies from ten lanes (one High Occupancy Vehicle (HOV) + four general purpose in each direction) at the south study limits to four general purpose lanes in each direction at the north study limits.

1.2 Greater Golden Horseshoe

The Ontario Ministry of Transportation published the Connecting the Greater Golden Horseshoe: A Transportation Plan for the Greater Golden Horseshoe (February 2022). The Greater Golden Horseshoe Transportation Plan provides a 30-year vision for mobility across the Greater Golden Horseshoe to provide the efficient and safe movement of people and goods. The improvements identified in this Transportation Environmental Study Report are consistent with the Transportation Plan for the Greater Golden Horseshoe as improvements to Highway 410 form part of the infrastructure required to support growth.

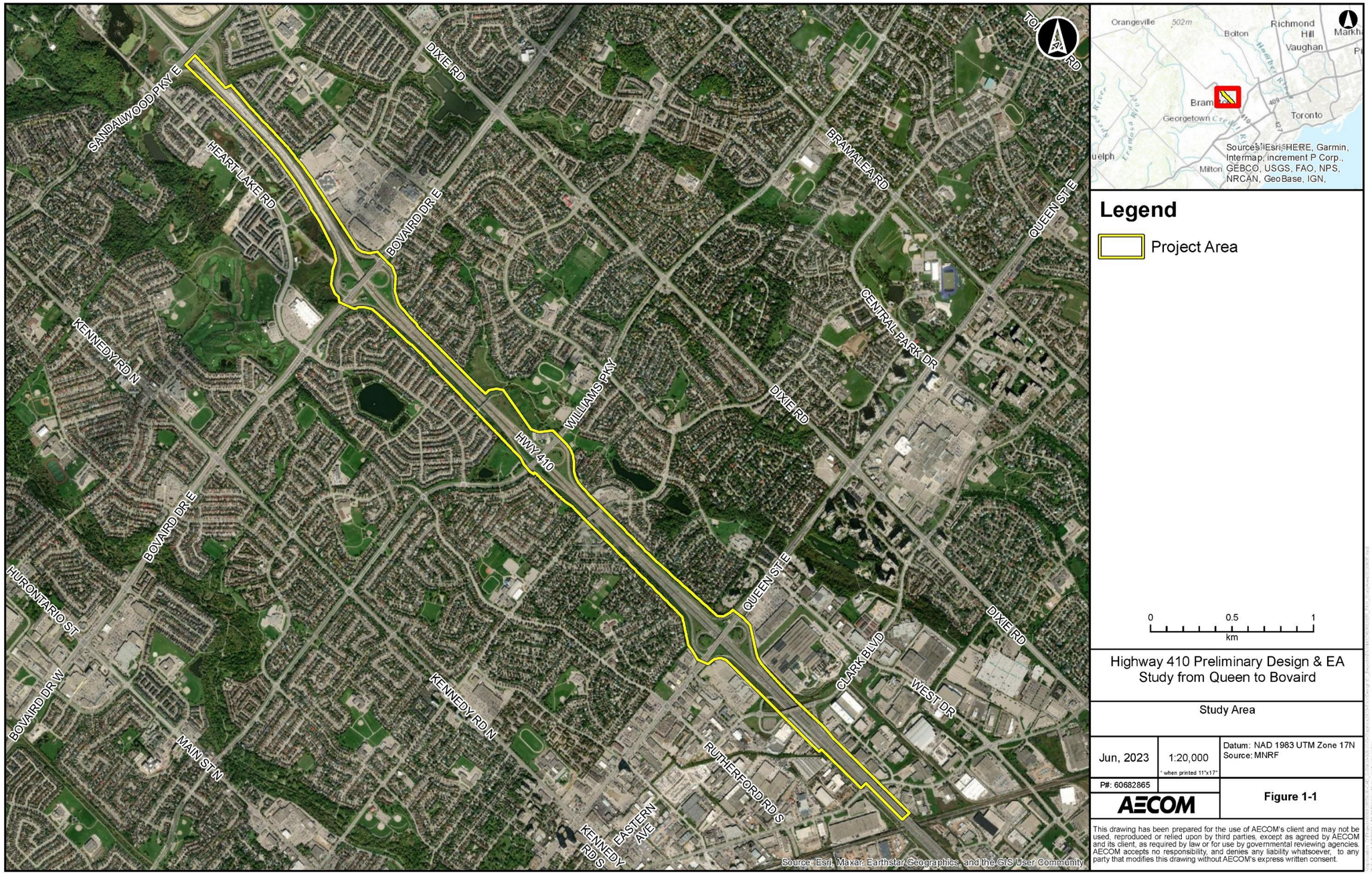
1.3 Study Purpose, Objectives and Scope

The purpose of this study was to identify improvements to the Highway 410 to ensure the highway can accommodate future traffic needs within the study limits for a horizon year of 2041.

The primary focus of this study is to review and confirm the operational needs and improvements for the highway corridor and determine the preferred plan for highway widening and extension of HOV lanes.

This study forms the basis for a future Detail Design and preparation of a contract package for construction. Timing is yet to be determined for these subsequent stages.

Figure 1-1: Study Area



1.4 Study Process

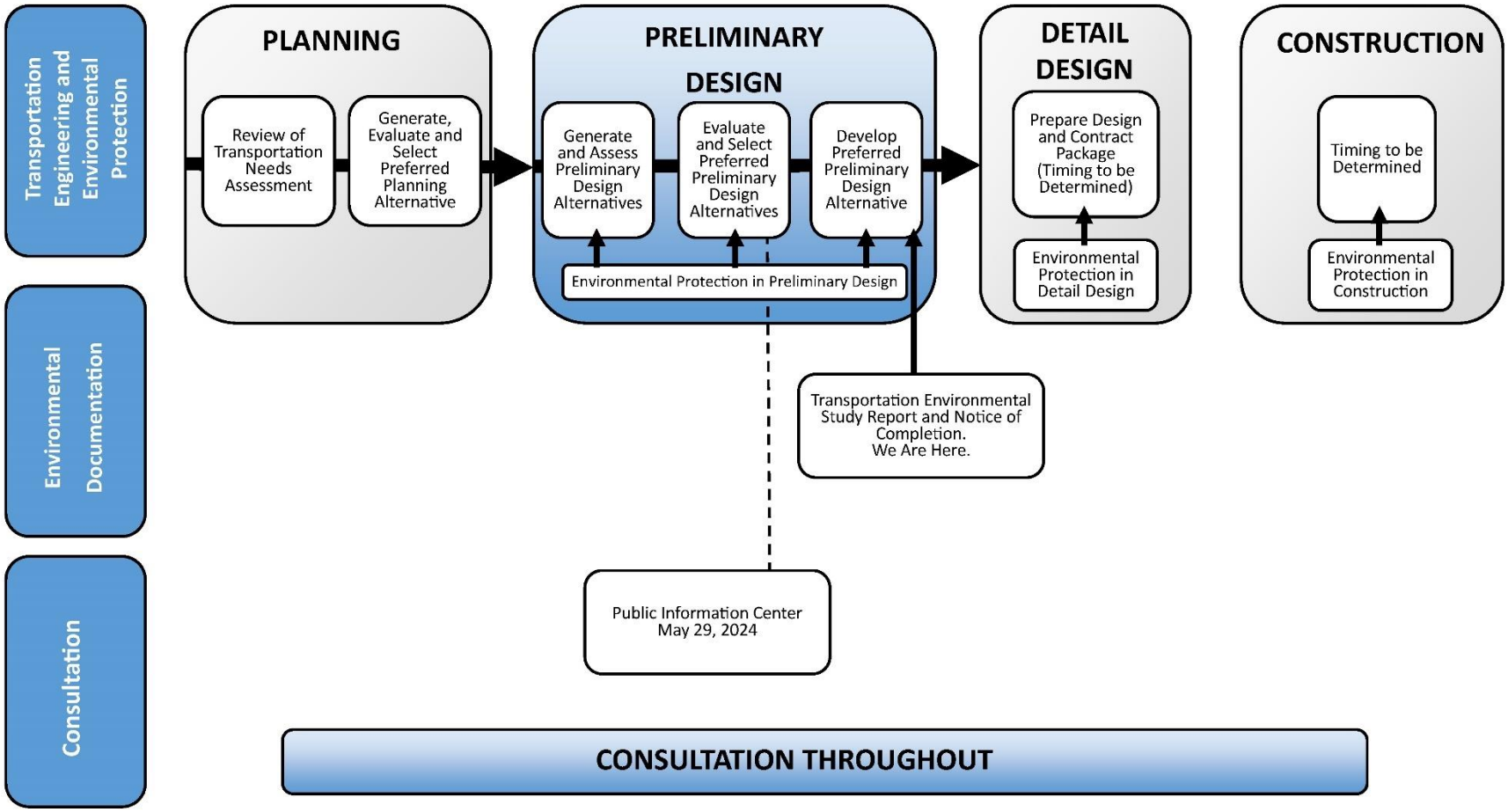
This study has been carried out in accordance with the approved planning process for a Group 'B' project under the Ontario Ministry of Transportation Class Environmental Assessment for Provincial Transportation Facilities (2000) (Class Environmental Assessment (EA)). This Transportation Environmental Study Report (TESR) documents the Class EA Process that was followed for the Study and includes the following:

- A description of the Environmental Assessment process and consultation that was undertaken throughout the study;
- Existing environmental (natural, socio-economic and cultural environments) and transportation conditions within the Study Area;
- An assessment of identified transportation problems and needs within the Study Area, along with opportunities to address identified issues;
- The generation, assessment, and evaluation of improvement alternatives;
- Details of the Technically Preferred Preliminary Design Alternative; and,
- Potential impacts associated with the Technically Preferred Alternative and proposed measures to avoid, minimize and mitigate potential impacts.

Figure 1-2 shows an overview of the Class EA process for Group 'B' projects. The study process provided opportunities for public and external agency review at key project milestones, as well as for a continuous, evolving approach to the technical work involved.

This Transportation Environmental Study Report has been prepared and made available for a 30-day public comment period from **Friday, May 15** and ending **Monday, June 15**.

Figure 1-2: Study Process



1.5 General Description of the Recommended Plan

The Recommended Plan for the study includes:

- Widening of Highway 410 to include HOV lanes from south of Clark Boulevard northerly to Bovaird Drive and auxiliary lanes in each direction to address mainline capacity deficiencies.
- Improvements to interchange ramp geometry.
- Extension of tall wall median barrier.
- New noise barrier on the west side of Highway 410 between Vodden Street East and Williams Parkway.
- Implementation of the Stormwater Management Plan (SWM)
- Adjustments to interchange illumination and high-mast lighting.
- Pavement rehabilitation of existing Highway 410 lanes.

The Recommended Plan (**refer to Section 8**) drawings can be found in **Appendix A**

An Environmental Assessment Report (EAR) for the extension of Highway 410 was completed in 1989. The project aimed to address growing traffic volumes in the City of Brampton and Town of Caledon. During the mid-1990s, MTO updated the EAR to meet current environmental standards at that time and to assess whether such an update would impact the original recommended route. This update confirmed that the original route was the preferred alternative. The Environmental Assessment Report (dated August 1995) received approval from the Minister of the Environment in 1997. An amendment to the 1995 EAR was required and documented in an Environmental Study Report (ESR) for the extension of Highway 410 from Bovaird Drive to Highway 10 (Main Street), that was published in October 1999 by MTO.

The Recommended Plan for the Project builds on the ESR completed in 1999. The ESR assessed the environmental impacts of the proposed highway extension and outlined the necessary mitigation measures. The project area included the City of Brampton and the Town of Caledon within the Regional Municipality of Peel. The work associated with this Project included approximately 9.0 kilometres of new limited access freeway connecting to Bovaird Drive in the south and existing Highway 10 just north of Valleywood Boulevard in the north. An extension of Highway 410 was planned as a 4-lane limited access freeway, with an ultimate expansion to 6 lanes from Bovaird Drive to Mayfield Road. The project included full interchanges at Bovaird Drive, Sandalwood Parkway, Mayfield Road, and Valleywood Boulevard. Most construction activities related to this previous project were completed.

Phase 1 of detail design, known as Work Project 130-99-00, extended the highway from Bovaird Drive to Sandalwood Parkway, focusing on grading and drainage works, and the construction of a structure at Sandalwood Parkway, as well as improvements to Sandalwood Parkway itself. The design included a shift in the centreline, an urban median with an Ontario Tall Wall barrier, and a full interchange at Sandalwood Parkway with a six-lane road structure with sidewalks. This phase also included utility crossings and advance grading for the future six-lane section of the highway. A modified parclo 'A' interchange was built at Sandalwood Parkway, while the realignment of Heart Lake Road was planned for future stages. These works were documented in a Design and Construction Report (June 2002). Phase II of detail design included re-configuration of Highway 410/Bovaird Drive interchange, completion of Highway 410/Sandalwood Parkway interchange, high mast illumination, and paving from Bovaird Drive to Mayfield Road. These works were documented in a Design and Construction Report (March 2006). The Design and Construction Reports for both phases documented the selected designs, environmental impacts and mitigation strategies, and a summary of the consultation process.

Based on reviews of traffic data the new plan (**Section 0**) introduces an additional northbound General Purpose Lane (GPL) from the proposed terminus of the northbound High Occupancy Vehicle (HOV) lane, located south of Bovaird Drive, extending to Sandalwood Parkway and an additional southbound GPL from south of Sandalwood Parkway to Queen Street. These additional GPLs are needed to transition from the existing 4-lane configuration to the HOV configuration (1 HOV lane + 3 GPL). As a result, this study includes a partial implementation of the ultimate (6-lane) configuration from the previous study discussed above. The plan also includes rehabilitation of the bridges within the study limits, including the Bovaird Drive Underpass. These modifications aim to enhance traffic flow and capacity, addressing anticipated increases in traffic volumes more effectively than the original design. The additional lanes are expected to improve overall transportation efficiency and reduce congestion, particularly during peak travel times, while maintaining the project's commitment to minimizing environmental and socio-economic impacts.

2. Environmental Assessment Process

2.1 Ontario *Environmental Assessment Act* and Class Environmental Assessment Process

The purpose of Ontario's *Environmental Assessment Act* is to help protect and conserve Ontario's environment by requiring that projects subject to the Act follow a planning process leading to environmentally sound decision-making.

For projects subject to the *Environmental Assessment Act*, an Environmental Assessment involves identifying and planning for environmental issues and effects prior to implementing a project. The process allows reasonable opportunities for public involvement in the decision-making process of the project. An Environmental Assessment document is prepared by the proponent of the project.

The Class Environmental Assessment process is a planning process approved under the *Environmental Assessment Act* that provides a streamlined process that must be followed for projects or activities within a defined "class". When the Class Environmental Assessment planning process is adhered to for a project, the requirements of the *Environmental Assessment Act* are also fulfilled and formal approval under the *Environmental Assessment Act* is not required. The Class Environmental Assessment requirements must be met before a project can be implemented. Projects and activities that are defined within a "class" are generally ones that are recurring, carried out routinely and have predictable environmental effects that can usually be mitigated.

The word "environment" within the *Environmental Assessment Act* is broadly defined and can include aspects of the natural, social, economic and cultural environments depending on the project in question. The Class Environmental Assessment for Provincial Transportation Facilities (2000*)* outlines the Environmental Assessment process to be followed for specific groups of provincial transportation projects. Project groupings within the Class Environmental Assessment were established for the purposes of consultation and documentation. The groups of projects are as follows:

- Group 'A' – Projects involving new facilities;
- Group 'B' – Projects involving major improvements to existing provincial transportation facilities;
- Group 'C' – Projects involving minor improvements to existing provincial transportation facilities; and
- Group 'D' – Activities that involve operation, routine maintenance, administration and miscellaneous work for provincial transportation facilities.

> These activities are approved under the *Environmental Assessment Act* subject to compliance with applicable environmental legislation other than the *Environmental Assessment Act*.

This project is following the Class Environmental Assessment process for a Group 'B' project, which generally includes major improvements to existing provincial transportation facilities. Other aspects of the Environmental Assessment process applicable to Group 'B' projects are contained in the Class Environmental Assessment.

2.2 Federal Impact Assessment Act

In August 2019, the Canadian *Environmental Assessment Act* (2012) was replaced by the Impact Assessment Act which revised the activities which could trigger a federal impact assessment and created a new impact assessment process. Projects which are listed on the Impact Assessment Act's Physical Activities Regulations are automatically designated for assessment. Additionally, the Minister of the Environment and Climate Change has the discretionary authority to designate a proposed project that is not on the list following a request from the proponent, public, Indigenous Communities, interested stakeholders, agencies or other jurisdictions.

The proposed improvements to Highway 410 do not meet the criteria within the Physical Activities Regulations and assessment of the project under the Impact Assessment Act is therefore not required.

2.3 Purpose of the Transportation Environmental Study Report

This Transportation Environmental Study Report (TESR) documents the transportation problems and opportunities, the generation, assessment and evaluation of alternatives, the Recommended Plan for improvements to this section of the Highway 410 corridor, a summary of potential environmental effects and proposed mitigation measures, and a summary of consultation undertaken throughout the study.

As required under the Class Environmental Assessment, this Transportation Environmental Study Report is being made available to the public, other interested parties and external agencies for a 30-day comment period commencing on **Friday, May 15** and ending **Monday, June 15** on the project website:

- www.hwy410queentobovaird.ca/documents-links/

A "Notice of Completion" was placed in the Brampton Guardian (in English) and Le Métropolitain (in French) to notify interested parties of the opportunity to review this

Transportation Environmental Study Report. Letters were also sent to individuals on the project mailing list on **Thursday, May 14**.

Detailed background information, including supporting study reports, is contained in the environmental study file. The Ministry of Transportation and the AECOM Project Team members are available to discuss this information.

Interested persons are encouraged to review the Transportation Environmental Study Report and provide comments by **Monday, June 15** through the project website or Project Team contacts:

- **Parshad Patel, M.Eng.**
  Senior Project Manager
  Ministry of Transportation
  159 Sir William Hearst Avenue, 4th Floor
  Toronto, Ontario M3M 0B7
  ProjectTeam@hwy410queentobovaird.ca
- **Tim Sorochinsky, P.Eng.**
  Consultant Senior Project Manager
  AECOM Canada ULC
  105 Commerce Valley Drive West
  Markham, Ontario L3T 7W3
  ProjectTeam@hwy410queentobovaird.ca

  Click to visit the Highway 410 Preliminary Design EA Project Team Website

In addition, a request may be made to the Ministry of the Environment, Conservation and Parks for an order requiring a higher level of study (i.e., requiring a comprehensive EA approval before being able to proceed), or that conditions be imposed (e.g., require 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 contact information and full name for the ministry.

Requests should specify what kind of order is being requested (request for additional conditions or a request for a comprehensive environmental assessment), how an order may prevent, mitigate or remedy those potential adverse impacts, and any information in support of the statements in the request. This will ensure that the ministry is able to efficiently begin reviewing the request.

The request should be sent in writing or by email to the Ministry of Transportation Project Manager listed above and to:

- **Minister of the Environment, Conservation and Parks**
  Ministry of the Environment, Conservation and Parks
  777 Bay Street, 5th Floor
  Toronto, Ontario M7A 2J3
  Email: minister.mecp@ontario.ca

and

- **Director, Environmental Assessment Branch**
  Ministry of the Environment, Conservation and Parks
  135 St. Clair Avenue West, 1st Floor
  Toronto, Ontario M4V 1P5
  Email: EABDirector@ontario.ca

Comments are being collected to provide and obtain information, and to identify concerns in accordance with the *Environmental Assessment Act*. This material will be maintained on file for use during the project and may be included in study documentation.

Information collected will be used in accordance with the Freedom of Information and Protection of Privacy Act. With the exception of personal information, all comments will become part of the public record.

If you have any accessibility requirements in order to participate in the review of this Transportation Environmental Study Report, please contact the Project Team.

3. Consultation

Consultation is an integral part of a Group 'B' project under the Class Environmental Assessment process, as it provides opportunity for two-way communication between the Project Team and interested persons. Interested persons consultation was undertaken to assist in planning the impact assessment for this project. Individuals and organizations consulted include:

- Members of Parliament (MPs) and Members of Provincial Parliament (MPPs)
- External agencies (Provincial Ministries and Agencies, Federal Departments, and the local Conservation Authority);
- Municipalities;
- Indigenous Communities; and
- Members of the public (including affected land and business owners, community / interest groups and the general public).

To facilitate a comprehensive consultation program for this Study, the Project Team implemented the following communication and consultation activities to reach all stakeholders and provide them the opportunity to submit comments and feedback for consideration by the Project Team:

- **Project Website:** www.hwy410queentobovaird.ca/
- **Project Telephone Line:** 1-844-698-9876;
- Project Contact List;
- Emails via the Project Team email address (ProjectTeam@hwy410queentobovaird.ca);
- Mailings / notifications (via physical mail or email);
- Newspaper advertisements;
- Distributions of brochure notifications (copy of the Ontario Government Notice) through Canada Post Neighbourhood Mail to residences and businesses within 500 metres (250 metres on each side of the highway centreline) of the Study Area);
- Public Information Centre (PIC);
- Outreach regarding engagement and consultation with Indigenous Communities;
- Meetings and correspondences with municipalities, the local Conservation Authority and government agencies; and
- Correspondence with technical stakeholders, local community groups and property owners.

Relevant correspondence including copies of notification materials are included in **Appendix B, Appendix C, and Appendix D** of this document.

3.1 Public Consultation

3.1.1 Study Notices

3.1.1.1 Notice of Study Commencement

A Notice of Study Commencement was published for the Highway 410 Improvements Preliminary Design and Class Environmental Assessment Study in the Brampton Guardian (in English) on September 1, 2022 and Le Métropolitain (in French) on September 8, 2022. Letters were distributed to the project contact list by mail and email on September 8, 2022. The notice was distributed as a brochure through Canada Post Neighbourhood Mail to residences and business within the Study Area (approximately 13,000 notices at the time of Study Commencement in September 2022).

3.1.1.2 Notice of Public Information Centre

A Notice of Public Information Centre was published for the Highway 410 Improvements Study in the Brampton Guardian (in English) and Le Métropolitain (in French) on May 16, 2024 notifying the public of the Public Information Centre being held on May 29, 2024. Letters were distributed to the project contact list by mail and email on May 15, 2024. The notice was distributed as a brochure through Canada Post Neighbourhood Mail to residences and business within the Study Area (approximately 13,000 notices).

3.1.1.3 Property Owner Letters

A Notice of PIC letter was mailed on May 15 2024, to the owner of a property that is expected to be directly impacted by construction of the Recommended Plan.

3.1.1.4 Notice of Completion

Notification letters were mailed to individuals on the project contact list to notify stakeholders of the 30-day public and agency comment period for this Transportation Environmental Study Report. In addition, a “Notice of Completion” was placed in the Brampton Guardian (in English) and Le Métropolitain (in French) and was made available on the Project website (www.hwy410queentobovaird.ca/). A copy of the Transportation Environmental Study Report was also made available on the Project website.

3.1.2 Public Information Centre

3.1.2.1 Public Information Centre

A Public Information Centre (PIC) was held in person on May 29, 2024, to present and receive feedback on the preliminary design alternatives, the preliminary Technically Preferred Alternative, and potential mitigation strategies to minimize environmental and community impacts. The display materials presented at the Public Information Centre can be found in **Appendix D**

The format of the Public Information Centre was an in-person event from 4:00 pm to 8:00 pm. Stakeholders and members of the public were invited to attend the PIC at Professor's Lake Recreation Centre – Auditorium, 1660 North Park Drive, Brampton, Ontario, L6S 5S8. Project Team representatives answered questions and discussed the project in person at the PIC event. There were 27 stakeholders that attended the event including representatives of MPP Charmaine Williams, and 22 of the attendees elected to sign the visitors register for the event.

Attendees were encouraged to complete PIC comment forms at the PIC, or submit comments through the project website or by emailing the Project Team email address following the PIC. Responses received are shown below in **Table 3-1**.

Table 3-1: Summary of Public Information Centre Questions and Comments

Stakeholder Comments	Project Team Response
Detail Design and construction ■ **Questions about timings of project and the anticipated budget.**	■ At this time the project has not progressed into Detailed Design so information regarding the budget, design standards and software usage are not available. ■ At the end of this phase of the study preliminary design will be complete and documented in the Transportation Environmental Study Report that will be made available for a 30-day public and agency comment period.
Noise impacts ■ **Concerns related to the increased noise generated by the increased traffic flow due to the widening of the Highway 410 and inquiries related to whether noise mitigation measures, such as sound barrier walls or berms) will be installed.**	■ As part of this project, a traffic noise assessment was undertaken to review any noise sensitive areas. The Noise Assessment concluded that one of the noise sensitive areas (NSA03) on the west side of Highway 410 between Vodden Street and Williams Parkway warrants noise mitigation as a result of the proposed improvements. The exact details of the noise mitigation are unconfirmed at this stage of the project but further information will be available as the project progresses.
Property Impacts ■ **Old Heart Lake Road is not closed off at Queen Street.**	■ MTO will review the need for fencing at Queen Street and Old Heart Lake to close this access during the detail design phase of the project.
Traffic Flow ■ **Concerns about bottleneck effects and increased traffic due to the widening of Highway 410.**	■ As part of the Preliminary Design, the Project Team will investigate Highway 410 northbound and southbound traffic capacity and identify potential solutions to alleviate traffic related concerns. A Traffic Report will be prepared to capture the analysis and recommendations. The Project Team will consider your input regarding capacity concerns and turning lanes, as the Preliminary Design study progresses. ■ A copy of the recommended plan for the corridor can be found on the project website (https://hwy410queentobovaird.ca/wp-content/uploads/2024/08/Hwy-410-Queen-to-Bovaird-Technically-Preferred-Plan.pdf) and we can confirm that widening the highway has been recommended. Specifically, the recommended plan for the project involves HOV lane extensions from Clark Boulevard to Bovaird Drive in the northbound direction and from Bovaird Drive to Orenda Road in the southbound direction, and additional lanes in the following locations: **Northbound** • South of Orenda Road to Clark Boulevard • Clark Boulevard to Queen Street • Queen Street to Williams Parkway • Bovaird Drive to Sandalwood Parkway **Southbound** • Sandalwood Parkway to Queen Street
Lighting ■ **Concerned there will be an increase in highway lighting.**	■ The recommended plan does include adjustments to interchange illumination and high-mast lighting. Further information will be available as the project progresses.

3.2 External Stakeholder and Indigenous Consultation

3.2.1 Indigenous Communities

The following Indigenous Communities were contacted at key milestones throughout the study:

- Haudenosaunee Confederacy Chiefs Council / Haudenosaunee Development Institute;
- Wendat Nation;
- Mississaugas of the Credit First Nation; and
- Six Nations of the Grand River First Nation.

The Ministry of Transportation provided notifications for Study Commencement, the Public Information Centre, and Study Completion.

Table 3-2: Summary of Indigenous Community Questions and Comments

Stakeholder	Comments	Project Team Response
Mississaugas of the Credit First Nation (MCFN)	Acknowledged notice of Stage 1 Archaeological Assessment; requested to review the draft report; require Field Liaison Representative (FLR) on-site if archaeological field work occurs.	MTO acknowledges MCFN's requirements and the draft Stage 1 Archaeological Assessment Report will be shared when available. Participation of a FLR will be co-ordinated if field work is planned.
Wendat Nation	Requested confirmation of whether archaeological studies/field work will occur; provided updated contact email for future consultations and requested removal of old emails from the contact list.	The draft Stage 1 Archaeological Assessment Report will be shared when available and Wendat Nation will be contacted if field work is planned.
Haudenosaunee Confederacy	Raised concerns that the project infringes on Haudenosaunee rights and interests; asked for a meeting to discuss engagement, terms of reference.	MTO acknowledged concerns and offered to meet. No response has been received to date regarding scheduling a meeting. MTO also clarified that some related planning projects (Elgin County, Niagara) are outside MTO's jurisdiction. Details for those projects were provided and it was reaffirmed that MTO was willing to engage on Hwy 410 project.

3.2.2 External Agencies and Utility Providers

External agencies and other technical stakeholders were engaged throughout the project to-date, including federal, provincial and municipal agencies, conservation authorities and other technical stakeholders (e.g., utility companies) and are listed below. The project Contact List can be found in **Appendix B**.

Federal Agencies

- Canadian Transportation Agency
- Fisheries and Oceans Canada
- NAV Canada
- Transport Canada

Provincial Agencies

- Infrastructure Ontario
- Ministry of Agriculture, Food and Agribusiness
- Ministry of Community Safety and Correctional Services
- Ministry of the Environment, Conservation and Parks
- Ministry of Citizenship and Multiculturalism
- Ministry of Indigenous Affairs and First Nations Economic Reconciliation
- Ministry of Municipal Affairs and Housing
- Ministry of Natural Resources
- Ontario Heritage Trust
- Ontario Provincial Police
- Metrolinx

Municipal Agencies

- City of Mississauga
- City of Brampton
- Town of Caledon
- Peel Region
- Brampton Transit
- MiWay Transit
- Peel Regional Police
- Peel Regional Paramedic Services
- Mississauga Fire and Emergency Services
- Brampton Fire and Emergency Services

Conservation Authorities

- Toronto and Region Conservation Authority (TRCA)

Utility Service Providers

- Enbridge Gas
- Bell Canada
- Rogers Communications
- Alectra Utilities
- Public Sector Network
- TC Energy Co.
- Zayo
- Street lighting (MTO and Municipal owned)
- Storm sewers (MTO and Municipal owned)
- Municipal watermains.

Other Technical Stakeholders

- Ontario Cycling Association
- Jacobs
- Brampton Golf Club
- Peel Federation of Agriculture
- Valleywood Resident Association
- Greater Toronto Airports Authority
- Brampton Board of Trade
- Mississauga Board of Trade
- Riocan Management Inc.
- Toronto / Tarten - CPA5
- Toronto Cardinal Couriers - CPL8
- Ontario Federation of Agriculture
- Ontario Trucking Association

School Boards and Transportation

- Peel District School Board
- Dufferin-Peel Catholic District School Board

3.2.3 External Stakeholder Meetings and Comments

At the outset of the study and at key milestones, external agencies were contacted by mail/e-mail and asked to provide input. The Project Team met with municipalities within the Study Area, including Peel Region and City of Brampton on February 23, 2023; March 6, 2024; and May 27, 2024, to obtain Study Area information, input on the generation, assessment and evaluation of alternatives and their potential impacts, and support for the preliminary Recommended Plan (Table 3-3).

Meetings were held with the Metrolinx Queen Street-Highway 7 Bus Rapid Transit (BRT) project team to discuss the short-list design options for Highway 410 and any required design and traffic considerations relating to the BRT route to ensure both projects can proceed as planned.

Table 3-3: External Stakeholder Meetings

Date	External Agency Meeting	Meeting Purpose
February 23, 2023	Region of Peel and City of Brampton	■ Discussion focused on the study overview and a question period for general project inquiries.
March 6, 2024	Region of Peel, City of Brampton, and Metrolinx	■ Discussion focused on the Project Team requesting an update on any completed studies or future planned improvements, by the City, Region and Metrolinx that may impact the design at the Highway 410 interchanges within the project limits. ■ An overview of the project, environmental assessment process, consultation, environmental studies, and the alternative development and evaluation process were presented. Details of the proposed rehabilitation and improvements work were provided, followed by a review of the five Preliminary Design Alternatives developed as part of the study.
May 27, 2024	Region of Peel and City of Brampton	■ Discussion was held in advance of the Public ■ Information Centre (PIC) to share the preliminary technically preferred alternative.

Meeting minutes can be found in **Appendix C**.

4. Overview of Existing Conditions

To support the examination of a reasonable range of alternatives, all significant features within the Study Area were identified to determine their sensitivity and potential for impacts associated with the Highway 410 highway improvements. Identifying significant features involved the collection of primary and secondary source data derived from surveys, field investigation, published and unpublished literature, government sources and consultation with agencies and the public. The data collected was grouped in the following categories:

- Natural Environment;
- Socio-Economic Environment;
- Cultural Environment; and
- Transportation.

Information about the existing environmental features within the Study Area was collected from the following sources:

- Desktop reviews of online mapping data;
- Observations recorded during site visits;
- Aerial photos of the Study Area;
- City of Brampton and City of Mississauga Official Plans;
- Peel Region's Official Plan;
- Cole, Sherman and Associates, Highway 410 Extension from Bovaird Drive to Highway 10 – Environmental Study Report (1999);
- URS Canada Inc., Highway 410 Widening from South of Highway 401 Northerly to Queen Street – Design and Construction Report (2014);
- Ministry of Natura Resources Natural Heritage Information Centre database for significant species and designated natural features within, adjacent to, or in the vicinity of the Study Area; and
- Consultation with the Ministry of the Environment, Conservation and Parks, Ministry of Natural Resources and Forestry District Office and Toronto and Region Conservation Authority to obtain any additional information about significant species, designated natural features and fisheries.

The following sections provide an overview of the existing environmental conditions within the Study Area.

4.1 Natural Environment

Natural environment studies have been conducted to document and assess existing features, to inform a discussion of potential impacts and mitigations associated with the proposed highway improvements, and to identify applicable municipal, provincial, federal or other regulatory approvals or permits associated with the environment that may be required for the Project.

4.1.1 Fish and Fish Habitat

All of the features within the Study Area are tributaries of Spring Creek and are located within the Etobicoke Creek Watershed, ultimately draining to Lake Ontario and covers 4,966 hectares.

In addition to reviewing background information from Government Agencies, a detailed fish and fish habitat assessment of the water features in the vicinity of the Study Area was conducted in August 2022 and May/June 2023. Fisheries assessments were conducted in accordance with the requirements under the 2020 Ontario Ministry of Transportation Interim Environmental Guide for Fisheries.

Through the background information review, consultation with Ministry of Natural Resources and Forestry and Ministry of the Environment, Conservation and Parks, and 2022/2023 fish habitat field investigations it was determined that two watercourses associated with the Highway 410 Study Area provide direct fish habitat for fish use, while one watercourse provides indirect fish habitat. No Species at Risk (SAR) were found in waterbodies WC-01-CI, WC-02-Bo, or WC-03-Sa.

The location and description of the existing conditions for each watercourse within the Study Area is outlined in **Table 4-1**. Mapping of the watercourses within the Study Area can be found in **Figure 4-1**. The existing fish community at each watercourse is summarized in **Table 4-2.**

Table 4-1: Waterbody Locations within the Study Area

Waterbody I.D.	Date	Flow	Thermal Regime	Fish Habitat	Substrate Type	Channel Morphology	Vegetation	Constraints and Opportunities	Significant Fish Habitat
WC-01-CI	2022-08-05 2023-05-26	Permanent	Warm	Direct	**Upstream**: Concrete/brick **Downstream**: Concrete/brick	**Upstream**: Run **Downstream**: Run	**Upstream**: Moderate coverage provided by woody trees (ash, maple). Minimal instream vegetation provided by European common reed rhizomes. **Downstream**: High coverage provided by woody shrubs (honeysuckle, riverbank grape, willow). No instream vegetation.	**Constraint**: Seasonal low flow may cause decrease in depth and barrier to fish migration. Gabion baskets are beginning to fail in some of the downstream locations. **Opportunities:** Re-stabilize gabion baskets and add in natural channel features (artificial riffles, plunge pools, etc.)	None
WC-02-Bo	2022-08-05 2023-05-26	Intermittent	Warm	Indirect	**Upstream**: Sand/silt/clay **Downstream**: Sand/silt/clay	**Upstream**: N/A **Downstream**: N/A	**Upstream**: High in-channel coverage provided by cattails and European common reed. Bordered by terrestrial herbaceous plants and grasses. **Downstream**: High in-channel coverage provided by cattails, European common reed, terrestrial grasses. Bordered by terrestrial herbaceous plants and grasses.	**Constraint**: Check dams and stepped Gabion baskets interrupt fish passage and prevent connectivity. -Phragmites **Opportunities:** Invasive plant control	None
WC-03-Sa	2023-05-26 2023-06-21	Permanent	Warm	Direct	**Upstream:** Cobble / gravel / sand / detritus **Downstream:** Sand / gravel / cobble/ silt / muck	**Upstream:** Run, beaver pond/ wetland **Downstream:** Run, Flat, pool, riffle, culvert	**Upstream:** Moderate coverage that was provided by woody shrubs and trees (willow spp.) and wetland plants (cattails, European common reed) **Downstream:** high coverage that was predominately provided by European common reed, some cattails and a few riparian trees were present throughout the downstream reach.	**Constraints:** Beaver dam could be contributing to seasonal low flows downstream; stabilize erosion on left bank approximately 100 metres downstream from culvert outlet; European common reed prevalent throughout site. **Opportunities:** invasive plant control	None

Figure 4-1: Existing Fish Habitat

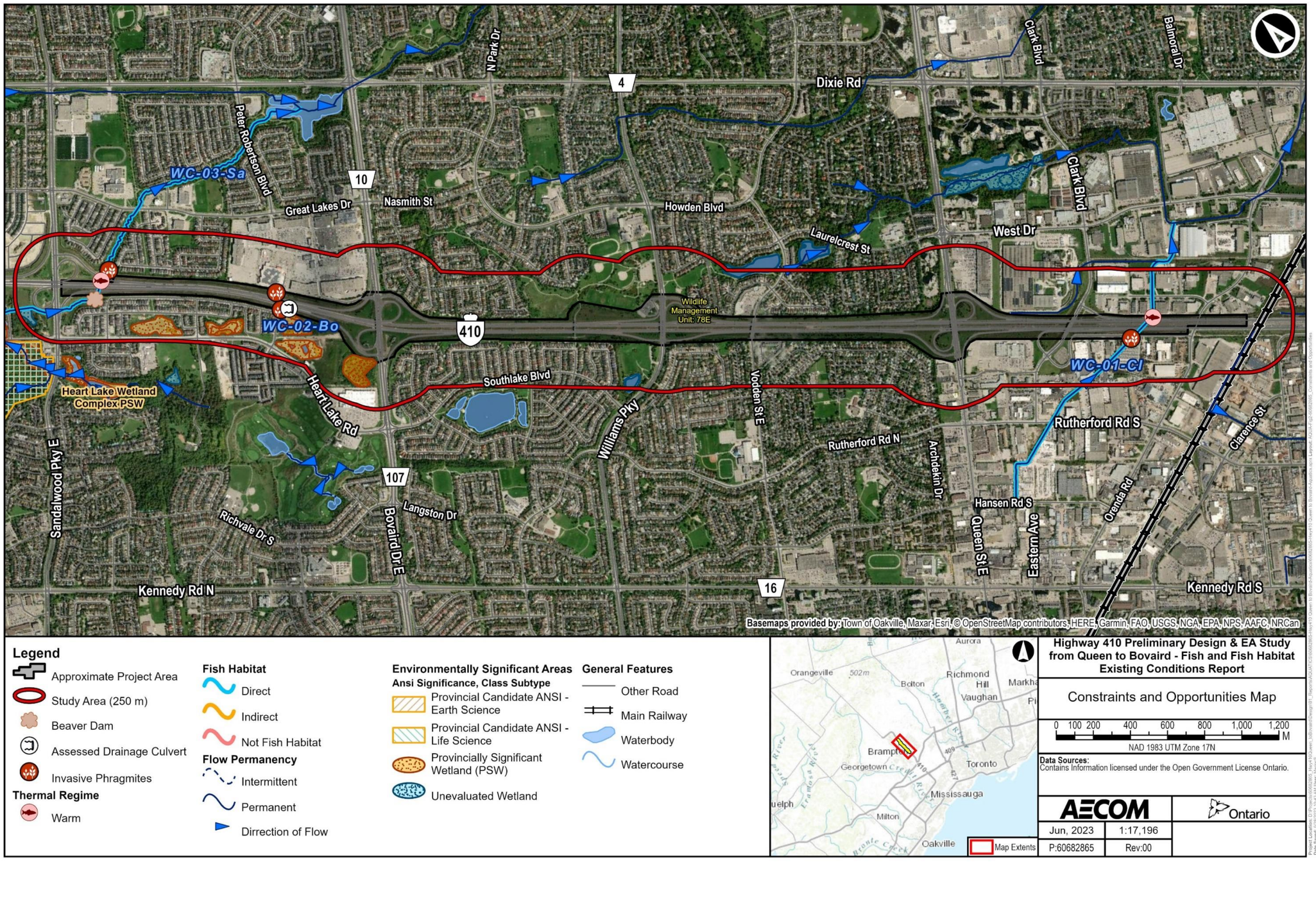


Table 4-2: Existing Fish Community Summary Table

Waterbody I.D.	Date	Fish Species Present	Year Class(es)	Species at Risk Present	In-water Works Timing Window[1,2]
WC-01-Cl	August 5, 2022 & May 26, 2023	Western Blacknose Dace, Bluntnose Minnow, Brook Stickleback, Cyprinidae hybrids, Central Stoneroller, Common Shiner, Creek Chub, Emerald Shiner, Fathead Minnow, Green Sunfish, Johnny Darter x Tesselated Darter, Longnose Dace, Pumpkinseed, Rock Bass, White Sucker		No	In-water work is permitted from July 16 – March 14.
WC-02-Bo	August 5, 2022 & May 26, 2023	No fish community data available.	N/A	No	In-water work is permitted from July 16 – March 14.
WC-03-Sa	May 26, 2023 & June 21, 2023	Brook Stickleback, Creek Chub, Fathead Minnow		No	In-water work is permitted from July 16 – March 14.

4.1.2 Topography

The topography of the Study Area is determined by its geologic foundations and associated landforms. The “Physiography of Southern Ontario” and “Map 2226-Physiography of the South-Central Portion of Southern Ontario” were accessed to review topographic features in the general vicinity of the Study Area. Surface topography of the Study Area ranges considerably. The ground surface within the Study Area is generally undulating, with ground surface elevation generally decreasing to the south towards Lake Ontario, and with low localized points at wetlands and streams. Specifically, ground elevation is at a maximum of approximately 246 meters above sea level (mASL) at the northern edge of the Study Area and generally decreases southwards to approximately 208 mASL at the southern edge of the Study Area.

The Study Area is situated within the Toronto Source Protection Area (SPA), intercepting a great portion of the Brampton Esker. The Brampton Esker stretches from Heart Lake southeastward to south of Queen Street in the Etobicoke Creek watershed. The Esker Drainage network intersects the Study Area from Bovaird Dr. to south of Queen St.

4.1.3 Physiography

The Study Area falls within multiple physiographic regions. The Study Area from the south limit up to Orenda Road is located within the Peel Plain physiographic region. The Study Area northwest of Queen Street East is located within the South Slope physiographic region. The Peel Plain is described as bevelled till plains, while the South Slope is described as drumlinized till plains. An esker associated with the South Slope physiographic region is identified running roughly parallel to the Study Area from Queen Street East to approximately 500 metres southeast of Highway 407.

4.1.4 Geology

Surficial geology varies throughout the Study Area. Glaciolacustrine-derived silty to clayey till; interbedded flow till, rainout deposits and silt and clay; organic deposits; Paleozoic bedrock; and, modern alluvial deposits: clay, silt, sand, gravel, potential organic remains, are located within the Study Area.

4.1.4.1 Bedrock Geology

The bedrock geology within the Study Area is shale, limestone, dolostone, and siltstone of the Queenston Formation.

4.1.5 Groundwater

4.1.5.1 Windshield Survey

On January 17th, 2023 and June 22nd 2023, AECOM field staff completed a limited drive-by Windshield Survey of the Study Area to identify potential hydrogeologic features visible from public roadways, including groundwater seepage areas (i.e., wetlands), exposed geologic features such as bedrock outcrops, and the presence of private water wells within the Study Area.

4.1.5.2 Groundwater Seepage Areas and Wetlands

Areas of standing water and potential wetlands were identified at several locations within the Field Investigation Area, most notably at low lying areas associated with creek crossings. According to the Ontario Wetland Evaluation System (OWES), there is one Provincially Significant Wetland (PSW) located at the northwestern edge of the Study Area. Additional sections of wetland observed during the Windshield Survey include one open-water wetland unevaluated as per OWES classification occurring in the southwest corner of Major Oaks Park at Highway 410 and Williams Parkway. It lays adjacent to, and at a lower elevation than, a residential area bordering the park. A second observed open-water wetland complex unevaluated as per OWES occurs within 500 meters of the northern boundary of the Right of Way (ROW) on either side of Vodden Street East. This complex consists of two open-water wetlands collectively known as the Parr Lakes, which together form the source waters of the watercourse flowing southeast towards a third unevaluated wetland complex outside of the Study Area at Norton Place Park. Additional sections of potential wetland are anticipated to be present throughout the Study Area.

4.1.5.3 Exposed Geologic Features

Exposed bedrock was not visible during the limited drive-by Windshield Survey of the Study Area. The lack of exposed bedrock within the Study Area indicates that overburden is present at ground surface throughout the Study Area.

4.1.5.4 Private Water Wells

Private water wells were noted at several locations within the Field Investigation Area, scattered along Highway 410, especially in the northern part of the study area, from Williams Parkway to Sandalwood Parkway East. According to MECP Water Well Records (WWR), approximately 19 existing private wells are present within the Study Area. The results of the Windshield Survey confirm presence and use of private water wells within the Study Area. One presumed irrigation well at Heart Lake Road was confirmed during the Windshield Survey.

4.1.6 Drainage and Hydrology

Field investigations and desktop assessments were completed to assess the existing and proposed drainage conditions within the Highway 410 corridor project limits. The potential impacts were evaluated, and a conceptual drainage/stormwater management plan was prepared as part of the proposed works (refer to Section 9.1.4). Based on the preceding analysis, the following conclusions and recommendations are made. The following can be concluded based on the findings from the field investigations, modelling and assessments completed as part of this study.

4.1.6.1 Existing Drainage Conditions

The Highway 410 project is located within the Spring Creek sub-watershed of Etobicoke Creek, which is under the jurisdiction of TRCA. Within the study area, three tributaries of Spring Creek (east branch of Etobicoke Creek) traverse Highway 410. Generally, the watercourses flow in a west to east direction, across the Highway 410 discharging to Etobicoke Creek and ultimately discharging to Lake Ontario.

Spring Creek is a watercourse draining approximately 50 km^2 of lands within the Etobicoke Creek Watershed. The Spring Creek sub-watershed, along with the rest of Etobicoke Creek watershed, is heavily urbanized with low amounts of natural and rural covers.

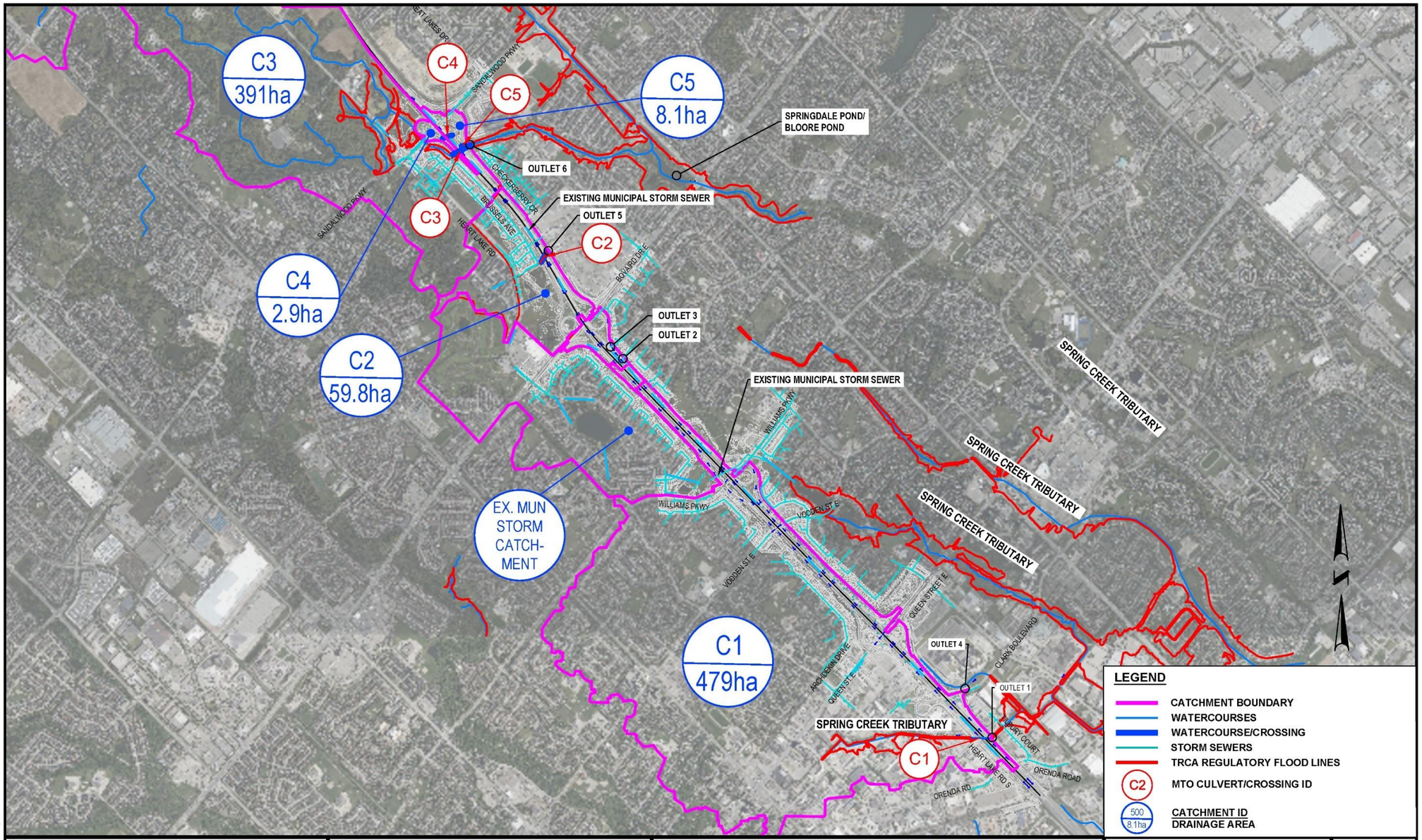
The existing watercourses and Regulatory flood lines for this section of Etobicoke Creek watershed were obtained from TRCA**.** Several properties east of Highway 410 are within the TRCA floodplain. TRCA's 2019 Spring Creek Floodplain Mapping update also identifies the existing channels, downstream of the highway watercourse crossings have capacity issues resulting in riverine flooding even during frequent storm events.

4.1.6.2 Watercourse/Drainage Crossings

The existing drainage pattern, water course crossings, and other drainage features in the study area are shown in **Figure 4-2**. As noted in **Figure 4-2**, there are five culvert crossings and two municipal storm sewers traversing Highway 410 within the project limit. Three of the crossings are classified as tributary watercourses of Spring Creek (Culverts C1, C2 and C3), while the remaining two culverts (Culvert C4 and C5) discharge interchange drainage.

A culvert inspection was completed by AECOM drainage staff on November 09, 2022, to provide photographic inventory and visual inspection of structure and stream conditions and preliminary recommendations. Results of the culvert inspection are documented in the Memorandum dated February 03, 2023.

Figure 4-2: Drainage Area



PLOTDATE: Jul 31, 2025 - 2:01pm

AECOM

Ontario Ministry of Transportation

HIGHWAY 410 IMPROVEMENTS FROM SOUTH OF QUEEN STREET TO NORTH OF BOVAIRD DRIVE PRELIMINARY DESIGN & CLASS EA STUDY

EXISTING WATERCOURSE CROSSING LOCATIONS AND DRAINAGE MOSAIC

SCALE: 250m 0m 500m
1:25000

DATE: FEBRUARY 2025

FIGURE 4.2

An existing condition assessment was completed for the subject watercourse crossings to determine hydraulic performance, identify deficiencies and provide mitigation measures, if needed, as well as requirements for rehabilitation. The existing municipal storm sewers crossing the highway were not part of the scope as they only drain external municipal drainage and are not connected to the Highway 410 drainage.

Results of the existing condition assessment completed for the watercourse crossings indicates that the existing culvert crossings have sufficient conveyance capacity, therefore, no hydraulic improvement is being recommended.

4.1.7 Terrestrial Ecosystems

A background review was completed to obtain information on known natural heritage features and species records including Species at Risk within the Study Area. As part of the background review, the Ministry of Natural Resources and Forestry and Ministry of the Environment, Conservation and Parks were consulted to acquire background natural heritage information. Field investigations were also completed in accordance with the Ministry of Transportation's Environmental Reference for Highway Design to supplement available background information. Findings and recommendations in this report are based upon the ESA prior to amendments on June 5, 2025.

4.1.7.1 Designated Natural Areas

Natural features and areas identified for protection in the Provincial Policy Statement and other legislation (e.g., Greenbelt Act, 2005) are collectively referred to as 'designated natural areas'. These include, but are not limited to, Areas of Natural and Scientific Interest, significant wetlands, Environmentally Significant/Sensitive Area, etc., and may be identified by the planning authority (e.g., province, municipality, conservation authority).

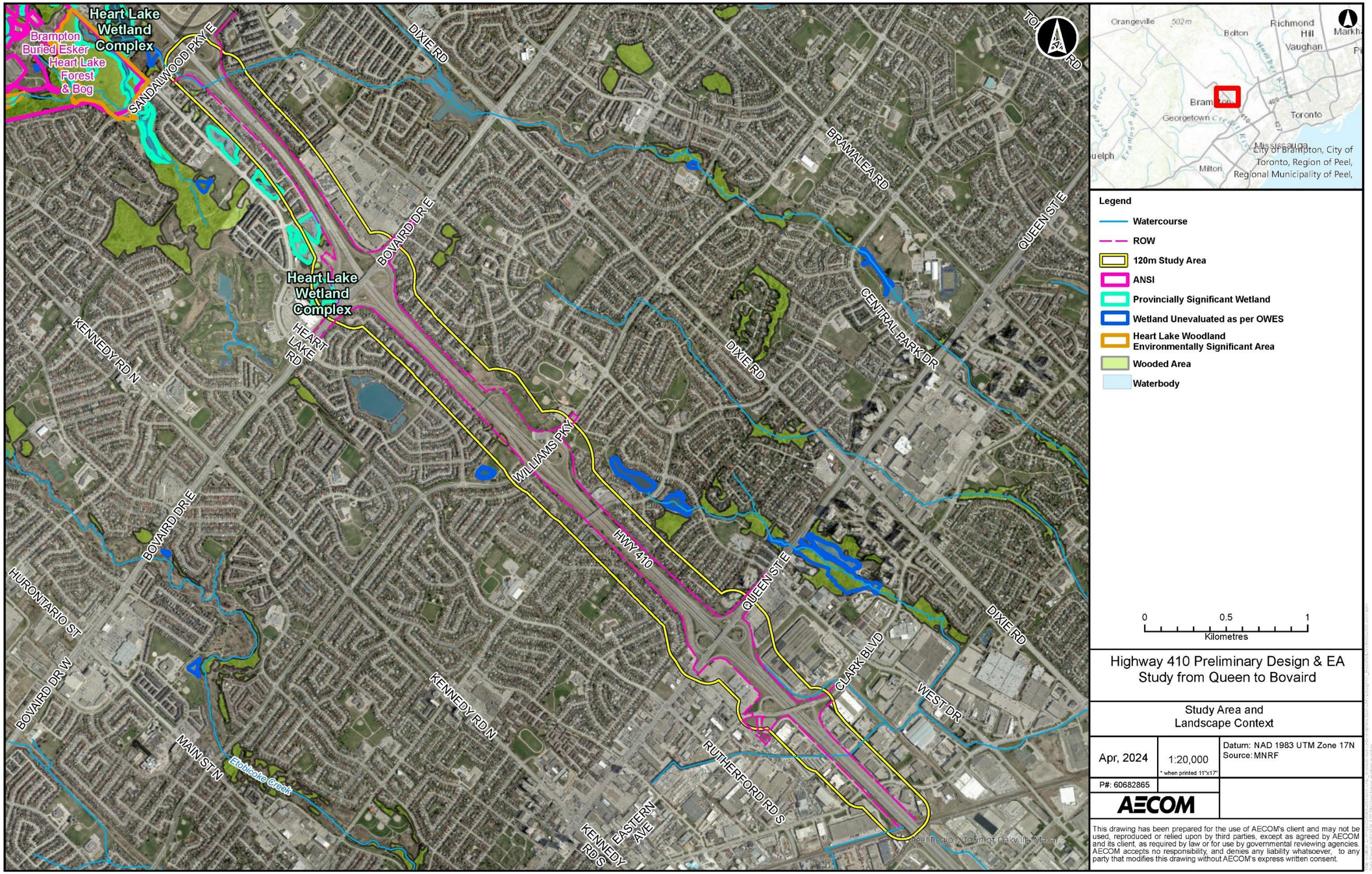
The Heart Lake Forest and Bog Regional Life Science Area of Natural and Scientific Interest (ANSI) and the Brampton Buried Esker Regional Earth Science ANSI are located adjacent to the northwest of the Study Area. Similarly, according to Schedule D of the City of Brampton Official Plan (2022), the Heart Lake Woodland Environmentally Significant Area (ESA) occurs northwest of the Study Area.

A summary of designated natural areas within the Study Area is provided in **Table 4-3** below and areas are shown on **Figure 4-3**. Maps highlighting the Ecological Land Classification (ELC) can be found in Appendix E.

Table 4-3: Designated Natural Areas within the Study Area

Designated Natural Area	Description	Location within the Study Area
Wetlands	■ Heart Lake Provincially Significant Wetland (PSW) Complex	■ Along the southbound side of Highway 410, north of Bovaird Drive East and adjacent to the southbound off-ramp to Bovaird Drive East.
Peel Region Natural Heritage System	■ Core Areas of the Greenlands System	■ Heart Lake PSW Complex northwest of the Highway 410 and Bovaird Drive interchange. ■ Also, small woodlands adjacent to the Study Area east of the Highway 410 and Bovaird Drive interchange and east of Highway 410 between Queen Street East and Vodden Street are Potential Natural Areas and Corridors and Natural Areas and Corridors, respectively.
City of Brampton Official Plan	■ Natural Heritage System ■ Linkages and Enhancement Areas ■ Valley and Watercourse Corridors ■ Woodland	■ Natural Heritage System along watercourses (south of Sandalwood Parkway East, north of Clark Boulevard and north of Orenda Road) and around Heart Lake PSW Complex at the Highway 410 and Bovaird Drive interchange. ■ Linkages and Enhancement Area within Bramalea Limited Community Park and south of Williams Parkway, east of Highway 410. ■ Valley and Watercourse Corridor south of Sandalwood Parkway East, north of Clark Boulevard and north of Orenda Road. ■ Small woodland adjacent to Study Area west of the Highway 410 and Bovaird Drive interchange. Also adjacent to Study Area east of Highway 410 and Bovaird Drive interchange and east of Highway 410 between Queen Street East and Vodden Street.

Figure 4-3: Designated Natural Areas



4.1.7.2 Vegetation Communities and Plants

In Ontario, vegetation communities are delineated according to the Ecological Land Classification system. The Ecological Land Classification system provides methods for identifying and mapping vegetation communities in a way that can be used for land use planning.

The Study Area north of Vodden Street is located within Ecoregion 6E (Lake Simcoe-Rideau). Ecoregion 6E, which is part of the Mixedwood Plains Ecozone, extends from Lake Huron in the west to the Ottawa River in the east, and includes most of the Lake Ontario shore and the Ontario portion of the St. Lawrence River Valley. The Simcoe-Rideau Ecoregion is underlain by Paleozoic dolomite and limestone, mainly of Ordovician and Silurian ages. The vegetation is relatively diverse. Hardwood forests dominated by sugar maple (*Acer saccharum*), American Beech (*Fagus grandifolia*), white ash (*Fraxinus americana*), eastern hemlock (*Tsuga canadensis*), and numerous other species are found where substrates are well developed on upland sites. Lowlands, including rich floodplain forests, contain Green Ash (*Fraxinus pennsylvanica*), Silver Maple (*Acer saccharinum*), Red Maple (*Acer rubrum*), Eastern White Cedar (*Thuja occidentalis*), Yellow Birch (*Betula alleghaniensis*), Balsam Fir (*Abies balsamea*) and Black Ash (*Fraxinus nigra*).

The southern half of the Study Area is located within Ecoregion 7E (Lake Erie-Lake Ontario). Ecoregion 7E, part of the Mixedwood Plains Ecozone, extends from Windsor to Toronto and includes the Niagara Region. The Lake Erie Lowland Ecoregion is underlain by carbonate-rich, Paleozoic bedrock, and is dominated by various deep glacial deposits (Ecological Stratification Working Group, 1995). Forests in this Ecoregion are characterized by Sugar Maple, American Beech, Oaks (*Quercus* spp.), Ash (*Fraxinus* spp.), American Elm (*Ulmus americana*), Eastern Cottonwood (*Populus deltoids*), Balsam Poplar (*Populus balsamifera*) and Silver Maple (Ecological Stratification Working Group, 1995). Forests in Ecoregions 6E and especially 7E are sparse due to urban development and agriculture.

Further details on the vegetation communities observed during field investigations is summarized in **Table 4-4**.

Table 4-4: Summary of Vegetation Communities Within the Study Area

Community	ELC Code	ELC Name	Tree Canopy	Shrub Layer	Ground Layer	Location in Study Area	Comments
Forest Communities (FO)	FOD2	Dry – Fresh Oak – Maple Deciduous Forest Ecosite	Greater than 60% tree cover: dominated by Northern Red Oak *(Quercus rubra),* Sugar Maple *(Acer saccharum)*, Black Sherry *(Prunus serotina*) and Eastern Cottonwood *(Populus deltoides*).	Between 25 and 60% shrub cover: dominated by European Buckthorn *(Rhamnus cathartica*), Chokecherry *(Prunus virginiana*) and Sugar Maple saplings.	Ground species observed included Riverbank Grape (*Vitis riparia*), Purple Crown-vetch (*Coronilla varia*) and Smooth Brome (*Bromus inermis*).	One polygon located along the southbound off-ramp to Bovaird Drive East.	Designated Heart Lake PSW Complex. Survey completed from roadside/edge of community due to presence of an encampment and safety concerns.
Cultural Communities (CU)	CUH	Cultural Hedgerow	Dominate tree cover of Norway Spruce, Blue Spruce, Austrian Pine and Norway Maple.	Shrub layer consisted of European Buckthorn.	Little to no ground vegetation. Mowed areas.	Three polygons; one south of Hwy 410 and along northern edge of Brussels Avenue, and two along north and south side of Highway 410 between Vodden Street East and Queen Street East.	None.
Cultural Communities (CU)	CUM1-1	Dry – Moist Old Field Type	Sparse (1-10%) tree cover of Norway Spruce, Russian Olive (*Elaeagnus angustifolia*), Norway Maple *(Acer platanoides*) and Freeman's Maple (*Acer x freemanii*).	Shrub layer consisted of European Buckthorn, Russian-olive and Red Ash (*Fraxinus pennsylvanica*) saplings.	Greater than 60% ground cover: dominated by Thistles *(Cirsium spp.*), Kentucky Bluegrass *(Poa pratensis*), Canada Goldenrod (*Solidago canadensis*) and Smooth Brome.	Two polygons; one northwest of Bovaird Drive East and the other within Bramalea Limited Community Park, north of Williams Parkway.	None.
Cultural Communities (CU)	CUT1	Mineral Cultural Thicket Ecosite	Trees observed included Russian Olive and Manitoba Maple (*Acer negundo*).	Shrubs observed included European Buckthorn, Staghorn Sumac (*Rhus typhina)*, Cottony Willow (*Salix eriocephala*) and Red-osier Dogwood (*Cornus sericea*).	Ground cover was dominated by tufted vetch (*Vicia cracca*), Kentucky bluegrass and Canada goldenrod with reed canarygrass (*Phalaris arundinacea*) and European reed (*Phragmites australis* ssp. *Australis*) along watercourse.	East and west of Highway 410 along watercourse south of Sandalwood Parkway East.	None.
Cultural Communities (CU)	CUT1-1	Sumac Cultural Thicket Type	Sparse (0-10%) tree cover includes Freeman's Maple and Norway Spruce (*Picea abies*).	Greater than 60% shrub cover: dominated by Staghorn Sumac, Red Ash saplings, Thicket Creeper *(Parthenocissus vitacea)* and European Buckthorn.	About 25% ground cover: species dominated by equal parts Canada goldenrod *(Solidago canadensis)* and Kentucky Bluegrass with less Thicket Creeper, Garlic Mustard *(Alliaria petiolate)* and Common Dandelion (*Taraxacum officinale*).	One polygon within Bramalea Limited Community Park, north of Williams Parkway.	None.
Cultural Communities (CU)	CUW1	Mineral Cultural Woodland Ecosite	Between 30 and 60% tree cover. Canopy included Crack Willow, Freeman's Maple, Manitoba Maple, hybrid Crack Willow (*Salix x fragilis*), Eastern Cottonwood, Norway Spruce (*Picea abies*) and Bur Oak (*Quercus macrocarpa*).	Shrub layer consisted of European Buckthorn and Tartarian Honeysuckle (*Lonicera tatarica*).	Groundcover similar to roadside vegetation but particularly dominated by smooth brome.	One polygon adjacent to MAS2-1 and Highway 410 north of Bovaird Drive East.	Survey conducted from roadside/edge of community.

Community	ELC Code	ELC Name	Tree Canopy	Shrub Layer	Ground Layer	Location in Study Area	Comments
Open Aquatic (OAO)	OAO	Open Aquatic	None.	None.	None.	One polygon along perimeter of Study Area near Heart Lake Road between Sandalwood Parkway East and Bovaird Drive East, south of Highway 410.	None.
Swamp Communities (SW)	SWT2	Mineral Swamp Thicket Ecosite	Between 25 and 60% tree cover: dominated by Manitoba Maple and White Elm (*Ulmus americana*).	Greater than 60% shrub cover: species observed included Eastern Buttonbush (*Cephalanthus occidentalis*) with less Black Elderberry (*Sambucus nigra*) and European Buckthorn.	Ground cover included Spotted Jewelweed, Narrow-leaved Cattail *(Typha angustifolia)* and Riverbank Grape.	One polygon located along the southbound off-ramp to Bovaird Drive East.	Designated Heart Lake PSW Complex. Located at the bottom of a slope adjacent to the FOD2.
Marsh Communities (MA)	MAS2-1	Cattail Mineral Shallow Marsh Type	There was no distinct tree canopy layer.	There was no distinct shrub layer.	Greater than 60% ground cover dominated by Narrow-leaved Cattail with less Purple Loosestrife *(Lythrum salicaria)*, Tall Goldenrod (*Solidago altissima*) and European Reed.	Two polygons located west of Highway 410 north of Bovaird Drive East.	Designated Heart Lake PSW Complex.

4.1.7.3 Wildlife and Significant Wildlife Habitat

Incidental Wildlife Observations

During field investigations, any evidence (e.g., observation, scat, tracks, calls, etc.) of wildlife and their associated habitat and habitat usages were documented. Incidental wildlife observations made during field investigations are provided in **Table 4-5**.

Monarch (Danaus plexippus), designated as Special Concern under the *Endangered Species Act (ESA)*, were observed flying/foraging near the Heart Lake PSW Complex, adjacent to the Study Area and within the ROW at the Highway 410 and Queen Street interchange.

Table 4-5: Incidental Wildlife Observations

Taxon	Common Name	Scientific Name	ESA Status
Amphibian	Green Frog	*Lithobates clamitans*	-
Bird	American Robin	*Turdus migratorius*	-
Bird	American Goldfinch	*Cardeulis tristis*	-
Bird	Black-capped Chickadee	*Poecile atricapillus*	-
Bird	Blue Jay	*Cyanocitta cristata*	-
Bird	Canada Goose	*Branta canadensis*	-
Bird	Eastern Kingbird	*Tyrannus tyrannus*	-
Bird	Mallard	*Anas platyrhynchos*	-
Bird	Northern Cardinal	*Cardinalis cardinalis*	-
Bird	Red-winged Blackbird	*Agelaius phoeniceus*	-
Bird	Rock Pigeon	*Columba Livia*	-
Insect	Monarch	*Danaus plexippus*	Special Concern (SC)

Significant Wildlife Habitat

Natural areas within the Study Area were mostly limited to within the Heart Lake PSW Complex, located adjacent to the MTO ROW; as such, there is low potential for Significant Wildlife Habitat (SWH). The deciduous forest associated with the Heart Lake PSW may provide candidate maternity roosting habitat for bats while marsh and open water features provide candidate overwintering and nesting habitat for turtles, breeding habitat for amphibians and stopover for migrating waterfowl; however, species-specific surveys were not performed and presence of SWH could not be confirmed. The MTO ROW provides confirmed SWH (Special Concern and Rare Wildlife Species) as Monarch and milkweed were observed incidentally during the 2022 field investigations. There is potential for other Species of Conservation Concern (SOCC) to occur within the Study Area (**Table 4-6**).

Table 4-6: Species of Conservation Concern Identified with Medium or High Potential to Occur within the Study Area

Taxa	Common Name	Scientific Name	ESA Status	Probability of Occurrence	Confirmed or Candidate Habitat
Amphibian	Western Chorus Frog	*Pseudacris triseriata*	-	Medium	Wetlands and ponds within the Study Area may provide suitable habitat.
Bird	American Coot	*Fulica americana*	-	Medium	Wetlands and ponds within the Study Area may provide suitable habitat.
Bird	Barn Swallow	*Hirundo rustica*	SC	Medium	Anthropogenic structures (bridges and culverts) within the Study Area may provide suitable habitat.
Bird	Common Gallinule	*Gallinula galeata*	-	Medium	Wetlands and ponds within the Study Area may provide suitable habitat.
Bird	Common Nighthawk	*Chordeiles minor*	SC	Medium	Open areas with little to no ground vegetation were observed within cultural meadow adjacent to the Heart Lake PSW Complex.
Bird	Eastern Wood-pewee	*Contopus virens*	SC	Medium	Suitable habitat is located within the deciduous forest west and north of Highway 410 within the northern extent of the Study Area.
Bird	Purple Martin	*Progne Subis*	-	Medium	Open areas with potential nesting sites may be present in the Study Area.
Bird	Ruddy Duck	*Oxyura jamaicensis*	-	Medium	Wetlands and ponds within the Study Area may provide suitable habitat.
Insect	Black Dash	*Euphyes conspicua*	-	Medium	Marshes within the Study Area may provide suitable habitat.
Insect	Monarch	*Danaus plexippus*	SC	High	Species and milkweed confirmed present within the Study Area.
Reptile	Eastern Musk Turtle	*Sternotherus odouratus*	SC	Medium	Wetlands and ponds within the Study Area may provide suitable habitat.
Reptile	Snapping Turtle	*Chelydra serpentina*	SC	Medium	Wetlands and waterbodies within the Study Area may provide suitable habitat.

Generally, Significant Wildlife Habitat occurs with designated natural areas within the Study Area.

4.1.7.4 Species at Risk and Species at Risk Habitat

Species at Risk include Endangered (END) or Threatened (THR) species under the Ontario Endangered Species Act or migratory birds with these designations under Schedule 1 of the Species at Risk Act. A total of 12 Species at Risk were recorded within or in the vicinity of the Study Area based on a review of the background information sources. A habitat assessment was completed for each of the 12 Species at Risk to determine whether there is potential for that Species at Risk to occur within the Study Area.

Species listed as Special Concern provincially are not afforded protection under the Endangered Species Act but have been included in the Species at Risk screening to avoid future implications should the status of these species change under the Endangered Species Act. Furthermore, habitats of Species of Conservation Concern, which includes Special Concern species, are considered Significant Wildlife Habitat under the Provincial Policy Statement and associated Natural Heritage Reference Manual. For this reason, consideration was given to identifying Special Concern species in addition to Threatened and Endangered species.

Through this assessment, 8 Species at Risk were determined to have medium potential to occur within the Study Area based on the presence of suitable habitat. A table summarizing these species and the locations of their respective potential habitats is provided in **Table 4-7** below.

Table 4-7: Species at Risk Identified with High or Medium Potential to Occur within the Study Area

Taxa	Common Name	Scientific Name	ESA Status	SARA Status	Probability of Occurrence	Confirmed or Candidate Habitat
Bird	Chimney Swift	*Chaetura pelagica*	THR	THR	Medium	Suitable chimneys may be present within the Study Area.
Mammal	Little Brown Myotis	*Myotis lucifugus*	END	END	Medium	Deciduous forest, cultural woodland and buildings may provide suitable maternity roost habitat.
Mammal	Eastern Small-footed Myotis	*Myotis leibii*	END	-	Medium	Deciduous forest, cultural woodland and buildings may provide suitable maternity roost habitat.
Mammal	Northern Myotis	*Myotis septentrionalis*	END	END	Medium	Deciduous forest may provide suitable maternity roost habitat.
Mammal	Tri-colored Bat	*Perimyotis subflavus*	END	END	Medium	Deciduous forest, cultural woodland and buildings may provide suitable maternity roost habitat.
Plant	Black Ash	*Fraxinus nigra*	END	-	Medium	The Heat Lake PSW Complex may provide suitable habitat.
Plant	Butternut	*Juglans cinerea*	END	END	Medium	Deciduous forest and hedgerows may provide suitable habitat.

4.2 Socio-Economic Environment

Socio-economic environment studies were undertaken to document and assess existing social and economic features.

4.2.1 Land Use and Property

Background data was collected from relevant secondary sources to identify the existing and planned land use information within the Study Area. A review of the following sources was undertaken:

- Provincial Policy Statement, 2020;
- Growth Plan for Greater Golden Horseshoe, 2019;
- Parkway Belt West Plan, 1978;
- City of Brampton Official Plan, 2006
- Region of Peel Official Plan, 2022
- City of Brampton Transportation Master Plan (TMP), 2015
- Region of Peel Transportation Master Plan (TMP), 2051
- Municipal secondary plans.

4.2.1.1 Existing Land Use Conditions

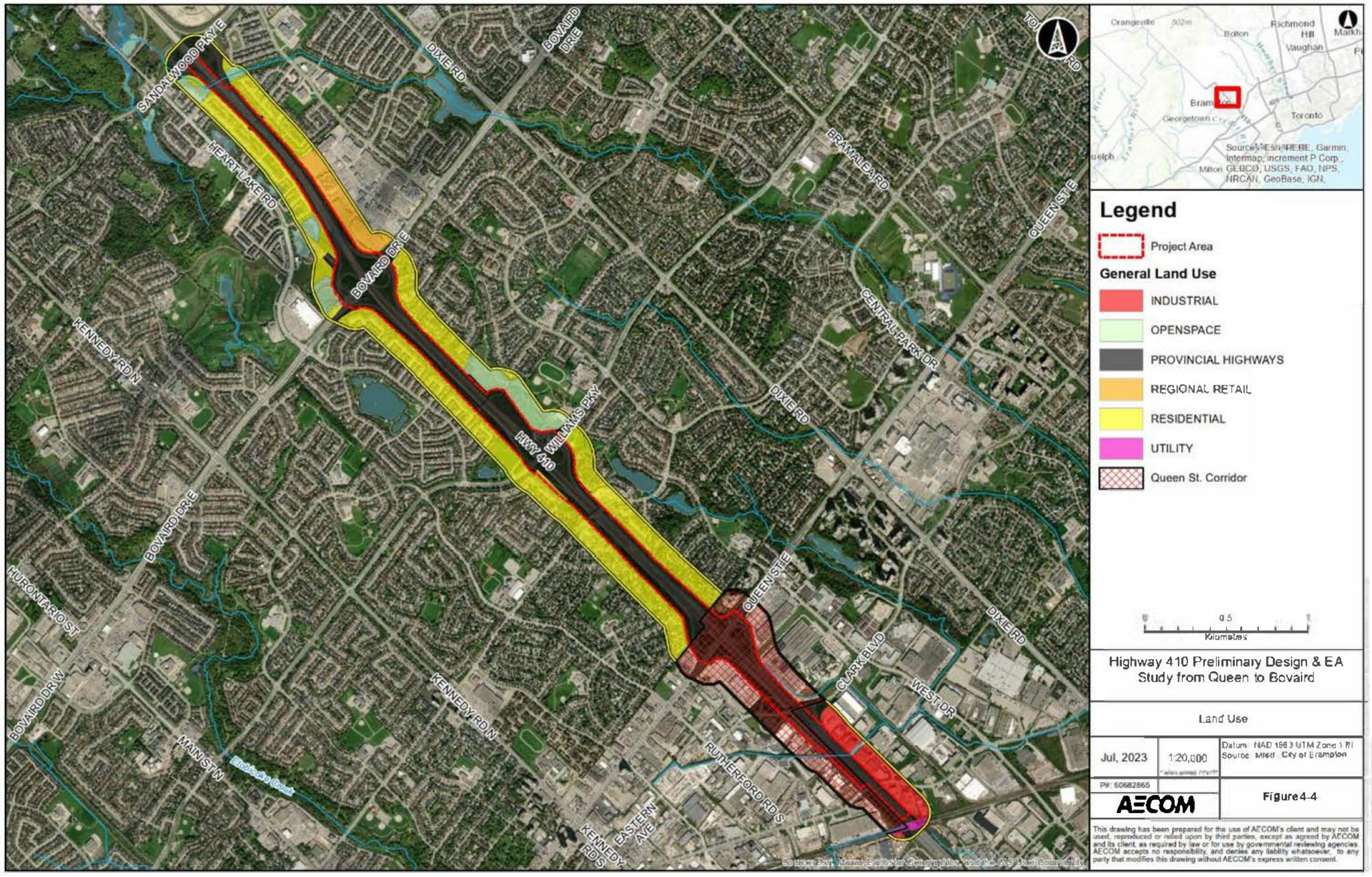
The Study Area is entirely located within the City of Brampton urban planning area. The predominant land uses within the Study Area are characterized as commercial, residential, institutional, environmental protection areas, and open space. A map of the Land Use designations within the Study Area can be found in **Figure 4-4**.

Residential Land Use

In the Study Area there is a mix of residential land use. Between Queen Street and Bovaird Drive, the land use is generally low density located along each side of the existing highway within the Study Area. These residential areas primarily consist of single detached houses.

There are also areas of medium-high density residential development through the Study Area with a mixture of detached houses, semi-detached houses, and townhouses. In several areas along the corridor there are houses directly adjacent to the MTO right-of-way (ROW). In the areas of the Williams Parkway and Bovaird Drive on-ramps and exit ramps, directly adjacent to the ROW there are residential properties on both sides of the highway. Since 1999 there have not been any notable changes in residential development directly adjacent to the Highway 410 corridor.

Figure 4-4: Land Use Designations



Rural Lands

There are no agricultural areas along the Highway 410 study corridor.

Soil Classification

Soils were classified according to their agricultural capability classes. The lands within the Study Area consists of soils with Class 1 (No Significant Limitations).

Open Space

There are several parcels of land along the Highway 410 corridor that are currently open space, both vegetated and unvegetated. Some of these areas include public parks. There are several small City parks located close to the Study Area; however, Major Oaks Park and Bramalea Limited Community Park, both located north of the Williams Parkway and Highway 410 Interchange, are the only parks adjacent to the corridor.

Commercial Lands

There are a significant number of businesses located directly adjacent to the Highway 410 corridor within the Study Area that are classified as either commercial or industrial land use.

The City of Brampton has seen a lot of growth since 2000 which has increased the number of commercial / industrial businesses along the corridor. At the interchanges of Queen Street, Williams Parkway, and Bovaird Drive and Highway 410, and the Vodden Street overpass, there are commercial developments concentrated along the interchanges. These interchanges are filled with large department stores, restaurants, banks, gas stations and various smaller retail stores.

Employment Lands

The Employment Lands are the main locations where office and industrial activities will occur. A portion of the study area south of the Clark Boulevard and Highway 410 Interchange has been designated as General Employment Area in the City of Brampton Official Plan. These lands are currently occupied by industrial properties. This is consistent with the Region’s policy to locate employment areas in the vicinity of existing major highway interchanges and rail yards, where appropriate, within the Urban Area. Within the northern section of the Study Area, in the vicinity of the Bovaird Drive Interchange, there is Trinity Common Mall. At the Vodden Street overpass there is a small plaza consisting of a grocery store and other small commercial spaces. Within the southern section of the Study Area, in the vicinity of the Queen Street Interchange, there are several distribution centre type businesses, and storage facilities, predominately located on the east side of Highway 410 along West Drive. There is also the 410 @7 Centre shopping mall at the Queen Street interchange.

Environmental Protection Areas

There are patches of dense woodlots that are found along the Highway 410 corridor, with planted shrubs and trees in the grassed medians as well. In addition to the communities observed within the ROW, a small woodland, wetlands, cultural meadows, and cultural thickets were present within the Study Area. The Study Area crosses or encroaches on one Provincially Significant Wetlands (PSW): the Heart Lake Wetland Complex located on the west side of Highway 410 and travels from Bovaird Drive to north of the Sandalwood Parkway Interchange.

Institutional

Academic Institutes

HF Loughlin Public School, Father C W Sullivan School, Madoc Drive Public School, and Sainte-Jeanne-d'Arc Catholic Elementary School are all located within 1 kilometre of the Highway 410 to the north of the Queen Street Interchange.

Esker Lake Public School is located near the Highway 410 Study Area. There are also several corporate/public training facilities and health centres adjacent to the highway.

Religious Institutes

There is a church (The Universal Church) located approximately 150 metres west of Highway 410 in City of Brampton. Various other religious institutes surrounding Highway 410 are located beyond the Study Area.

Utilities

There are several utilities that have been identified within the Study Area, including Enbridge Gas, Bell Canada, Rogers Communications, Alectra Utilities, Public Sector Network, TC Energy Co., Zayo, street lighting, storm sewers and municipal watermains.

4.2.1.2 Future and Planned Land Use

The following outlines a summary of the approved and/or pending municipal future development plans within the Study Area.

Official Plan

The City of Brampton is preparing an update to the Official Plan to establish a detailed planning framework for the future urban development of the city. Growth Management is a theme included in the update with a focus on: Imagining Brampton, Shaping Brampton, City Structure, and Strategies for Building an Urban City.

There are 32 settlement areas within the City of Brampton: Heritage Heights, Snelgrove Heartlake, Springdale, Northwest Sandalwood Park, Bramalea, Airport Intermodal,

Highway 410 and Steeles, Brampton Flowertown, Downtown Brampton, Bramalea Mobility Hub, Fletchers Creek South, Huttonville, Queen Street Corridor, Bramalea Road South Gateway Redevelopment Area, Goreway Drive Corridor, Bram West, Bram East, Vales of Castlemore, Fletchers Creek Village, Fletchers Meadow, Credit Valley, Highway 427 Industrial, Countryside Villages, Vales of Castlemore North, Vales of Humber, Mount Pleasant, Kennedy Road South Revitalization Area, Hurontario-Main Corridor.

To address the forecasted growth the City of Brampton has created a growth management hierarchy with 6 unique area classifications: Centres, Boulevards, Corridors, Community Areas, Employment Areas, and Natural Heritage System. The majority of growth will occur within the current built-up area with a focus on residential intensification. Residential and employment growth will be located in Centres, Boulevards, Corridors and Employment Areas.

Transportation Plan

The City of Brampton has a projected growth of nearly double its current population by 2051 which presents the city challenges and opportunities. In preparation for this projected growth the City developed a TMP in 2015 to improve the current transportation network. The city has decided to emphasize sustainable transportation solutions whilst addressing future travel demand. The city has adopted an incremental approach to improving road network improvements including widening roads with a greater use before residential roads.

The City of Brampton developed a new Multi-Modal Active Transportation Master Plan in 2019. The Plan was developed to update the previous Transportation Study completed in 2015 to determine recommended transportation improvements and a schedule for implementation of these improvements. The Plan reflects the intensification of Brampton in order to combat automobile congestion. The Multi-Modal Active Transportation Master Plan will differ from previous Transportation Studies in Brampton by assessing and recommending improvements to modes other than just vehicular traffic circulation. Improvements supporting active transportation and transit are recommended.

4.2.2 Noise

As part of this study, a Noise Impact Assessment was prepared in accordance with the Ministry of Transportation Environmental Guide for Noise (MTO Guide) published in 2022.

Under the MTO Guide, the “noise impact” is defined as the difference between the “Future No Project” and the “Future With Project” noise levels during the subject year of assessment (Horizon Year), which is typically 10 years post-construction. The horizon year of 2041 was used as the basis of assessment.

Land uses designated as “Traditional Noise Sensitive Areas (NSAs)” by the MTO Guide consist of the following land uses with associated Outdoor Living Areas (OLAs):

- Private homes such as single-family residences;
- Townhouses;
- Multiple unit buildings, such as apartments with Outdoor Living Areas for use by all occupants; and
- Hospitals, nursing homes for the aged, where there are Outdoor Living Areas for the patients.

In addition to the above, where certain land uses are considered “part of a community”, meaning located next to a Traditional NSA, the land use is considered noise sensitive and included in the analysis. The land uses considered noise sensitive when part of a community are:

- Educational facilities and day care centres, where there are OLAs for students;
- Campgrounds that provide overnight accommodation;
- Hotels/motels where there are OLAs for visitors;
- Community centres with OLAs (e.g., outdoor basketball courts etc.);
- Municipal parks (excluding golf courses and trails);
- Places of worship with OLAs.

Land uses that do not qualify as noise sensitive by the MTO Guide consist of the following:

- Apartment balconies above ground floor;
- Cemeteries; and
- All commercial and industrial areas.

Eight Noise Sensitive Areas were determined to be within the Study Area for this project and are shown in **Figure 4-5**. Results of the noise impact assessment completed for this project are summarized in **Section 9.2.2.**

4.2.3 Air Quality

4.2.3.1 Sensitive and Critical Receptors

The Study Area extends from the Canadian National Railway (CNR) Highway 410 overpass (south of Queen Street) at the south to Sandalwood Parkway at the north (north of Bovaird Drive). This Study Area includes a 500-metre buffer to be able to capture air quality impacts and effects from traffic within the City of Brampton and Regional Municipality of Peel. The 500-metre buffer was recommended as per the MTO’s Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects (2020).

Figure 4-5: Noise Sensitive Areas

Locations of existing sensitive and critical receptors were reviewed within the Study Area. Sensitive receptors include primarily permanent locations of residential dwellings (e.g., detached housing, semi-detached housing, or town-housing) and critical receptors include health care facilities, educational institutions, childcare facilities, or nursing and/or long-term care. Within the Study Area, a total of 94 sensitive receptors and 12 critical receptors were identified.

4.2.3.2 Existing Ambient Air Quality

The baseline ambient air quality levels were based on publicly available historical data from ambient air quality monitoring stations within Ontario. Data utilized is the most recent publicly available at the time of the preparation of the assessment (February 2024). The background air quality concentrations within the Study Area were determined from existing Environment and Climate Change Canada (ECCC) air monitoring station data operating under the National Air Pollution Surveillance (NAPS) network. Five years of existing data sets were analyzed from stations within the regions, and the complete data set from the closest station or most representative station for each contaminant of concern was selected to represent the background air quality for the Study Area. As this project is located close to Highway 410, monitoring stations closest to the study area were given preference as the one of the most representative locations for the air quality contaminants of concern. As such the following NAPS air quality monitoring stations were selected as representative of the ambient air quality within the Study Area (all located approximately 4 to 27 kilometres from the Study Area, the closest monitoring station was located in Brampton, approximately 4 kilometres from the Study Area):

- Toronto Roadside (NAPS ID 60438)
- Roadside Wallberg (NAPS ID 60439)
- Toronto West (NAPS ID 60430)
- Brampton (NAPS ID 60450)

These stations are located nearest to the Study Area and monitored (in combination) all relevant Criteria Air Contaminants (CACs) for the assessment, since one station is unable to monitor all CACs. Where multiple stations were found to monitor a common CAC, the closest representative station was selected for the assessment. Three contaminants were found to exceed the Provincial Ambient Air Quality Criteria (AAQC) in the existing ambient air levels. The exceedances for Nitrogen dioxide, Benzene, and Benzo(a)pyrene are based on the existing background levels within the study area.

4.2.4 Contamination, Waste, and Excess Materials Management

A Contamination Overview Study was undertaken for the Study Area. The Contamination Overview Study involved a records review, Study Area inspection and documentation, interpretation and assessment of data to identify potential sources of site contamination within the Study Area based on land uses. The assessment of presence or absence of site contamination was only based on visual observations made from the roadside in the publicly accessible areas.

Based on the observations identified during the site visit and review of available historical information including Environmental Risk Information Services (ERIS) databases, 42 properties/areas within the Study Area have been identified as having a “high” potential for soil and groundwater contamination, including gas stations/service centres, petroleum and related products transfer and bulk storage facilities, road maintenance storage facilities, vehicle storage facility, possible vehicle repair garages, former waste disposal sites, an apple orchard and industrial or manufacturing sites. In addition to the individual properties, the land parcels containing railway tracks are also considered as having “high” potential for soil and groundwater contamination. Twenty-one properties/areas within the Study Area have been identified as having “medium” potential for soil and groundwater contamination. Properties which were never developed or were developed but only used for agricultural, residential or parkland uses were rated as having a “low” potential for contamination, unless evidence from the historical records review suggests a higher potential.

In addition to the properties rated high or medium due to site activities, there were 98 significant spill records, representing 51 spill locations, which are also considered as having “high” potential for soil and/or groundwater contamination. The significant spill records and additional details from the ERIS report are detailed in the Contamination Overview Study (AECOM, 2024) available under separate cover.

Based on field observations and data available, AECOM identified certain facilities and areas to be of particular environmental concern and ranked them accordingly as high or medium potential. In addition, as per the Contamination Overview Study, further environmental studies / investigations of “high” and “medium” properties to be directly impacted by Highway 410 improvements from south of Queen Street to north of Bovaird Drive are recommended to confirm the environmental conditions on those lands in support of property acquisition, environmental due diligence, road construction and management of excess soil / materials. These studies / investigations may include Phase One Environmental Site Assessments (ESAs) and Phase Two ESAs and recommendations related to next steps will be determined during these studies (e.g., if contamination is identified, mitigation measures may need to be developed and

implemented which may include environmental site clean-up / remediation and/or risk assessment). Any additional studies / investigations that are required will be completed in future design phases of the project.

4.3 Cultural Environment

4.3.1 Archaeology

A Stage 1 Archaeological Assessment was undertaken in accordance with the requirements of the Ontario Heritage Act and the Standards and Guidelines for Consultant Archaeologists.

Based on a review of the Ontario Archaeological Sites Database, there are 10 registered archaeological sites within or in close proximity to the Study Area.

Based on the results of the Stage 1 Archaeological Assessment, areas where archaeological potential has been removed include areas that have been previously assessed and areas determined to have been subject to extensive land alterations that have significantly compromised the recovery of archaeological materials. All potentially undisturbed areas must be subject to Stage 2 field survey. The Stage 1 Archaeological Assessment identified some areas that have not been previously assessed and require Stage 2 Archaeological Assessment.

4.3.2 Built Heritage and Cultural Heritage Landscapes

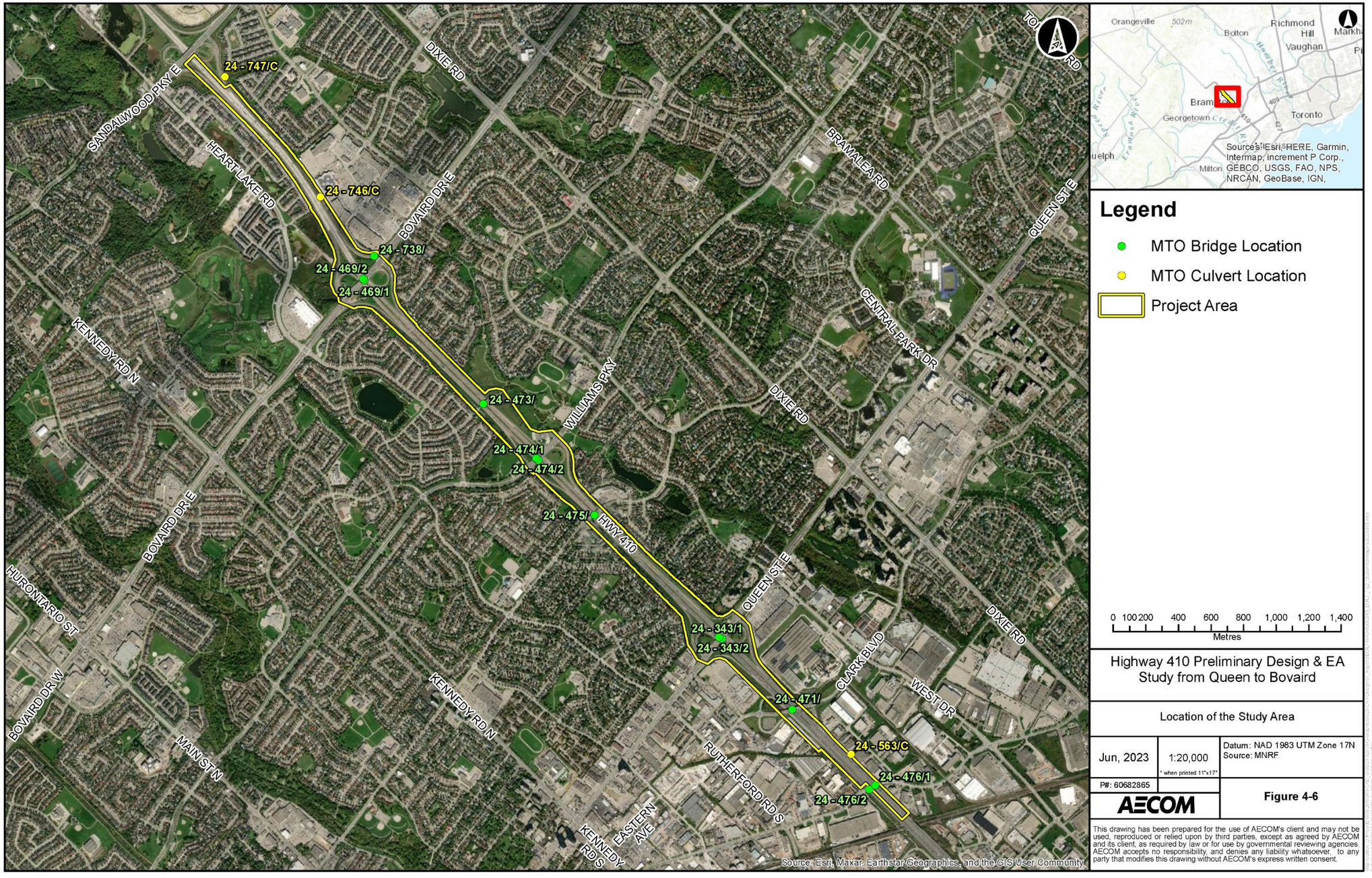
A Cultural Heritage Resource Assessment Report (CHRAR) was prepared to identify all potential built heritage resources and cultural heritage landscapes located within the project Study Area. Based on the results of the CHRAR for this project, it has been determined that there will be no direct and indirect impacts from the project to potential built heritage resources and cultural heritage landscapes, since none were identified within the Study Area. It was determined that the 12 bridges and three culverts identified within the Study Area do not require further heritage evaluation. As such, no further steps in MTO's cultural heritage conservation process are required since there are no cultural heritage concerns for the Study Area.

Table 4-8 summarizes the results of screening the above-noted bridges and culverts for potential cultural heritage value or interest (CHVI) and their location relative to the Study Area is presented in **Figure 4-6**. MTO screened the bridge and culvert structures in accordance with MTO's cultural heritage conservation process and determined that none of the structures within the Study Area have CHVI and will not require further documentation or heritage assessments.

Table 4-8: Results of Screening for Potential Cultural Heritage Value or Interest (CHVI)

Ministry ID #	Structure	Construction Date	Structure Category	Results of Screening for Potential CHVI
24 – 476/1	Orenda Road Overpass – North Bound Lanes	1985	Bridge	No potential CHVI
24 – 476/2	Orenda Road Overpass – South Bound Lanes	1985	Bridge	No potential CHVI
24 – 563/C	Hwy 410 - South of Clark Boulevard Culvert	1983	Culvert	No potential CHVI
24 - 471/	Clark Boulevard Underpass	1984	Bridge	No potential CHVI
24 - 343/1	Highway 7 Overpass – East Bound Lanes	1985	Bridge	No potential CHVI
24 - 343/2	Highway 7 Overpass – West Bound Lanes	1985	Bridge	No potential CHVI
24 - 475/	Highway 410/Vodden Street Underpass	1985	Bridge	No potential CHVI
24 - 474/1	Highway 410/Williams Parkway Underpass East Bound Lanes	1986	Bridge	No potential CHVI
24 - 474/2	Highway 410/Williams Parkway Underpass West Bound Lanes	1986	Bridge	No potential CHVI
24 - 473/	Highway 410/Franceschini Drive Underpass	1984	Bridge	No potential CHVI
24 - 469/1	Highway 410 Underpass at Highway 7 – East Bound Lanes	1986	Bridge	No potential CHVI
24 - 469/2	Highway 410 Underpass at Highway 7 – West Bound Lanes	1986	Bridge	No potential CHVI
24 - 738/	Highway 410/Bovaird Drive Access Overpass	2000	Bridge	No potential CHVI
24 - 746/C	Highway 410 - North of Bovaird Drive Culvert	2003	Culvert	No potential CHVI
24 – 747/C	Hwy 410 - Sandalwood Parkway I.C. Culvert	2003	Culvert	No potential CHVI

Figure 4-6: Bridges and Culverts Within the Project Area



4.4 Transportation Infrastructure

4.4.1 Highway 410

Highway 410 is a major north-south controlled access freeway linking the cities of Mississauga, Brampton and the Town of Caledon. The project limits are from south of Clark Boulevard to Sandalwood Parkway, for a total length of approximately 6.4 kilometres. This section of Highway 410 consists of divided four, six, eight and 10-lane urban highway sections with a posted speed limit of 100 kilometres per hour. The study area encompasses several crossing roads, underpasses and overpasses which include: Orenda Road Overpass; Clark Boulevard Underpass (Interchange); Queen Street Underpass (Interchange); Vodden Street Underpass; Williams Parkway Underpass (Interchange); Franceschini Drive Underpass; and Bovaird Drive Underpass (Interchange).

Horizontal Alignment

There are two horizontal curves along Highway 410 within the project limits. One horizontal curve meets the requirements of the 120 kilometres per hour design speed, while the curve through the Bovaird Drive interchange meets the design standards based on lateral friction, but does not meet requirements based on the standard minimum stopping sight distance for freeways.

Vertical Alignment

There are 18 vertical curves along Highway 410 within the project limits. One vertical curve is below the minimum requirement based on a design speed of 120 kilometres per hour. However, the stopping sight distance may still be achievable because the length of the vertical curve is shorter than the required stopping sight distance for the design speed. All other existing vertical curves meet or exceed the requirements of the existing 120 kilometres per hour design speed.

4.4.2 Interchanges

There are four interchanges located within the project limits. The following provides brief overviews of each of the interchanges that provide access to and from Highway 410.

Clark Boulevard Interchange

Clark Boulevard is a four-lane road (divided between ramp terminals and undivided beyond ramp terminals) designated as an urban arterial which crosses over Highway 410. The alignment of Clark Boulevard is skewed at approximately 28 degrees with respect to Highway 410 at the structure.

The Highway 410/Clark Boulevard interchange has one northbound directional off-ramp and one southbound entrance loop ramp. It has a two-span rectangular voided slab bridge carrying four lanes of Clark Boulevard traffic over Highway 410. The west and east ramp terminal intersections are signalized, and a carpool lot on Heart Lake Road can be accessed from the west ramp terminal intersection. Rutherford Road and West Drive are the two closest adjacent municipal intersecting roads and run north/south intersecting Clark Boulevard. Clark Boulevard has a sidewalk on the north side of the roadway and posted speed limit is assumed to be 50 kilometres per hour.

Queen Street Interchange

Queen Street is a six-lane divided road designated as an urban arterial which crosses over Highway 410. Queen Street through the interchange is on a tangent alignment with no horizontal curves. The alignment of Queen Street is skewed at approximately 6 degrees with respect to Highway 410 at the structure.

The Highway 410/Queen Street interchange has a Parclo A4 configuration with a two-span circular voided slab bridge carrying Queen Street traffic over Highway 410. The structure accommodates six through lanes of traffic on Queen Street. There are several commercial entrances along Queen Street and municipal intersecting roads located east and west of the interchange. Rutherford Road and West Drive/Laurelcrest Street are the two closest adjacent public intersecting roads and run north/south intersecting Queen Street. Both Rutherford Road and West Drive/Laurelcrest Street provide access to heavy residential and commercial property north and south of Queen Street. Queen Street has sidewalks on both sides of the roadway, has a posted speed limit of 60 kilometres per hour from east of the interchange to the west ramp terminal and a posted speed limit of 50 kilometres per hour west of the west ramp terminal.

An improved bus corridor is proposed for Queen Street across Highway 410 but will not involve the widening of the road. It is not anticipated that this will impact the current project.

Williams Parkway Interchange

Williams Parkway is a four-lane divided road designated as an urban arterial which crosses over Highway 410. Williams Parkway through the interchange is on a tangent alignment with two horizontal curves beyond the west and east ramp terminals. The alignment of Williams Parkway has a 90 degree skew angle to the centreline of Highway 410.

The Highway 410/Williams Parkway interchange has a Diamond ramp configuration west of the structure and a Parclo A4 ramp configuration east of the structure. The structure is a two-span circular voided slab bridge carrying Williams Parkway traffic over

Highway 410. The structure accommodates four through lanes and two auxiliary lanes on Williams Parkway. Southlake Boulevard and Howden Boulevard/N Park Drive are the two closest adjacent municipal intersecting roads and run north/south intersecting Williams Parkway, providing access to residential neighbourhoods, schools, and local parks. There is a north leg access point at the east ramp terminal from Ramp S-E/W to a Commuter Parking Lot (CPL). Williams Parkway has sidewalks on both sides of the roadway, a posted speed limit of 60 kilometres per hour from west of the interchange to the east ramp terminal, and a posted speed limit of 50 kilometres per hour (40 kilometres per hour when school zone traffic light is flashing) east of the east ramp terminal.

Bovaird Drive Interchange

Bovaird Drive is a six-lane divided road designated as an urban arterial, which crosses over Highway 410. Bovaird Drive through the interchange is mostly on a tangent alignment with one horizontal curve through the east ramp terminal. The alignment of Bovaird Drive is skewed at approximately 12 degrees with respect to Highway 410 at the structure.

The Highway 410/Bovaird Drive interchange has a Parclo A4 configuration with a two-span circular voided slab bridge carrying Bovaird Drive traffic over Highway 410. The structure accommodates six through lanes of traffic on Bovaird Drive. There are commercial entrances and public intersecting roads located along Bovaird Drive, east and west of the interchange. Heart Lake Road/Southlake Boulevard and Nasmith Street/Great Lakes Drive are the two closest adjacent municipal intersecting roads and run north/south intersecting Bovaird Drive. South Lake Boulevard provides access to a residential neighbourhood south of Bovaird Drive, while Heart Lake Road provides access to the NINE 18 Golf Clubhouse parking lot and Lowes Home Improvement Hardware Store north of Bovaird Drive. Nasmith Street provides access to a residential neighbourhood south of Bovaird Drive, while Great Lakes Drive provides access to the Trinity Commons Shopping Mall north of Bovaird Drive. There is a north leg access point at the east ramp terminal from Ramp S-E/W to the Trinity Commons Shopping Mall. Bovaird Drive has a sidewalk on the north side and multi-use path (MUP) on the south side of the roadway, and has a posted speed limit of 60 kilometres per hour through the interchange.

4.4.3 Municipal Roads

There are two municipal roads with no direct access to Highway 410 and one pedestrian bridge crossing Highway 410 within the study limits.

Orenda Road

Orenda Road is a four-lane urban arterial road crossing under Highway 410. The bridge has a 21-degree skew angle to the centreline of Highway 410 and is a single span bridge with CPCI girders. Orenda Road under Highway 410 is on a tangent alignment with two horizontal curves beyond the west and east structure limits. Orenda Road has sidewalks on both sides of the roadway and a posted speed limit of 50 kilometres per hour.

Vodden Street

Vodden Street is a two-lane urban arterial road. The bridge has an 8-degree skew angle to the centreline of Highway 410 and is a two-span circular voided slab bridge. Vodden Street over Highway 410 is on a tangent alignment with two horizontal curves beyond the west and east structure limits. Vodden Street has sidewalks and bike lanes on both sides of the roadway, and a posted speed limit of 50 kilometres per hour.

Franceschini Drive

Franceschini Drive is a pedestrian bridge structure that crosses over Highway 410. The bridge has a 0-degree skew to the centreline of Highway 410 and is a two-span circular voided slab bridge.

4.4.4 Transit Service

There are no rail crossings located within this stretch of Highway 410.

There is currently a Metrolinx / GO Transit Rail corridor that crosses under Highway 410 to the south of the Study Area.

The City of Brampton has 53 transit routes running throughout the city. Since the Highway 410 corridor does not run through the centre of the city there are four locations where the transit routes cross over/under the highway.

These crossings occur at the following Highway 410 interchanges:

- Bovaird Drive
- Williams Parkway
- Queen Street

There are also bus routes along the following Highway 410 municipal crossing roads:

- Vodden Street

4.4.5 Commuter Parking Lots

There are two commuter parking lots along the Highway 410 corridor that provides free carpooling opportunities to travelers along the highway.

Highway 410 - Williams Parkway Commuter Lot

This lot is entered from Williams Parkway Eastbound or Westbound, and the Highway 410 Northbound Exit Ramp Terminal, and is located in the northeast quadrant of the Highway 410/Williams Parkway Interchange. This lot has 88 parking spaces, including seven accessible spaces, and GO Transit access.

Highway 410 – Clark Boulevard Commuter Lot

This lot is entered from Heart Lake Road, and is located in the southwest quadrant of the Highway 410/Clark Boulevard Interchange. This lot has 117 parking spaces, including six accessible spaces.

4.4.6 Structures

Eleven bridges are located within the Study Area, as described below. A visual inspection of all structures was carried out by AECOM in October 2022.

Orenda Road Overpass (Site No. 24X-0476/B1&B2)

The Orenda Road Overpass is a twin structure carrying 11 lanes of Highway 410 traffic over Orenda Road. The existing bridge is a single span concrete slab on prestressed concrete CPCI girders constructed in 1985 under MTO Contract 1984-0045. The span measures 22.2 metres (m) measured between the centreline of bearings. The structure is in a north-to-south orientation with the abutments skewed 21° to the centreline of Orenda Road.

The bridge was rehabilitated in 2014 under MTO Contract 2014-2026. The rehabilitation consisted of removal of: original interior barrier walls; existing deck slabs at overhang limits; retaining walls between the northbound lane (NBL) and southbound lane (SBL) structures; approach slabs; ballast walls; and asphalt and waterproofing. Delaminated concrete was removed from the deck surface, deck soffit, girders, abutments, wingwalls, retaining walls, fascias, and remaining barrier walls. The rehabilitation also included the replacement of original bearings, the addition of new footings and abutments for the bridge widening, new bearings at the widening as well as erecting new CPCI 1200 precast girders, construction of deck widening, installation of semi-integral deck extensions, construction of new approach slabs, and new barrier walls on the new deck widening. The existing retaining walls, wingwalls and barrier walls were reconstructed.

The deck was patch repaired and protected by a 90 mm asphalt/waterproofing system. Miscellaneous patch repairs were carried out for the deck soffit, girders, abutments, wingwalls, retaining walls, fascias, and remaining barrier walls.

Based on the detailed visual inspection and Ontario Bridge Management System (OBMS) Reports dated June 2022, the existing structures are in overall good condition.

Clark Boulevard Underpass (Site No. 24X-0471/B0)

The Clark Boulevard Underpass is a single structure carrying four lanes of Clark Boulevard traffic over Highway 410. The existing bridge is a two span post tensioned voided concrete deck constructed in 1984 under MTO Contract 1983-0039. The total span of the bridge is 95.0 metres measured between the centreline of abutment bearings, with the spans being 54.0 metres and 41.0 metres. The structure is in an east-to-west orientation with the abutments skewed 28° to the centreline of Highway 410.

The bridge was rehabilitated in 2014 under MTO Contract 2014-2026. The rehabilitation consisted of removal of existing waterproofing, median curbs, approach slabs, portions of the barrier walls, ballast walls, top portion of existing cleats and wingwalls, and a portion of the deck slab. Delaminated concrete was removed from the deck surface, deck soffit, deck fascia, abutments, wingwalls, piers, and remaining barrier walls. The original bearings were replaced at the abutments. New semi-integral deck extensions were installed at the abutments. Barrier walls and wingwalls were reconstructed to suit the semi-integral abutment details. New approach slabs, sleeper slabs, sidewalks and median were reconstructed. The deck was patch repaired and protected by a 90 mm asphalt/waterproofing system. Miscellaneous patch repairs were carried out for the deck soffit, deck fascia, barrier walls, abutments, wingwalls, pier columns and sidewalks.

Based on the detailed visual inspection (October 2022) and OBMS Reports dated April 2022, the existing structure is in overall good condition.

Queen Street Underpass (Site No. 24X-0343/B1&B2)

The Queen Street Underpass is a twin structure carrying six lanes of Queen Street traffic over Highway 410. Each of the existing bridges are two span post-tensioned voided concrete decks constructed in 1985 under MTO Contract 84-45. The total span of the bridge is 77.0 metres measured between the centreline of abutment bearings, with two equal spans of 38.5 metres. The structure is in an east-to-west orientation with the abutments skewed 6° to the centreline of Highway 410.

The bridge was rehabilitated in 2016 under MTO Contract 2014-2026. The rehabilitation consisted of removal of existing waterproofing, median curbs, approach slabs, portions of the barrier walls, ballast walls, top portion of existing cleats and wingwalls, and a

portion of the deck slab. Delaminated concrete was removed from the deck surface, deck soffit, deck fascia, abutments, wingwalls, pier columns, and remaining barrier walls. The original bearings were replaced at the abutments. New semi-integral deck extensions were installed at the abutments. Barrier walls and wingwalls were reconstructed to suit the semi-integral abutment details. New approach slabs, sleeper slabs, sidewalks and median were reconstructed. The deck was patch repaired and protected by a 90 mm asphalt/waterproofing system. Miscellaneous patch repairs were carried out for the deck soffit, deck fascia, barrier walls, abutments, wingwalls, pier columns and sidewalks.

Based on the detailed visual inspection (October 2022) and OBMS Reports dated October 2020, the existing structures are in overall good condition.

Vodden Street Underpass (Site No. 24X-0475/B0)

The Vodden Street East Underpass is a structure carrying two lanes of Vodden Street traffic over Highway 410. The existing bridge is a two span post tensioned concrete deck with circular voids constructed in 1988 under MTO Contract 1988-0067. The total span of the bridge is 74.0 metres measured between the centreline of abutment bearings, with two equal spans of 37.0 metres. The structure is in an east-to-west orientation with the abutments skewed 8° to the centreline of Highway 410.

The bridge was rehabilitated in 2017 under MTO Contract 2017-2043. The rehabilitation consisted of removal of concrete end dams, expansion joint assemblies and a portion of the barrier walls. Delaminated concrete was removed from the deck surface, deck soffit, abutments, wingwalls, retaining walls, piers, fascias, and remaining barrier walls. The existing concrete end dams, expansion joint assemblies and barrier walls were reconstructed. The deck was patch repaired and protected by a 90 mm asphalt/waterproofing system. Miscellaneous patch repairs were carried out for the deck soffit, abutments, wingwalls, retaining walls, piers, fascias and barrier walls.

Based on the detailed visual inspection and OBMS Reports dated July 2022, the existing structures are in overall good condition.

Williams Parkway Underpass (Site No. 24X-0474/B1&B2)

The Williams Parkway Underpass is a structure carrying four lanes of Williams Parkway traffic over Highway 410. The existing bridge is a two span post tensioned concrete deck constructed in 1986 under MTO Contract 1986-0080. The total span of the bridge measures 69.0 metres measured between the centreline of bearings, with the spans being 31.5 metres and 37.5 metres. The structure is in an east-to-west orientation with the abutments skewed 90° to the centreline of Highway 410.

To our current knowledge, these bridges have not been rehabilitated since their construction in 1986. Based on the detailed visual inspection and OBMS Reports dated April 2022, the existing structures are in overall good condition.

Franceschini Drive Underpass (Site No. 24X-0473/B0)

The Franceschini Drive Underpass is a structure carrying Franceschini Drive pedestrians over Highway 410. The existing bridge is a two span post-tensioned voided concrete deck constructed in 1986 under MTO Contract 86-80. The total span of the bridge is 72.3 metres measured between the centreline of abutment bearings, with spans of 35.5 metres and 36.8 metres. The structure is in an east-to-west orientation with the abutments skewed 0° to the centreline of Highway 410.

The bridge was rehabilitated in 2018 under City of Brampton Contract T2017-034. The rehabilitation consisted of removal of existing waterproofing, existing barrier wall railing and expansion joint seal. Delaminated concrete was removed from the deck surface, deck soffit, deck fascia, abutments, wingwalls, pier columns, and barrier walls. The deck was patch repaired and protected by a 90 mm asphalt/waterproofing system. New light pole bases, light poles, barrier wall railings and expansion joint seals were installed. Miscellaneous patch repairs were carried out for the deck soffit, deck fascia, barrier walls, abutments, wingwalls, pier columns and sidewalks.

Based on the detailed visual inspection and OBMS Reports dated July 2022, the existing structure is in overall good condition.

Bovaird Drive Underpass (Site No. 24X-0469/B1&B2)

The Bovaird Drive Underpass is originally a twin structure with an extension on the south sidewalk to accommodate a shared pathway for pedestrians and cyclists. The structures carry six lanes of Bovaird Drive traffic over Highway 410. The existing bridges are two span post tensioned voided concrete deck structures constructed in 1986 under MTO Contract 1985-0013. The total span of the bridge is 80.0 metres measured between the centreline of abutment bearings, with the spans being 40.0 metres each. The structure is in an east-to-west orientation with the abutments skewed 12° to the centreline of Highway 410.

The bridge was rehabilitated in 2019 under MTO Contract 2017-2043. The rehabilitation consisted of removal of existing waterproofing, median curbs, a portion of the approach slabs, the south sidewalk and barrier walls, a portion of the barrier walls on the north side, and concrete end dams. Delaminated concrete was removed from the deck surface, deck soffit, deck fascia, abutments, wingwalls, pier columns, and remaining barrier walls. The original bearings were replaced at the abutments for the south structure. New expansion joint assemblies were installed at the abutments. Barrier walls

and wingwalls were reconstructed at the joints. A shared pathway with barrier walls on the bridge deck adjacent to traffic and adjacent to the deck fascia was constructed on the south side of the south structure. A portion of the approach slabs, and the median were reconstructed. The deck was patch repaired and protected by a 90 mm asphalt/waterproofing system. Miscellaneous patch repairs were carried out for the deck soffit, deck fascia, barrier walls, abutments, wingwalls, pier columns and sidewalks.

Based on the detailed visual inspection and OBMS Reports dated April 2022, the existing structures are in overall good condition.

4.4.7 Pavement

A pavement structure investigation program consisting of a pavement surface condition investigation and a subsurface exploration program was conducted to supplement the geotechnical information reviewed as part of the desktop study. The investigations included a historical desktop review for the site, conducting a visual condition survey, a ground penetrating radar (GPR) survey, and pavement field investigation (boreholes).

The existing pavement surface of the Highway 410 northbound and southbound lanes was observed to be an asphalt (flexible) pavement structure from the CNR overpass to the Bovaird Drive underpass. From the Bovaird Drive underpass to Sandalwood Parkway underpass, the pavement structure was observed to be a concrete (rigid) pavement structure.

An overall assessment of the pavement condition rating for Highway 410 was found to range from Good at the CNR overpass to fairly good at Sandalwood Parkway underpass. The ride quality was reported to range from Good to Fair.

The Highway 410 pavement structure has been rehabilitated over the course of numerous years through various MTO construction contracts, including Contracts 94-82, 98-113, 98-100, 2005-2006, 2006-2018, 2010-2031, 2014-2026 and 2017-2043.

4.4.8 Electrical

The existing illumination along Highway 410 through the study limits includes continuous high mast illumination along the median, and full illumination at the interchanges.

The existing MTO electrical facilities within the study area include the following:

- Base mounted median high mast lighting from the south to the north study limit;
- Base mounted high mast lighting at the Clark Blvd., Queen St., Williams Parkway and Bovaird Dr. interchanges;

- Conventional lighting along ramps at the Queen St., Williams Parkway and Bovaird Dr. interchanges;
- Traffic signals at the ramp terminals of Clark Blvd., Queen St., Williams Parkway and Bovaird Dr. interchanges;
- Underpass lighting on the Clark Blvd., Queen St., Williams Parkway and Bovaird Dr. structures;
- Embedded ducts in the Clark Blvd., Queen St., Williams Parkway and Bovaird Dr. structures;
- Numerous traffic counting stations (24/7 automatic traffic recorder (ATR) counts) which are permanent devices used to ascertain the traffic volumes passing along a given point on a roadway or ramp.

The existing municipal electrical facilities within the study area include the following:

- Municipal lighting along the Clark Blvd., Queen St., Williams Parkway and Bovaird Dr. structures;
- Decorative lighting along the Franceschini Pedestrian structure;
- Underpass lighting along the Orenda structure;
- Cameras on the Queen Street structure.

4.4.9 Utilities

A number of existing aerial and underground utilities are located along Highway 410 within the study limits.

The following stakeholders have infrastructure within the Study Area:

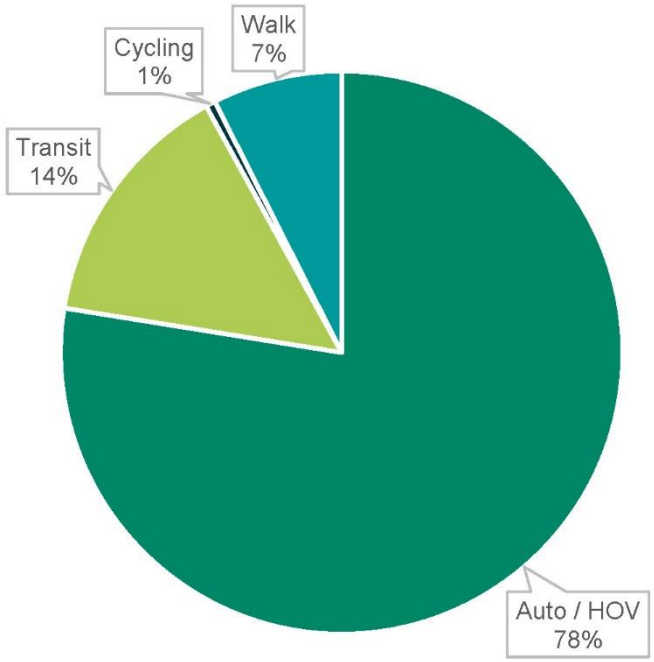
- Enbridge Gas
- Bell Canada
- Rogers Communications
- Alectra Utilities
- Public Sector Network
- TC Energy Co.
- Zayo
- Street lighting (MTO and Municipal owned)
- Storm sewers (MTO and Municipal owned)
- Municipal watermains.

5. Need for Highway Improvements

5.1 Existing Peak Hour Traffic

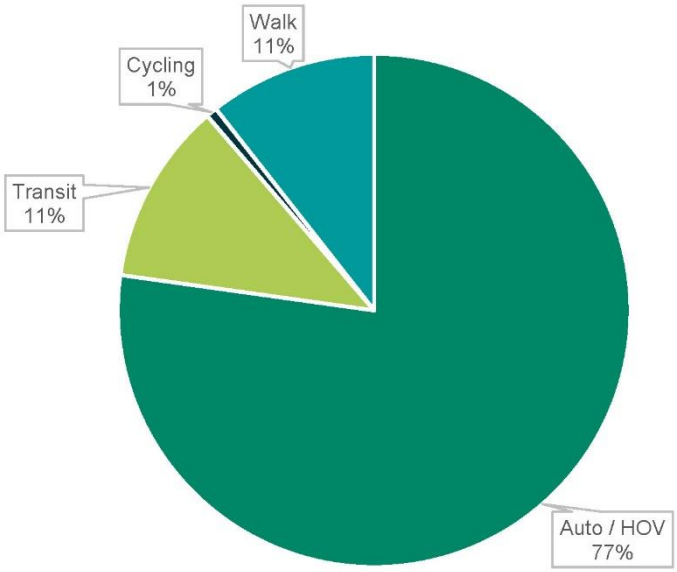
Based on the 2016 Transportation Tomorrow Survey (TTS), most trips originating in Brampton during the AM peak period (6:00 AM to 9:00 AM) are made by automobiles, followed by transit, walking, and cycling. **Figure 5-1** below shows the modal split during the AM peak period.

Figure 5-1: TTS Modal Split During AM Peak Period



During the PM peak period (2:00 PM to 5:00 PM), similar to the AM peak period, most trips originating in Brampton are made by automobiles, followed by transit, walking, and cycling. **Figure 5-2** shows the PM modal split.

Figure 5-2: TTS Modal Split During PM Peak Period



For the traffic analysis, the AECOM Traffic Team reviewed the 2016 Emme macro-models obtained from the MTO's System Analysis and Forecasting Office (SAFO) to break down vehicular trips into different vehicle classes. The estimated splits between automobiles and trucks during the AM and PM peak hours are presented in **Figure 5-3**.

Figure 5-3: Existing Automobile and Truck Splits in the AM and PM Peak Periods

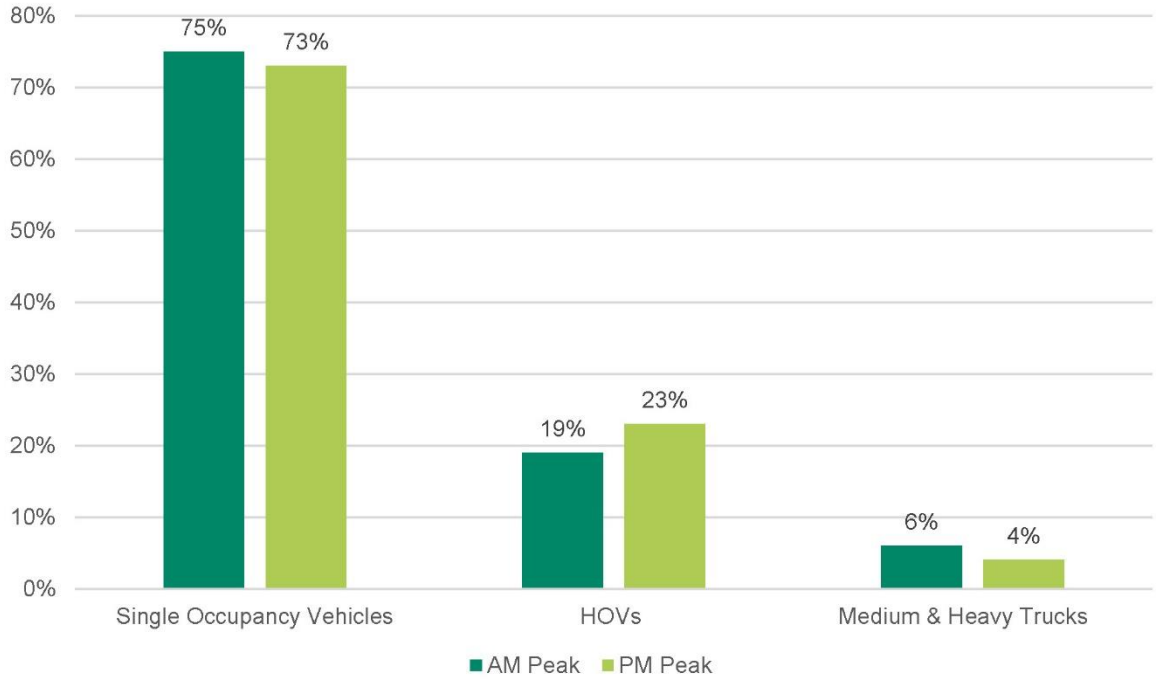


Table 5-1 and **Table 5-2** present the observed speed and volume along the Highway 410 sections in the northbound and southbound directions, respectively. Notable slowdown areas are observed in the northbound direction during the PM peak hour, with average speeds ranging from 35 kilometres per hour to 63 kilometres per hour on the section between Steeles Avenue and Williams Parkway. Additionally, slowdown areas are observed in the southbound direction during the AM peak hour, with average speeds ranging from 35 kilometres per hour to 65 kilometres per hour on the section between Mayfield Road and Queen Street. These slowdowns indicate capacity deficiencies in the peak travel directions.

Table 5-1: Observed Speeds and Traffic Volume along Highway 410 – Northbound

Highway 410 Northbound Mainline Section	Observed (MTO 2018) AM Speed (kilometres per hour)	Observed (MTO 2018) PM Speed ((kilometres per hour))	Observed 2019 AM Volume (vehicles per hour)	Observed 2019 PM Volume (vehicles per hour)
Steeles Ave to Clark Blvd Interchange (IC)	102	35	4,521	6,943
Clark Blvd to Queen St IC	106	47	3,508	6,219
Queen St to Williams Pkwy IC	105	63	3,619	7,008
Williams Pkwy to Bovaird Dr IC	104	79	3,500	6,374
Bovaird Dr to Sandalwood Pkwy IC	103	98	2,471	4,974
Sandalwood Pkwy to Mayfield Rd IC	103	98	1,600	3,183

Table 5-2: Observed Speeds and Traffic Volume along Highway 410 – Southbound

Highway 410 Southbound Mainline Section	Observed (MTO 2018) AM Speed (kph)	Observed (MTO 2018) PM Speed (kph)	Observed 2019 AM Volume (veh/hr)	Observed 2019 PM Volume (veh/hr)
Mayfield Rd to Sandalwood Pkwy IC	55	97	3,609	2,136
Sandalwood Pkwy to Bovaird Dr IC	35	101	4,558	3,354
Bovaird Dr to Williams Pkwy IC	42	104	5,841	4,600
Williams Pkwy to Queen St IC	65	109	6,558	4,894
Queen St to Clark Blvd IC	78	107	6,197	4,665
Clark Blvd to Steeles Ave IC	88	109	6,834	5,436

5.2 Population and Employment Forecast

Peel Region and the City of Brampton are situated within the Greater Golden Horseshoe region, the most populous and economically active part of Ontario. Some of these centres are the fastest growing areas within the Province.

Population and employment forecasts for municipalities within Peel Region were obtained from the Region. Between 2018 and 2031 the population in the Region is expected to increase by approximately 285,600 people.

Population and employment forecasts for the City of Brampton were obtained from the City and Statistics Canada. Between 2016 and 2021 the employed work force in Brampton has been growing faster than the population overall. The City of Brampton's 2021 population increased by 10.6%, surpassing the Provincial Average of 5.8%.

5.3 Transportation Network Improvements

Highway 413 is a proposed new 52 kilometres highway and transit corridor running through York, Peel and Halton regions. It will extend from Highway 401/407 ETR interchange in the west to Highway 400 in the east. The project includes a 4 kilometres extension to Highway 410 and 3 kilometres extension to Highway 427. This proposed highway is anticipated to attract additional traffic demand to and from Highway 413 through the studied sections of Highway 410.

5.4 Future Traffic Demand

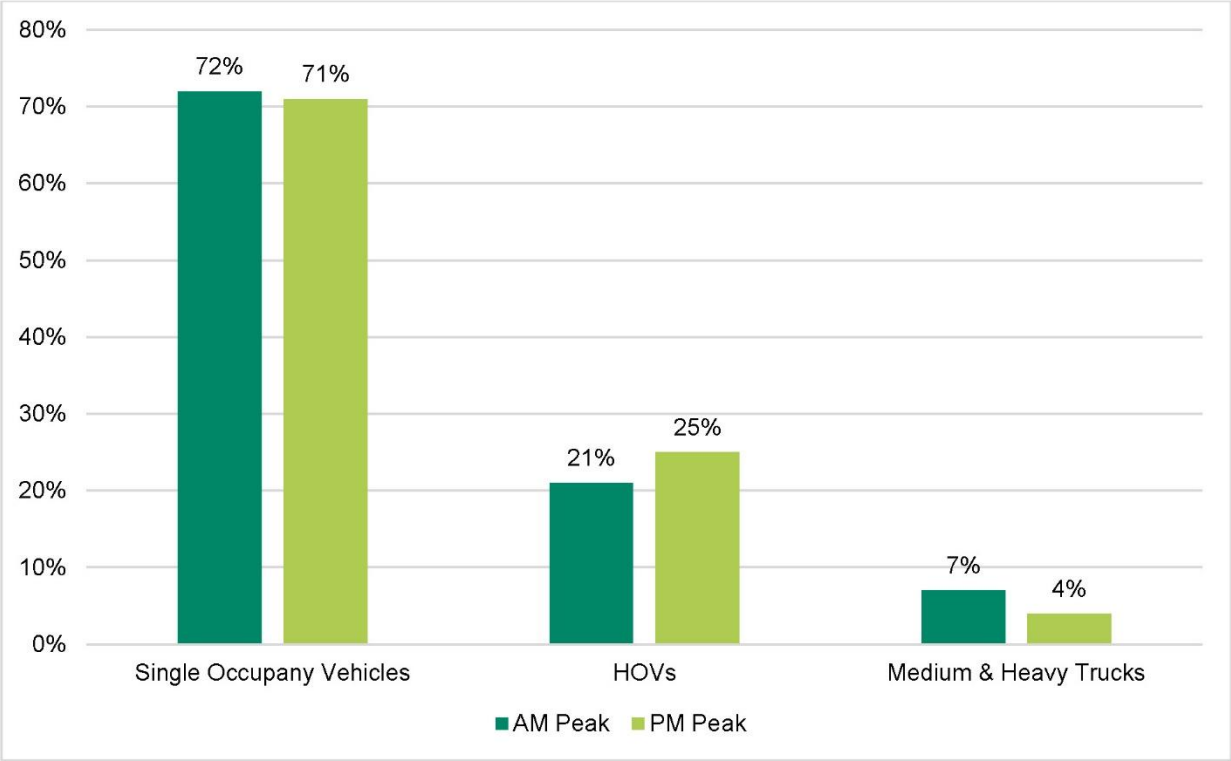
The anticipated traffic demand in the future horizon year of 2041 was estimated by comparing the travel demand forecast output from the 2041 Emme models and the 2016 Emme models and applying the growth to the existing traffic data. To determine the number of lanes needed to accommodate the anticipated traffic demand, the guidelines outlined in the Highway Capacity Manual (HCM), 7th Edition were followed. Design requirements for roadways vary according to the desired capacity and level of service. Level of Service (LOS) D indicates "practical capacity" of a roadway. **Table 5-3** presents the projected traffic demand and the required number of lanes as per the HCM methodology. For comparison purposes, this table also presents the existing number of lanes on each mainline section. The findings establish the need for additional capacity on Highway 410 to accommodate future traffic demand and offer more reliable travel times.

The estimated future automobile and truck splits during the AM and PM peak hours are presented in **Figure 5-4**.

Table 5-3: Future Traffic Demand and Required Number of Lanes

Highway 410 Mainline Section	Direction	2041 Design Hourly Volume (in Passenger Car Equivalent)	Maximum Service Flow Rate for Target LOS D (in Passenger Car Equivalent)	Required Number of Lanes	Existing Number of Lanes
Steeles Ave to Clark Blvd IC	Northbound	8,249	2,110	4	4
Steeles Ave to Clark Blvd IC	Southbound	9,685		5	5
Clark Blvd to Queen St IC	Northbound	7,217	2,110	4	3
Clark Blvd to Queen St IC	Southbound	8,822		5	4
Queen St to Williams Pkwy IC	Northbound	7,721	2,110	4	3
Queen St to Williams Pkwy IC	Southbound	8,025		4	3
Williams Pkwy to Bovaird Dr IC	Northbound	7,394	2,110	4	3
Williams Pkwy to Bovaird Dr IC	Southbound	7,307		4	3
Bovaird Dr to Sandalwood Pkwy IC	Northbound	6,340	2,110	3	2
Bovaird Dr to Sandalwood Pkwy IC	Southbound	6,130		3	2
Sandalwood Pkwy to Mayfield Rd IC	Northbound	4,822	2,110	3	2
Sandalwood Pkwy to Mayfield Rd IC	Southbound	4,468		3	2

Figure 5-4: Future Automobile and Truck Splits in the AM and PM Peak Periods



5.5 Collision Analysis

A collision analysis was completed for the mainline, ramps, and ramp terminal intersections within the section of Highway 410 between Steeles Avenue interchange and Sandalwood Parkway interchange. The collision analysis includes a comprehensive assessment of all reported collisions that occurred between January 1, 2017, and December 31, 2021, inclusive (i.e., five-year period). During the five-year period, a total of 1,761 collisions were recorded on Highway 410, 194 collisions on the ramps, and 110 intersection-related collisions within the limits of the collision assessment study area.

Collisions Analysis – Mainline

In the northbound travel direction, a total of 947 collisions were reported along Highway 410, with no fatal collisions. Higher collision rates were recorded on Highway 410 in the northbound direction between Clark Boulevard and Queen Street East, followed by the section between Steeles Avenue East and Clark Boulevard. These sections recorded higher frequency of rear-end and sideswipe collisions, with the majority occurring during the PM peak periods between 3 PM to 7 PM. These elevated collision numbers are

potentially attributed to longer queues and heavy traffic that builds up during a typical PM peak period, as well as due to the multiple lane transitioning over a short distance.

In the southbound travel direction, a total of 814 collisions were recorded along Highway 410, with no fatal collisions. Collisions in the southbound directions are mostly evenly distributed over the study area, however, comparatively, higher collision frequencies were reported at the merging and diverging sections of the interchange ramps with collision types ranging from rear-end collisions to sideswipes. The section of Highway 410 between Clark Boulevard and Queen Street East was noted to have elevated collision activity, followed by the section between Williams Parkway and Queen Street East. These sections recorded higher rear-end, sideswipe and single motor vehicle collisions, with the majority occurring during the AM peak hours between 6 to 9 AM, potentially resulting from traffic congestion, which starts to build up from 6 AM from the Queen Street East interchange extending northerly to north of the Sandalwood Parkway East interchange.

Collisions Analysis – Ramps:

The highest number of ramp collisions was recorded at the Bovaird Drive East interchange ramps with a total of 59 collisions, followed by the Queen Street East interchange ramps with a total of 56 collisions. No fatal collisions were reported on any of the ramps. Single vehicle and rear-end collisions were the predominant types of collisions on the ramps, and mainly attributed to drivers' non-compliance with the advisory speeds and/or following too closely.

Collisions Analysis – Ramp Terminal Intersections:

The highest number of collisions at the ramp terminal intersections was reported at the Williams Parkway west ramp terminal with a total of 33 collisions, followed by the Bovaird Drive east ramp terminal with 21 collisions. Turning and rear-end collisions were generally the two predominant types of collisions at the ramp terminal intersections, mainly attributed to inattentive drivers following too closely.

There was one collision at the Williams Parkway west ramp terminal which resulted in a fatality. This intersection is identified as a collision hotspot location, with an evident collision pattern between the westbound left-turning vehicles and the eastbound through vehicles. While the desktop assessment of sight distances did not identify any sightline deficiencies for either the horizontal or vertical curves, the combination of both (to the west of the intersection) may effectively reduce the overall sightlines for the westbound left-turning vehicles. This could potentially result in misjudging available gaps within the eastbound traffic stream, as suggested by the elevated number of collisions between

left-turning vehicles from the westbound approach and through traffic from the eastbound approach at this intersection.

Additionally, another potential contributing factor is the eastbound right-turn lane, which must exit at the west ramp terminal but functions as a de facto through lane as it continues to the W-N loop on-ramp, thereby potentially confusing westbound left-turning motorists during the permissive left-turn phase, as they mistakenly anticipate the eastbound vehicle to turn right onto the inner lane of the ramp. Based on the available police reports, such vehicular interaction resulted in at least two collisions at the intersection. The signal timing parameters at the Williams Parkway west ramp terminal were also reviewed for the purpose of confirming the adequacy of the vehicular clearance times.

To mitigate the above-noted issues, the following measures could be considered:

- Introduce a fully protected westbound left-turn phase to eliminate the interaction between westbound left turning vehicles and eastbound through traffic. This refers to a protected green arrow interval that is only displayed in advance of the conflicting through phase. Left turning vehicles are not permitted to turn unless the left turn green arrow is active. Based on traffic assessment, if a fully protected phase were to be implemented, two left turn lanes would be required to accommodate the queues. This dual left turn lane option was assessed and found not to be feasible based on a structural review.
- Provide only two receiving lanes for the eastbound through traffic. Reducing the number of receiving lanes for eastbound through traffic can help drivers to adhere to their designated lanes and avoid utilizing the must exit right-turn lane as a de facto through lane. This can be implemented through placement of curb and line paint.
- Improve signage by installing a clear and visible “Right Turn Must Exit” sign upstream of the intersection at the eastbound right-turn lane that can help prevent drivers from using it as a through lane. Improved signage can enhance driver awareness and compliance with lane restrictions.

It should be noted the last two bullet points would only apply if the westbound left turn phase remains protected-permitted.

5.6 Summary of Problems and Opportunities

Transportation Problems and Opportunities within the Study Area are summarized as follows:

- Commuter traffic on Highway 410 is currently experiencing significant delays during weekday peak periods;
- Population and employment forecasts for the City of Brampton indicate that traffic demand will continue to grow in the future;
- The proposed Highway 413 is anticipated to attract additional traffic demand to and from this highway through the studied sections of Highway 410;
- Future traffic demand in the 2041 horizon year is projected to exceed the available capacity on Highway 410; and
- Mitigation measures could be considered at the Highway 401 Williams Parkway west ramp terminal to improve the safety performance of the intersection.

To address the identified problems and opportunities, transportation capacity improvements are required along the section of Highway 410 between south of Queen Street and Sandalwood Parkway. As discussed in **Sections 6** and **7**, several improvement alternatives were considered and evaluated, including widening alternatives with HOV extension, to identify the recommended improvement alternative that would address the study objectives.

6. Assessment of Alternatives to the Undertaking

6.1 Alternatives to the Undertaking

'Alternatives to the Undertaking' are broad-based alternatives that represent functionally different ways of addressing future transportation needs. **Section 6.1.1** through **Section 6.1.5** discuss the Alternatives to the Undertaking that were considered in this study. These alternatives were evaluated based on their ability to meet the following study objectives:

- Address future capacity and operational issues along Highway 410;
- Improve safety conditions on Highway 410;
- Address the future rehabilitation needs along Highway 410; and
- Reduce or minimize impacts to the natural, social, economic and cultural environments.

6.1.1 Do Nothing

The "Do Nothing" alternative maintains the status quo of transportation infrastructure and services with no actions. To do nothing would result in further deterioration of level of service, resulting in an increase in travel time, congestion, potential for collisions, driver frustration and increased fuel consumption. Hence, the "Do Nothing" alternative does not address the objectives of this study and was not carried forward for detailed evaluation.

6.1.2 Transportation Demand and System Management

Transportation demand and system management (TDM/TSM) involves strategies that improve efficiency of the existing transportation system by inducing changes to travel behaviour. These strategies aim to reduce reliance on single-occupancy vehicles and encourage use of sustainable non-auto modes of transportation. Examples of such strategies/measures include provision of carpool lanes/parking lots, active transportation facilities, alternative/hybrid work arrangements, transit priority at intersections, etc. The City of Brampton is a participant in the Smart Commute Program, a carpool program under Metrolinx. Such measures could reduce vehicular traffic demand, but they would likely not reduce demand sufficiently to eliminate the need for capacity improvements. As this alternative cannot solely meet the study objectives, it may be considered along with other alternatives.

6.1.3 Transit Expansion / Improvements

There are number of initiatives planned in the Study Area by Metrolinx, the Crown agency of the Government of Ontario that manages and integrates road and public transport in Peel Region. Examples of some initiatives include the Queen Street-Highway 7 Bus Rapid Transit (BRT), GO Expansion Program, and Hazel McCallion Light Rail Transit (LRT). These initiatives may result in a shift from the use of passenger vehicles to transit, however, the shift would not be sufficient to ease the existing or future traffic congestion or address the other study objectives. As such, this alternative may be considered along with other alternatives.

6.1.4 Adjacent Road System Improvements

Improvements to the adjacent road system would not adequately solve the problems along this section of the Highway 410 corridor. The adjacent parallel roads in proximity to the study area are generally municipal arterial roads designed to deliver local access and are not suitable for carrying high traffic demand for long distance travel. Improving the arterial road network to serve long distance travel needs is not a desirable solution and was not considered further.

6.1.5 Improvements to Highway 410

Improvements to Highway 410, such as widening to extend the existing HOV lanes, adding general purpose lanes, improving interchange geometrics, and rehabilitating or replacing structures and pavement, have the potential to address most operational and geometric deficiencies as well as rehabilitation needs along this section of Highway 410. This alternative has been carried forward for further assessment as part of this study.

6.2 Assessment of Alternatives to the Undertaking

Table 6-1 summarizes the assessment of the Alternatives to the Undertaking. The benefits of transit expansion / improvements and TDM / TSM measures from a traffic operation and capacity perspective were recognized. However, the implementation of these alternatives (individually or as a combination alternative) will not fully address the projected future capacity needs of this section of Highway 410.

Table 6-1: Assessment of the Alternatives to the Undertaking

Alternatives to the Undertaking	Study Objective 1 Address future capacity and operational issues along Highway 410	Study Objective 2 Improve safety conditions of Highway 410	Study Objective 3 Address future rehabilitation needs along Highway 410	Study Objective 4 Reduce or minimize impacts to the environment	Alternative Carried Forward for Further Evaluation
Do Nothing					Not Carried Forward
Transportation Demand and System Management					Consider with Other Alternatives
Transit Expansion / Improvements					Consider with Other Alternatives
Adjacent Road System Improvements					Not Carried Forward
Highway 410 Improvements					Carried Forward

Legend	Least Preferred	-	-	-	Most Preferred
Icon					

7. Generation, Assessment and Evaluation of Highway Improvement Alternatives

Following assessment of the Alternatives to the Undertaking and the decision to carry forward the 'Improvements to Highway 410' alternative, a set of preliminary design alternatives (Alternative Methods) were developed to implement the improvements along Highway 410. Alternatives were developed and assessed for widening of the Highway 410 cross-section including extension of High Occupancy Vehicle (HOV) lanes from the existing terminus south of Queen Street, northerly to Bovaird Drive.

7.1 Highway 410 Mainline Alternatives

Five alternatives were developed for the Highway 410 widening and HOV extension in the northbound and southbound directions, within the project limits. All alternatives have the same proposed southbound HOV initiation point located north of Bovaird Drive with the HOV lane extending southbound to the existing initiation point near Orenda Road; however, the proposed northbound termination location varies between alternatives (**Figure** 7-1). To optimize traffic operations, each alternative provides additional lanes at various locations along Highway 410 to address traffic capacity requirements. Alternatives are discussed in the following sections and roll plans can be found in Appendix F.

7.1.1 Alternative 1

This alternative includes the extension of the northbound and southbound HOV lanes from their current terminus near Orenda Road northerly to Bovaird Drive, with additional geometric improvements as follows:

- **Northbound**
  - Extension of the Speed Change Lane (SCL) from Steeles Avenue (Ramp West (W)-North (N)) to a forced exit at Clark Boulevard.
  - Addition of one General Purpose Lane (GPL) from the proposed terminus of the northbound (NB) HOV lane (south of Bovaird Drive) to Sandalwood Parkway.
- **Southbound**
  - No additional improvements.

7.1.2 Alternative 2

This alternative includes the extension of the northbound and southbound HOV lanes from their current terminus near Orenda Road northerly to Bovaird Drive, with additional geometric improvements as follows:

- **Northbound**
  - Extension of the SCL from Steeles Avenue (Ramp W-N) to a forced exit at Clark Boulevard.
  - Addition of one GPL from the proposed terminus of the NB HOV lane (south of Bovaird Drive) to Sandalwood Parkway.
  - Extension of the GPL from its current terminus (forced exit to Queen Street) to Williams Parkway.
  - At William's Parkway, the two entrance ramps (W-N and East (E)-N) are separate and then merge and enter the highway as a single entrance.
- **Southbound**
  - Addition of one GPL from south of Sandalwood Parkway to south of Bovaird Drive.
  - Addition of one GPL from south of Williams Parkway to Queen Street.

7.1.3 Alternative 3

This alternative includes the extension of the northbound and southbound HOV lanes from their current terminus near Orenda Road northerly to south of Williams Parkway (in the northbound direction) and to north of Bovaird Drive (in the southbound direction), with additional geometric improvements as follows:

- **Northbound**
  - Extension of the GPL from its current terminus (forced exit to Queen Street) to Williams Parkway.
  - Addition of one GPL from the proposed terminus of the NB HOV lane (approximately 500 metres south of Williams Parkway) to Sandalwood Parkway.
  - Extension of the SCL from Steeles Avenue (Ramp W-N) to a forced exit at Queen Street.
  - To avoid the weaving issue between the Queen Street Ramp E-N and the "standard" HOV gate location at Williams Parkway, the HOV lane has been shortened to terminate approximately 500 metres south of Williams Parkway.
- **Southbound**
  - Addition of one GPL from south of Sandalwood Parkway to Queen Street.

7.1.4 Alternative 4

This alternative includes the extension of the northbound and southbound HOV lanes from their current terminus near Orenda Road northerly to Bovaird Drive, with additional geometric improvements as follows:

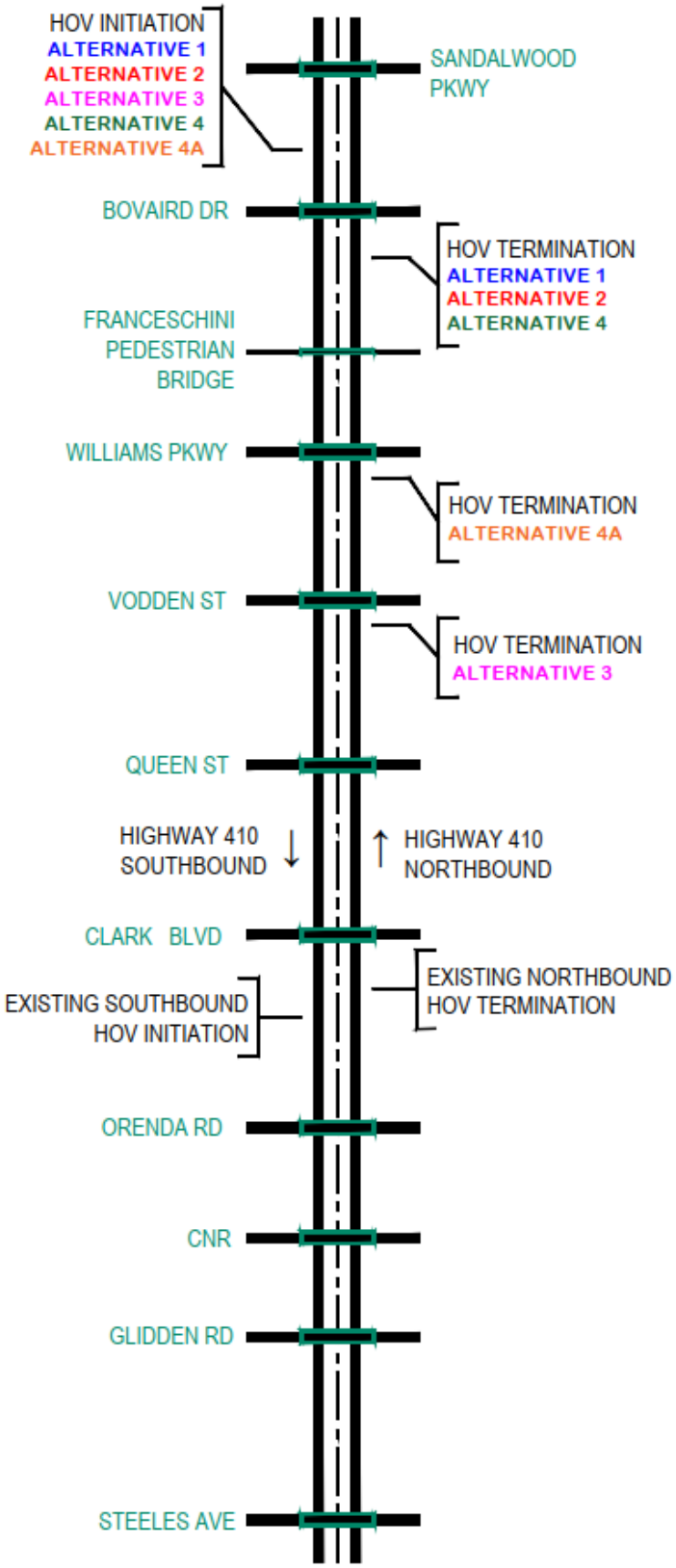
- **Northbound**
  - Extension of the SCL from Steeles Avenue (Ramp W-N) to a forced exit at Queen Street.
  - Addition of one GPL from the proposed terminus of the NB HOV lane (south of Bovaird Drive) to Sandalwood Parkway.
  - Extension of the GPL from its current terminus (forced exit to Queen Street) to Williams Parkway.
  - At William's Parkway, the two entrance ramps (W-N and E-N) are separate and then merge and enter the highway as a single entrance.
- **Southbound**
  - Addition of one GPL from south of Sandalwood Parkway to Queen Street.

7.1.5 Alternative 4A

This alternative includes the extension of the northbound and southbound HOV lanes from their current terminus near Orenda Road northerly to south of Williams Parkway (in the northbound direction) and to north of Bovaird Drive (in the southbound direction), with additional geometric improvements as follows:

- **Northbound**
  - Extension of the SCL from Steeles Avenue (Ramp W-N) to a forced exit at Queen Street.
  - Addition of one GPL from the proposed terminus of the NB HOV lane (approximately 60 metres south of Williams Parkway) to Sandalwood Parkway.
  - Extension of the GPL from its current terminus (forced exit to Queen Street) to Williams Parkway.
  - At William's Parkway, the two entrance ramps (W-N and E-N) are separate and then merge and enter the highway as a single entrance.
- **Southbound**
  - Addition of one GPL from south of Sandalwood Parkway to Queen Street.

Figure 7-1: HOV Initiation/Termination Locations by Alternative



7.2 Assessment and Evaluation of Alternatives

7.2.1 Evaluation Methodology and Criteria

A detailed set of evaluation criteria relevant to this project was developed. These criteria were grouped into the Transportation/Constructability, Natural Environment, Socio-Economic Environment, Cultural Environment, and Cost categories. The criteria utilized in the evaluation of alternatives is provided in **Table 7-1**.

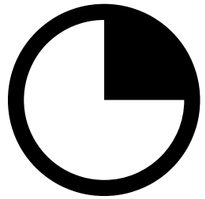
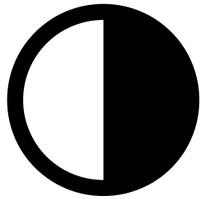
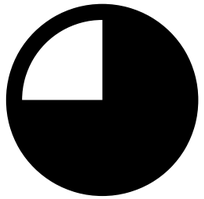
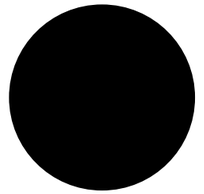
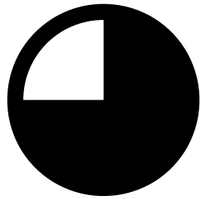
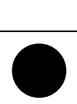
Table 7-1: Evaluation Criteria

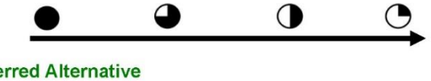
Evaluation Component	Criteria
Transportation/ Constructability	■ Traffic Operations ■ Safety & Geometrics ■ High Occupancy Vehicle Lane Ingress/Egress Locations ■ Constructability ■ Existing utility and servicing infrastructure
Natural Environment	■ Fish and Fish Habitat ■ Species at Risk ■ Terrestrial Ecosystems ■ Surface Water / Drainage ■ Groundwater ■ Designated Natural Areas and Wetlands
Socio-Economic Environment	■ Community Effects ■ Commercial / Industrial Operations ■ Contamination ■ Agricultural Operations ■ Municipal / Provincial Land Use Planning / Policies / Goals / Objectives ■ Noise & Air Quality ■ Climate Change ■ Landscape Composition ■ Recreational Trails / Active Transportation Networks
Cultural Environment	■ Archeological ■ Built Heritage and Cultural Heritage Landscapes
Cost	■ Construction Costs

7.2.2 Summary of the Highway 410 Evaluation

A summary of the evaluation of alternatives for the Improvements to Highway 410 is provided in **Table 7-2**. The complete assessment and evaluation tables are provided in **Appendix F**.

Table 7-2: Highway 410 Evaluation Summary

Category	Summary	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 4A
Transportation/ Constructability	■ Alternative 3, 4 and 4A are anticipated to have significant improvements to traffic operations in the southbound direction and considerable improvements in the northbound direction, while Alternative 2 will have moderate improvements and Alternative 1 shows minimal improvements. ■ Alternative 3, 4 and 4A are anticipated to have considerable improvements to bottlenecks and merging/weaving issues, while Alternative 2 will have minor improvements and Alternative 1 shows no improvements. ■ Alternatives 1, 2 and 4 meet the study objectives to extend the northbound HOV lane to south of Bovaird Drive, while Alternative 3 and 4A have northbound HOV lane termination points south of Williams Parkway. ■ Alternative 1, 2, 4 and 4A do not preclude future extension of the northbound and southbound HOV lanes north of Bovaird Drive, while Alternative 3 would require relocation, removal or reconfiguration of ingress/egress locations for a future extension of the northbound HOV lane. ■ Given the short distances between existing interchanges (<2 kilometres), the HOV lane lengths are less than the desirable 1.6 kilometres. Alternative 1, 3 and 4A show slight improvements over Alternative 2 and 4 for HOV lane lengths. ■ Overall, Alternative 4 scored the highest in the Transportation and Constructability category, followed closely by Alternative 4A and Alternative 3.					
Natural Environment	■ Alternative 1 has the least amount of Highway 410 widening to the outside, resulting in the lowest impacts to Terrestrial Ecosystems and Designated Natural Areas and Wetlands, compared to Alternatives 2, 3, 4 and 4A.					
Socio-Economic Environment	■ Alternative 1 has the least amount of Highway 410 widening to the outside, resulting in the lowest impacts to Noise, compared to Alternatives 2, 3, 4 and 4A.					
Cultural Environment	■ Impacts to archaeological resources or built heritage features and cultural heritage landscapes are not anticipated for any of the Alternatives.					
Cost	■ Alternative 1 is the lowest cost, as this option provides minimal additional capacity beyond the extension of HOV lanes.					
Recommendation		✗	✗	✗	✓	✗

Legend	
	Highest Category Weighting  Lowest Category Weighting
	Most Preferred Alternative  Least Preferred Alternative
	✓ Preferred Alternative ✗ Not Recommended

Based on the evaluation of alternatives, **Alternative 4 is the technically preferred alternative** with the following key advantages:

- Considerable to significant improvements to traffic operations
- Considerable improvements to traffic bottlenecks and merging/weaving issues
- Meets the objective of this study to maximize the extent of the HOV lanes (i.e., to the vicinity of Bovaird Drive)
- Does not preclude future extension of the northbound and southbound HOV lanes north of Bovaird Drive.

Alternative 1 scored highest in the Natural Environment, Socio-Economic Environment and Cost Categories, however, it does not improve the traffic operations (including traffic bottlenecks and merging/weaving issues), as it does not provide additional capacity in areas with these operational issues and it therefore does not address the problems and opportunities identified during this Project.

8. The Recommended Plan

8.1 Summary of the Recommended Plan

The Highway 410 corridor within the Study Area will be widened to extend HOV lanes in both directions from south of Queen Street to Bovaird Drive, and to provide additional capacity in both directions within the study limits through the extension of auxiliary lanes. **Figure 8-1** to **Figure 8-3** show the recommended cross-sections of the Highway 410 mainline widening.

In summary, the Recommended Plan includes the following improvements:

- Extension of HOV lanes through median side widening on Highway 410 to south of Bovaird Drive in the northbound direction and to north of Bovaird Drive in the southbound direction.
- Outside widening of Highway 410 through extension of auxiliary lanes in both directions, and additional geometric improvements as follows:
  - **Northbound**
    - Extension of the speed change lane (SCL) from Steeles Avenue (Ramp from west to north) to a forced exit at Queen Street.
    - Addition of one general purpose lane (GPL) from the proposed terminus of the northbound HOV lane (south of Bovaird Drive) to Sandalwood Parkway.
    - Extension of the GPL from its current terminus (forced exit to Queen Street) to Williams Parkway.
    - At William's Parkway, the two entrance ramps (from west to north and from east to north) are separate and then merge and enter the highway as a single entrance. The current interchange configuration of a diamond ramp configuration west of the structure and a Parclo A4 ramp configuration east of the structure will be maintained.
  - **Southbound**
    - Addition of one GPL from south of Sandalwood Parkway to Queen Street.
    - New ramp tie-ins at interchanges to accommodate the widening.
- Improvements to interchange ramp geometry.
- Extension of tall wall median barrier from Clark Boulevard to Bovaird Drive.

Figure 8-1: Proposed Highway 410 Mainline Typical Cross-section (Urban Section – Curb & Gutter (C&G))

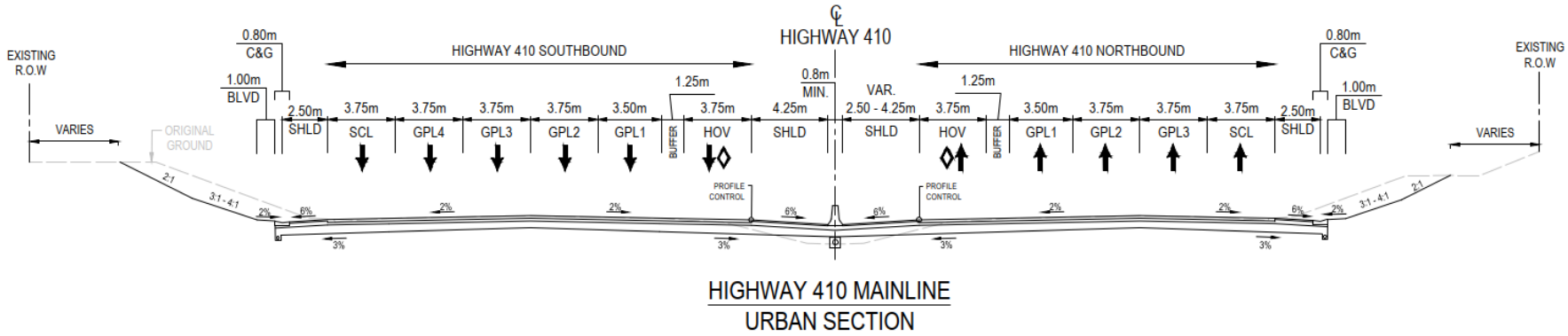


Figure 8-2: Proposed Highway 410 Mainline Typical Cross-section (Rural Section – Ditches)

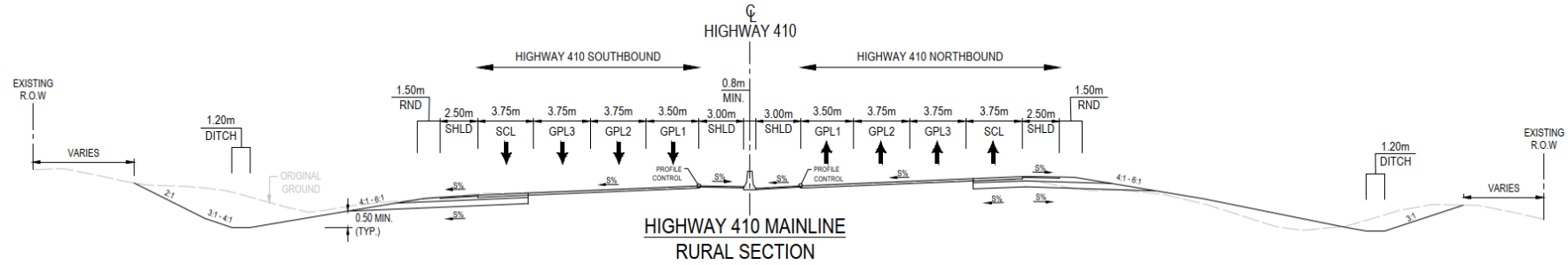
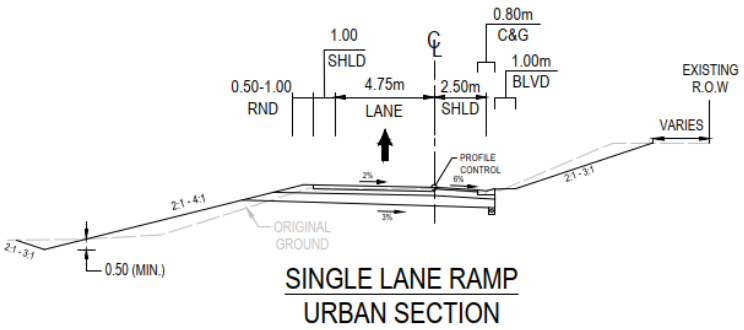
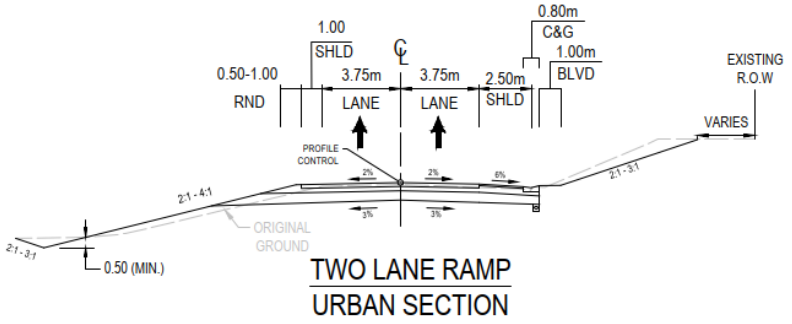


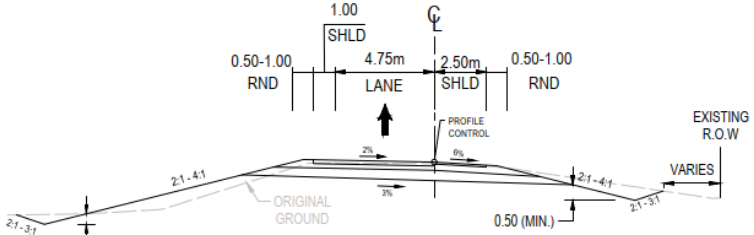
Figure 8-3: Proposed Ramp Typical Sections



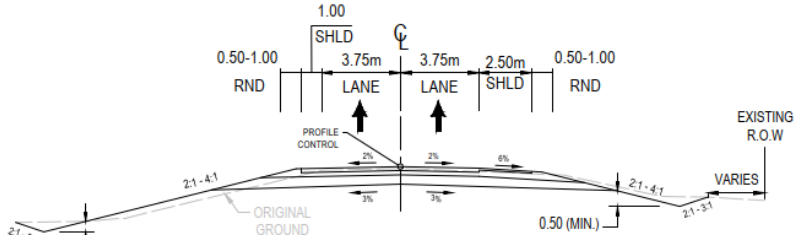
SINGLE LANE RAMP
URBAN SECTION



TWO LANE RAMP
URBAN SECTION



SINGLE LANE RAMP
RURAL SECTION



TWO LANE RAMP
RURAL SECTION

- New storm sewers and roadside drainage. Refer to Section 9.1.4 for details on stormwater management facilities, dry ponds, water quality ponds, superpipe system and storm sewer recommendations.
- Rehabilitation of the bridges within the study limits, including Orenda Road Overpass, Clark Boulevard Underpass, Queen Street Underpass, Vodden Street Underpass, Williams Parkway Underpass, Franceschini Drive Underpass and Bovaird Drive Underpass.
- Implementation of toe walls at underpass structures impacted by the widening, including Queen Street, Bovaird Drive, Clark Boulevard, Williams Parkway, Vodden Street, and Franceschini Drive.
- Adjustments to interchange ramp illumination to accommodate the widening and ramp realignment.
- Installation of high-mast lighting on new tall wall median barrier.
- Installation of one new noise barrier, on the west side of Highway 410 between Vodden Street and Williams Parkway.
- Improvements to Williams Parkway including new multi-use paths on the north and south sides, new painted cross-rides at ramp terminal intersections, and geometric and safety improvements. Geometric and safety improvements include new curb and line paint at the west ramp terminal intersection to remove the option for eastbound traffic from driving through the intersection from the right turn lane.
- Three new retaining walls to mitigate property and environmental impacts south of Clark Boulevard along the east and west side of Highway 410, and adjacent to the Queen Street ramp from north to east/west).
- Rehabilitation/reconstruction of existing pavement and new pavement including the following:
  - Rehabilitation of the existing asphalt (flexible) pavement in the southbound Highway 410 lanes from the south limit to approximately Station 14+350.
  - Reconstruction of the existing asphalt (flexible) pavement in the southbound Highway 410 lanes from approximately Station 14+350 to 17+400.
  - Rehabilitation of the existing asphalt (flexible) pavement in the northbound Highway 410 lanes from approximately Station 12+685 to Sta 17+400.
  - Rehabilitation of concrete (rigid) pavement in the existing Highway 410 lanes will include concrete repair and asphalt overlay.

- New asphalt pavement in areas of widening/addition of new HOV lanes along the northbound and southbound main lanes from the south project limit to approximately Station 17+400.
- New composite pavement (asphalt over concrete) in areas of widening from approximately Station 17+400 to the north project limit.

Figures of the Recommended Plan can be found in **Appendix A.**

9. Environmental Issues, Effects, Mitigation Measures and Commitments

The following sections outline the direct and indirect environmental (natural, socio-economic and cultural) effects, as well as transportation effects, associated with the Recommended Plan for improvements to the Highway 410 corridor within the Study Area as identified in **Section 8**. This section also describes the mitigation measures that will be implemented to avoid or minimize the potential effects associated with the Recommended Plan. Mitigation includes planning decisions, design features, construction requirements and construction constraints. The mitigation measures and commitments outlined in this report will be refined in greater detail in the Detail Design stage. Specific environmental controls based on these detailed mitigation measures will then be included in the contract documents to address specific environmental and operational concerns during the preparation of the contact documents in the Detail Design stage.

9.1 Natural Environment

These sections describe potential impacts and proposed mitigation measures to the natural environment based on the existing conditions described in **Section 4**. These impacts and mitigation measures will be reviewed and refined during the Detail Design stage.

9.1.1 Fish and Fish Habitat

A fish and fish habitat impact assessment was completed based on the Recommended Plan to identify any potential constraints to proposed activities, and suggest general mitigation measures to avoid harm to fish and fish habitat which shall be refined in Detail Design.

9.1.1.1 Summary of Proposed Work at Watercourse Crossings

The details of the proposed works at each of the watercourse crossings identified in **Table 4-1** along Highway 410 located within the study are discussed below.

WC-01-CI

No work is proposed at this culvert. Adjacent to this culvert crossing will be the construction of retaining walls along the Highway 410 embankment, including above the culvert, to support the embankment on the east side of Highway 410. In water works are not anticipated during construction of the retaining wall.

At this time, rehabilitation within the culvert is not proposed, however it may be required in the future. The future rehabilitation works may include patch repairs on the walls, soffit, and drain openings, and crack repairs. When rehabilitation is required, a fish and fish habitat impact assessment at WC-01-CI will be completed in advance of the culvert rehabilitation works.

WC-02-Bo

No works on the culvert or within the channel are currently proposed. Grading for highway widening will be within 30 metres of the watercourse.

WC-03-Sa

No work is currently proposed at this culvert.

MTO Routine Works

Based on a preliminary impact assessment, project activities were assessed against the list of Routine MTO Works in Table 2-1 of the Interim Environmental Guide For Fisheries (MTO, 2020). Routine works are those within the MTO ROW, which includes the shoulders and paved areas that do not occur within the waterbody and can be mitigated to prevent sediment/debris from entering an aquatic feature. Proposed works associated with drainage (where no in-water work is proposed within fish habitat), electrical, signage, and pavement resurfacing are all covered by Routine MTO Works.

All appropriate mitigation measures outlined in *Ontario Provincial Standard Specification* (*OPSS) 182: General Specification for Environmental Protection for Construction in and around Waterbodies and on Waterbody Banks* can be applied to the proposed grading within 30 metres of WC-01-CI and WC-02-Bo. These grading activities are considered Routine MTO Works.

The remaining proposed activities within 30 metres of a watercourse includes the construction of retaining walls at culvert crossing WC-01-CI. These activities do not qualify as Routine MTO Works and therefore a preliminary fisheries impact assessment was completed and is summarized in **Section 9.1.1.2.**

9.1.1.2 Summary of Potential Impacts to Fish and Fish Habitat

The following is a summary of the potential direct and indirect effects on fish and fish habitat which may result in the activities associated with the proposed work described in **Section 9.1.1.1.**

Land-based Activities

- Use of industrial equipment may result in alterations to contaminant concentrations from fuel or fluid leaks. An increase in sediment may result from increased erosion potential where industrial equipment has exposed and loosened soils. Cleaning or maintenance of structures may result in changes to contaminant and sediment concentrations if wash water can enter a waterbody.
- Vegetation clearing may result in alterations to sediment concentrations and habitat structure and cover because of increased erosion potential and sediment deposition. Changes in food supply and nutrient concentrations may result from the loss of external inputs with a reduction in riparian vegetation. The use of herbicides may result in changes to contaminant concentrations.
- Grading may result in alterations to sediment concentrations and habitat structure and cover because of increased erosion potential and sediment deposition.

9.1.1.3 Proposed Mitigation Measures

The following section provides a summary of proposed mitigation measures to avoid or mitigate potential impacts to fish and fish habitat. Although mitigation measures presented below are anticipated to be generally applicable for all proposed works discussed in **Section 9.1.1.1**, the efficacy of these mitigation measures to negate or avoid impacts will be further assessed during Detail Design. The fisheries impact assessment completed during this study is preliminary. Through the implementation of all applicable mitigation measures, it was determined that no negative residual impacts to fish or fish habitat are anticipated, and therefore, the death of fish or harmful alteration, disruption or destruction (HADD) of fish habitat is unlikely. However, a detailed fisheries impact assessment will be completed for all applicable works during the detail design phase of the project prior to construction in order to confirm this determination.

Operational Constraints

- An Access Management Plan shall be created to limit access to waterbodies and banks to protect riparian vegetation and to minimize bank disturbance.

- Work on watercourse banks shall be carried out during the appropriate in-water work timing window of **July 16 – March 14** (i.e., no in-water work is permitted from March 15 – July 15).

Management Practices and Controls

- The contractor shall develop and implement an Erosion and Sediment Control (ESC) plan to contain/isolate exposed soils, stockpiled materials, and unstable areas in the work zone to prevent the release of sediment to all waterbodies and ensure the work site is stabilized prior to removal of ESC measures following construction (as per OPSS 804 and 805). Site-specific ESC plans should be developed for each watercourse crossing where work is proposed within 30 metres of a watercourse.
- Design and implement a work area containment plan to isolate to prevent the release of sediment or other contaminants to a waterbody (as per OPSS 517). The design shall include regular inspection, repair, removal, and disposal of isolation measures and materials. Work zones should be clearly delineated before work to avoid unintentional intrusions into nearby natural areas.
- Where possible, organic material barriers (i.e., fibre roll barrier, sediment log, coir rolls, etc.) shall be used in the drainage ditches to mitigate sediment transport.
- Materials used or generated during construction (i.e., organics, soil, woody debris, temporary stockpiles, construction debris, etc.) shall be stored and managed in a way that prevents the release of these materials to a waterbody. This shall include storing materials a safe distance from a waterbody (i.e., greater than 30 metres from any watercourse) and/or isolation measures (as per OPSS 182).
- A Spills Management Plan shall be prepared and shall include materials, instructions, education, and emergency numbers. The plan shall be kept on site at all times, communicated to work crews and be properly implemented in the event of accidental spills (Spill Prevention and Response Contingency Plan as per OPSS 182).
- Operate, store, and maintain equipment and associated materials in a manner and at a distance that prevents the entry of any deleterious substance from entering a waterbody (as per OPSS 182). Any part of equipment entering the waterbody or operating from the bank shall be cleaned, free of fluid leaks and in good working condition.
- The contractor shall refer to and incorporate mitigations and obtain permits highlighted in the Wildlife Management Plan, Access Management Plan, Erosion and Sediment Control Plan, Invasive Species Management Plan, among others that shall be developed at a later stage of the Project, as required.

- Stabilize the banks of a waterbody that have been disturbed during construction to pre-construction conditions or better (as per OPSS 182 and OPSS 803). This shall include riparian vegetation or stone material, temporary measures, and the avoidance of hard engineering.
- Stabilize and re-vegetate soils exposed or disturbed during construction, including new or cleaned-out ditches (as per OPSS 182 and OPSS 803).

Monitoring

- Near-water work shall be monitored to ensure mitigation measures are properly implemented, functioning, maintained and repaired as needed, and removed following construction (as per OPSS 182).
- Erosion and Sediment Control monitoring shall be completed in accordance with OPSS 804, OPSS 805, SP 804F02 and SP805F01.

9.1.2 Erosion and Sediment Control

An Erosion and Sedimentation Overview Risk Assessment was undertaken for the proposed Highway 410 improvements. The purpose of the Erosion and Sedimentation Overview Risk Assessment was to complete a preliminary assessment of the site regarding erosion potential as part of construction of the Recommended Plan and to outline an Erosion and Sediment Control Plan approach.

9.1.2.1 Summary of Potential Impacts

There is potential for adverse effects of uncontrolled erosion and resultant sedimentation due to the proximity of works to watercourses and provincially significant wetlands within the Study Area.

9.1.2.2 Proposed Mitigation Measures

In addition to the recommendations provided in the Terrestrial and Fish Reports, it will be the responsibility of the contractor to review the current ESCP and potentially develop a supplementary ESCP.

Implementation of the following standard mitigation will assist in addressing erosion and sediment control for this project:

- Sediment fencing should be installed around potentially suitable habitats, which should protect it from degradation by sediment deposition or other contaminants

- Flow check dams (or equivalent flow checks) will be placed as necessary at appropriate intervals in roadside ditches down gradient from areas of soil disturbance to trap suspended sediments and reduce the erosive force of runoff.
- Seed mix and / or mulch, and topsoil shall be placed in areas of soil disturbance to provide adequate slope protection and long-term slope stabilization.
- The extent and duration that disturbed soils are exposed to the elements shall be minimized.
- Delineate storage, stockpiling and staging areas prior to construction and frequently inspect erosion and sediment control measures that are containing them.
- Ensure that material generated during maintenance of sediment control measures (i.e., silt fence, flow checks, etc.) will be taken off-site for disposal.
- Erosion and sediment control structures shall be routinely inspected as well as checked after storms and repaired as required. The structures will be cleaned out when accumulated sediment reaches half the design height.
- Following construction, once disturbed areas have stabilized, all temporary erosion and sedimentation controls should be removed.

9.1.3 Groundwater

A Groundwater Assessment was conducted using a 500-metre buffer zone around the project limits to establish a baseline of groundwater environmental conditions prior to the start of the construction activities for the project and identify mitigation measures to prevent impacts to the environment. There are several private water supply wells particularly in the northern portion of the Study Area.

The overburden aquifers within the Study Area are considered to have a low to medium vulnerability to potential contamination. Higher vulnerability is expected in the areas where coarse-textured soil (i.e., sand and gravel) are present at the ground surface and where confining overburden layers are not present above bedrock.

In addition, certain areas of the Study Area have been identified as Highly Vulnerable Aquifers (HVA). These areas are associated with the central portion of the Study Area, from Queen Street East to Bovaird Drive East, and the southeast end of the study area, at Orenda Road. Based on a review of the Source Water Protection Threats Tool, there are no significant threats identified for the HVA within the Study Area.

9.1.3.1 Summary of Potential Impacts

Change in Groundwater Recharge and Discharge

Effects on groundwater recharge could reduce infiltration capacity to the aquifer system and result in an alteration of groundwater storage and flow patterns. Road construction activities might also disrupt groundwater recharge/discharge and possibly the environmental groundwater quality in the shallow aquifer system. In addition, compaction during roadbed preparation prior to road surfacing activities will reduce the void space in the soil, and therefore result in reduced groundwater recharge to the overburden and bedrock aquifers systems. Obstruction to groundwater recharge will have the greatest impact in elevated areas where permeable deposits such as sand and gravel are removed, compacted, or paved over.

Construction Dewatering

Cuts and excavations which intercept the water table have the potential to capture and redirect groundwater flow in the shallow aquifer system. Excavations below the water table in areas where fine-textured soils are present will release a limited quantity of groundwater; most of the groundwater would be retained in the soil during excavation. In these areas, seepage into excavations would be minimal and dewatering may not be needed. More significant impacts would occur when excavating within saturated permeable deposits, where dewatering may be required. Construction under the water table and the consequent dewatering activities can result in a temporary or permanent change of groundwater level, groundwater flow patterns and possibly the groundwater quality of the underlying aquifer and water wells in surrounding areas.

Potential Water Well Impacts

Based on the windshield studies completed for the Study Area, it appears that several private wells exist within the Study Area and have the potential to be impacted by construction activities.

Potential groundwater impacts resulting from highway construction activities are expected to be greatest for private water well users with the following conditions:

- Water wells of shallow depth and/or large diameter in areas where road construction work is being performed below the shallow water table. Groundwater seeping into the excavation has the potential to impact groundwater resources as groundwater will have to be pumped out during excavation. This action may lower the water table, temporarily reducing water supply to local wells, particularly shallow water wells;

- Water wells drilled/bored/dug in the shallow aquifer, as road construction activities have the potential to adversely impact the shallow aquifer through disturbing contaminated soils, or handling and management practices (e.g., spills of fuel, lubricants etc.); therefore introducing contaminants that could enter the groundwater system and impact nearby water wells; and
- Water wells closest to the area of construction, as road construction activities have the potential to physically impact water wells due to vibration and shock.

Spills and Releases of Contaminants

There is a potential of accidental spill / release of fuels during highway construction work. Spills onto fine-textured soils (i.e., clay and silt) have a higher potential to impact the surface water quality due to surface runoff. Spills onto more permeable soils, directly onto the bedrock or bedrock with thin soil cover, have more potential to impact the groundwater systems due to faster infiltration. Spills occurring in the wetland areas or where the water table is at or near the ground surface have the most potential to impact the groundwater quality. Higher risk is present for the shallow overburden aquifer when compared to the deep bedrock aquifer. The risk for contamination also increases in areas where there is coarse-textured soil, a shallow groundwater table, and in the vicinity of surface water bodies.

Road salting within the Study Area will occur during the winter season. Concentrations of sodium and chloride will continue to be present in the runoff along roadside drainage ditches and through roadside infiltration and will most likely impact surface water features. Ontario Ministry of Transportation employs and recognizes the importance of salt best management practices and has developed a Salt Management Plan in accordance with Environment Canada's Code of Practice for the Environmental Management of Road Salts.

9.1.3.2 Proposed Mitigation Measures

The following mitigation measures are recommended to manage the potential impacts:

- Minimize disturbance to existing vegetation and grassed slopes where re-grading is required (disturbed areas should be re-vegetated as quickly as possible after completion of construction activities);
- Prepare and implement a spill prevention and control management plan;
- If excavations and groundwater dewatering are required during the highway work:
  - Dewatering activities should be conducted in accordance with the control procedures as specified in OPSS 517 – Construction Specification for Dewatering and Temporary Flow Passage Systems;

  - As per Ontario Regulation 387/04 (water taking regulation) and Ontario Regulation 63/16 (water taking registration regulation), the dewatering activities will need to be registered as "prescribed activities" on the Environmental Activity and Sector Registry (EASR) if the amount of water taking exceeds 50 m^3/day and is below 400 m^3/day. A Category 3 Permit to Take Water (PTTW) must be obtained from the MECP if the amount of water taken exceeds 400 m^3/day. Further site-specific investigations including drilling/installation of groundwater monitoring wells, and groundwater and/or soil sampling will be required in support of the hydrogeological assessment in support of the EASR registration and/or Category 3 PTTW applications; and
  - A door-to-door water well survey will be completed as required to confirm the presence and/or absence of water wells in the vicinity (i.e., 500 metre radius) of dewatering locations to establish baseline conditions. A Groundwater Monitoring and Water Well Protection Program will be developed as required to monitor and mitigate potential impacts to water wells in the vicinity of dewatering locations.

- Any groundwater monitoring wells or water wells if no longer in use and in the construction zone will be properly decommissioned as per the Ontario Wells Regulation (R.R.O. 1990, Reg. 903) to avoid the creation of potential pathways for surficial contamination to get to the underlying aquifers.

9.1.4 Drainage and Hydrology

A preliminary stormwater management and drainage plan has been developed for the Recommended Plan for Highway 410 and can be found in Appendix H.

9.1.4.1 Proposed Drainage Conditions

The proposed Highway 410 improvements includes widening of Highway 410 to provide additional mainline capacity including a High Occupancy Vehicle (HOV) lane in each direction generally through reconstruction of the existing median and auxiliary lanes. The existing grassed medians will be replaced with paved shoulders and concrete barrier while the outer lanes will be widened to facilitate additional lanes.

The proposed widening will result in additional pavement and impervious areas which will affect stormwater quantity and quality as well as the existing drainage configuration and alignments.

9.1.4.2 Watercourse/Drainage Crossings

Stormwater management control will be implemented within the project limit; therefore, it is anticipated that the existing culvert crossings will not be impacted by additional flows from the highway. Retaining walls will be implemented, therefore, no culvert extensions will be required. Furthermore, no hydraulic improvement is being recommended to the existing watercourse crossings.

9.1.4.3 Proposed Highway Surface Drainage

The proposed drainage improvements will maintain existing drainage patterns and stormwater management will be implemented where feasible.

All roadway drainage infrastructure such as ditches, storm sewers, catch basins, etc. that are impacted by the highway improvement works may require full or partial replacement, modifications and/or adjustments.

A high-level review of the required drainage improvements generally consists of, but is not limited, to the following:

- Construction of new median sewer systems to convey runoff from the proposed concrete median, paved shoulders and inner lanes.
- Replacement and realignment of existing storm sewers located at the outer limits of the Highway 410 Southbound Lane.
- Realignment of existing roadside ditches impacted by proposed works particularly at the interchange ramps. The realigned ditches will be designed as grassed swales to provide water quality, with details to be considered in the next design phase.
- New drainage outlets to intercept flow from existing and proposed storm sewers and discharged to the new grassed swales for water quality treatment.
- East ditch diversion between Clark Boulevard to the storm sewer confluence southeast of Highway 410 and Queen Street Interchange (Swale S1).
- Three stormwater management (SWM) facilities, one dry pond at Queen Street Interchange southeast quadrant, one water quality pond at Willams Parkway Interchange southeast quadrant, and one dry pond at Bovaird Drive East Interchange southeast quadrant.
- Two new underground storage (Superpipe) systems at Outlets 1 and 2 utilizing existing storm sewers and additional superpipes storage.
- New storm sewers at several locations to facilitate drainage to the proposed grassed swales and SWM facilities.

As noted, the proposed widening will result in additional pavement and impervious areas. These additional impervious areas will result in increased runoff volume and peak flows to the recipient drainage infrastructure.

9.1.4.4 Stormwater Management and Controls

The proposed Highway 410 improvements will result in an increase in impervious pavement areas which could result in an increase in pollutant loading and peak flow rates. These increases will potentially impact the receiving watercourses, existing highway culvert crossings, and municipal sewer systems as well as the internal highway drainage system.

A list of stormwater best management practices (BMPs) was screened, with consideration of the general advantages and disadvantages, experience, and practical feasibility for the site-specific conditions such as:

- Integration with the standard type of drainage (storm sewers and outside ditches).
- Land availability within the right-of-way.
- Outlet type, locations and elevations; and
- Practicality of small orifice sizes to control peak outflow and future maintenance.

Based on the results of the screening process, the solutions considered were dry and wet ponds, underground storage tanks/super pipes and vegetative Stormwater Management Plans based on the filtering effect of grassed swales and highway embankment.

Results of the impact assessment completed for the proposed highway improvements and mitigation measures are as follows:

- The total increase in impervious pavement area is approximately 7.40 ha, approximately 21% of the overall existing pavement area.
- The increase in peak flows at outlets range from 0.05 m^3/s to 0.43 m^3/s.
- A stormwater management strategy was developed for the study area based upon the result of the hydrologic impact assessment completed at each drainage outlet, the potential for upstream and/or downstream impact, and the environmental sensitivity of the recipient drainage system. The recommended SWM strategy will consist of the following:
    i. Two underground storage systems utilizing available storage from existing storm sewers as well as proposed storm sewers.

ii. Three new stormwater management ponds as follows:

- **Pond 1** - a dry pond located within the southeast area of Highway 410 and Queen Street Interchange
- **Pond 2** - a water quality pond located within southeast area of Highway 410 and Williams Parkway Interchange
- **Pond 3** - a dry pond located within the southeast area of Highway 410 and Bovaird Drive East Interchange

iii. Springdale Pond/ Bloore Pond - an existing wet pond located at 10150 Dixie Road.

iv. Existing and proposed grassed swales, ditches and embankments. To facilitate treatment to the swales, the following will be required:

- New drainage outlets to intercept flow from existing and proposed storm sewers and discharged to the grassed swales for water quality treatment.
- East ditch diversion between Clark Boulevard to the storm sewer confluence southeast of Highway 410 and Queen Street Interchange.

- **Table 9-1** provides a summary of the overall impact at each outlet and potential SWM mitigation measures.
- Quantity control is proposed for outlets discharging to Spring Creek Tributary and the City of Brampton municipal sewers (directly or indirectly) to achieve a net zero increase in peak flows. Quantity control is proposed at Outlet 1, 2, and 3 while Outlet 4, 5 and 6 do not require quantity control.
- Best effort SWM control to address water quality and erosion will be provided to an area equivalent to increase in impervious pavement areas or higher impervious area.
- Quality control will be provided by a treatment train strategy consisting of vegetative SWMPs based on the filtering effect of grassed swales and highway embankment, grass-lined ditches, a water quality pond in the southeast quadrant of the Williams Parkway Interchange, and existing Springdale Pond / Bloore Pond.

Table 9-1: Summary of Outlet Impacts

Outlet No.*	External Drainage Area in hectares (ha)	Existing Hwy Drainage Area (ha)	Existing Impervious Area (ha)	Proposed Hwy Drainage Area (ha)	Proposed Impervious Area (ha)	Change in Impervious Area ha	Change in Impervious Area %	Hydrologic Impact Peak Flow Increase (2-yr to 100-yr) m^3/s	Hydrologic Impact Remarks	Outlet Description	SWM Strategy Quantity Control	SWM Strategy Quality Control
1	432.10	46.94	23.08	48.44	29.39	6.31	27%	0.26-0.43	■ Significant Impact	■ Spring Creek Tributary located ■ downstream of Culvert C1 (Open Channel) ■ Direct fish habitat	■ Combination of Dry Pond (Pond 1) and underground storage pipe (utilizing available storage from existing storm sewer system)	■ Dry Pond (Pond 1), ■ Wet Pond (Pond 2), ■ Grass Embankment, and ■ Grass Swale
2*	-	2.15	0.85	2.10	1.12	0.27	32%	0.05-0.09	■ Significant Impact	■ Existing 750 mm pipe connected to Nepean Place storm sewer	■ Underground storage (superpipe)	■ Grass Swale
3*	-	8.45	3.94	8.52	4.53	0.59	15%	0.11-0.22	■ Significant Impact	■ Existing 1050 mm pipe connected to Natalie Court storm sewer	■ Dry Pond (Pond 3)	■ Grass Swale and Dry Pond (Pond 3)
4	-	2.25	0.41	0.74	0.00	0.00	0%	-	■ No Impact	■ Existing channel crossing Clark Boulevard culvert discharging to Spring Creek Tributary downstream of Outlet 1	■ Not required	■ Not Required
5	41.13	18.67	5.52	18.67	6.02	0.50	9%	-	■ Insignificant Impact. Insignificant impervious area increase in comparison with overall drainage area (0.84%)	■ Existing 1650 mm pipe at Trinity Common Development, located downstream of Culvert C2, discharging to Springdale Pond. Indirect fish habitat	■ Not required	■ Existing Grass Swale and Springdale Pond
6	394.54	4.56	2.06	4.55	2.20	0.14	7%	-	■ Insignificant Impact. Insignificant impervious area increase in comparison with overall drainage area (0.56%)	■ Existing channel (Spring Creek Tributary) located downstream of Culvert C3, discharging to Springdale Pond. Direct fish habitat	■ Not required	■ Existing Grass Swale and Springdale Pond
Total		**83.02**	**35.86**	**83.02**	**43.26**	**7.40**	**21%**					

9.1.4.5 Summary of Proposed Works

The proposed stormwater management plan to mitigate impacts to surrounding watercourses and water bodies primarily involves utilising the roadside ditches along Highway 410 to implement grassed swales with rock check dams to provide quality and quantity control. At several Highway 410 interchanges, stormwater management will be provided via the construction of a new stormwater management pond.

With the proposed improvements, the drainage pattern will remain largely the same as in existing conditions.

9.1.4.6 Summary of Potential Impacts

The proposed Highway 410 improvements include widening at the median and outer lanes which will result in an increase in pavement areas. The total increase in pavement area is approximately 7.40 hectares, approximately 21% of the overall existing pavement area (35.86 hectares), which could result in increased pollutant loadings and peak flow rates. This will potentially impact the receiving watercourses, existing culvert crossings, and municipal sewer systems as well as internal highway drainage system.

A separate Fish and Fish Habitat Existing Condition and Impact Assessment in the study area was completed by AECOM (2024). The study identified three crossings as potential fish habitat, Culverts C1 and C3 were classified as direct warmwater fish habitat and Culvert C2 was classified as indirect fish habitat. The in-water work timing window is from July 16 – March 14 (i.e., no in-water work is permitted from March 15 – July 15) of any given year.

9.1.4.7 Proposed Mitigation Measures

Quality of surface water will need to be protected during the construction stage of the project by avoiding fuel, lubricant and fluid spills and construction debris falling in road-side ditches, culverts and surface water catchment grates. Equipment refuelling and maintenance activities shall not take place within 30 metres of a watercourse. A monitoring plan to prevent spills and fall of debris in surface water features and contingency plan to efficiently mitigate any potential spills will be prepared prior to the construction stage of the project.

The need for an Environmental Activity and Sector Registry and/or Permit to Take Water from the Ministry of the Environment, Conservation and Parks for surface water and/or groundwater diversion for bridge construction work will be determined during Detail Design.

9.1.5 Terrestrial Ecosystems

9.1.5.1 Summary of Potential Impacts

The proposed highway improvements occur mostly within the existing Right of Way (ROW); however, in various locations the grading limits and/or ROW is proposed to be expanded into adjacent vegetation communities. The potential impacts associated with the proposed undertaking include:

- Loss or degradation of vegetation cover, wildlife habitat, Significant Wildlife Habitat (SWH) and Species at Risk (SAR) habitat;
- Disturbance to wildlife including Species at Risk and Species of Conservation Concern (SOCC) through noise or possible mortality; and
- Possible injury and mortality of wildlife, including Species of Conservation Concern and Species at Risk during construction.

Potential effects on vegetation communities, wildlife and wildlife habitat including Significant Wildlife Habitat, and Species at Risk and their habitats as a result of vegetation removal are summarized in **Table 9-2** below. A total of 0.514 hectares (ha) will be removed to accommodate proposed works which is represented by cultural hedgerow community within the MTO ROW. Up to 4.218 ha within the MTO ROW may also be temporarily impacted by project works for potential staging and access areas; this includes cultural hedgerows (CUH), cultural meadows (CUM1-1), cultural thickets (CUT1-1) and swamp thickets (SWT2). The remaining 14.092 ha of vegetation communities within the Study Area are not anticipated to have any permanent or temporary impacts.

Furthermore, any work required within culvert or bridge infrastructure may potentially affect SOCC Barn Swallow (*Hirundo rustica*) or migratory birds, if they begin using the existing structures for nesting, or other wildlife that may be moving through the area in between habitats (e.g., reptile SOCC and SAR moving between overwintering habitat and nesting habitat).

Designated Natural Areas, Vegetation Communities and Plants

The potential impacts to vegetation communities are described as follows:

- **Permanent loss of and/or damage to vegetation and ELC communities:** The majority of the permanent vegetation removal required for the proposed works will be within the cultural hedgerow community (approximately 0.514 ha or 3% of vegetation communities within the Study Area), which is typically represented by sparse woody vegetation of mostly shrubs and saplings and few mature trees. The sizes in hectares (ha) of all the vegetation communities including their permanent and temporary impacts are provided in **Table 9-2**.

Table 9-2: Summary of Vegetation Community Impacts

ELC Community	ELC Vegetation Code	Total Area (ha) in Study Area	Permanently Impacted Area (ha)	Temporarily Impacted Area (ha)	Potentially Affected SWH	Potentially Affected SAR habitat
Cultural Meadow (CUM)	CUM1-1	5.632	-	1.900	■ Candidate habitat for Common Nighthawk (*Chordeiles minor*), Purple Martin (*Progne Subis*) and Monarch (*Danaus plexippus*).	■ N/A
CUM Subtotal	-	5.632	-	1.900	-	-
Cultural Hedgerow (CUH)	CUH	3.979	0.514	2.221	■ N/A	■ N/A
CUH Subtotal	-	3.979	0.514	2.221	-	-
Cultural Thicket (CUT)	CUT1	1.656	-	-	■ N/A	■ N/A
Cultural Thicket (CUT)	CUT1-1	1.386	-	0.073	■ N/A	■ N/A
CUT Subtotal	-	3.042	-	0.073	-	-
Cultural Woodland (CUW)	CUW1	0.433	-	-	■ N/A	■ Black Ash ■ Butternut ■ Bat SAR: – Eastern Small-footed Myotis – Little Brown Myotis – Northern Myotis – Tri-coloured Bat
CUW Subtotal	-	0.433	-	-	-	-
Deciduous Forest (FOD)	FOD2	0.420	-	-	■ Candidate maternity roosting habitat for SAR Bats ■ Candidate habitat for Eastern Wood-pewee (*Contopus virens*)	■ Black Ash ■ Butternut ■ Bat SAR: – Eastern Small-footed Myotis – Little Brown Myotis – Northern Myotis – Tri-coloured Bat
FOD Subtotal	-	0.420	-	-	-	-
Open Aquatic (OAO)	OAO	0.856	-	-	■ N/A	■ N/A
OAO Subtotal	-	0.856	-	-	-	-
Swamp Thicket (SWT)	SWT2	2.281	-	0.024	■ N/A	■ N/A
SWT Subtotal	-	2.281	-	0.024	-	-
Mineral Shallow Marsh (MAS)	MAS2-1	2.180	-	-	■ Candidate overwintering turtle habitat ■ Candidate turtle nesting habitat ■ Candidate amphibian breeding habitat (wetlands) ■ Candidate stopover habitat for migrating waterfowl ■ Candidate habitat for: – Western Chorus Frog (*Pseudacris triseriata*) – American Coot (*Fulica americana*) – Common Gallinule (*Gallinula galeata*) – Ruddy Duck (*Oxyura jamaicensis*) – Black Dash (*Euphyes conspicua*) – Eastern Musk Turtle (*Sternotherus odouratus*) – Snapping Turtle (*Chelydra serpentina*)	■ N/A
MAS Subtotal	-	2.180	-	-	-	-
Grand Total	-	18.823	0.514	4.218		

- **Temporary loss of and/or damage to vegetation and ELC communities:** Up to 4.218 ha (22% of vegetation communities within the Study Area) of the MTO ROW may be temporarily impacted by Project works for potential staging and access areas. The communities included within the ROW that may be temporarily affected include the cultural hedgerows (CUH), cultural meadows (CUM1-1), cultural thickets (CUT1-1) and swamp thickets (SWT2). The sizes in hectares (ha) of all the vegetation communities including their permanent and temporary impacts are provided in **Table 9-2**.
- **Fill and sediment deposition within vegetation communities:** During grubbing or grading of the site, fill and sediment runoff from the active construction area may enter vegetation communities and adjacent watercourses, if not appropriately controlled.
- **Soil or water contamination (including groundwater):** Oil, gasoline, grease and other materials from construction equipment, materials, storage and handling may enter vegetation communities and adjacent watercourses, if not appropriately managed.
- **Introduction or spread of invasive species:** A total of 35 of the 67 plants (52%) recorded within the Study Area during field investigations are non-native including some highly invasive species such as European Reed, Garlic Mustard and European Buckthorn. European Reed is an aggressive non-native invasive plant that crowds out native vegetation which can lower plant biodiversity as well as lower water levels since water is transpired faster than with native vegetation. Vegetation clearing and grubbing or grading and movement of construction equipment may perpetuate the establishment of invasive species in new areas and further spread in already established areas if control measures are not implemented.
- No direct impacts to the Heart Lake PSW Complex are anticipated as a result of the proposed works. The Heart Lake PSW Complex is approximately 98.932 ha in size. The Heart Lake PSW is considered a Core Area of the Region of Peel Greenlands System. The Heart Lake PSW is not anticipated to be impacted by the proposed work and will therefore be protected. Mitigation measures described below will minimize indirect impacts on the Heart Lake PSW Complex.

The potential effects to vegetation, ELC communities and designated natural areas described above are anticipated to be minimal provided that mitigation measures described below are implemented.

Wildlife and Wildlife Habitat

Vegetation communities provide breeding habitat and movement corridors for a variety of wildlife including SOCC and/or birds protected under the Migratory Birds Convention Act (MBCA). SOCC and their habitats potentially affected by proposed works include Barn Swallow, Common Nighthawk, Purple Martin, Monarch and Snapping Turtle. Furthermore, migratory birds may use humanmade structures, isolated trees and shrubs as well as suitable ground cover for nesting. The potential impacts to wildlife and wildlife habitat as a result of the proposed works are described as follows:

- **Disturbance or displacement of migratory birds and destruction of their nests:** Cliff Swallow nests were observed under the Sandalwood Parkway bridge (Site 24/739) in 2017. There is potential for these and other MBCA-protected to species to occur on structures identified for rehabilitation or replacement. Structure rehabilitation may therefore result in the disturbance or displacement of birds protected under the MBCA and destruction of their nests if conducted during the overall bird nesting period of **April 1 to August 31**. Vegetation removal has the potential to disturb or displace nesting birds including SOCC and/or species protected under the MBCA and destroy their active nests where there are trees or shrubs or where suitable ground cover occurs, if activities are conducted during the overall bird nesting period of **April 1 to August 31.**
- **Accidental mortality of turtles and destruction of their nests:** Risk of wildlife morality may be increased during construction, resulting from collisions with vehicles or heavy equipment. Slow-moving reptiles including Snapping Turtles are particularly susceptible. Furthermore, stockpiles may provide suitable turtle nesting habitat. Snapping Turtles dig nests in late May or June; therefore, access to stockpiles placed prior to June 30 may result in the destruction of turtle nests.
- **Loss of and/or damage to wildlife habitat:**
  Vegetation removal may result in the direct or indirect loss of wildlife habitat including candidate SWH (refer to **Table 9-2**), such as habitat for SOCC (Common Nighthawk, Purple Martin, and Monarch). A total of 1.900 ha of the CUM1-1 community is anticipated to be temporarily impacted due to the proposed work. The impacts are temporary until vegetation is re-established or rehabilitated following the completion of construction activities.
- **Disturbance to wildlife from noise and vibration:**
  Wildlife within the surrounding area, although likely already adapted to and tolerant of existing anthropogenic sources of noise (i.e., adjacent high-volume traffic) may be temporarily disturbed or displaced initially by increased noise emissions from construction activities, including use of heavy equipment; however, wildlife can become habituated to temporarily increased noise levels.

- **Incidental wildlife injury or mortality from construction activities:** There are several SWHs, and other wildlife habitats present within the Study Area. Wildlife may enter the construction work area and become susceptible to accidental injury or mortality associated with construction machinery and equipment if not mitigated.

Potential impacts to wildlife and wildlife habitat are anticipated to be low provided avoidance and mitigation measures as described below are implemented.

9.1.5.2 Species at Risk

Generally, it is anticipated that there will be very limited impacts to SAR as a result of the proposed works.

No direct impacts to bat SAR and candidate habitat are anticipated as vegetation removal will be limited to the ROW communities and Cultural Hedgerow (CUH) communities. Bat SAR may be indirectly affected (i.e., disturbed/displaced) as a result of increased noise associated with construction or accidental damage of suitable maternity roost trees if proposed works occur during the bat roosting season between **March 31 and October 1**.

No impacts to Chimney Swift are anticipated as no buildings will be demolished.

No impacts to Butternut or Black Ash are anticipated as no plant SAR were identified during field investigations.

Potential impacts to SAR and SAR habitat are anticipated to be low provided avoidance and mitigation measures described below are implemented.

An updated SAR habitat screening and field investigations may be required during detailed design as the protection statuses of SAR may change under the ESA in the future. It is recommended that regulatory requirements be confirmed as the project approaches implementation to verify if adjustments are required for the project (i.e., as legislative instruments are updated by MECP).

9.1.5.3 Proposed Mitigation Measures

Proposed mitigation and avoidance measures for the potential impacts on specific terrestrial features as identified in the previous sections are described below.

- To assist in mitigating potential impacts, the following MTO provisions and mitigation measures should be utilized, at a minimum:
  - Ontario Provincial Standard Specification (OPSS) 201: Construction Specification for Clearing, Close Cut Clearing, Grubbing and Removal of Surface and Piled Boulders;

- Vegetation removal, grading and soil compaction should be kept to a minimum;
- OPSS 801: Construction Specification for the Protection of Trees;
- OPSS 803: Construction Specification for Vegetative Cover;
- Any woody vegetation removed during the proposed works should be replaced with a similar native species;
- Seeded mixes that include common milkweed and native flowering plants should be used to rehabilitate or restore areas of herbaceous vegetation temporarily disturbed during proposed works.
- OPSS 180: General Specification for the Management of Excess Materials;
- Construction material should be stored within an authorized location and any soil stockpiles should be located within a suitable sediment fenced and protected location only;
- Exclusion fencing should be installed, in accordance with the Reptile and Amphibian Exclusion Fencing Best Management Practices (MECP, 2020), around any stockpiles placed in the vicinity of a watercourse/waterbody prior to June 30 to prevent turtle nesting. Stockpiles placed after June 30 do not require exclusionary fencing as this is after the typical period for turtle egg laying.
- OPSS 182: General Specification for Environmental Protection for Construction in and Around Waterbodies and on Waterbody Banks;
- OPSS 804: Construction Specification for Temporary Erosion Control
- OPSS 805: Construction Specification for Temporary Sediment Control
- Sediment fencing should be installed along the construction footprint within 30 metres of the Heart Lake PSW Complex;
- OPSS 517: Construction Specification for Dewatering and Temporary Flow Passage Systems;
- Special Provision (SP) 199S56: Control of Emissions During Structural Work
- OPSS 100: MTO General Conditions of Contract. Should SAR be encountered within the work area, The Contractor will follow the requirements of GC 3.07.06.

- Non-Standard Special Provision (NSSP): Operational Constraint – Migratory Bird Protection:
  - Schedule vegetation removal to occur outside of the overall bird nesting period of **April 1 to August 31** to avoid disturbance to breeding migratory birds including SAR and/or damage/destruction of their nests. If vegetation

removal must occur within this time period, active nest searches can be conducted prior to vegetation removal by a qualified biologist within 'simple habitats' (e.g., manicured lawn) to ensure that no active nests of breeding migratory birds or bird SAR are destroyed, in order to prevent contravention of the MBCA and/or the ESA;

- Structures likely to be affected by construction may provide suitable nesting habitat for MBCA protected birds in the future. Active and non-active Cliff Swallow nests were observed under Sandalwood Parkway over Highway 410 at Site 24-739 in 2017. As such, it is recommended that structures identified for rehabilitation be examined to confirm the presence or absence of migratory or SAR bird nests the year prior to construction. If birds are observed nesting in, under or on the structure prior to or during rehabilitation, a qualified biologist should be consulted to determine the appropriate steps taken to reduce impacts to birds and avoid a potential contravention of the MBCA and/or the ESA. Measures may include the installation of bird exclusion measures;

- During the bat roosting season between **April 1 and September 30**, any construction activities within 30 metres of suitable maternity roost habitat will be restricted to daylight hours, when possible, to minimize duration of disturbance;
- All machinery, construction equipment and vehicles should be washed prior to leaving the construction site in order to prevent the spread of invasive species to other locations; and
- European Reed patches relative to detail design should be delineated prior to construction.

9.2 Socio-Economic Environment

9.2.1 Land Use and Property

Approximately 0.5 hectares of property beyond the Ontario Ministry of Transportation Right of Way will be impacted and needs to be acquired by the Ontario Ministry of Transportation to accommodate the Recommended Plan (Appendix A) for highway improvements. The land is composed of a sliver of property just beyond the existing limits of the exiting Right of Way. A meeting was held with the impacted property owner on July 24, 2025. The Meeting Minutes are included in Appendix C.

Efforts have been made to minimize the amount of property required. Potentially impacted property owners will be consulted further regarding the details of the required

property taking and property acquisition process. Compensation will be based on the fair market value of the property at the time of acquisition.

9.2.2 Noise

A Noise Impact Assessment was completed for the Highway 410 improvements. The assessment was completed in accordance with the Ministry of Transportation's Environmental Guide for Noise (the Guide) published in 2022. The Guide provides detailed guidance for the assessment of two categories; the long-term traffic noise levels, and construction noise.

With respect to long term noise; under the Ministry of Transportation Guide, the "noise impact" is defined as the difference between the "Future No Project" and the "Future With Project" noise levels during the subject year of assessment (Horizon Year), which is typically 10 years post-construction. The Horizon Year of 2041 was used as the basis of the assessment. A total of eight Noise Sensitive Areas (**Figure 4-5**) were assessed for this project. In general, the areas adjacent to the Project consist mainly of residential and commercial properties.

9.2.2.1 Proposed Mitigation Measures

The location of assessment is an outdoor location associated with the representative noise receptor. Where the future noise level with the proposed improvements in the Outdoor Living Area (OLA) results in equal or greater than 5 dB increase over the future noise level without the proposed improvements; or the projected noise level is equal to or is greater than 65 dBA, the following must occur:

- noise control measures must be investigated within the Right of Way; and
- if a minimum attenuation of 5 dB can be achieved in the OLA averaged over first row receivers, the feasibility of the selected measures within the right-of-way are to be investigated.

The OLA can be situated on any side of a noise sensitive area which accommodates outdoor living activities, and is generally taken to be the backyard. For this assessment, the location has been taken as three metres from the façade with a height of 1.5 metres above ground level.

Where predicted noise levels trigger mitigation investigation, the mitigation efforts to be applied for the predicted change in noise level above the ambient and the projected noise level with the proposed improvements are shown **Table 9-3**.

Table 9-3: Noise Mitigation Effort Required

Change in Noise Level Above Future Ambient/ Projected Noise Levels with Proposed Improvements	Mitigation Effort Required
< 5 dB Change AND <65 dBA Overall	■ None
≥ 5 dB Change OR ≥ 65 dBA Overall	■ Investigate noise control measures on right of way ■ Introduce noise control measures within the right of way and mitigate to ambient if technically, economically, and administratively feasible. ■ Noise control measures, where introduced, should achieve a minimum of 5 dBA attenuation, over first row receivers.

The determination of whether mitigation is provided must be based on the review of technical, economical, and administrative feasibility:

- Technical Feasibility: Review the constructability of the noise mitigation (i.e., design of wall, roadside safety, shadow effect, topography, achieve a minimum 5 dBA reduction, ability to provide a continuous barrier, etc.).
- Economic Feasibility: Carry out a cost/benefit assessment of the noise mitigation (i.e., determine cost per benefited receiver).
- Administrative Feasibility: Determine the ability to locate the noise mitigation on lands within public ownership (i.e., provincial, or municipal right-of-way).

The Noise Impact Assessment concluded that one of the noise sensitive areas (NSA03) on the west side of Highway 410 between Vodden Street and Williams Parkway warrants noise mitigation as a result of the proposed improvements. The preliminary recommended noise barrier location is shown in the Recommended Plan (Appendix A). The recommended noise barrier is anticipated to be 5 metres high.

MTO has a Noise Barrier Retrofit Policy for existing provincial freeways that includes the requirement that noise sensitive areas must have outdoor, ground level, leisure areas that were approved for development under the Planning Act before February 8, 1977 and where the sound levels are above 60 dBA. Further details on requirements are in MTO's Noise Barrier Retrofit Policy. NSA01 and NSA02 are pre-1977 residential noise sensitive areas included under the Noise Barrier Retrofit Policy. These are located at the south end of the study area between Queen Street and Vodden Street (refer to **Figure 4-5**. Construction of the Retrofit Noise Barriers for NSA01 and NSA02 will be considered in the future based on provincial planning priorities.

The results of the Noise Impact Assessment are detailed under separate cover.

9.2.2.2 Construction Noise

Construction noise is temporary in nature and will cease at the end of the construction activities; it can however be a cause of disturbance to the surrounding noise sensitive areas. Construction noise disturbance and potential for complaints can be reduced with the implementation of best practices and other noise control measures. The following outlines the construction noise controls and mitigation to be employed for this project:

- Equipment shall comply with the sound emission standards for construction equipment outlined in the Ministry of the Environment, Conservation and Parks' publications NPC-115 Construction Equipment and NPC-118 Motorized Conveyances. The Contractor is to confirm the latest version by contacting the Ministry of the Environment, Conservation and Parks.
- Where feasible, equipment with broadband backup alarms instead of the tonal backup alarms/beepers shall be utilized.
- Equipment shall be maintained in an operating condition that prevents unnecessary noise, including but not limited to non-defective muffler systems, properly secured components, and the lubrication of moving parts.
- Idling of equipment shall be restricted to the minimum necessary to perform the specified work.
- Stationary equipment shall be located as far away from sensitive locations as feasible.
- A noise complaint process shall be established in accordance with the Ministry of Transportation's Environmental Guide for Noise.
- Noise complaints shall be investigated in accordance with the Ministry of Transportation's Environmental Guide for Noise.
- The Ontario Ministry of Transportation does not require a municipal noise By-law exemption.

9.2.3 Air Quality

The air quality assessment undertaken as part of this study examined criteria air contaminants including nitrogen dioxide (NO2), carbon monoxide (CO), sulphur dioxide (SO2), particulate matter (PM10), particulate matter (PM2.5), benzene, 1,3-butadiene, formaldehyde, acetaldehyde, benzo(a)pyrene, and acrolein. These contaminants of concern are considered Criteria Air Contaminants (CAC), which have the corresponding Provincial Ambient Air Quality Criteria (AAQC) and Canadian Ambient Air Quality Standards (CAAQS).

The overall objective of the Air Quality Impact Assessment was to determine the impacts of the project on regional air quality and generation of greenhouse gases for the preferred alternative. This was done by incorporating traffic study data combined with a configuration of traffic-links in the CAL3QHCR model. Through this analysis, regional air quality impacts were predicted at the identified sensitive and critical receptors present within the Study Area for the three conditions (Existing Conditions (2019), Future No-Build (2041), and Future Build (2041)).

9.2.3.1 Summary of Potential Impacts

The results of the Air Quality Impact Assessment show that the addition of the proposed infrastructure will have the following outcomes:

- Overall it will have a lower impact on the sensitive and critical receptors within the Study Area in comparison to Existing Conditions for all contaminants, and a slightly higher impact in comparison to Future No-Build Conditions.
- With the implementation of the project, the majority of CACs are expected to be below the respective provincial and federal air quality criteria, with the project's contributions to the overall concentration levels accounting for a small fraction compared to existing background levels.
- For the Future Build Condition, there are three CACs with modelled cumulative (background concentration included) concentrations above the respective provincial and/or federal air quality criteria: the 1-hour and annual averaging period of Nitrogen Dioxide (NO_2), the annual averaging period of Benzene, and the 24-hour and annual averaging periods of Benzo(a)pyrene. The following exceedances of these three contaminants are predominately due to elevated existing ambient air quality concentrations, which already exceed the provincial and/or federal air quality criteria, prior to including the project contributions:
  - The Future Build cumulative concentration of NO_2 is 193% (CAAQS 2025) and is 135% (CAAQS 2020) of the CAAQS limit for the 1-hr averaging period and is 101% of the CAAQS for the annual averaging period (CAAQS 2025).
  - The Future Build cumulative concentration of Benzene is 126% of the AAQC limit for the annual averaging period.
  - The Future Build cumulative concentration of Benzo(a)pyrene is 451% of the AAQC for the 24-hr period and is 1382% of the AAQC for the annual averaging period.

- However, even with these exceedances, when compared to Existing Conditions, the cumulative concentrations for these contaminants decrease in the Future Build Conditions. For example:
  - The cumulative concentration of Benzo(a)pyrene for 24 hour and annual averaging periods in the Future Build Conditions decreased by 64% and 49%, respectively, compared to the Existing Condition cumulative concentrations.
  - The cumulative concentrations of NO_2 for 1 hour and annual averaging periods in the Future Build Conditions decreased by 29% and 64%, respectively, compared to the Existing Condition cumulative concentrations.

Greenhouse Gas Emissions Assessment

Mobile vehicles emit the following greenhouse gases (GHGs) in significant amounts:

- Carbon dioxide (CO_2)
- Methane (CH_4); and
- Nitrous oxide (N_2O).

Total GHG emissions were calculated using a combination of MOVES emission rates and total annual vehicle usage projections for the project sources of air quality contaminant emissions. The emissions modelling software MOVES is capable of calculating atmospheric carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emissions varying with vehicle class, speed, and emission process type (i.e., running emissions, starting emissions, etc.).

Individual greenhouse gases have differing abilities to absorb heat in the atmosphere. These varying heat absorption properties are quantified by an individual global warming potential (GWP) factor for each contaminant which converts the mass of a GHG to the representative equivalent mass of CO_2 ($CO_{2\ eq}$).

Currently, there are no GHG emission standards in Canada or the United States on a per-source basis. However, National Resources Canada reports annual GHG emissions for various industrial sectors, including the Transportation sector. The project contributions of GHG in the Future Build year (2041) were compared to the 2021 $CO_{2\ eq}$ contributions from the Ontario Transportation sector, shown below in **Table 9-4**.

Table 9-4: Greenhouse Gas Project Contribution Regional Assessment

Contaminant	Future Build (Year 2041) (Mt) [1]	Ontario 2021 Reported GHG Emissions for the Transportation Sector [3] (Mt CO2 eq.)	% Future Build Project Contribution
Carbon dioxide (CO_2)	1.78	-	-
Methane (CH_4)	2.54E-03	-	-
Nitrous Oxide (N_2O)	1.15E-04	-	-
CO_2 equivalent [2]	1.88	45.1 [3]	4.16%

Notes: (1) Mt = Megatonnes
(2) CO_2 equivalent was calculated for the Future Build Condition using GWP conversion for N_2O and CH_4 (265 and 28), respectively
(3) National Resource Canada: Table 8 “GHG Emissions by Transportation Mode”, Comprehensive Energy Use Database (accessed January 2024), excluding off-road, air, rail, and marine emissions.

As shown above, the project GHG contributions are less than 5% compared to the total Transportation 2021 CO_2e emissions.

Potential mitigation actions to counteract the project emission impacts are limited due to the project’s projected increase in vehicular travel along Highway 410. Increased percentage of electric vehicles and fuel-efficient vehicles within the vehicular fleet can provide significant CAC and GHG reduction in the short to medium term. The introduction and increasing popularity and affordability of hybrid and full electric vehicles, as well as transit authority led initiatives to increase the percentage of fuel efficient and hybrid vehicles will continue to reduce emission impacts from vehicles in the future.

9.2.3.2 Construction Air Quality Impacts

Construction activity creates and releases fine particulates (fugitive dust) and other vapours into the surrounding community, including diesel combustion exhaust, asphalt volatile contaminant emissions, etc. Emissions from construction activity are temporary and unlikely to have long-lasting effects on the surrounding area.

Construction activities which potentially prove most impactful to the local air quality include, but are not limited to:

- Clearing and grubbing
- Grading and rock blasting
- Road and surface paving
- Storage of granular material
- Structure construction/deconstruction; and
- Mobile on-site equipment.

Exposure to construction-related emissions can be mitigated by the following:

- Determining that mobile equipment is in good condition, properly and regularly maintained, and compliant with applicable federal and provincial regulations for off-road diesel engines.
- Determining that all machinery is maintained and operated in accordance with manufacturer's specification.
- Locating stationary equipment (generators, compressors, etc.) as far away from sensitive receptors as practical.
- Minimizing idling time and posting signage to this effect around the construction site.
- Determining that stationary and mobile equipment are not operated during early morning (before 6 AM, or sunrise) or evening periods (after 8 PM, or sunset) as often as practical.
- Implementing the use of non-chloride dust suppressants.
- Temporary seeding or mulching and compression of bare soil and storage piles to reduce erosion, and
- Implementing an Air Quality Management Plan for the duration of the construction phase, which includes practices to minimize fine particulate release from mobile equipment, materials handling, and wind erosion.

9.2.4 Contamination, Waste, and Excess Materials Management

9.2.4.1 Summary of Potential Impacts

As outlined in **Section 4**, areas of potential environmental concern have been identified within the Study Area. The areas of potential environmental concern correspond to the locations where land uses consist of commercial or industrial operations that could impact soil and/or groundwater quality within the Study Area, according to Ontario Regulation 153/04 (as amended). No areas of moderate or high potential for contamination were identified within the Right of Way (except for spill locations) and none were identified in areas where works are required beyond the existing Right of Way.

9.2.4.2 Proposed Mitigation Measures

Property Acquisition Environmental Due Diligence: For the purpose of undertaking the future roadway construction, if property acquisition is required within areas of potential environmental concern with moderate to high potential for contamination, it is

recommended that property specific Phase One Environmental Site Assessments (and if necessary, Phase Two Environmental Site Assessments) be completed in such areas in support of the property acquisition.

Road Construction and Management of Excess Soil: With respect to construction activities and management of excess soil, it is recommended that a soil contaminant investigation, where excavation is proposed, be carried out by a qualified environmental consultant to assess soil quality in support of surplus/excess soil management in areas within or in close proximity to areas with moderate to high potential for contamination.

Excess soil generated during construction will be managed in accordance with Ontario Regulation 406/19: On-Site and Excess Soil Management with all required documentation and soil sampling and analysis completed in future phases of the project.

9.2.5 Climate Change Considerations

9.2.5.1 Summary of Potential Impacts

In the future, the climate of the Study Area is projected to be warmer and wetter. Temperature follows an increasing trend. Consequently, more heatwaves, more days with temperatures higher than 30 degrees Celsius and higher seasonal temperatures are expected. This will cause the freeze-thaw cycles to follow a decreasing trend. Along with this trend, precipitation follows an increasing trend as well. An increasing trend of temperature will likely cause a drop in annual snowfall; however, the total winter precipitation increases. This suggests that in transition seasons, the light snowfall events will turn into rainfall. The variation of climate indicators (for example annual average temperature, number of days per year with + 20 millimetres of rainfall, freeze-thaw cycle, etcetera) can introduce new risks / hazards or intensify the current risks / hazards including but not limited to washout and accelerated deterioration of roads, damage to road-side vegetation and snow drifting.

9.2.5.2 Proposed Mitigation Measures for the Identified Hazards

Mitigations for the potential impacts to highway infrastructure and user safety are already incorporated into existing Ontario Ministry of Transportation standards and guidelines. Mitigation measures such as sizing culverts and ditches appropriately to accommodate large precipitation events, shall be reviewed at Detail Design.

As feasible/applicable, design related solutions to manage hazards and potential impacts to highway infrastructure and road user safety related to climate change considerations, as well as opportunities to reduce impacts during highway construction, maintenance and operations on climate will be revisited in Detail Design.

9.2.6 Landscape Composition

9.2.6.1 Summary of Potential Impacts

A conceptual landscape plan has been developed for the Recommended Plan as shown in Appendix G. This plan is conceptual, and will be further refined and confirmed during the Detail Design phase of the project.

As the proposed alignment generally follows the same footprint as existing, it is not anticipated that the construction of the highway improvements will significantly impact existing views.

9.2.6.2 Proposed Mitigation Measures

General Mitigation Measures

Native species shall be used for new plantings as a priority with exceptions only executed to fulfill a specific function for which there is not a suitable native species. Select non-native species may be utilized for functional reasons such as salt-tolerant evergreens to mitigate snow drifting, which is difficult to source with native varieties. Invasive species shall not be used under any circumstance.

Establish a Tree Protection Zone through the installation of tree protection fencing which follows standard arboricultural procedures (per OPSS 801).

The following are basic precautions and procedures related to tree management during construction:

- Areas within the dripline of trees designated for preservation are not to be used for any type of storage (e.g., storage of debris, construction material, surplus soils, and construction equipment). Trenching or tunneling for underground services shall not take place within the Tree Protection Zone or dripline of trees designated for preservation within or adjacent to the construction zone.
- No grade changes shall occur within the Tree Protection Zone. Where grade changes may occur, either as a cut or fill situation, precautions to preserve the tree may be undertaken prior to the placement of fill or excavation activities.
- Trees to be preserved shall not have any rigging cables or hardware of any sort attached or wrapped around them. Potential contaminants shall not be dumped or flushed within the Tree Protection Zone or where they may come into contact with the feeder roots of the trees.

- Ensure that the Contractor takes every precaution to prevent damage to trees or shrubs. This includes protecting crown and root systems from damage, preventing compaction and contamination resulting from the construction. Any damage to trees such as broken limbs, damage to roots, or wounds to the main trunk or stem systems should be immediately reported to the Contract Administrator so that the damage can be addressed promptly by a Landscape Architect and Certified Arborist, as appropriate.
- In the event that it is necessary during construction to remove limbs, portions of trees or excavate in root zones of trees that are designated for preservation, all operations should be executed carefully and in accordance with proper arboricultural techniques and under the guidance of a Certified Arborist.
- Maintenance and monitoring of any new plant materials for a minimum 2-year warranty period to ensure the establishment of healthy, vigorous plantings at the end of the warranty period. This should include an action plan to replace any plantings that are deemed unacceptable.
- Monitoring of groundcover plantings (i.e., seeded areas) to ensure soils exposed during construction have been adequately covered and erosion / sedimentation is not occurring. This should include an action plan for any areas requiring remediation.

9.3 Cultural Environment

9.3.1 Archaeology

9.3.1.1 Summary of Potential Impacts

Based on the Stage 1 Archaeological Assessment, four areas require Stage 2 Archaeological Assessment prior to construction commencing. These areas are associated with interchanges throughout the Study Area and will be subject to Stage 2 Archaeological Assessment in accordance with Section 2.1 of the Standards and Guidelines for Consultant Archaeologists (2011).

9.3.1.2 Proposed Mitigation

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. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological field work, in compliance with Section 48(1) of the Ontario Heritage Act.

The Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33 requires that any person discovering human remains must notify the police or coroner and the Registrar of Burial Sites at the Ministry of Public and Business Service Delivery.

9.3.2 Built Heritage and Cultural Heritage Landscapes

9.3.2.1 Summary of Potential Impacts

Based on the results of the Cultural Heritage Resource Assessment Report (CHRAR) for this project, it has been determined that no built heritage resources or cultural heritage landscapes are present within the study area. As such, no heritage resources have the potential to be indirectly or directly adversely impacted by the Project.

In addition, it was determined that the 12 bridges and three culverts identified within the Study Area do not require further heritage evaluation. As such, no further steps are required since there are no cultural heritage concerns for the Study Area.

9.4 Transportation and Infrastructure

9.4.1 Traffic Disruptions and Construction Staging

A construction staging plan will be further developed during the Detail Design stage. During construction, notification of detours will be posted in co-ordination with municipalities if needed.

- In order to accommodate rehabilitation of existing structures on their current alignment, temporary traffic disruptions or full closures are anticipated to be required during construction. For all closures, advanced notification and signage will be provided, including a corresponding detour plan for full closures. Additional consultation will be undertaken during Detail Design with municipalities, emergency services and potentially affected stakeholders regarding the details of traffic disruption associated with road closures, access restrictions and the development of the construction staging plan during the Detail Design stage. It is anticipated that:
  - The widening work will be completed in stages, with traffic shifts to create required work zones;
  - Existing lanes will be maintained along Highway 410 in both directions during peak traffic periods (off-peak night-time lane reductions may be required);

- Night-time / weekend closures of existing ramps are anticipated to complete tie-ins between the existing road / ramps and newly constructed road / ramps.

9.4.2 Lighting

Additional high mast lighting may result in light trespass and high mast lighting will be upgraded with LEDs. Shielded luminaires will be installed to meet MTO light trespass criteria and minimize visible luminaire brightness.

9.4.3 Utilities

All potentially affected utility companies will be contacted prior to construction to determine potential impacts. Any utility company that is anticipated to be affected following the investigation will be consulted to develop a utility relocation plan prior to construction during Detail Design. Furthermore, all utility relocations will be completed before construction of this project is initiated, to the extent possible. If it is necessary to complete utility relocations during construction, the Contractor will be required to co-ordinate the timing of each operation to ensure that they are carried out independently. Special provisions will be included in the contract to address this, and to ensure that care and precautions are taken to safeguard existing utilities from damage.

9.5 Summary of Environmental Effects, Mitigation and Commitments to Future Work

The proposed mitigation measures and commitments to future work to address specific concerns associated with the Recommended Plan are listed in **Table 9-5.**

Table 9-5: Summary of Environmental Concerns, Mitigating Measures and Commitments to Future Work

Summary of Environmental Concerns, Mitigating Measures and Commitments from this Transportation Environmental Study Report To be Confirmed During Detail Design

Discipline	ID #	Environmental Concern and Potential Impact	Concerned Agencies	ID #	Mitigation, Protection, Monitoring, and Study Commitments to be carried forward to Detail Design
1.0 Fish and Fish Habitat	1.1	Changes to water quality and quantity due to construction works and alterations to fish and fish habitat.	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada	1.1.1	■ Access to waterbodies and banks shall be limited to protect riparian vegetation and to minimize bank disturbance.
1.0 Fish and Fish Habitat	1.1	Changes to water quality and quantity due to construction works and alterations to fish and fish habitat.	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	1.1.2	■ In-water and near-water work shall be monitored to ensure mitigation measures are properly implemented, functioning, maintained and repaired as needed, and removed following construction (as per OPSS 182).
1.0 Fish and Fish Habitat	1.1	Changes to water quality and quantity due to construction works and alterations to fish and fish habitat.	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	1.1.3	■ Re-stabilize any portion of the bed of a waterbody disturbed during construction to pre-construction conditions (or better). This shall include substrates (as per OPSS 182 and OPSS 1005).
1.0 Fish and Fish Habitat	1.1	Changes to water quality and quantity due to construction works and alterations to fish and fish habitat.	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	1.1.4	■ Re-stabilize the banks of a waterbody that have been disturbed during construction (as per OPSS 182, OPSS 803 and OPSS 804).
1.0 Fish and Fish Habitat	1.1	Changes to water quality and quantity due to construction works and alterations to fish and fish habitat.	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	1.1.5	■ Effective erosion and sediment control measures shall be installed before starting work to prevent sediment from entering the water body. ■ Site-specific Erosion and Sediment Control plans should be developed for each watercourse crossing where work is proposed within 30 metres of a watercourse.
1.0 Fish and Fish Habitat	1.1	Changes to water quality and quantity due to construction works and alterations to fish and fish habitat.	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	1.1.6	■ Grading shall be carried out in stages and stabilized as soon as possible.
1.0 Fish and Fish Habitat	1.1	Changes to water quality and quantity due to construction works and alterations to fish and fish habitat.	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	1.1.7	■ Regular inspection and maintenance of erosion and sediment control measures and structures shall occur during the course of construction, and repairs to erosion and sediment control measures and structures will be completed promptly if damage occurs.
1.0 Fish and Fish Habitat	1.1	Changes to water quality and quantity due to construction works and alterations to fish and fish habitat.	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	1.1.8	■ If dewatering is necessary, a temporary water passage/isolation/containment system shall be implemented during construction to isolate the work area from the open area of the watercourse, in order to maintain fish passage where feasible and water flow that is both adequate and clean.
1.0 Fish and Fish Habitat	1.1	Changes to water quality and quantity due to construction works and alterations to fish and fish habitat.	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	1.1.9	■ An appropriate back up pump will be available on-site as a contingency in the event of primary pump failure.
1.0 Fish and Fish Habitat	1.1	Changes to water quality and quantity due to construction works and alterations to fish and fish habitat.	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	1.1.10	■ Where by-pass pumping of flows is required or temporary channel restriction occurs, the contractor will limit the discharge pump velocity and/or partial channel restriction to ensure discharge velocities will not result in localized scouring in the receiving water feature.
1.0 Fish and Fish Habitat	1.1	Changes to water quality and quantity due to construction works and alterations to fish and fish habitat.	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	1.1.11	■ Measures will be undertaken to contain and stabilize waste material (e.g., dredging spoils, construction waste and materials, uprooted or cut plants, accumulated debris) above the high-water mark of nearby waterbodies to prevent re-entry.

Discipline	ID #	Environmental Concern and Potential Impact	Concerned Agencies	ID #	Mitigation, Protection, Monitoring, and Study Commitments to be carried forward to Detail Design
1.0 Fish and Fish Habitat	1.1	Changes to water quality and quantity due to construction works and alterations to fish and fish habitat.	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	1.1.12	■ Activities near water shall be conducted such that materials such as paint, primers, blasting abrasives, rust, solvents, degreasers, grout or other chemicals do not enter the watercourse.
1.0 Fish and Fish Habitat	1.1	Changes to water quality and quantity due to construction works and alterations to fish and fish habitat.	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	1.1.13	■ A Spills Management Plan shall be prepared and shall include materials, instructions, education, and emergency numbers. The plan shall be kept onsite at all times, communicated to work crews and be properly implemented in the event of accidental spills (Spill Prevention and Response Contingency Plan as per OPSS 182).
1.0 Fish and Fish Habitat	1.1	Changes to water quality and quantity due to construction works and alterations to fish and fish habitat.	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	1.1.14	■ Operate, store, and maintain equipment and associated materials in a manner and at a distance that prevents the entry of any deleterious substance from entering a waterbody (as per OPSS 182). Any part of equipment entering the waterbody or operating from the bank shall be cleaned, free of fluid leaks and in good working condition.
1.0 Fish and Fish Habitat	1.1	Changes to water quality and quantity due to construction works and alterations to fish and fish habitat.	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	1.1.15	■ Refuelling will be conducted 30 metres or further from the watercourse, at a minimum, on a refuelling pad to prevent spills from entering the watercourse.
1.0 Fish and Fish Habitat	1.1	Changes to water quality and quantity due to construction works and alterations to fish and fish habitat.	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	1.1.16	■ Construction material will be removed from site upon completion of the project.
1.0 Fish and Fish Habitat	1.2	Loss of vegetation	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	1.2.1	■ Clearing of riparian vegetation shall be kept to a minimum to avoid disturbance to the riparian vegetation and prevent soil compaction. When practicable, prune or top the vegetation instead of grubbing/uprooting.
1.0 Fish and Fish Habitat	1.2	Loss of vegetation	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	1.2.2	■ Re-stabilize and re-vegetate soils exposed or disturbed during construction, including new or cleaned-out ditches (as per OPSS 182).
1.0 Fish and Fish Habitat	1.3	Fisheries Act Approvals from Fisheries and Oceans Canada	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	1.3.1	■ Confirm in Detail Design the need to submit a Request for Review to DFO (Culverts 403-C7 and SR2).
2.0 Erosion and Sediment Control	2.1	Erosion and sedimentation	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	2.1.1	■ The contractor shall complete an Erosion and Sediment Control plan to contain/isolate exposed soils, stockpiled materials and unstable areas in the work zone and to prevent the release of sediment to all waterbodies and ensure the work site is stabilized prior to removal of Erosion and Sediment Control measures following construction (as per OPSS 805 and 804).
2.0 Erosion and Sediment Control	2.1	Erosion and sedimentation	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Fisheries and Oceans Canada ■ Conservation Authority	2.1.2	■ Compliance with Ontario Provincial Standard Specifications and Best Management Practices during the construction phase.
3.0 Groundwater	3.1	Alteration of groundwater storage and flow patterns	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks ■ Ministry of Natural Resources and Forestry ■ Conservation Authority ■ Municipalities	3.1.1	■ Minimize the need for dewatering during construction, particularly in areas designated as having a high potential for groundwater impact.

Discipline	ID #	Environmental Concern and Potential Impact	Concerned Agencies	ID #	Mitigation, Protection, Monitoring, and Study Commitments to be carried forward to Detail Design
3.0 Groundwater	3.1	Alteration of groundwater storage and flow patterns	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks ■ Ministry of Natural Resources and Forestry ■ Conservation Authority ■ Municipalities	3.1.2	■ Conduct dewatering activities in accordance with approved control procedures.
3.0 Groundwater	3.2	Increased likelihood of the release of contaminants	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks ■ Ministry of Natural Resources and Forestry ■ Conservation Authority ■ Municipalities	3.2.1	■ Protect water quality that may infiltrate groundwater resources.
3.0 Groundwater	3.3	Changes in the water supply to private water users	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks ■ Ministry of Natural Resources and Forestry ■ Conservation Authority ■ Municipalities	3.3.1	■ In Detail Design determine the need for a Permit to Take Water or Environmental Activities and Sector Registry. ■ Water well surveys in unserved areas where replacement structures are proposed shall be undertaken during Detail Design to evaluate the sensitivities of these locations to construction activities. ■ Undertake an existing well monitoring program, including the monitoring of potentially affected wells by highway construction or blasting, prior to, during and after the construction activities (to be determined in Detail Design).
4.0 Drainage and Hydrology	4.1	Changes in the amount of surface water runoff, drainage patterns, water levels and flow volumes	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks	4.1.1	■ Prepare and implement a Stormwater Management plan and include spill prevention and control measures in the contract documents (to be determined in Detail Design).
4.0 Drainage and Hydrology	4.1	Changes in the amount of surface water runoff, drainage patterns, water levels and flow volumes	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks	4.1.2	■ Equipment refuelling and maintenance activities shall not take place within 30 metres of a watercourse.
5.0 Terrestrial Ecosystems	5.1 Designated Natural Areas, Vegetation Communities and Plants 5.1.1	Loss of and/or damage to vegetation, Ecological Land Classification communities and designated natural areas	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Ministry of the Environment, Conservation and Parks ■ Conservation Authority	5.1.1.1	■ Vegetation removal, grading and soil compaction shall be kept to a minimum.
5.0 Terrestrial Ecosystems	5.1 Designated Natural Areas, Vegetation Communities and Plants 5.1.1	Loss of and/or damage to vegetation, Ecological Land Classification communities and designated natural areas	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Ministry of the Environment, Conservation and Parks ■ Conservation Authority	5.1.1.2	■ Trees not identified for removal shall not be damaged. Tree protection measures shall be identified during Detail Design (OPSS 801).
5.0 Terrestrial Ecosystems	5.1 Designated Natural Areas, Vegetation Communities and Plants 5.1.1	Loss of and/or damage to vegetation, Ecological Land Classification communities and designated natural areas	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Ministry of the Environment, Conservation and Parks ■ Conservation Authority	5.1.1.3	■ Re-vegetate disturbed areas with native seed mixes and plants species appropriate to the Study Area. (OPSS 803).

Discipline	ID #	Environmental Concern and Potential Impact	Concerned Agencies	ID #	Mitigation, Protection, Monitoring, and Study Commitments to be carried forward to Detail Design
5.0 Terrestrial Ecosystems	5.1 Designated Natural Areas, Vegetation Communities and Plants 5.1.1	Loss of and/or damage to vegetation, Ecological Land Classification communities and designated natural areas	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Ministry of the Environment, Conservation and Parks ■ Conservation Authority	5.1.1.4	■ Sediment fencing shall be installed along the construction footprint within 30 metres of vegetation, ELC communities and designated natural areas (OPSS 182).
5.0 Terrestrial Ecosystems	5.1 Designated Natural Areas, Vegetation Communities and Plants 5.1.1	Loss of and/or damage to vegetation, Ecological Land Classification communities and designated natural areas	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Ministry of the Environment, Conservation and Parks ■ Conservation Authority	5.1.1.5	■ If stockpiles of gravel and sandy substrates are required during the active turtle season (April 1 to October 15), install turtle exclusion fencing in accordance with the Reptile and Amphibian Exclusion Fencing Best Management Practices (Ministry of the Environment, Conservation and Parks, 2020) around stockpiles prior to April 1 or immediately after stockpile created if after April 1.
5.0 Terrestrial Ecosystems	5.1.2	Introduction or spread of invasive species	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Ministry of the Environment, Conservation and Parks ■ Conservation Authority	5.1.2.1	■ During Detail Design, the precise locations of invasive species (ex. European Reed, Garlic Mustard and European Buckthorn) will be identified to aid in the development of mitigation measure to halt the spread of this species.
5.0 Terrestrial Ecosystems	5.1.2	Introduction or spread of invasive species	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Ministry of the Environment, Conservation and Parks ■ Conservation Authority	5.1.2.2	■ Cleaning of Equipment and Invasive Species Prevention. All machinery, construction equipment and vehicles shall be washed prior to leaving the construction site in order to prevent the spread of invasive species to other locations.
5.0 Terrestrial Ecosystems	5.2 Wildlife and Wildlife Habitat 5.2.1	Disturbance or displacement of migratory birds and destruction of their nests	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Ministry of the Environment, Conservation and Parks ■ Conservation Authority	5.2.1.1	■ Structures likely to be affected by construction may provide suitable nesting habitat for Migratory Bird Convention Act protected birds and Barn Swallow in the future. Structures will be examined to confirm the presence or absence of migratory or Species at Risk bird nests the year prior to construction. If birds are observed nesting in, under or on the structure prior to or during rehabilitation or replacement, a qualified biologist shall be consulted to determine the appropriate steps taken to reduce impacts to wildlife and avoid a potential contravention of the Migratory Birds Convention Act and/or the Endangered Species Act. Such measures may include the installation of bird exclusion measures.
5.0 Terrestrial Ecosystems	5.2 Wildlife and Wildlife Habitat 5.2.1	Wildlife mortality through construction or vehicle collisions	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Ministry of the Environment, Conservation and Parks ■ Conservation Authority	5.2.1.2	■ The need for Wildlife Exclusion Fencing will be further examined during Detail Design.
5.0 Terrestrial Ecosystems	5.3 Species at Risk (Species at Risk) 5.3.1	Disturbance or displacement of Species at Risk and Species at Risk habitat	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Ministry of the Environment, Conservation and Parks ■ Conservation Authority	5.3.1.1	■ During the bat roosting season between April 1 and September 30, any construction activities within 30 metres of suitable maternity roost habitat should be restricted to daylight hours when possible to minimize duration of disturbance.
5.0 Terrestrial Ecosystems	5.3 Species at Risk (Species at Risk) 5.3.1	Disturbance or displacement of Species at Risk and Species at Risk habitat	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Ministry of the Environment, Conservation and Parks ■ Conservation Authority	5.3.1.2	■ All vegetation removal within suitable maternity roost habitat for bat Species at Risk habitat shall occur outside of the bat roosting season between April 1 and September 30 and can only proceed upon confirmation from the Ministry of the Environment, Conservation and Parks as an authorization under the Endangered Species Act may be required.

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5.0 Terrestrial Ecosystems	5.3 Species at Risk (Species at Risk) 5.3.1	Disturbance or displacement of Species at Risk and Species at Risk habitat	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Ministry of the Environment, Conservation and Parks ■ Conservation Authority	5.3.1.3	■ Should Species at Risk be encountered within the work area, construction activities will cease and Ontario Ministry of Transportation and the Ministry of the Environment, Conservation and Parks will be contacted for next steps.
5.0 Terrestrial Ecosystems	5.3 Species at Risk (Species at Risk) 5.3.2	Species at Risk Regulation Changes	■ Ontario Ministry of Transportation ■ Ministry of Natural Resources and Forestry ■ Ministry of the Environment, Conservation and Parks ■ Conservation Authority	5.3.2.1	■ It is recommended that regulatory requirements be confirmed as the project approaches implementation to verify if adjustments are required for the project (i.e., as legislative instruments are updated by MECP).
6.0 Land Use and Property	6.1	Property Impacts / Acquisitions	■ Ontario Ministry of Transportation ■ Municipalities	6.1.1	■ Property impacts will be confirmed during the subsequent Detail Design phase and compensation will be provided at market value, which is determined at the time of purchase by a property appraisal report.
6.0 Land Use and Property	6.1	Property Impacts / Acquisitions	■ Ontario Ministry of Transportation ■ Municipalities	6.1.2	■ Safe access to the commercial and private entrances shall be maintained at all times during construction.
6.0 Land Use and Property	6.1	Property Impacts / Acquisitions	■ Ontario Ministry of Transportation ■ Municipalities	6.1.3	■ If there are impacts to signs, vegetation, landscaping or driveways of any of the commercial, private or municipal properties, the area of impact shall be returned to the conditions of the land prior to construction or better.
6.0 Land Use and Property	6.2	Restricted access to commercial buildings during construction	■ Ontario Ministry of Transportation ■ Municipalities	6.2.1	■ The timing of the interchange on and off ramp replacement works will be co-ordinated to minimize access impacts. Additional consultation will be undertaken with the commercial properties during Detail Design regarding the development of the construction staging plan.
7.0 Noise	7.1	Impacts to noise levels	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks ■ Municipalities	7.1.1	■ A Notice of Works letter will be provided to the municipalities in advance of construction works.
7.0 Noise	7.1	Impacts to noise levels	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks ■ Municipalities	7.1.2	■ Equipment shall comply with the sound emission standards for construction equipment outlined in the Ministry of the Environment, Conservation and Parks' publications NPC-115 Construction Equipment and NPC-118 Motorized Conveyances, or latest version.
7.0 Noise	7.1	Impacts to noise levels	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks ■ Municipalities	7.1.3	■ Where feasible, equipment with broadband backup alarms instead of the tonal backup alarms/beepers shall be utilized.
7.0 Noise	7.1	Impacts to noise levels	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks ■ Municipalities	7.1.4	■ Equipment shall be maintained in an operating condition that prevents unnecessary noise, including but not limited to non-defective muffler systems, properly secured components, and the lubrication of moving parts.
7.0 Noise	7.1	Impacts to noise levels	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks ■ Municipalities	7.1.5	■ Idling of equipment shall be restricted to the minimum necessary to perform the specified work.
7.0 Noise	7.1	Impacts to noise levels	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks ■ Municipalities	7.1.6	■ Stationary equipment shall be located as far away from sensitive locations as feasible.

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7.0 Noise	7.1	Impacts to noise levels	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks ■ Municipalities	7.1.7	■ A noise complaint process shall be established in accordance with the Ministry of Transportation's Environmental Guide for Noise.
7.0 Noise	7.1	Impacts to noise levels	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks ■ Municipalities	7.1.8	■ Noise complaints shall be investigated in accordance with the Ontario Ministry of Transportation Guide.
8.0 Contamination, Waste, and Excess Materials Management	8.1	Potential contamination of soil and water	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks	8.1.1	■ Property specific Phase One Environmental Site Assessments (and if necessary Phase Two Environmental Site Assessments) be completed in such areas of potential environmental concern in support of the property acquisition.
8.0 Contamination, Waste, and Excess Materials Management	8.1	Potential contamination of soil and water	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks	8.1.2	■ Soil contaminant investigation, where excavation is proposed, be carried out by a qualified environmental consultant to assess soil quality in support of surplus/ excess soil management in areas within or in close proximity to areas of environmentally sensitive areas with moderate to high potential for contamination.
9.0 Air Quality	9.1	Increased nitrogen oxides, carbon monoxide, sulphur dioxide, particulate matter, and volatile organic compound emission impact levels at nearby receptors from increased traffic	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks	9.1.1	■ Explore opportunities of landscape plantings in the vicinity of sensitive receptors where land is available within the Right of Way. A landscape plan will be developed during the Detail Design stage.
9.0 Air Quality	9.2	Short term effects of construction operations on adjacent sensitive receivers (residences, flora and fauna)	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks	9.2.1	■ Implement Best Management Practices to minimize potential air quality impacts during construction, which includes the following types of operational procedures for control of dust and other emissions: – All equipment and vehicles shall be kept properly maintained and repaired to minimize exhaust emissions, including odours; – Excessive idling of vehicles and equipment (greater than 3 minutes in a 60-minute period) shall be minimized; – Implementing the use of non-chloride dust suppressants; – Use of alternative-fuelled or electric equipment where feasible; – Locating stationary equipment (generators, compressors, etc.) as far away from sensitive receptors as practical; and – Ensuring stationary and mobile equipment are not operated during early morning (before 6 AM, or sunrise) or evening periods (after 8 PM, or sunset) as often as practical.
9.0 Air Quality	9.2	Short term effects of construction operations on adjacent sensitive receivers (residences, flora and fauna)	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks	9.2.2	■ Potential mitigation measures to be employed during construction to reduce fugitive dust include: – Seeding, paving, covering, wetting, or otherwise treating disturbed soil surfaces; – Using wind screens or fences; – Covering all truckloads of dust-producing material; – Removing all loose or unsecured debris or materials from empty trucks prior to leaving the site; – Reducing traffic speeds on any unpaved surfaces; – Vacuum sweeping or watering of all paved surfaces and roadways on which equipment and truck traffic enter and leave the construction areas; – Using wheel washes and truck washes at site egresses; and – Modifying work schedules when weather conditions could lead to adverse impacts (e.g., very dry soil and high winds).

Discipline	ID #	Environmental Concern and Potential Impact	Concerned Agencies	ID #	Mitigation, Protection, Monitoring, and Study Commitments to be carried forward to Detail Design
9.0 Air Quality	9.2	Short term effects of construction operations on adjacent sensitive receivers (residences, flora and fauna)	■ Ontario Ministry of Transportation ■ Ministry of the Environment, Conservation and Parks	9.2.2	■ Special Provision 199S56 Control of Emissions During Structural Work.
10.0 Archaeology	10.1	Archaeological material may be encountered during construction of the proposed improvements	■ Ontario Ministry of Transportation ■ Ministry of Citizenship and Multiculturalism	10.1.1	■ During Detail Design undertake Stage 2 Archaeological Assessments for areas with archaeological potential that will be impacted by construction activities.
10.0 Archaeology	10.1	Archaeological material may be encountered during construction of the proposed improvements	■ Ontario Ministry of Transportation ■ Ministry of Citizenship and Multiculturalism	10.1.2	■ Should previously undocumented archaeological resources be discovered, during construction there may be a new archaeological site which would be subject to Section 48 (1) of the Ontario Heritage Act. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licenced consultant archaeologist to carry out archaeological field work, in compliance with Section 48 (1) of the Ontario Heritage Act.
10.0 Archaeology	10.1	Archaeological material may be encountered during construction of the proposed improvements	■ Ontario Ministry of Transportation ■ Ministry of Citizenship and Multiculturalism	10.1.3	■ The Cemeteries Act, R.S.O. 1990, c.C 4 and the Funeral, Burial and Cremation Services Act, 2002, S.O. 20002, c33 (when proclaimed in force) require that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Public and Business Services Delivery.
11.0 Indigenous Communities	11.1	Indigenous Engagement	■ Ontario Ministry of Transportation ■ Indigenous Communities	11.1.1	■ Continued consultation and engagement with Indigenous Communities during the Detail Design stage.
13.0 Transportation and Infrastructure	12.1	Traffic disruptions and construction staging	■ Municipalities ■ Ontario Ministry of Transportation	12.1.1	■ A construction staging plan will be developed during Detail Design.
12.0 Transportation and Infrastructure	12.1	Traffic disruptions and construction staging	■ Municipalities ■ Ontario Ministry of Transportation	12.1.2	■ Consultation with municipalities, emergency services and potentially affected stakeholders regarding the details of traffic disruptions associated with road closures, access restrictions, detour plans and the development of the construction staging plan during the Detail Design stage.
12.0 Transportation and Infrastructure	12.2	Disruptions/damage to utility infrastructure	■ Ontario Ministry of Transportation ■ Municipalities ■ Utilities	12.2.1	■ All potentially affected utility companies (i.e., Bell, Cogeco Cable, Burlington Hydro, Hydro One, Century Link, Enbridge Gas, Canadian National Railway, Canadian Pacific Railway) will be contacted to develop a utility relocation plan prior to construction during Detail Design.
12.0 Transportation and Infrastructure	12.2	Disruptions/damage to utility infrastructure	■ Ontario Ministry of Transportation ■ Municipalities ■ Utilities	12.2.2	■ If it is necessary to complete utility relocations during construction, the Contractor will be required to co-ordinate the timing of each operation to ensure that they are carried out independently. Special provisions will be included in the contract to address this, and to ensure that care and precautions are taken to safeguard existing utilities from damage.

10. Next Steps

Following the 30-day comment period of the Transportation Environmental Study Report, the Ministry of Transportation may proceed to Detail Design.

The Detail Design phase will advance the recommended Preliminary Design to a refined level and a contract package for construction will also be prepared. Additional field investigations will be completed to provide more data that is specific to the refined design.

Permits and approvals will be obtained during Detail Design. Any mitigation, monitoring or reporting requirements identified through a permit or approval will be implemented and completed through the construction contract requirements.

The construction phase is the implementation of the project. During construction, the Ministry of Transportation or Contract Administrator will ensure that the implementation of the mitigation measures and key design features are consistent with the construction contract.

Inspection by Construction Administration staff will occur during construction to make certain that all environmental mitigation and design measures are properly installed and maintained, and additional measures are provided as required for any unanticipated issues that may develop during construction.

11. References

The following specialist reports were reviewed as part of the preliminary design study:

1. Air Quality Impact Assessment Report
2. Contamination Overview Study
3. Cultural Heritage Resource Assessment Report: Built Heritage Resources & Cultural Heritage Landscapes
4. Drainage and Stormwater Management Report
5. Electrical Existing Conditions Report
6. Fish and Fish Habitat Existing Conditions and Impact Assessment Report
7. Groundwater Impact Assessment Report
8. Overview of Existing and Planned Land Use Report
9. Noise Impact Assessment Report
10. Terrestrial Ecosystems Existing Conditions and Impact Assessment Report
11. Memorandum: Development and Calibration / Validation of Base VISSIM Microsimulation Models
12. Erosion and Sedimentation Overview Risk Assessment (ESORA) Memo
13. Draft Stage 1 Archaeological Assessment Report