REPORT

Highway 401 Colborne to Brighton Planning Study

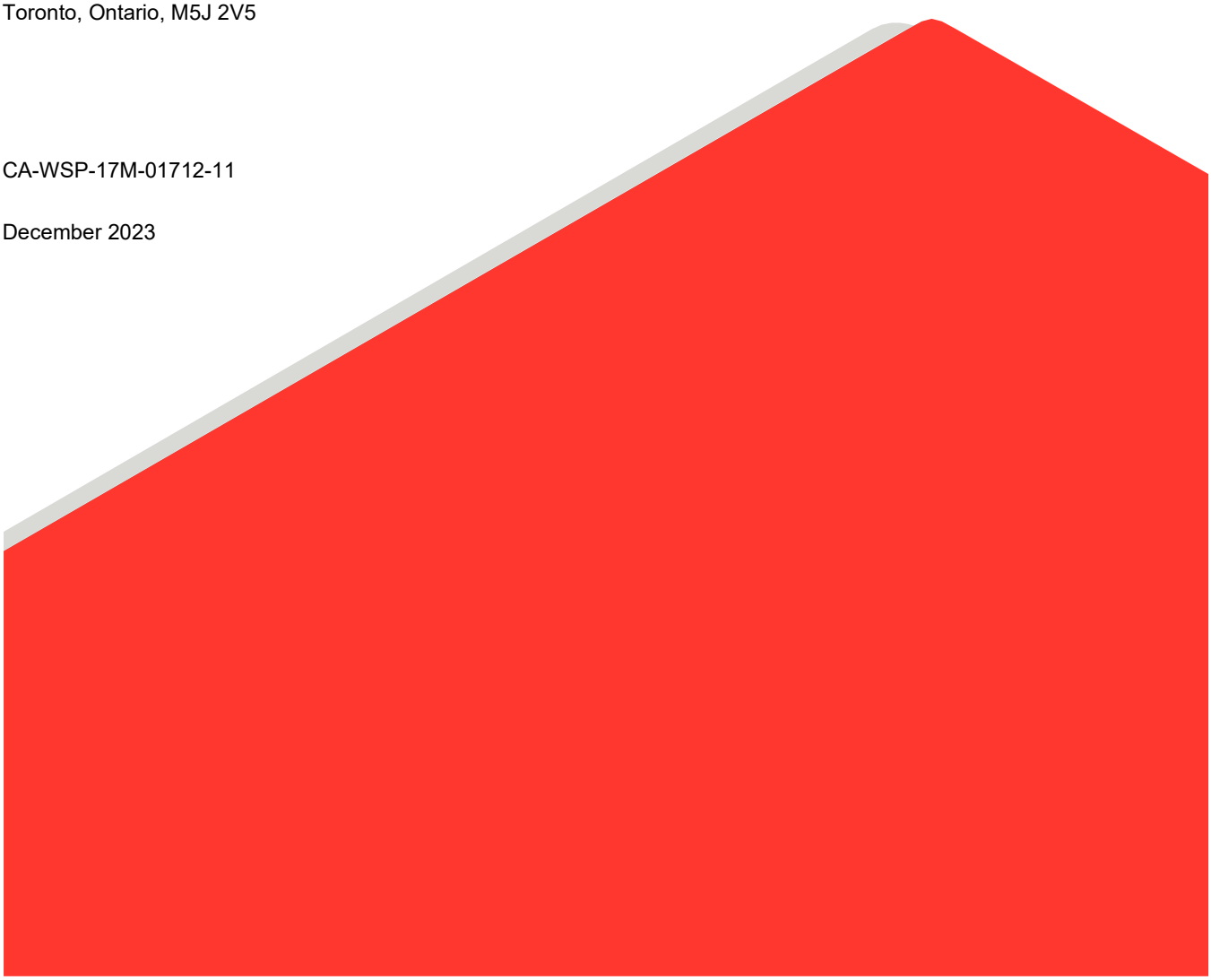
Transportation Environmental Study Report G.W.P. 4054-17-00

Submitted to:

Ontario Ministry of Transportation
Project Delivery East
1355 John Counter Boulevard, P.O. Box 4000
Kingston, Ontario, K7L 5A3

Submitted by:

WSP Canada Inc.
25 York Street, Suite 700
Toronto, Ontario, M5J 2V5



CA-WSP-17M-01712-11

December 2023

This page was intentionally left blank.

Disclaimer

WSP Canada Inc. (WSP) prepared this report solely for the use of the intended recipient, Ontario Ministry of Transportation (MTO), in accordance with the professional services agreement between the parties. The report is intended to be used in its entirety. No excerpts may be taken to be representative of the findings in the assessment.

The conclusions presented in this report are based on work performed by trained, professional and technical staff, in accordance with their reasonable interpretation of current and accepted engineering and scientific practices at the time the work was performed.

The content and opinions contained in the present report are based on the observations and/or information available to WSP at the time of preparation, using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by WSP and other engineering/scientific practitioners working under similar conditions, and subject to the same time, financial and physical constraints applicable to this project.

WSP disclaims any obligation to update this report if, after the date of this report, any conditions appear to differ significantly from those presented in this report; however, WSP reserves the right to amend or supplement this report based on additional information, documentation or evidence.

WSP makes no other representations whatsoever concerning the legal significance of its findings.

The intended recipient is solely responsible for the disclosure of any information contained in this report. If a third party makes use of, relies on, or makes decisions in accordance with this report, said third party is solely responsible for such use, reliance or decisions. WSP does not accept responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken by said third party based on this report.

WSP has provided services to the intended recipient in accordance with the professional services agreement between the parties and in a manner consistent with that degree of care, skill and diligence normally provided by members of the same profession performing the same or comparable services in respect of projects of a similar nature in similar circumstances. It is understood and agreed by WSP and the recipient of this report that WSP provides no warranty, express or implied, of any kind. Without limiting the generality of the foregoing, it is agreed and understood by WSP and the recipient of this report that WSP makes no representation or warranty whatsoever as to the sufficiency of its scope of work for the purpose sought by the recipient of this report.

In preparing this report, WSP has relied in good faith on information provided by others, as noted in the report. WSP has reasonably assumed that the information provided is correct and WSP is not responsible for the accuracy or completeness of such information.

Benchmarks and elevations used in this report are primarily to establish relative elevation differences between the specific testing and/or sampling locations and should not be used for other purposes, such as grading, excavating, construction, planning, development, etc.

Design recommendations given in this report are applicable only to the project and areas as described in the text and then only if constructed in accordance with the details stated in this report. The comments made in this report on potential construction issues and possible methods are intended only for the guidance of the designer. The number of testing and/or sampling locations may not be sufficient to determine all the factors that may affect

construction methods and costs. We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

This limitations statement is considered an integral part of this report.

Public Record

A copy of this document has been submitted electronically to the following office of the Ontario Ministry of the Environment, Conservation, and Parks (MECP) to fulfill the requirements of the Ontario Ministry of Transportation (MTO) *Class Environmental Assessment for Provincial Transportation Facilities* (2000):

Ministry of the Environment, Conservation and Parks
Eastern Region Office
1259 Gardiners Rd, Unit 3
Kingston, ON K7P 3J6

This Transportation Environmental Study Report (TESR) is also available for a 45-day public review period starting on **December 18, 2023** on the project website at www.highway401colbornebrighton.ca.

The TESR is also available for in-person viewing at the following locations:

Cramahe Township Public Library – Colborne Branch
6 King Street West
Colborne, ON K0K 1S0

The Township of Cramahe Town Hall
1 Toronto Street
Colborne, ON K0K 1S0

Brighton Town Hall / Brighton Public Library
35 Alice Street
Brighton, ON K0K 1H0

Ce document hautement spécialisé n'est disponsible qu'en anglais en vertue du règlement 411/97, qui en exempte l'application de la Loi sur les services en français. Pour de l'aide en français, veuillez communiquer avec le 905-829-6262.

.

Executive Summary

PROJECT OVERVIEW

This Transportation Environmental Study Report (TESR) documents the Planning, Preliminary Design Study and Class Environmental Assessment (EA) undertaken by the Ontario Ministry of Transportation (MTO) for the Highway 401 Colborne to Brighton. In particular, the objectives of the study include:

- Improvements and widening to Highway 401;
- Rehabilitation/widening/replacement of structures in the Study Area;
- Commuter Parking Lot; and,
- Addressing local access needs.

The study has followed the approved environmental planning process for Group 'B' projects under the MTO *Class Environmental Assessment for Provincial Transportation Facilities* (2000) with the opportunity for public input throughout.

The west study limit along the Highway 401 corridor is 0.8 km east of Percy Street and the east study limit is 0.4 km west of Christiani Road. The Study Area excludes the Highway 30 Interchange, which was the subject of a previously completed EA in 2005 (GWP 256-98-00), except for a commuter parking lot at the interchange which is part of this study.

TRANSPORTATION NEEDS AND OPPORTUNITIES

Highway 401 is a crucial part of Ontario's transportation network, spanning the province from the U.S. border to the Quebec border. It serves commuter, commercial trade, and tourism needs. However, the aging infrastructure, including underpass structures and culverts, is in need of significant rehabilitation or replacement to meet the current standards and maintain its vital role.

The study has examined the structural requirements and replacement strategies for Highway 401's existing structures and potential improvements to the highway's geometry. Since these structures have a lifespan of 75 years, there is a need to ensure they can accommodate future expansions of Highway 401. To accommodate expected traffic growth, the Recommended Plan includes widening the highway to six lanes initially and planning for an eventual expansion to eight lanes.

EVALUATION OF ALTERNATIVES AND RECOMMENDED PLAN

The study undertook a comprehensive review and analysis for the improvements to the Highway 401 and structures within the study area. The assessment and evaluation of alternatives consisted of the following key steps:

- Identification of the problems and opportunities within the Study Area;
- Identification of assessment factors and sub-factors to be used in the evaluation of alternatives;
- Assessment of alternatives to the undertaking to establish an approach most appropriate to address the overall problem;

- Development of a long list of alternative methods;
- Assessment and evaluation of short-listed alternative methods; and,
- Establishment of an overall Recommended Plan.

Section 5.0 outlines the development and evaluation of alternatives and **Section 7.0** outlines the Recommended Plan, which is detailed in the Preliminary Design Plates included in **Appendix A**.

CONSULTATION / ENGAGEMENT

An extensive stakeholder consultation/engagement program was undertaken to assist in the planning, preliminary design and impact assessment for this project. Throughout the study, the public, external agencies, local and regional municipalities, and Indigenous Communities were engaged through a variety of forums and activities, including:

- The Project Website (https://highway401colbornebrighton.ca/);
- Two Public Information Centres (PICs) held on April 21, 2021, and May 31, 2023;
- Meetings with External Agencies (Federal and Provincial), local municipalities (the County and local townships), property owners, and stakeholder interest groups.
- Direct contact with the Project Team via mail, email, phone, or online website contact form; and,
- Newspaper advertisements (for Study Commencement, each PIC, and for the filing of the TESR).
    - Digital newspaper advertisement on www.northumberlandnews.com for two weeks for the filing of the TESR as the previously used newspapers are no longer in circulation.

POTENTIAL ENVIRONMENTAL IMPACTS / PROPOSED MITIGATION MEASURES

Section 8 of the TESR outlines the potential environmental impacts associated with the selected design, proposed mitigation measures and commitments to future work. Identified concerns, proposed mitigation measures and future commitments are summarized briefly below.

There are several environmental features / constraints that will be impacted by the proposed works that require mitigation during Detail Design and construction. The construction of the new Highway 401 ROW will impact various areas of cultural vegetation and woodlands, including Butternut (*Juglans cinerea*; Tree B03) habitats, cultural meadows, savannahs, thickets, and woodlands, which are primarily composed of introduced and non-native species. Additionally, treed habitats and wetlands will be affected, potentially leading to changes in microclimates, plant and wildlife habitat loss, and damage to trees. However, most of the impacted areas have low ecological significance and are culturally influenced or contain invasive species, with no direct impacts on rare flora or vegetation types expected. The vegetation removals are primarily at the edge, minimizing the overall ecological impact.

Potential impacts on wildlife habitat are similar to those discussed for vegetation noted above (i.e., direct / indirect impacts to habitat – removals, fragmentation, etc.). The largest areas of vegetation removal include cultural meadow (CUM1-1), cultural thicket (CUT), cultural woodland (CUW) and cultural plantation (CUP) communities which are primarily composed of introduced species or non-native weed species. There is potential for indirect

impacts to wildlife habitat as a result of construction and changes to hydrology. Wildlife-specific mitigation measures are outlined in **Section 8.1.2.2**.

The environmental impact assessment identifies several terrestrial Species at Risk (SAR) and their habitats in the study area, including Butternut, Barn Swallow, Eastern Meadowlark, Eastern Wood-pewee, Monarch, Snapping Turtle, and potential SAR fauna.

There are 12 watercourse crossings of Highway 401 and one waterbody located within the study area. There is one potential record of aquatic SAR, Bridle Shiner (*Notropis bifrenatus*) (SARO status: Special Concern, SARA status: Special Concern) occurring in Colborne Creek. This species does not receive species or habitat protection under the ESA (2007) or SARA (2002).

Follow-up will be required if these species are observed during Detail Design or new records are provided by relevant authorities. Overall, the assessment outlines the potential impact on various species and outlines measures to mitigate these impacts (see **Section 8.1.3.2** for further details on SAR mitigation measures).

Other Potential Impacts and Mitigation Measures

Other potential impacts and mitigation measures for natural environment (**Section 8.1**), socio-economic environment (**Section 8.2**), cultural environment (**Section 8.3**), and technical considerations (**Section 8.4**) are discussed in greater detail in **Section 8.0**. **Section 8.5** provides a summary of identified concerns, proposed mitigation and commitments to future work.

OTHER APPROVAL REQUIREMENTS

To implement the Recommended Plan, additional provincial, municipal, and utility approvals/permits are required. A number of approvals/endorsements from the following ministries and government agencies may be necessary for the Recommended Plan:

- Ministry of Natural Resources and Forestry;
- Ministry of Citizenship and Multiculturalism;
- Ministry of the Environment, Conservation and Parks;
- Department of Fisheries Canada (DFO); and,
- Utility Providers.

During subsequent design phases, formal notification and consent will be obtained from relevant authorities.

NEXT STEPS

The Recommended Plan will be further refined during Detail Design and will adhere to the most current design standards at that time. All commitments to future work outlined in **Section 8.5** will be carried forward and completed during Detail Design.

Consultation with provincial agencies, municipalities, and utility providers and engagement with Indigenous communities will be continued during Detail Design.

During the Detail Design phase, the work initiated in Preliminary Design is refined and developed to a more detailed level. The overall project intent remains unchanged, but a Design and Construction Report (DCR) or

similar document is prepared to address any unresolved issues from Preliminary Design and new concerns arising during Detail Design. This process may involve minor design modifications or refinements, often influenced by discussions with relevant agencies, and these changes will be documented in the DCR. These refinements might lead to unanticipated environmental impacts or benefits that were not initially covered in the Preliminary Design's TESR.

Glossary

AA	Archaeological Assessment
AADT	Annual Average Daily Traffic
ANSI	Areas of Natural and Scientific Interest
APECs	Areas of Potential Environmental Concerns
ATR	Automatic Traffic Record
AQIA	Air Quality Impact Assessment
B(a)P	Benzo(a)pyrene
BHA	Butternut Health Assessment
BHE	Butternut Health Expert
BHR	Built Heritage Resource
BMPs	Best Management Practices
CAQMP	Construction Air Quality Management Plan
CH_4	methane
CHER	Cultural Heritage Evaluation Report
CHL	Cultural Heritage Landscape
CHRAR	Cultural Heritage Resource Assessment Report
CHVI	cultural heritage value or interest
CMP	Cycling Master Plan
CO_2	carbon dioxide
CO_{2eq}	CO_2 equivalent
COS	Contamination Overview Study
dBA	Decibels
DBH	diameter at breast height
DCR	Design and Construction Report
EA	Environmental Assessment
EA Act	Ontario Environmental Assessment Act

EASR	Environmental Activity and Sector Registry
ECA	Environmental Compliance Approval
ECCC	Environment and Climate Change Canada
EDR	Emergency Detour Route
ELC	Ecological Land Classification
ESA	Environmentally Sensitive Area
ESAs	Environmental Site Assessments
ESA	Endangered Species Act
ESC	Erosion and Sediment Control
ESORA	Erosion and Sedimentation Overview Risk Assessment
GAR	Groundwater Assessment Report
GGH	Greater Golden Horseshoe
GHG	greenhouse gas
GWP	global warming potential
HIA	Heritage Impact Assessment
IAA	Impact Assessment Act
IPZ	Intake protection zone
LCV	long combination vehicles
LSW	Locally Significantly Wetland
LTC	Lower Trent Conservation
LOS	Level of service
masl	meters above sea level
MBCA	Migratory Birds Convention Act
mbgs	meters below the ground surface
MCM	Ontario Ministry of Citizenship and Multiculturalism
MECP	Ontario Ministry of the Environment, Conservation and Parks
MNRF	Ontario Ministry of Natural Resource and Forestry
MTO	Ontario Ministry of Transportation

N_2O	nitrous oxide
NOx	nitrogen oxides
NHF	Natural Heritage Features
NHIC	Natural Heritage Information Centre
NPRI	National Pollutant Release Inventory
NRVIS	Natural Resources Value Information System
NSA	Noise Sensitive Area(s)
MPP	Member of Provincial Parliament
OLA	Outdoor Living Area
O. Reg.	Ontario Regulation
OPP	Ontario Provincial Police
OPSDs	Ontario Provincial Standard Drawings
OPSSs	Ontario Provincial Standard Specifications
OWRA	Ontario Water Resources Act
PIC	Public Information Centre
$PM_{2.5}$	Fine particulate matter with a diameter of 2.5 microns or less
PM_{10}	Fine particulate matter with a diameter of 10 microns or less
PSW	Provincially Significant Wetland
PTTW	Permit To Take Water
RfR	Request for Review
RGA	Rapid Geomorphic Assessment
RLU	rural local undivided
ROW	Right-of-Way
S&Gs	Standards and Guidelines
SADT	Summer Average Daily Traffic
SAR	Species at Risk
SARA	Species at Risk Act
SCC	Species of Conservation Concern

SPP	Source Protection Plan
SWH	Significant Wildlife Habitat
SWM	Stormwater Management
TDM	Transportation Demand Management
TLIs	Temporary Limited Interests
TMP	Transportation Master Plan
TPZ	Tree Protection Zone
TSP	Total Suspended Particulate
TESR	Transportation Environmental Study Report
WHPA	Wellhead Protection Areas
WWIS	Water Well Information System
WWRs	water well records

Table of Contents

EXHIBITS

APPENDICES

1.0 PROJECT OVERVIEW

1.1 Introduction

The Ontario Ministry of Transportation (MTO) retained WSP Canada Inc. (WSP) to undertake a Planning, Preliminary Design and Class Environmental Assessment (Class EA) for Highway 401 for the replacement and rehabilitation of structures, establishing the future Highway 401 footprint for an interim six lanes and ultimate eight lanes to address current and future transportation needs, and commuter parking lot improvements from 0.8 km east of Percy Street to 0.4 km west of Christiani Road. The approximate length of the Study Area is 16 km from Colborne to Brighton in Ontario.

The study follows the approved environmental planning process for Group 'B' projects under the MTO *Class Environmental Assessment for Provincial Transportation Facilities* (2000) which is an approved process under the *Ontario Environmental Assessment Act* for the planning and design of provincial highway projects.

The goal of this report is to document the environmentally significant aspects of the planning and design of the Recommended Plan. The study reviewed various planning alternatives resulting in the identification of a Preferred Alternative, which was further developed into the Recommended Plan. Engineering, environmental and property requirements were established, along with the identification of mitigation measures to avoid or minimize environmental impacts. The EA planning process satisfied all provincial and federal environmental legislation and included consideration of the cultural, natural, and socio-economic environments.

This Transportation Environmental Study Report (TESR) is made available for public review for a 30-day period and includes the following:

- Description of the project and its purpose;
- Identification of the range of alternatives considered;
- Evaluation and rationale for the selection of the Preferred Alternative;
- Development of the Preferred Alternative into the Preferred Plan (**Section 7.0**);
- Existing natural, cultural, and socio-economic factors;
- Anticipated environmental impacts and proposed mitigation;
- Summary of the stakeholder consultation undertaken, and key public and agency comments; and,
- Commitments to future work to mitigate negative impacts that may arise from the proposed works.

1.2 Study Area

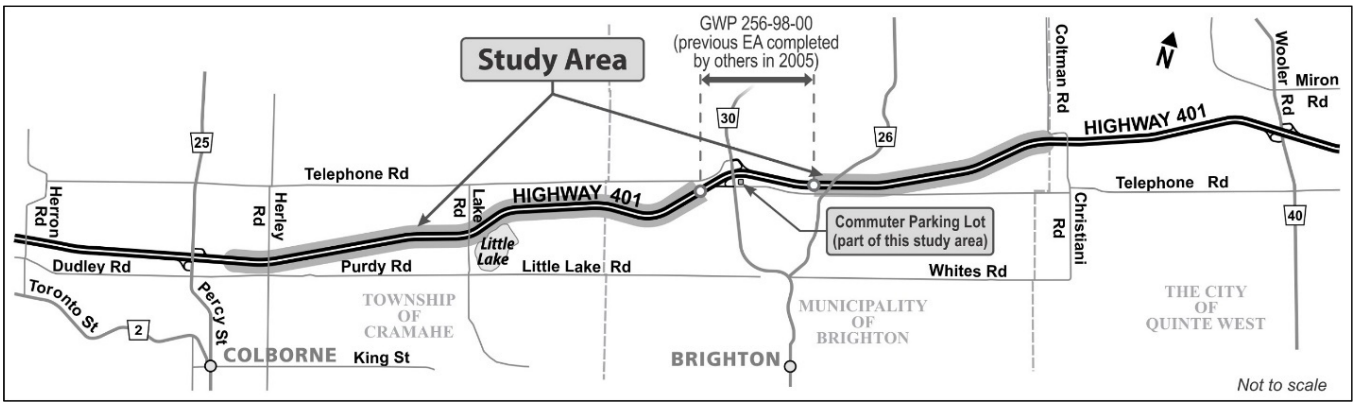
The assignment includes the Planning, Preliminary Design and Class Environmental Assessment (EA) of Highway 401 from Colborne and Brighton for the replacement and rehabilitation of structures, establishing the future Highway 401 footprint for an interim six lanes and ultimate eight lanes to address current and future transportation needs and commuter parking lot improvements at County Road 30.

The approximate length of the Study Area is 16 km. The west study limit is 0.8 km east of Percy Street and the east study limit is 0.4 km west of Christiani Road. The Study Area excludes the Highway 30 Interchange, which was the subject of a previously completed EA in 2005 (GWP 256-98-00), except for a commuter parking lot at the interchange which is part of this study.

The municipalities within the Study Area include the Township of Cramahe, the Municipality of Brighton, and Northumberland County. The City of Quinte West is just east of the eastern study limits.

Exhibit 1-1 illustrates the Study Area of Highway 401 widening.

Exhibit 1-1: Highway 401 Widening Study Limits



1.3 Background and Study Purpose

Highway 401 is Ontario's primary east-west freeway, extending from Windsor easterly to the Ontario-Quebec border. Highway 401 in the Study Area provides a connection to Toronto to the west and Kingston to the east and services the Township of Cramahe, Municipality of Brighton, and the City of Quinte West via local interchanges. Within the Study Area, Highway 401 has a posted speed of 100 km/h and has four basic lanes (two lanes in each direction), plus auxiliary lanes and speed-change lanes at interchange locations. The Highway 401 / County Road 30 interchange design was completed under a previous study and is the closest arterial interchange adjacent to the carpool lot that is included in the current EA study. Existing structures in the study include three underpasses crossing Highway 401 (Herley Road, Lake Road, and County Road 26) and four structural culverts.

1.4 Related and Adjacent Studies

The following studies and projects are related to this study and focus on locations in and adjacent to the Study Area.

1.4.1 Highway 401 Cobourg to Colborne Planning, Preliminary Design and Class EA Study (GWP 4060-11-00)

This project includes the replacement and rehabilitation of structures, interchange modifications, establishing the future footprint for the interim six lanes and ultimate eight lanes to address current and future transportation needs, and commuter parking lot expansions, from 2 km east of Nagle Road to 800 m east of Percy Street. The approximate length of the Study Area is 18 km. The Online Public Information Centre (PIC) #2 took place for this project in August and September 2020. At the time of this report, the TESR has not been made available to the public. More information about this study is available on the project website: https://www.highway401cobourgcolborne.ca/index.html.

1.4.2 Highway 401 County Road 30 Interchange, Preliminary Design and Class EA Study (GWP 256-98-00)

This project included improvements to the County Road 30 interchange. This EA study was previously completed in 2005.

1.4.3 Highway 401 Planning Study in Quinte West (GWP 4027-18-00)

This project includes identifying and developing a plan for the replacement and rehabilitation of structures, interchange modifications, and establishing the future Highway 401 footprint for an interim six lanes and ultimate eight lanes, from 0.4 km west of Christiani Road to 1 km west of Wallbridge Loyalist Road (approximately 20 km).

2.0 THE ENVIRONMENTAL ASSESSMENT PROCESS

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

The purpose of the *Ontario Environmental Assessment Act* (EA Act) is to provide for the protection, conservation, and wise management of Ontario's environment by requiring that projects subject to the EA Act follow a planning process leading to environmentally conscious decision-making. The "environment" is broadly defined within the EA Act and can include aspects of the natural, social, cultural, built and economic environments.

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

The Class Environmental Assessment (Class EA) is a planning process approved under the EA Act that provides a streamlined process that must be followed for projects or activities within a defined "class". The MTO's *Class Environmental Assessment (Class EA) for Provincial Transportation Facilities* was approved under the *Ontario Environmental Assessment Act* (EA Act) in 1999 and amended in 2000. This planning document defines groups of projects and activities and the environmental assessment processes that MTO has committed to follow for these projects. Provided that this process is followed, and its requirements are met for a project, projects, and activities included under the MTO Class EA are deemed to have been reviewed and approved under the EA Act.

The MTO Class EA process is principle-based. Where appropriate, this Transportation Environmental Study Report (TESR) will reference the principles and how they were achieved during the environmental assessment process.

The following principles underline the Class EA process for all transportation projects:

- Transportation engineering;
- Environmental protection;
- External public and agency consultation;
- Evaluation that is intended to achieve the best overall balance;
- Documentation;
- Section 16 Order; and,
- Environmental clearance to proceed.

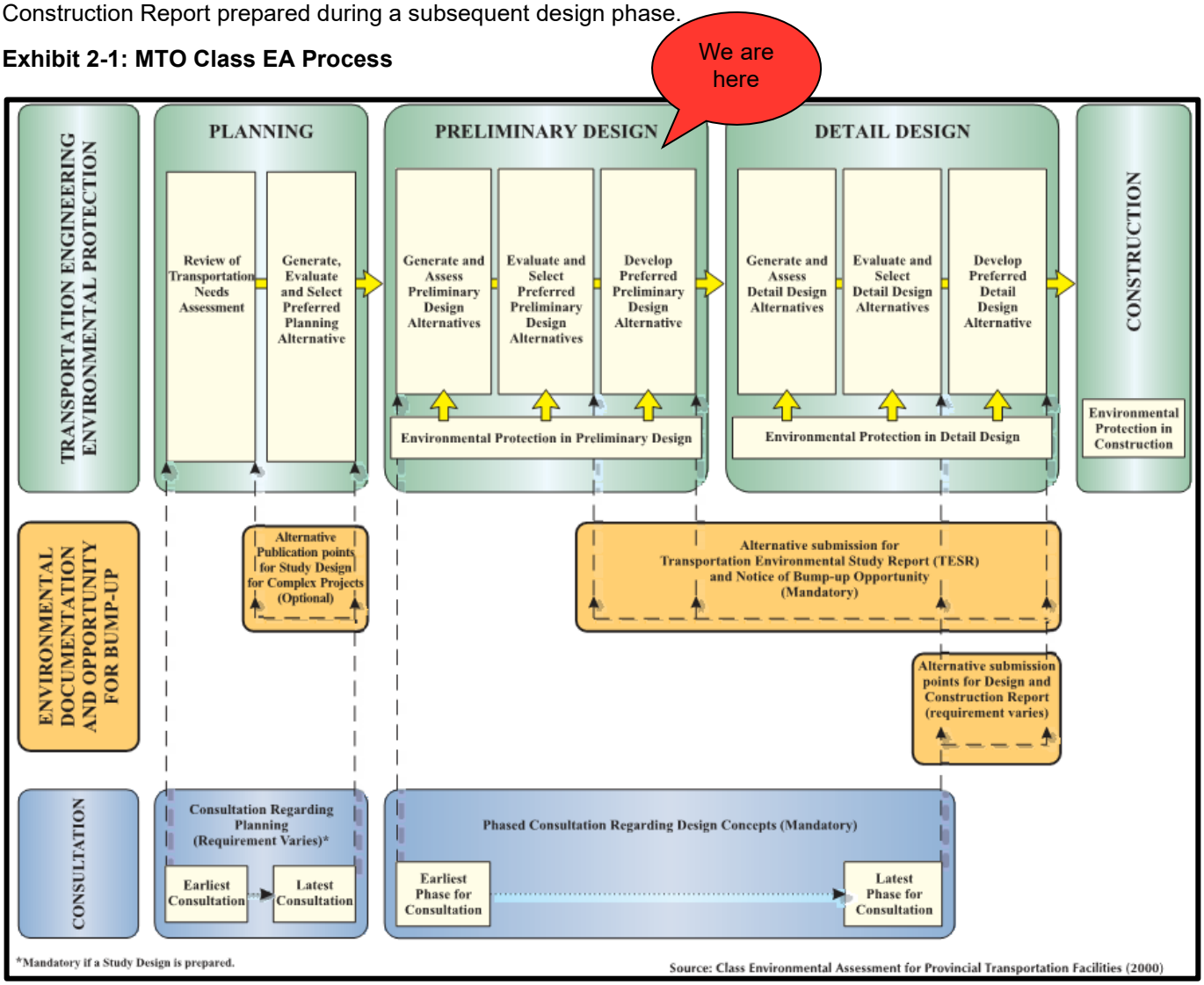
This project is following the Class EA process for Group 'B' projects. Group 'B' projects are considered major improvements to provincial transportation facilities and generally include:

- Improvements to existing highways and freeways that provide a significant increase in capacity;
- New interchanges or modifications to existing interchanges;
- Major road realignments;
- New or modified water crossings or watercourse alterations; and,
- New highway service facilities.

The Class EA process for Group 'B' projects is shown in **Exhibit 2-1**. This study addresses the Preliminary Design stage and includes submission of a Transportation Environmental Study Report (TESR). This TESR will be filed for a 45-day period of public and external agency review. All comments and concerns should be sent directly to MTO.

Commitments and minor changes to the Plan (detailed in **Section 7.0**) will be documented in a Design and Construction Report prepared during a subsequent design phase.

Exhibit 2-1: MTO Class EA Process



2.2 The Impact Assessment Act

The *Impact Assessment Act,* 2019 (IAA 2019) and associated regulations came into effect on August 28, 2019. Under IAA 2019, a federal environmental assessment is required for "designated projects." A designated project is one that includes one or more physical activities that are set out in the regulations under IAA 2019 or by order of the Federal Minister of the Environment and Climate Change.

This Planning, Preliminary Design and Class EA Study was reviewed by the Project Team against the Federal Regulations Designating Physical Activities, and the Project Team determined that the study is not "designated" and therefore does not require a federal environmental assessment.

More information about the *Impact Assessment Act* (2019) is available at the following link: https://www.canada.ca/en/impact-assessment-agency.html.

2.3 Study Process

The study's overall EA planning process approach and key study tasks are illustrated in **Exhibit 2-2**. The generalized flow chart details the various activities completed in the two study stages: Planning and Preliminary Design.

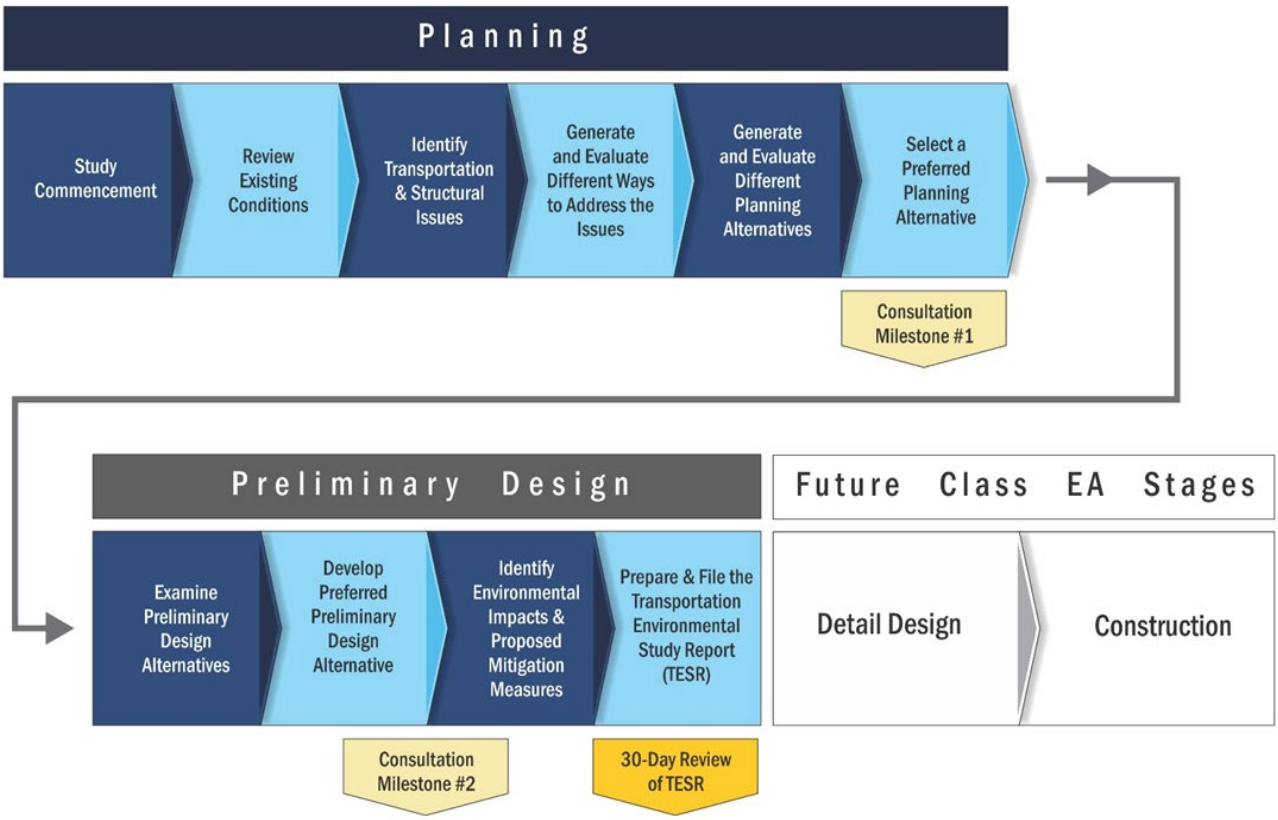
The Planning Stage consists of:

- Study Commencement (**Section 6.0**)
- Reviewing Existing Conditions (**Section 4.0**)
- Identifying Transportation & Structural Issues (**Section 3.0**)
- Generating and Evaluating Different Ways to Address the Issues (i.e., alternatives to the undertaking) (**Section 5.1**)
- Generating and Evaluating Different Planning Alternatives (i.e., alternative solutions) (**Section 5.2 to 5.5**)
- Selection of a Recommended Planning Alternative (**Section 5.6**)

The Preliminary Design Stage consists of:

- Examining Preliminary Design Alternatives
- Developing Preferred Preliminary Design Alternative
- Identifying Environmental Impacts and Proposed Mitigation Measures
- Preparing and Filing the Transportation Environmental Study Report (TESR)

Exhibit 2-2: Study Planning Process



2.4 Purpose of the Transportation Environmental Study Report

This TESR documents the environmentally significant aspects of the planning and design of the Recommended Plan. The TESR includes a description of the study and its purpose; the existing natural, socio-economic and cultural environmental factors; the analysis and evaluation of alternatives that were considered in the selection of the Recommended Plan; the anticipated environmental impacts and proposed mitigation measures for the Recommended Plan; commitments to future work; and consultation.

Additional information about the Class EA process for Group 'B' projects is contained in the MTO Class EA (2000).

This TESR is being made available to the public, other interested parties and external agencies for a 30-day review as required under the MTO Class EA. A Notice of Completion was placed as a digital newspaper advertisement on www.northumberlandnews.com for two weeks as the previously used newspapers are no longer in circulation, and letters were mailed and/or emailed to notify government agencies, stakeholders, Indigenous Communities and members of the public on the Project Team's mailing list.

All comments and concerns should be sent directly to Darren Cizmar at the Ontario Ministry of Transportation (MTO).

Darren Cizmar, Project Manager
Ministry of Transportation – Project Delivery East
1355 John Counter Boulevard, P.O. Box 4000
Kingston, Ontario K7L 5A3
Email: project-team@Highway401colbornebrighton.ca

In addition, a Section 16 Order request, previously known as a Part II Order 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 an individual/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 the 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 an individual/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 both:

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

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

Requests should also be sent to Darren Cizmar, MTO by mail or by e-mail.

Further information on requests for orders under Section 16 of the EA Act is available on the MECP website at: https://www.ontario.ca/page/class-environmental-assessments-section-16-order.

3.0 TRANSPORTATION NEEDS AND OPPORTUNITIES

3.1 Existing Operations

Highway 401 through the Study Area is a four-lane divided freeway with a design speed of 120 km/h (RFD120). The median varies between a 10 m closed median and a 30 m open median. The lane, centre median, and shoulder widths are detailed in **Section 7.1.1**. There are three roads crossing over Highway 401 within the Study Area, Herley / Durham Road, Lake Road, and County Road 26, which are further detailed in **Section 7.1.2**, **Section 7.1.3**, and **Section 7.1.4**, respectively.

3.2 Transportation Needs and Opportunities

3.2.1 Transportation Needs

Highway 401 through Colborne and Brighton was originally constructed in the 1950s and 1960s. Highway 401 is a critical component of the provincial highway network and is one of Ontario's most important transportation facilities in terms of commuter and commercial trade traffic, spanning from Ontario's border with the United States at Windsor in the west, to the Ontario-Quebec border in the east. Highway 401 also plays a key role as a tourist /

transit corridor route and provides access to significant tourist and recreational destinations. Thus, it is important the infrastructure of this critical provincial link be sustained and improved to current standards.

Highway 401 was constructed within the study corridor in the 1950s with two lanes in each direction. Since its construction, no significant capacity improvements have been made to the freeway. The original infrastructure is aging, and this includes the three underpass structures and four structural culverts within the Study Area. These structures are nearing the end of their service lives and will require (major) rehabilitation and/or replacement in the coming years.

3.2.2 Opportunities

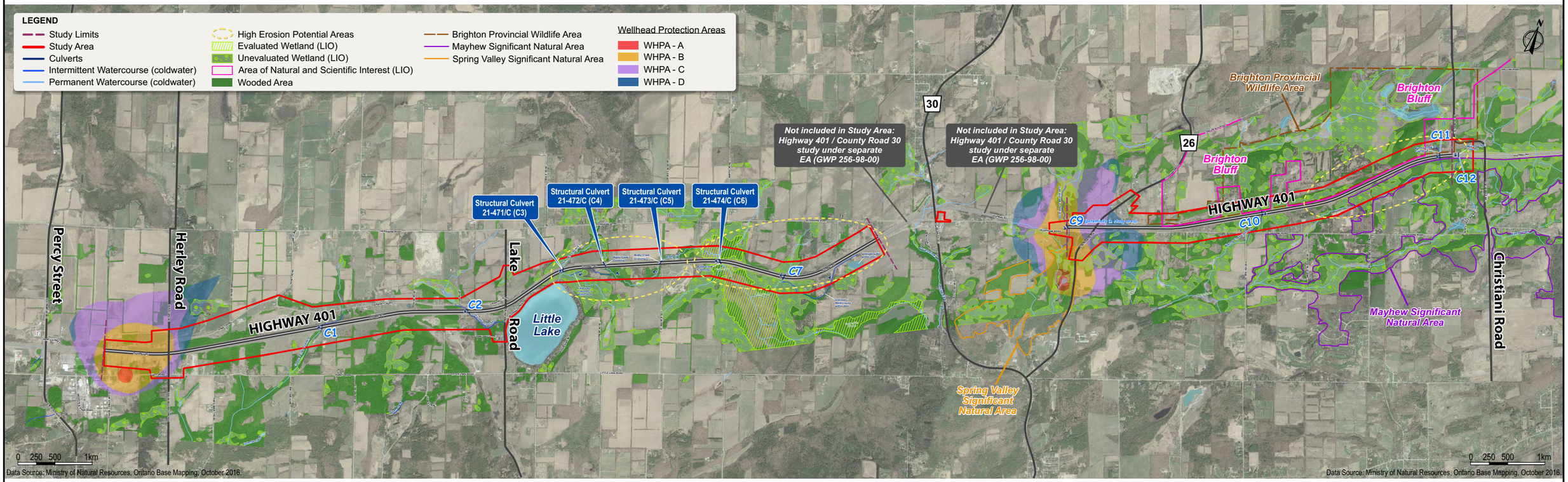
The study has assessed the structural needs and replacement strategies of the existing Highway 401 structures and potential improvements to existing highway geometry. As structures have a lifespan of 75 years, it is necessary to ensure that the structures can accommodate future Highway 401 expansion. As such, there is a need to identify the footprint of a widened Highway 401 to ensure that the proposed design permits the network to keep operating efficiently into the future. Given the current traffic growth projections, traffic volumes will continue to grow; therefore, widening of Highway 401 to six lanes in the interim, with the ultimate widening of the highway to eight lanes in the future, is required.

4.0 EXISTING CONDITIONS

The following sections provide an overview of the existing features within the Study Area, including Natural Environment (**Section 4.1**), Socio-Economic Environment (**Section 4.2**), Cultural Environment (**Section 4.3**), and Technical Consideration (**Section 4.4**). Information presented in this chapter was developed based on secondary source information, correspondence with regulatory agencies (including but not limited to the Ontario Ministry of Natural Resources and Forestry (MNRF), the Ontario Ministry of the Environment, Conservation and Parks (MECP), and the Study Team's own field investigations.

4.1 Natural Environment

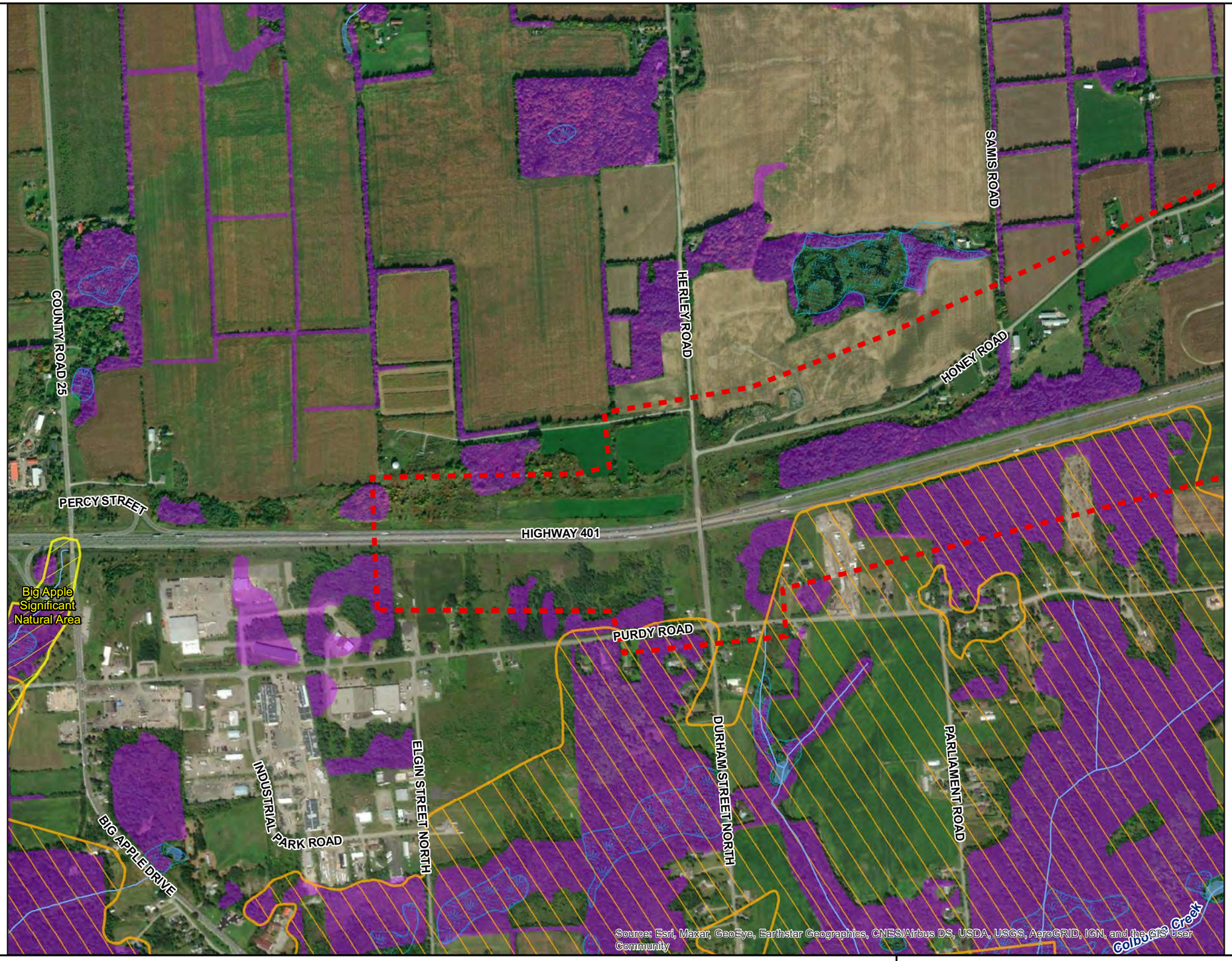
The existing natural environment features located within the Study Area are illustrated in **Exhibit 4-1**. More specifically, the terrestrial existing conditions are shown in **Exhibit 4-2** to **Exhibit 4-8**. The Environmental Reference for Highway Design (2013) outlines the protocols followed by the environmental specialists. Generally, the Study Area for most environmental specialities is defined as within the existing and proposed ROW, and adjacent lands for 120 m. Where an environmental speciality defined the Study Area differently, it is outlined in the appropriate sub-sections.



Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Environmental Existing Conditions

Exhibit
4-1



N
W
E
S

Legend

- Study Area
- Watercourse (LIO)
- Natural Heritage System Area (LIO)
- Natural Area - approximate (Lower Trent Conservation)
- Unevaluated Wetland (LIO)
- Wooded Area

250 125 0 250 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

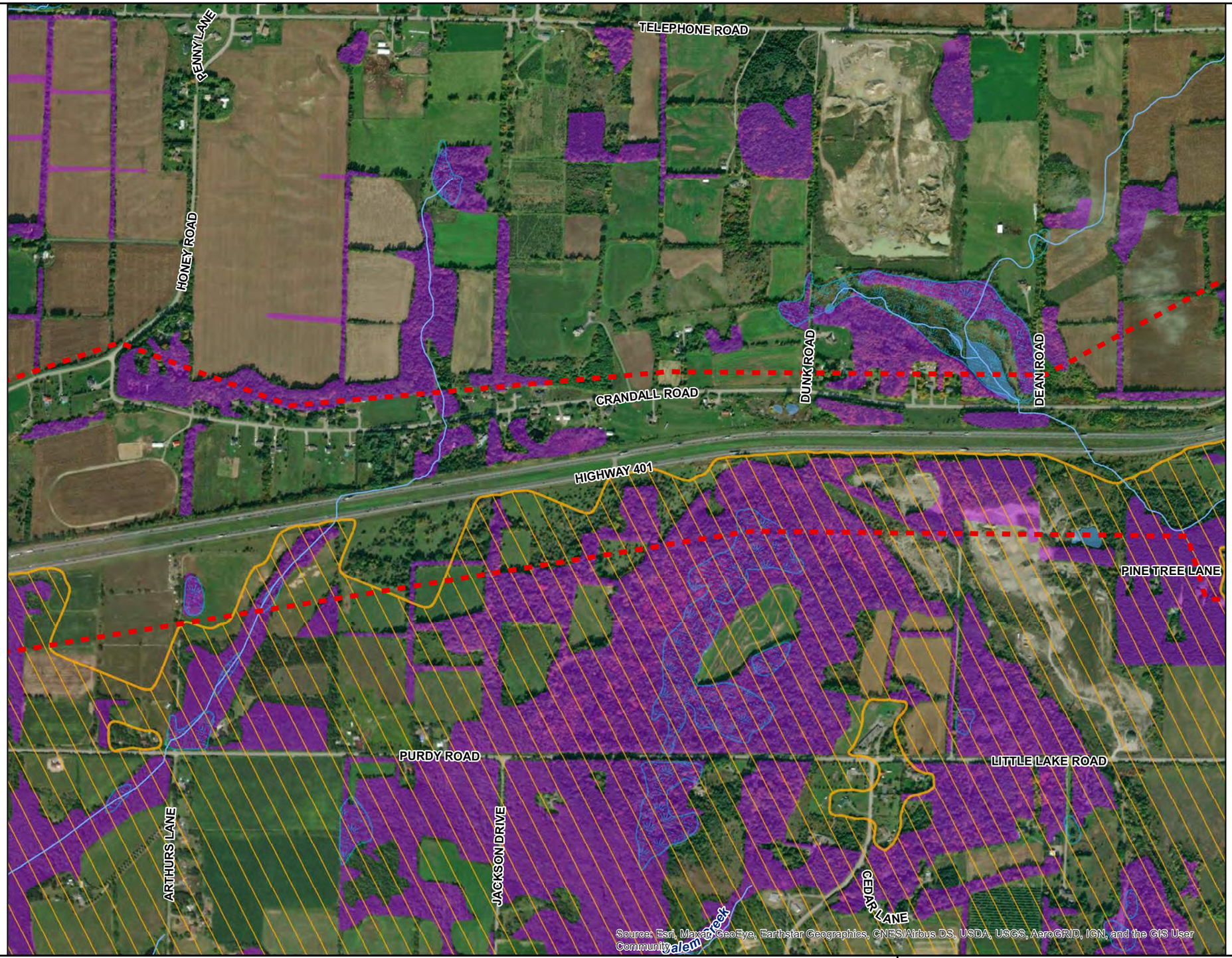
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Terrestrial Existing Conditions

Exhibit
4-2



N
W
E
S

Legend

- Study Area
- Watercourse (LIO)
- Natural Heritage System Area (LIO)
- Unevaluated Wetland (LIO)
- Wooded Area

250 125 0 250 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

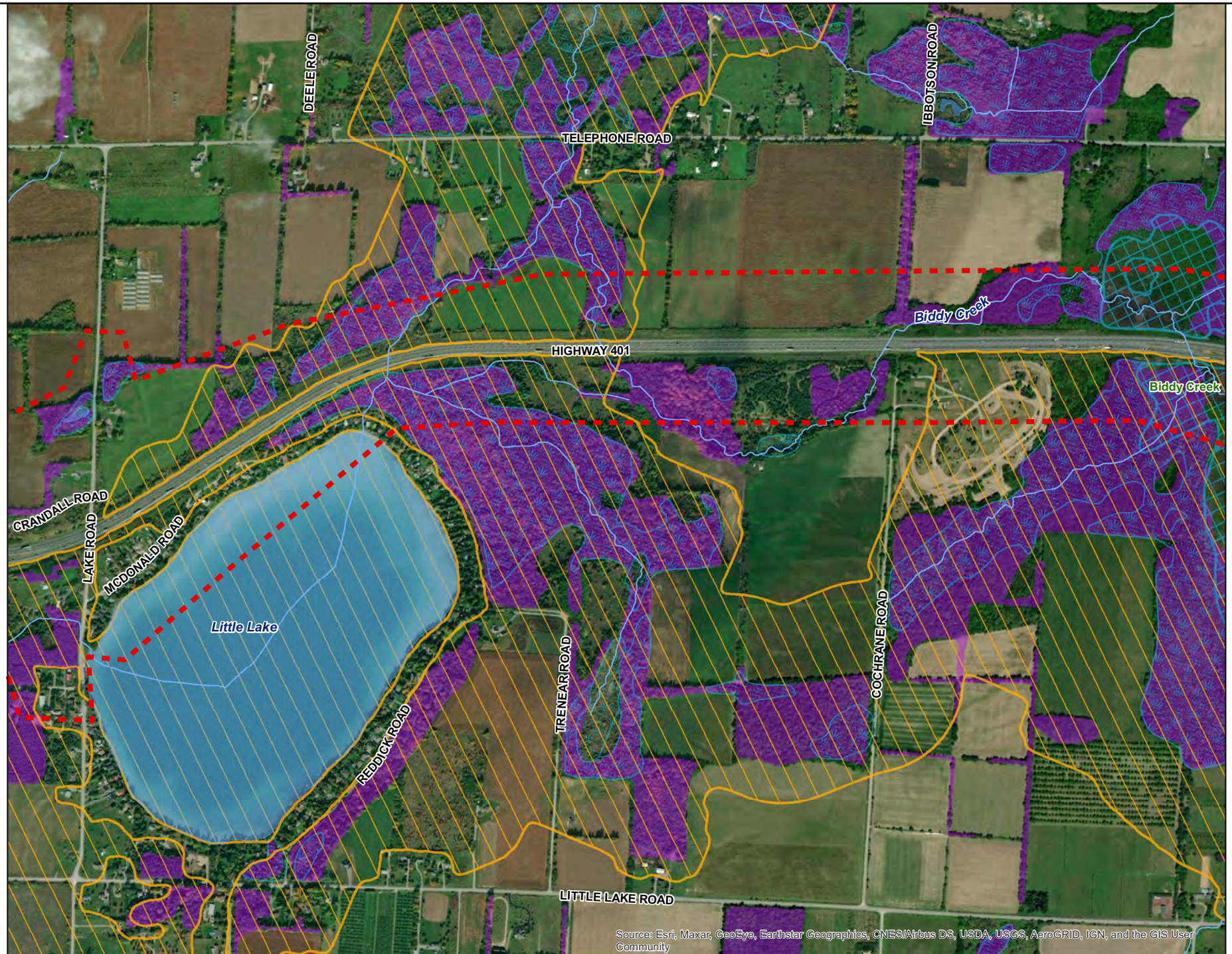
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Terrestrial Existing Conditions

Exhibit
4-3



N
W
E
S

Legend

- Study Area
- Watercourse (LIO)
- Natural Heritage System Area (LIO)
- Evaluated Wetland (LIO)
- Unevaluated Wetland (LIO)
- Wooded Area

250 125 0 250 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

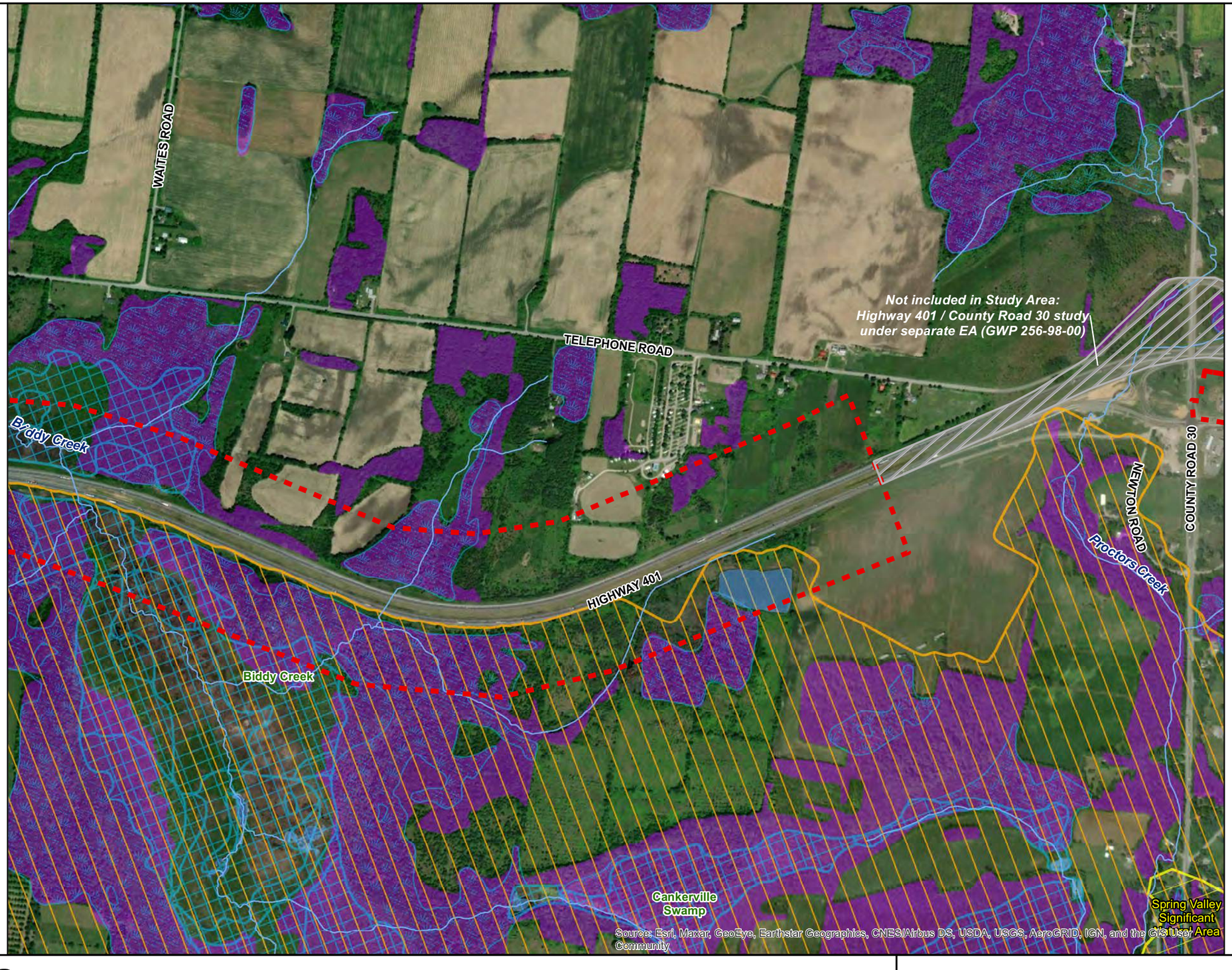
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Terrestrial Existing Conditions

Exhibit
4-4



N
W
E
S

Legend

- Study Area
- Watercourse (LIO)
- Natural Heritage System Area (LIO)
- Natural Area - approximate (Lower Trent Conservation)
- Evaluated Wetland (LIO)
- Unevaluated Wetland (LIO)
- Wooded Area

250 125 0 250 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

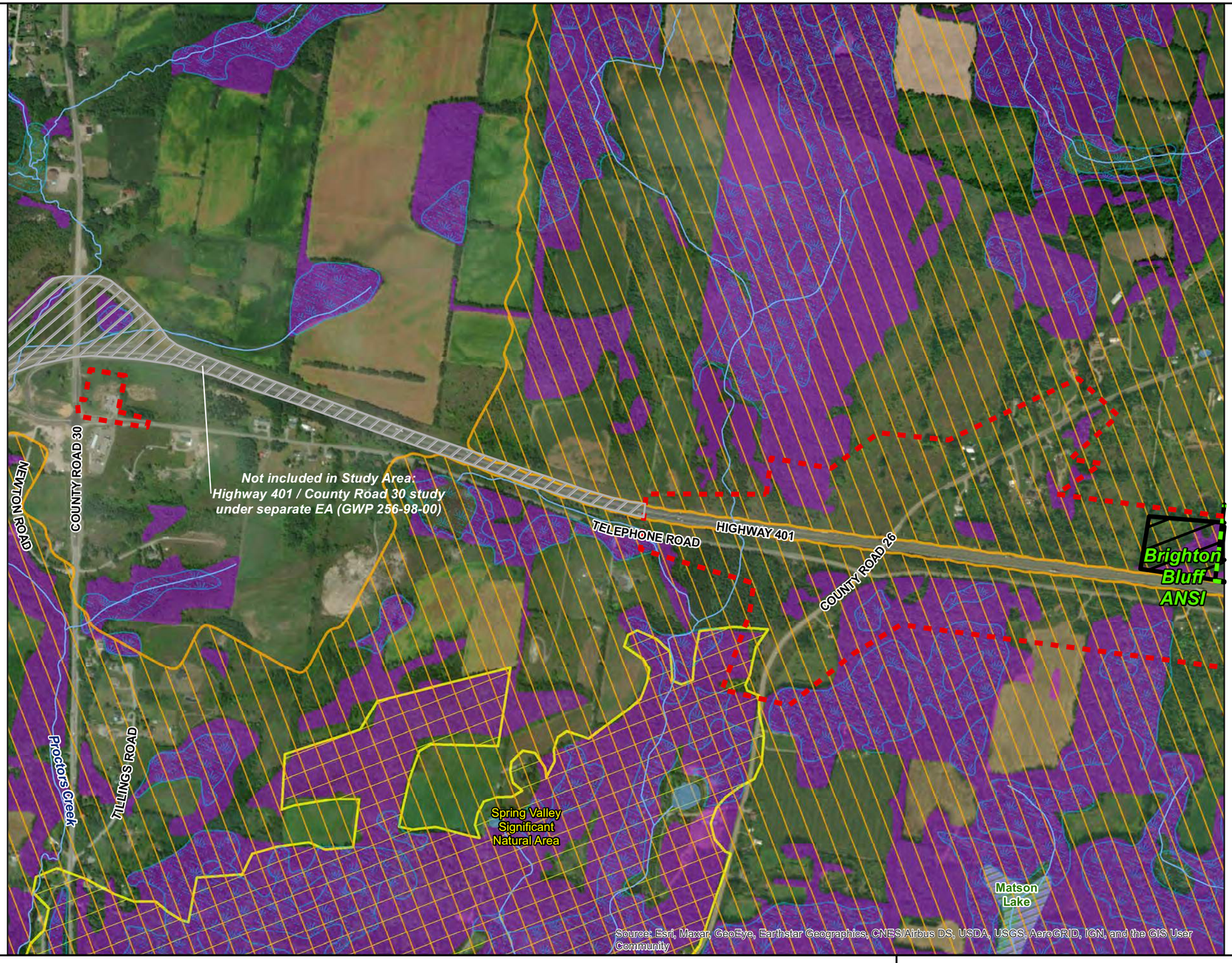
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Terrestrial Existing Conditions

Exhibit
4-5



N
W
E
S

Legend

- Study Area
- Area of Natural and Scientific Interest (LIO)
- Watercourse (LIO)
- Natural Heritage System Area (LIO)
- Natural Area - approximate (Lower Trent Conservation)
- Brighton Provincial Wildlife Area
- Provincially Significant Wetland (LIO)
- Unevaluated Wetland (LIO)
- Wooded Area

250 125 0 250 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

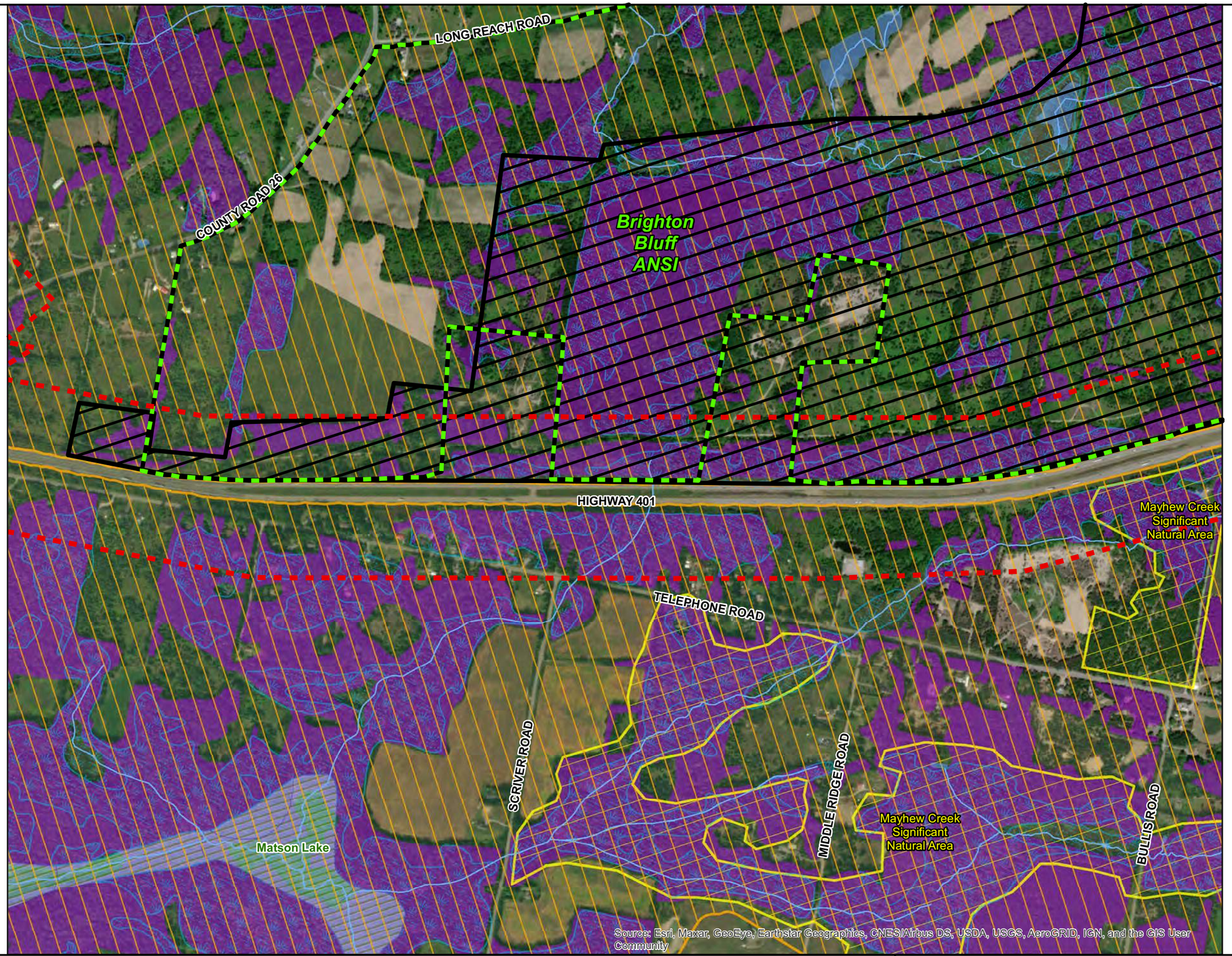
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Terrestrial Existing Conditions

Exhibit
4-6



Legend

- Study Area
- Area of Natural and Scientific Interest (LIO)
- Watercourse (LIO)
- Natural Heritage System Area (LIO)
- Natural Area - approximate (Lower Trent Conservation)
- Brighton Provincial Wildlife Area
- Provincially Significant Wetland (LIO)
- Unevaluated Wetland (LIO)
- Wooded Area

250 125 0 250 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

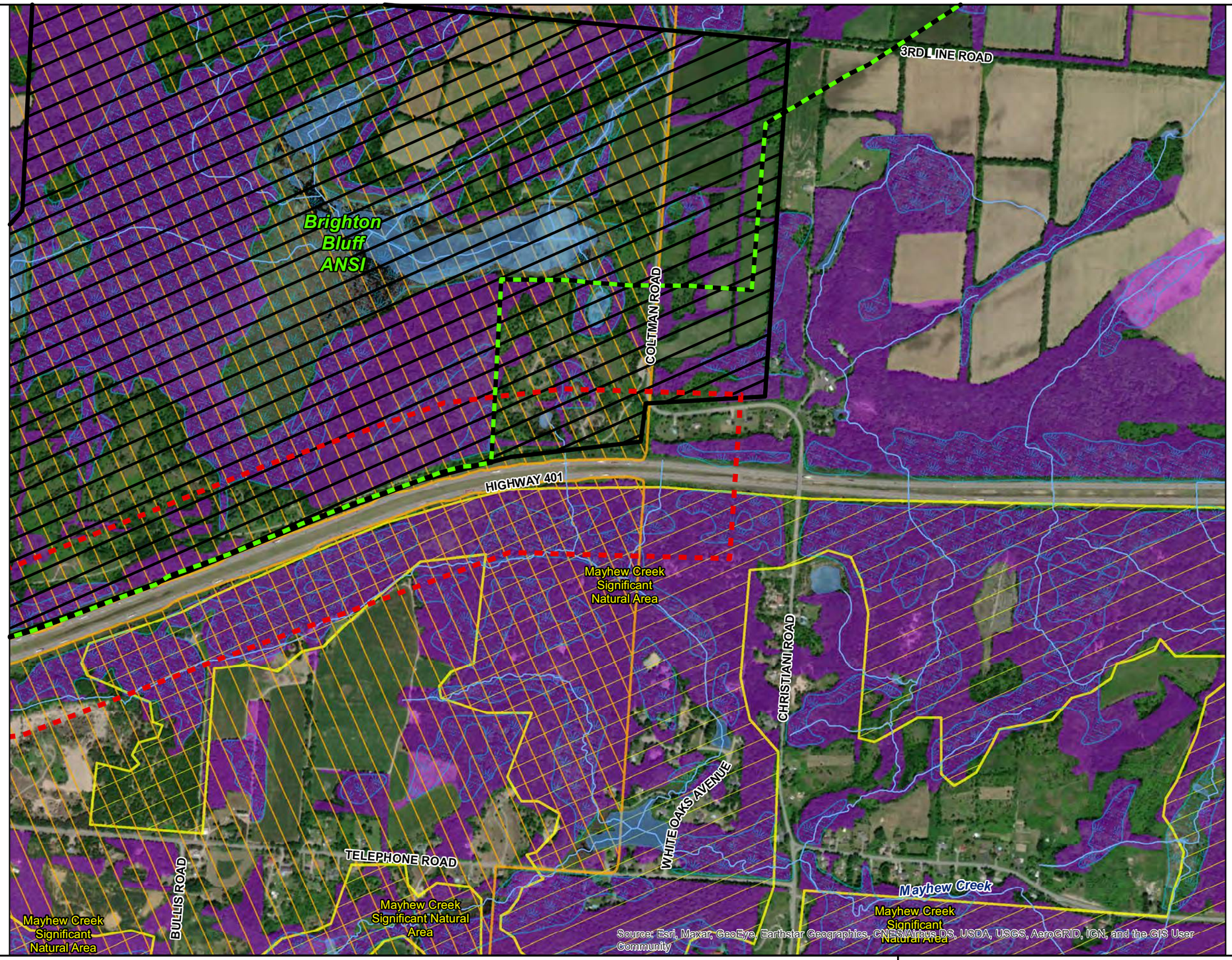
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Terrestrial Existing Conditions

Exhibit
4-7



N
W
E
S

Legend

- Study Area
- Area of Natural and Scientific Interest (LIO)
- Watercourse (LIO)
- Natural Heritage System Area (LIO)
- Natural Area - approximate (Lower Trent Conservation)
- Brighton Provincial Wildlife Area
- Unevaluated Wetland (LIO)
- Wooded Area

250 125 0 250 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Terrestrial Existing Conditions

Exhibit
4-8

4.1.1 Designated Natural Areas

"Designated Natural Areas" include evaluated wetlands (including both Locally Significant [LSW] and Provincially Significant Wetlands [PSW]), Natural Heritage Features (NFH), Environmentally Sensitive Areas/Environmental Protection Areas, Provincial Parks, Conservation Reserves, and Areas of Natural and Scientific Interest (ANSI).

A summary is provided in **Exhibit 4-9** below.

Exhibit 4-9: Summary of Natural Heritage Features

Feature	Present	Comment
Significant ANSI	Yes	Brighton Bluff is a provincially significant earth science ANSI at the eastern side of the study limit. The south limit of the ANSI abuts the ROW limit on the north side of the highway for most of its length along the highway.
Habitat for Threatened and Endangered Species	Yes	Using online database, it was found that 23 bird species, one insect species, three herpetile species and one plant species could occur in the Study Area.
Significant Wetlands	No	No Provincially Significant Wetlands were found in, or immediately adjacent to the Study Area.
Significant Wildlife Habitat (SWH)	Yes	Based on field study results show confirmed SWH for two criteria: Special Concern and Rare Wildlife Species – Eastern Wood-pewee, Monarch and Snapping Turtle; and Woodland Area-Sensitive Bird Breeding Habitat – Black-throated Green Warbler, Ovenbird, Red-breasted Nuthatch and Veery. Candidate (unconfirmed) SWH was identified for seven criteria.
Significant Woodland	Yes	Along the length of the Study Area including deciduous, coniferous, and mixed forest types. These woodlands were found to be of significant size (>2 ha) were in a rural to low-density residential setting and had a continuous canopy.

4.1.2 Vegetation

Field investigations were conducted on June 7-10, 2021, and included identifying vegetation communities and delineating them on aerial photography. The vegetation communities were classified and described using the Ecological Land Classification (ELC) for Southern Ontario (Lee et al. 1998).

Natural vegetated areas within the Study Area include Coniferous Forest, Mixed Forest, Deciduous Forest, Coniferous Swamp, Mixed Swamp, Deciduous Swamp, Thicket Swamp, Shallow Marsh and Meadow Marsh. Cultural Woodland, Cultural Savannah, Cultural Thicket and Cultural Meadow vegetation types are primarily composed of introduced species or non-native weed species that are often associated with recently disturbed sites (e.g., residential areas, industrial sites, fallow agricultural lands, road ROWs). Areas with species that demonstrate anthropogenic influence are generally found within the highway ROW and in areas that are used recreationally for campgrounds, off-road vehicle usage and pedestrian trails.

Three potential Butternuts (*Juglans cinerea*) (END) were identified during the field surveys. One specimen was documented along Crandall Road, north of Highway 401. A second specimen was recorded within the Lake

Road ROW adjacent to the Maple Mineral Deciduous Swamp type north of Crandall Road. The third individual was noted within the Brighton Provincial Wildlife Area and was observed at the edge of the Dry – Fresh Oak – Maple – Hickory Deciduous Forest type. Further information is provided in **Section 4.1.5**. The locations of the three Butternut specimens are shown in the ELC figures in the Terrestrial Ecosystem Existing Conditions and Impact Assessment Report (**Appendix B**).

Based on Vegetation Community List (NHIC 2016), the vegetation community types observed are considered common in Southern Ontario. A description of vegetation community findings and a list of recorded vascular plants are presented in the Terrestrial Ecosystem Existing Conditions and Impact Assessment Report (**Appendix B**).

4.1.3 Wildlife

4.1.3.1 Wildlife Habitat

Field investigations were completed on June 7-10, 2021. Habitats in the Study Area including forests, meadows and marshes have the potential to support a variety of wildlife that are tolerant of human landscapes. Areas beyond the ROW or adjacent to the Study Area generally provide greater opportunities for more sensitive wildlife including forest interior bird species. A list of wildlife species recorded for the project is found in the Terrestrial Ecosystem Existing Conditions and Impact Assessment Report (**Appendix B**).

4.1.3.2 Avifauna

In total, 56 bird species were recorded during the June 7-10, 2021, terrestrial field investigations As the majority of observations and listening for bird calls was conducted from the ROW, noise from road traffic on the highway was a barrier to the full complement of bird species that may have been present. The majority of these bird species are common in Ontario and expected within the broader landscape surrounding the Study Area. Seven avifauna Species of Conservation Concern (SCC) (including Species at Risk [SAR]) were recorded during the breeding bird period.

- **Species at Risk:** Three SAR were recorded:
  - Barn Swallow (*Hirundo rustica*) (Special Concern) – four individuals were observed foraging over horse pastures with adjacent barns in the area of Honey/Crandall Road intersection (**Appendix B**);
  - Eastern Meadowlark (*Sturnella magna*) (Threatened) – two singing males in potential breeding habitat (**Appendix B**); and
  - Eastern Wood-pewee (*Contopus virens*) (Special Concern) – two individuals recorded; one male singing within the forest on Lake Road and one male singing in Brighton Wildlife Area (**Appendix B**).
- **Area Sensitive Species (Ecoregion 6E (MNRF 2015)):**
  - Black-throated Green Warbler (*Setophaga virens*)– one individual recorded in the vicinity of Cochrane Road adjacent to the ROW (**Appendix B**);
  - Ovenbird (*Seiurus aurocapilla*) – one individual recorded in the CUP3-2 unit at 660 Purdy Road (**Appendix B**);
  - Red-breasted Nuthatch (*Sitta canadensis*) – one individual recorded in the small White Cedar Forest (FOC4) at Purdy Road, just west of Durham Street North (**Appendix B**); and

- Veery (*Catharus fuscescens*) – one individual recorded in the SWT2-1 unit (thicket swamp) in the vicinity of the Biddy Creek culvert crossing (**Appendix B**).

In their correspondence, the MNRF identified that the breeding bird season for the area of the project is April 15 – July 31.

4.1.3.3 Mammals

During the field investigations, eight mammal species were recorded. Eastern Chipmunk (*Tamias striatus*), Eastern Cottontail (*Sylvilagus floridanus*), Grey Squirrel (*Sciurus carolinensis*), and Red Squirrel (*Tamiasciurus hudsonicus*) were observed in the forested areas. Feeding evidence of Beaver (*Castor canadensis*) was observed near creek crossings. Raccoon (*Procyon lotor*) tracks were identified along the highway ditches and culverts. Coyote (*Canis latrans*) and White-tailed Deer (*Odocoileus virginianus*) scat and tracks were identified along trails and forested areas. All are common to the area and not SCC.

Although not confirmed during the field surveys, several other common mammal species are likely to occur within the Study Area based on presence of suitable habitat features, including Muskrat (*Ondatra zibethicus*), Striped Skunk (*Mephitis mephitis*) and Virginia Opossum (*Didelphis virginiana*). Also, a number of small mammals often go undetected (e.g., bats, mice, moles etc.)

4.1.3.4 Reptiles And Amphibians

No targeted surveys were completed for herpetofauna. However, during the field investigations, two (2) roadkill reptile species were confirmed in the Study Area:

- Snapping Turtle (*Chelydra serpentina*): One deceased Snapping Turtle was observed dead on the north shoulder of the highway at C3 – Little Lake Tributary 2 (**Appendix B**).
- Midland Painted Turtle (*Chrysemys picta marginata*): Three individuals were observed deceased. And one alive. One individual was observed dead on the road shoulder at the SWT2-1 unit at the Biddy Creek crossing. Two hatchlings were observed dead on a trail at Brighton Wildlife Area and one live turtle was observed in the vicinity of Crandall Road/Dunk Road intersection and may use the pond habitat between Crandall Road and Highway 401 (**Appendix B**).

Eastern Gartersnake (*Thamnophis sirtalis sirtalis*) and Grey Treefrog (*Hyla versicolor*) were also observed. Based on the background information review and habitat assessment, the following additional herpetofauna species are likely to occur in suitable wetland or forest edge / meadow habitats within the Study Area: American Toad (*Anaxyrus americanus*), Northern Leopard Frog (*Lithobates pipiens*), Spring Peeper (*Pseudacris crucifer*) and Wood Frog (*Lithobates sylvaticus*).

Wet ditches, meadows and forest habitats adjacent to the highway ROW may provide potential habitat for herpetiles. The creeks, waterbodies and wetlands provide suitable habitat for amphibians and turtles. Furthermore, turtles may attempt to nest along the gravel zones between the paved shoulder and vegetated ditches, or in agricultural fields or other open disturbed sites within proximity to aquatic features. However, no evidence of turtle nesting was observed.

In their correspondence, the MNRF identified general critical periods for the protection of turtles.

These are:

- Active Season: April 15 – October 15

- Hibernation: October 15 – April 15
- Mating: April, September, and October, but may occur at any time of year, including during hibernation
- Nesting: May 15 – June 30; lasts about 3 weeks each year
- Hatching: August 15 – September 30
- Dispersal/Migration: April 15 – May 15; September 1 – September 30

4.1.3.5 Other Wildlife

Six insect species were observed during the field surveys: including one SAR, Monarch (*Danaus plexippus*; Special Concern in Ontario). Two Monarchs were observed foraging at the Brighton Wildlife Area, one individual at 248 Cochrane Road and one individual in the CUM1-1 unit near the west project limit. All of the insect species are common in Ontario and expected within the broader landscape surrounding the Study Area.

4.1.3.6 Wildlife Movement Assessment and Opportunity

An assessment of wildlife movement within the Study Area was carried out to identify if there was evidence of locations where wildlife was crossing the highway and where suitable conditions may occur that would support and provide opportunity for wildlife to move across the highway including a provision for a new structure for wildlife passage beneath the highway (see **Appendix B**).

Field investigations carried out in 2020 and 2021 did not identify any evidence of concentrated wildlife activity/presence (foraging, staging, trails and scat) at the highway ROW and in adjacent habitat where access has been granted. Some wildlife mortality was observed (raccoon, turtles, small birds) during the investigations but there was no strong evidence of locations where wildlife were attempting to cross the highway. A review of locations of vehicle/wildlife collisions (assumes wildlife is white-tailed deer, coyote, red fox) indicated some concentration in the vicinity of the Brighton Provincial Wildlife Area at the east end of the project area as well as an area in the vicinity of Lake Road. A total of 34 vehicle/wildlife collision locations were identified for the assessment.

There are four structural culverts that cross beneath the highway. All are associated with watercourses. Based on their size and openness ratio and that their passage function is largely aquatic in nature it was identified that 3 of the 4 culverts could support turtle passage with some opportunity for medium sized mammals to use during the period of lowest water level. There are 35 non-structural drainage culverts that do not support wildlife movement opportunity due to their small opening and great length.

Opportunities to provide wildlife passage using white-tailed deer as the target wildlife group were examined. The larger sized culvert required for deer passage (3 m tall x 3 m wide) would likely support passage for smaller mammals. Factors that were considered for possible passage locations included evident patterns of wildlife mortality in attempting to cross the highway, physiographic conditions such as valley lands that would provide physical space to locate a culvert and supporting habitat on either side of the highway. Based on this, there were no locations that were suitable to locate a dedicated wildlife culvert and the low frequency of vehicle/wildlife collisions that ranged from 1-2 per year would not warrant the need for a wildlife culvert.

4.1.4 Significant Wildlife Habitat

Based on field survey results, significant wildlife habitat (SWH) was confirmed for two criteria:

- Special Concern and Rare Wildlife Species
  - Eastern Wood-pewee, Monarch and Snapping Turtle were recorded within the Study Area.
- Woodland Area-Sensitive Bird Breeding Habitat
  - Black-throated Green Warbler, Ovenbird, Red-breasted Nuthatch and Veery were recorded as probable breeders within the Study Area as males were observed singing.

In addition, candidate (unconfirmed) SWH was identified for seven criteria:

- **Bat Maternity Colonies** – Observations of potential cavity trees or characteristics such as peeling bark were recorded in the deciduous forested areas. Candidate SWH is present where mature Sugar Maple and other deciduous tree species with a diameter at breast height (DBH) >25 cm are present. No targeted snag surveys were conducted.
- **Marsh Breeding Bird Habitat** – Wetland habitats with varying water depths and emergent aquatic vegetation is present within the existing ROW and Study Area limit. No targeted marsh bird surveys were conducted.
- **Reptile Hibernaculum** – Rock piles and old stone fences were observed in the FOD5 unit at the west project limit and near Mayhew Creek Tributary that may go below the frost line. No targeted snake surveys were conducted.
- **Bald Eagle and Osprey Nesting, Foraging and Perching Habitat** – Super canopy trees were observed near Little Lake Tributary 2.
- **Amphibian Breeding Habitat (Woodland)** – Pools were observed within woodlands. No targeted amphibian breeding surveys were conducted.
- **Turtle Nesting Areas** – Candidate habitat is present adjacent to the marsh wetlands. SWH criteria are not definitive regarding exclusion of agricultural fields, but other man-made habitats are excluded (road embankments / shoulders). Active agricultural fields are less likely to provide successful nesting opportunities given frequent disturbance (e.g., ploughing, seeding, harvesting, soil compaction). No targeted surveys were conducted.
- **Deer Yarding or Wintering Area** – Through consultation with MNRF it was identified that there are no deer wintering areas within the Study Area. Due to the landscape mosaic of habitat types it is likely that deer wintering may occur in local woodlands.

4.1.5 Species-at-Risk and Species of Conservation Concern

The background information review generated a ‘long list’ of 33 potential Species-at-Risk (SAR). Those species that were considered to have at least some potential to occur in the vicinity of the Study Area were assessed for suitable habitat conditions.

Of the potential SAR, six species were confirmed within the ROW or on properties where access was granted:

- Barn Swallow (Special Concern) – Four birds were observed foraging. There are barns, bridges, culverts and other structures within the ROW for potential nesting.

- Butternut (Endangered) – Three butternut specimens were recorded. There is the possibility that they may be a hybrid species in which case the specimens would not be subject to the requirements of the *Endangered Species Act*. At the present time until hybridity can be determined they are identified as 'potential' butternuts.
- Eastern Meadowlark (Threatened) – Two adult males were heard singing adjacent to the Study Area. Throughout the Study Area there are meadows and agricultural lands that could be used for nesting and foraging.
- Eastern Wood-pewee (Special Concern) – Two adult males were heard singing. There are patches of deciduous forest habitat beyond the ROW that would be suitable for nesting.
- Monarch (Special Concern) – Four Monarch butterflies were observed. There is cultural meadow habitat with scattered patches of Milkweed throughout the Study Area and within the ROW for potential breeding.
- Snapping Turtle (Special Concern) – One adult turtle was observed dead on the highway shoulder. There are scattered creeks, wetlands and ponds for potential basking and breeding habitat. Movement beneath the highway may occur in some of the larger watercourse culverts with greater potential at locations where there are marshes for foraging and possible overwintering outside of the ROW.

4.1.6 Fish and Fish Habitat

A Fish and Fish Habitat Existing Conditions and Preliminary Impact Assessment Report (**Appendix C**) was prepared detailing the existing conditions of all watercourses / waterbodies within 30 m of Highway 401 within the current Study Area. There are 12 watercourse crossings of Highway 401 and one waterbody located within the Study Area. **Exhibit 4-10** below indicates the details regarding the location of the assessed water crossings, as well as the location of the proposed works within the Study Area.

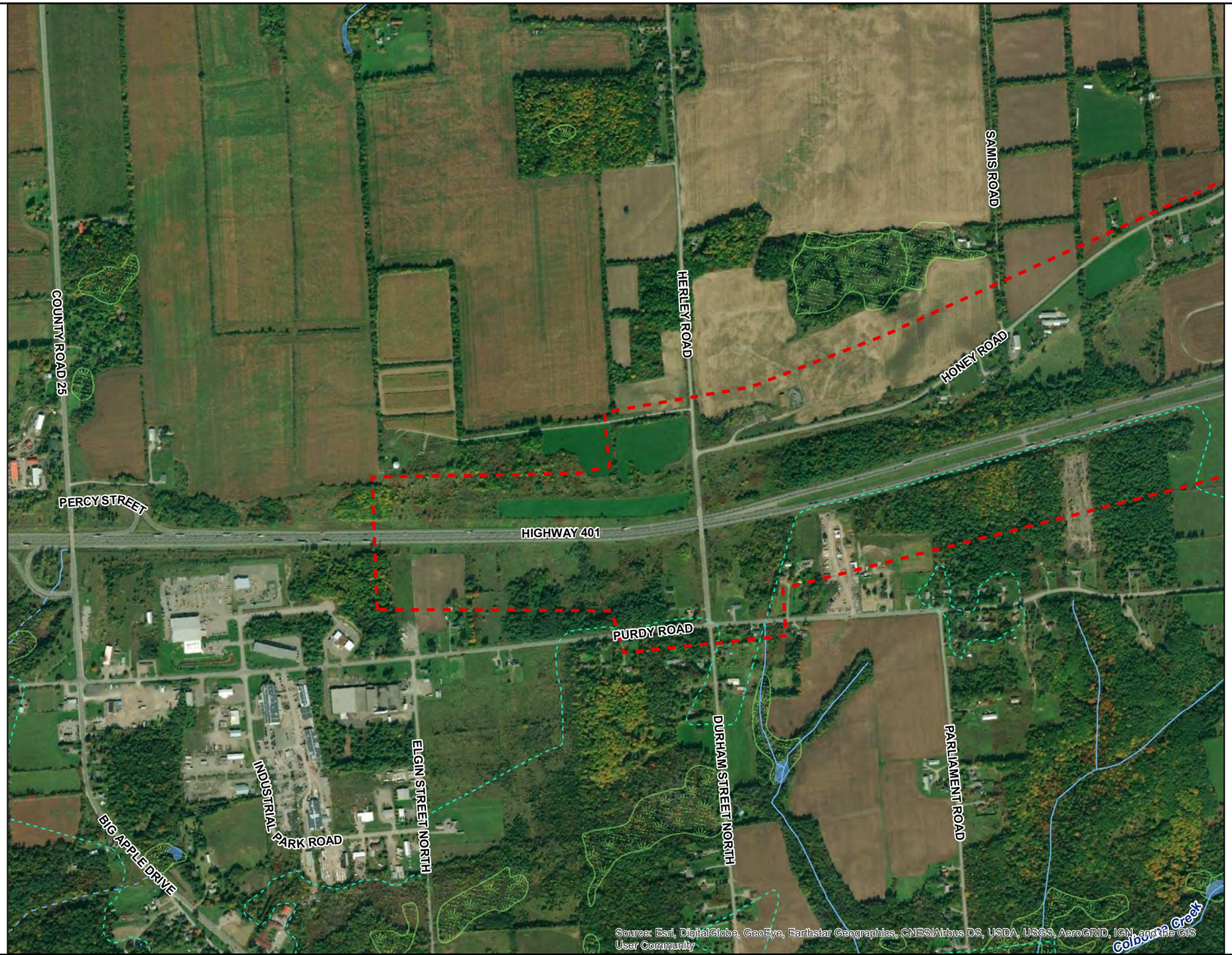
The purpose of the Fish and Fish Habitat Existing Conditions and Preliminary Impact Assessment Report is to use the fish habitat and fish community conditions collected through field data coupled with background data to provide fish and fish habitat sensitivities. The background data utilized included the following topographic maps, aerial photography, and Natural Resources Value Information System (NRVIS) and Natural Heritage Information Centre (NHIC) database information. Additionally, the MNRF – Peterborough District office was contacted in August 2020 requesting information on the existing conditions and community composition for the watercourses occurring within the study area. Specifically, the information request included any available information related to fish and fish habitat, sensitive or specialized habitat functions, or known / potential for use of the area by aquatic SAR. Based on MNRF recommendations, the permissible in-water construction timing window for all identified watercourses was assessed to be **July 1 to September 30** (no in-water work from October 1 – June 30) of any given year to protect the spring and fall spawning species. The permissible in-water construction timing window for the waterbody was assessed to be **July 1 to March 31** (no in-permissible in-water from April 1 – June 30).

The information presented will be used as a basis for design considerations to be carried forward in the full Fish and Fish Habitat Impact Assessment Report to be completed in Detail Design. The Fish and Fish Habitat Existing Conditions and Preliminary Impact Assessment Report has been conducted in accordance with the requirements of the MTO/DFO/MNRF Protocol for Protecting Fish and Fish Habitat on Provincial Transportation Undertakings – Version 4 (2020) (Protocol) and the associated guidance provided in MTO's Interim Environmental Guide for Fisheries (2020) (Fish Guide).

Exhibit 4-10: MTO Table Template D1: Location of Worktable

Waterbody ID	Culvert ID	Highway	Municipality	Location of watercourse (GPS Coordinates)
Colborne Creek Tributary	C1	401	Township of Cramahe	44°2’13.41”N, 77°51’34.76”W
Little Lake Tributary 1	C2	401	Township of Cramahe	44°2’40.56”N, 77°50’14.05”W
Little Lake Tributary 2	C3 / 21-471	401	Township of Cramahe	44°3’11.4”N, 77°49’28.8”W
Little Lake Tributary 3	N/A	401	Township of Cramahe	44°3’12.8”N, 77°49’19.5”W
Biddy Creek Crossing 1	C4 / 21-472	401	Town of Brighton	44°3’19.13”N, 77°49’5.48”W
Biddy Creek Crossing 2	C5 / 21-473	401	Town of Brighton	44°3’27.32”N, 77°48’34.14”W
Biddy Creek Crossing 3	C6 / 21-474	401	Town of Brighton	44°3’36.88”N, 77°48’0.61”W
Unknown watercourse	C7	401	Town of Brighton	44°3’39.39”N, 77°47’21.03”W
Unknown watercourse within 30 m	N/A	401	Town of Brighton	44°3’49.8”N, 77°46’53.5”W
Smithfield Creek Tributary	C9	401	Town of Brighton	44°5’12.38”N, 77°43’0.44”W
Mayhew Creek Tributary 1	C10	401	Town of Brighton	44°6’1.73”N, 77°41’29.46”W
Mayhew Creek Tributary 2	C11	401	Town of Brighton	44°6’4.79”N, 77°41’18.95”W
Mayhew Creek Tributary 3	C12	401	Town of Brighton	44°6’05.2”N, 77°41’19.1”W
Unknown Lake within 30 m	N/A	401	Town of Brighton	44°03’12.8”N, 77°49’19.5”W

For detailed descriptions of each watercourse / waterbody, refer to **Appendix C**. Fish and fish habitat constraints mapping is shown in **Exhibit 4-11** to **Exhibit 4-17**.



N
W
E
S

Legend

- Study Area
- Intermittent Watercourse (coldwater)
- Permanent Watercourse (coldwater)
- Natural Heritage System Area (LIO)
- Unevaluated Wetland (LIO)

250 125 0 250 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

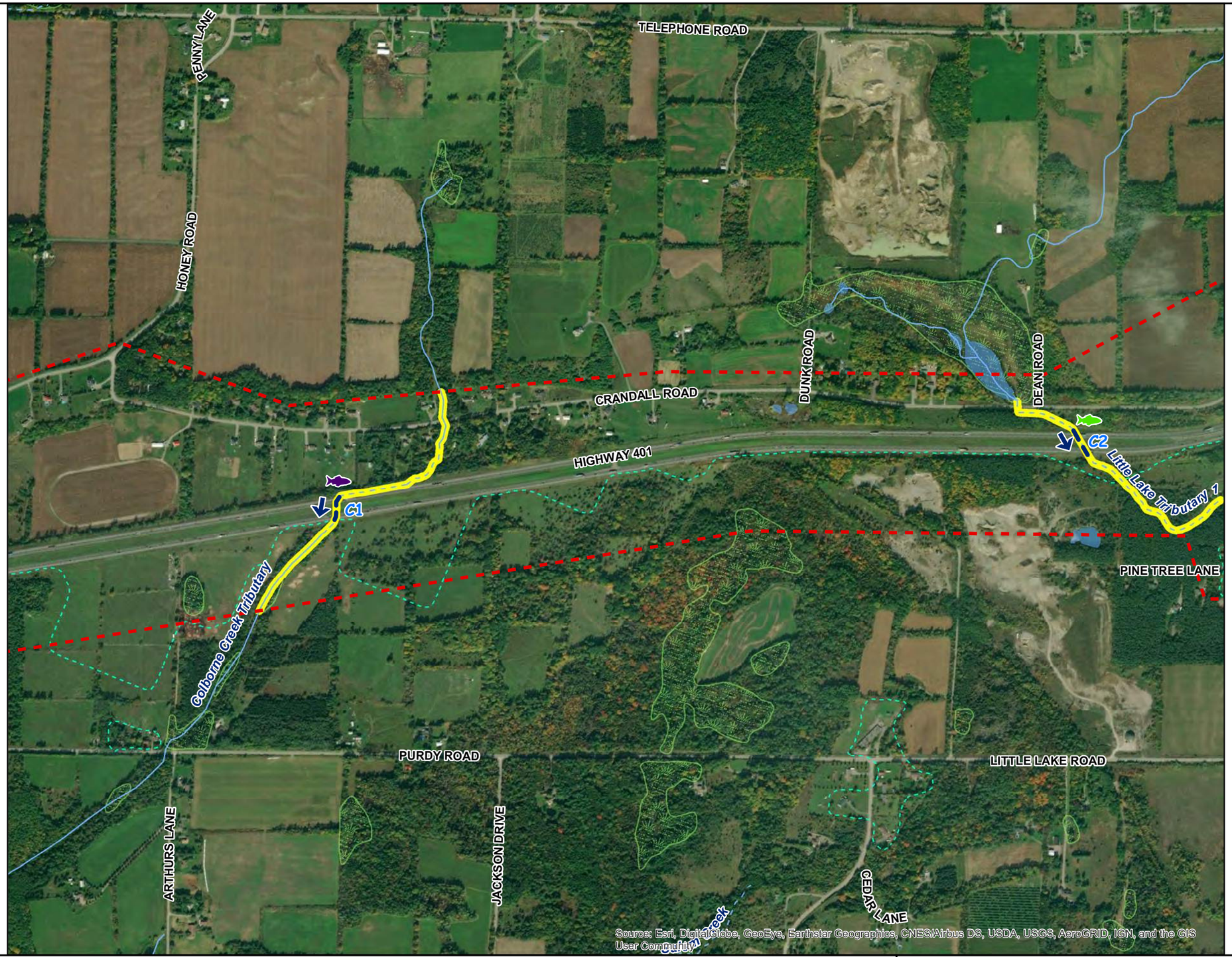
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Fish and Fish Habitat Constraints

Exhibit
4-11



N
W
E
S

Legend

- Flow Direction
- Culvert
- Study Area

Fish Habitat

- Indirect Fish Habitat
- Seasonally Direct Fish Habitat

Reach Sensitivity

- Low Sensitivity
- Intermittent Watercourse (coldwater)
- Permanent Watercourse (coldwater)
- Natural Heritage System Area (LIO)
- Unevaluated Wetland (LIO)

250 125 0 250 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

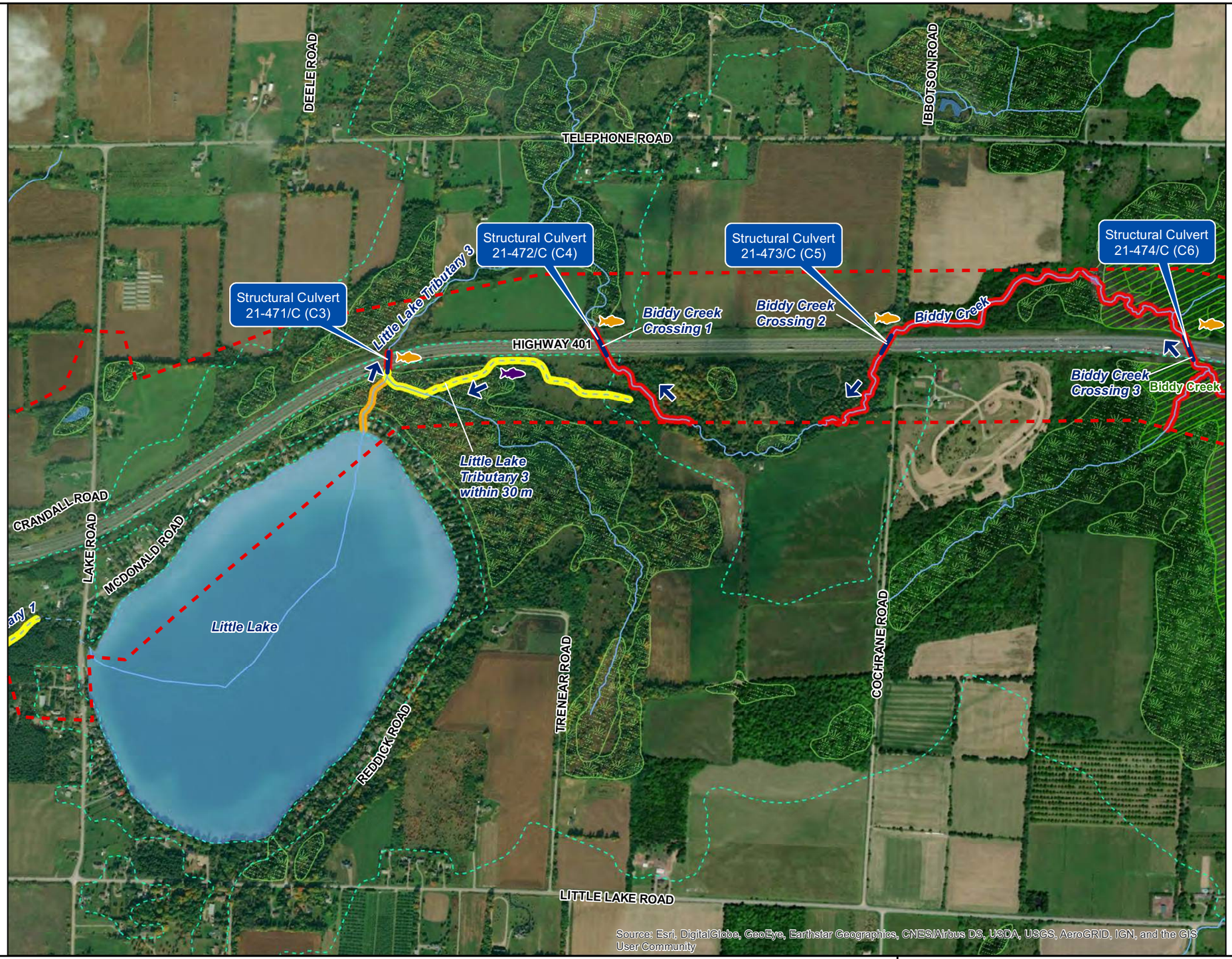
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Fish and Fish Habitat Constraints

Exhibit
4-12



Legend

- Flow Direction
- Culvert
- Study Area

Fish Habitat

- Direct Fish Habitat (confirmed)
- Indirect Fish Habitat

Reach Sensitivity

- High Sensitivity
- Moderate Sensitivity
- Low Sensitivity
- Permanent Watercourse (coldwater)
- Natural Heritage System Area (LIO)
- Evaluated Wetland (LIO)
- Unevaluated Wetland (LIO)

250 125 0 250 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

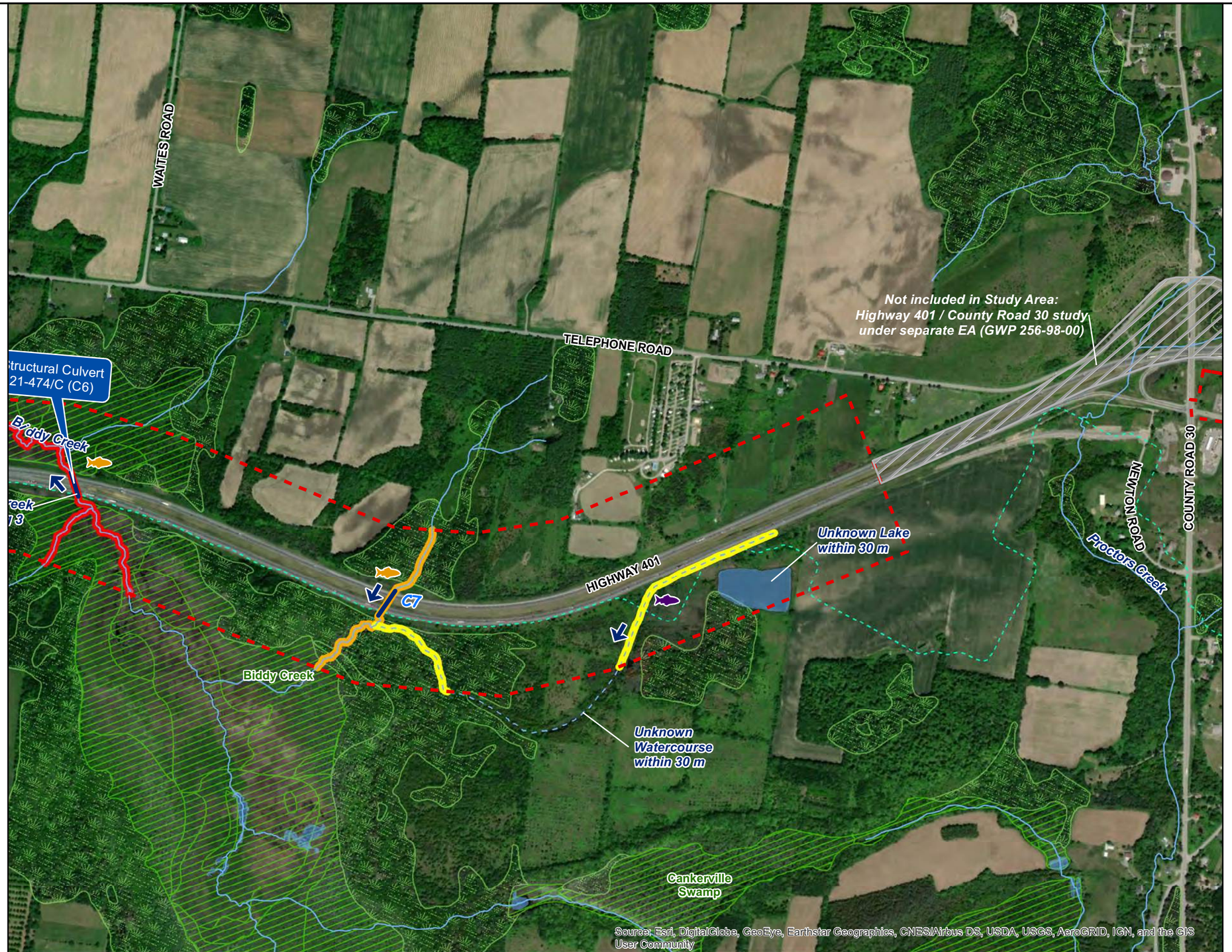
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Fish and Fish Habitat Constraints

Exhibit
4-13



N
W
E
S

Legend

- Flow Direction
- Culvert
- Study Area

Fish Habitat

- Direct Fish Habitat (confirmed)
- Indirect Fish Habitat

Reach Sensitivity

- High Sensitivity
- Moderate Sensitivity
- Low Sensitivity
- Permanent Watercourse (coldwater)
- Natural Heritage System Area (LIO)
- Evaluated Wetland (LIO)
- Unevaluated Wetland (LIO)

250 125 0 250 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

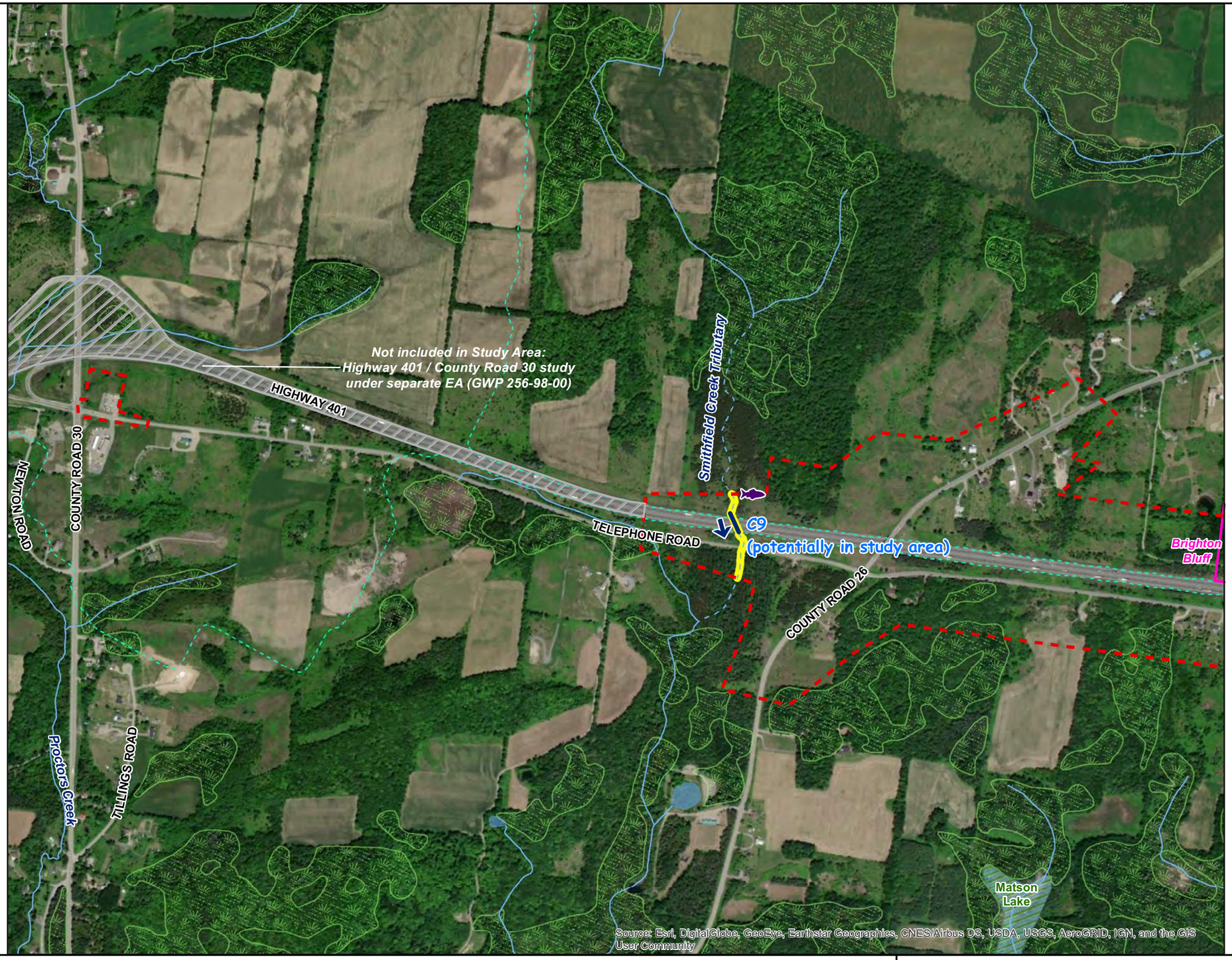
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Fish and Fish Habitat Constraints

Exhibit
4-14



N
W
E
S

Legend

- Flow Direction
- Culvert
- Study Area

Fish Habitat

- Indirect Fish Habitat

Reach Sensitivity

- Low Sensitivity
- Area of Natural and Scientific Interest (LIO)
- Permanent Watercourse (coldwater)
- Natural Heritage System Area (LIO)
- Provincially Significant Wetland (LIO)
- Unevaluated Wetland (LIO)

250 125 0 250 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

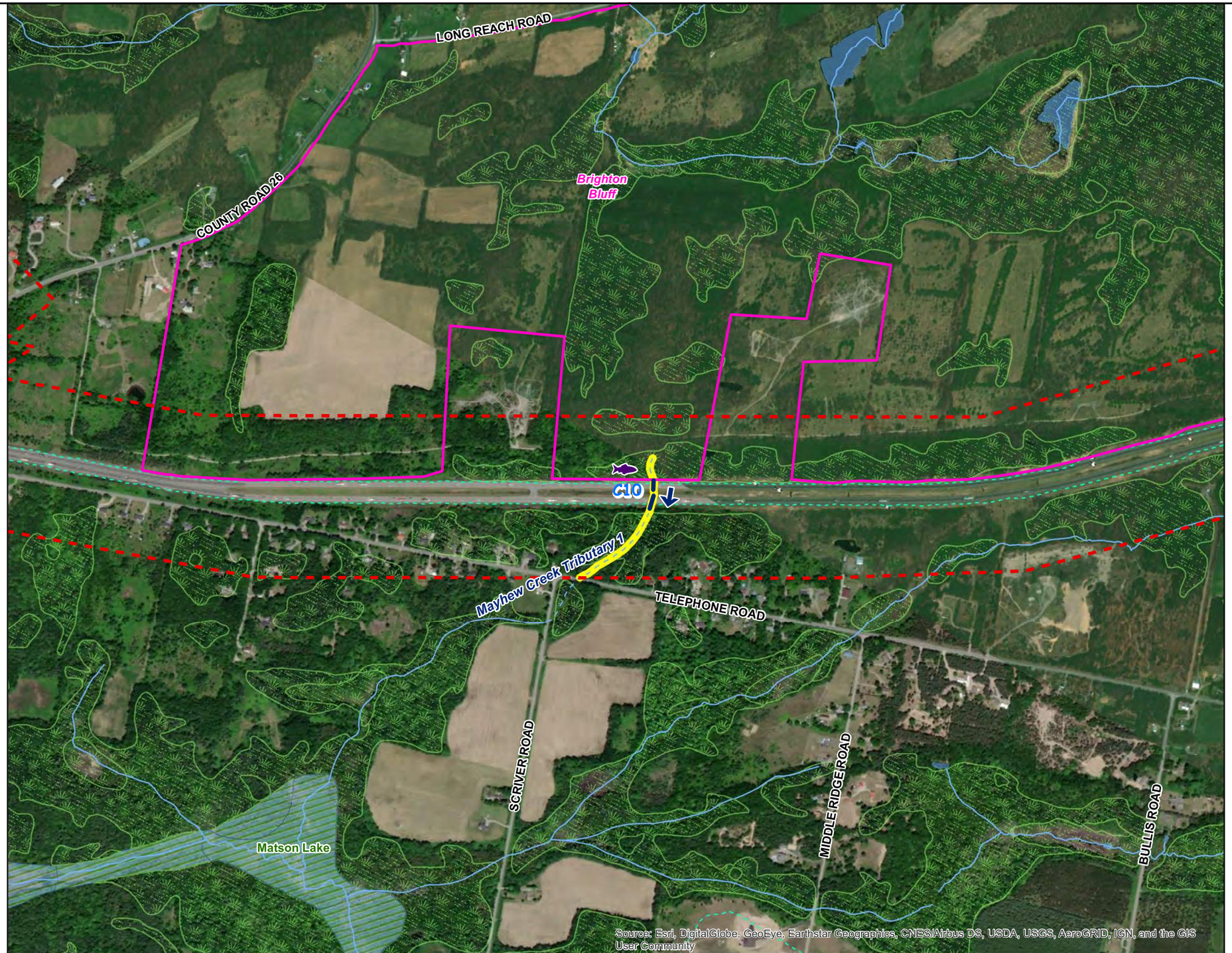
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Fish and Fish Habitat Constraints

Exhibit
4-15



N
W
E
S

Legend

- Flow Direction
- Culvert
- Study Area

Fish Habitat

- Indirect Fish Habitat

Reach Sensitivity

- Low Sensitivity
- Area of Natural and Scientific Interest (LIO)
- Permanent Watercourse (coldwater)
- Natural Heritage System Area (LIO)
- Provincially Significant Wetland (LIO)
- Unevaluated Wetland (LIO)

250 125 0 250 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

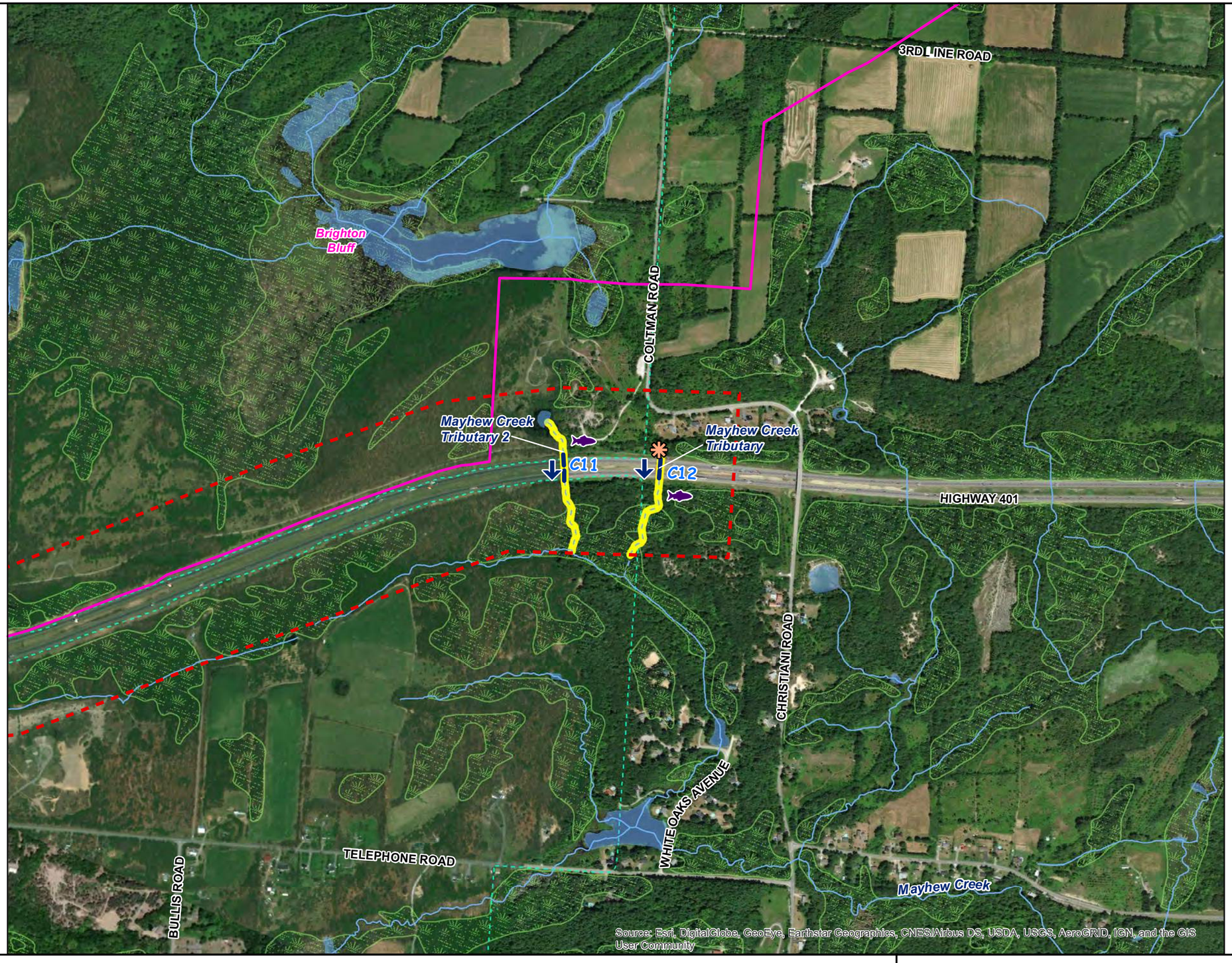
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Fish and Fish Habitat Constraints

Exhibit
4-16



N
W
E
S

Legend

- Catch Basin
- Flow Direction
- Culvert
- Study Area

Fish Habitat

- Indirect Fish Habitat

Reach Sensitivity

- Low Sensitivity
- Area of Natural and Scientific Interest (LIO)
- Permanent Watercourse (coldwater)
- Natural Heritage System Area (LIO)
- Unevaluated Wetland (LIO)

250 125 0 250 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Fish and Fish Habitat Constraints

Exhibit
4-17

4.1.6.1 Aquatic Species-at-Risk

MNRF provided an aquatic SAR review which indicated that there is one potential record of aquatic SAR, Bridle Shiner (*Notropis bifrenatus*) (SARO status: Special Concern, SARA status: Special Concern) occurring in Colborne Creek. This species does not receive species or habitat protection under the ESA (2007) or SARA (2002). The Department of Fisheries and Oceans Canada (DFO) aquatic SAR mapping was assessed on November 11, 2020 and did not indicate any potential presence of federally listed SAR or critical habitat to be present in the study area. MECP did not identify any additional aquatic species or SAR present within the study area.

4.1.7 Drainage and Stormwater Management

A Drainage and Stormwater Management Report was prepared in support of this project and is available in **Appendix D**.

The Study Area contains several water bodies including a tributary of Colborne Creek (west portion of the Study Area), Little Lake and Biddy Creek (central portion of the Study Area), and a tributary of Proctors Creek (east portion of the Study Area). The inferred water flow is south, towards Lake Ontario.

The Study Area is located within the jurisdiction of the Lower Trent Conservation (LTC). According to “The Hydrogeology of Southern Ontario” (Singer et al. 2003), the LTC is part of the Trent River Drainage Basin and overburden is characterized by thin overburden in the northern portion, and thicker overburden in the southern part of the basin.

The overburden within the basin consists of glacial, glaciofluvial and glaciolacustrine sediments of Pleistocene age with alluvial and swamp deposits of Recent age. Overburden wells account for 17,982 of the wells within the basin and are identified to be an important source of water supply.

The Trent River Drainage Basin bedrock is characterized by the Lindsay Formation, which consists of fine to coarse grained limestone with undulating shales (Rowell & Gao 2010). There are 26,541 bedrock wells within the basin, indicating that both the bedrock and overburden are important sources of water supply (Singer et. al., 2003).

There are 42 culverts in the Study Area, four of them are structural culverts and the rest are non-structural culverts. Catchment areas were delineated for each culvert under existing conditions using contour maps covering the Study Area. Existing drainage mosaics shows the location of the existing structural and non-structural culverts and their catchment delineation (see **Appendix D**).

Hydrologic modelling was completed for existing conditions to simulate the hydrologic responses of the drainage areas during the design storm. It calculated runoff characteristics during different return periods for the catchment area contributing to each culvert. Further details on this assessment are provided in the Drainage and Stormwater Management Report (**Appendix D**).

A HEC-RAS model was used to analyze the structural culverts while a CulvertMaster model was used for the non-structural culverts. The 50-year storm was used as the design storm and the 100-year storm was used as a check storm for all culverts with a span less than 6 m. The hydraulic analysis involved the comparison of the headwater elevation and the elevation at which water would spill onto the highway. This comparison will determine if the existing culvert meets the freeboard and flood depth design criteria.

There is a total of five existing non-structural culverts that do not meet the design criteria under existing conditions:

- Culverts 0019, 0015, 0056, 0014 and 0057 in Cramahe Township.

Hydraulic analysis for each existing structural culverts was completed and below are the following results:

- Culvert 471: proposed to be replaced under the proposed conditions as a result of the highway widening. The structural culvert is also reaching the end of it's designed life span.
- Culvert 472: proposed to be replaced under the proposed conditions as a result of the highway widening.
- Culvert 473: proposed to be replaced under proposed conditions as a result of the highway widening. The structural culvert is also reaching the end of it's life span.
- Culvert 474: proposed to be replaced under proposed conditions as a result of the highway widening. The structural culvert is also reaching the end of it's life span.

Existing storm sewer assessment was completed using rainfall intensities for the 10-year design and the catchment areas of each catch basin. The existing runoff from Highway 401 within the Study Area flows towards the grassed median and side ditches. When a concrete median is present instead of a grassed median, runoff flowing towards the medium will be collected through existing catch basins and conveyed to an outlet through existing storm sewers. The outlets discharge to the outer ditches of the highway. **Appendix D** shows the existing storm sewer catchment areas. Each drainage areas includes the eastbound westbound lane contribution to the catch basins. Catchments 530, 535 and 540 drains towards an outlet that is outside the project limits.

4.1.8 Groundwater

A Groundwater Assessment Report (GAR) (**Appendix E**) was completed in support of this project to broadly characterize the local hydrogeological conditions within the Study Area and provide hydrogeological input to the project's preliminary design by completing a desktop review and an inspection of the Study Area. The GAR divides the project Study Area into two Study Areas. Study Area A includes Highway 401 from approximately 800 m east of Big Apple Drive to 890 m east of County Road 30. The carpool lot immediately south of Highway 401 and east of County Road 30 off Telephone Road is included in Study Area A (i.e., east of County Road 30 interchange). Study Area B includes the stretch of Highway 401 located approximately 1.5 km east of County Road 30 to approximately 150 m east of Christiani Road (i.e., west of County Road 30 interchange).

Current land uses in the Study Areas are a mix of natural areas, open space, rural residential, and light commercial/industrial use.

Tributaries of Colborne Creek, Biddy Creek, and Proctors Creek, in addition to Little Lake, are present in Study Area A. Tributaries of Proctors Creek, Smithfield Creek, and Mayhew Creek are present in Study Area B.

4.1.8.1 Source Water Protection Areas

Study Areas A and B are both located in the Lower Trent Source Protection Area (SPA; MECP, 2020a). Source Protection Areas (SPAs) were established under the *Clean Water Act* (2006) by Ontario Regulation (O. Reg.) 284/07. The *Clean Water Act* focusses on protecting municipal residential and designated private drinking water sources from water quantity and water quality threats. Source Protection Plans (SPP) are policies developed to manage, prevent or eliminate significant threats to drinking water quality and identify who is responsible to take corrective action (Trent Conservation Coalition Source Protection Region, 2014).

The Trent Source Protection Area includes the Crowe Valley, Kawartha-Haliburton, Lower Trent and Otonoabee-Peterborough Source Protection Areas, covering an area of approximately 12, 900 km2. Approximately 43% of the population of the Trent Source Protection Area is served by 46 municipal residential drinking water systems, which include 31 groundwater systems and 15 surface water systems.

Drinking water systems in the larger Trent Conservation Coalition Source Protection Region include municipal systems of varying sizes, drawing water from both groundwater and surface water sources. Municipal residential drinking water systems are owned and/or operated by municipalities and serve residential developments. Small municipal residential systems serve fewer than 101 private residences, and large municipal residential systems serve more than 100 private residences (Trent Conservation Coalition Source Protection Region, 2014).

Vulnerable areas are delineated around water intakes, based on the area of land and water that contributes source water to a drinking water system intake within a specified distance, period of flow time, and/or watershed area and within which it is desirable to regulate or monitor drinking water threats (see **Exhibit 4-1**).

Intake protection zones (IPZ) are those delineated around surface water intakes. An IPZ-1 is the area closest to the intake pipe and is considered the most vulnerable area for surface water intakes due to its proximity to the intake. An IPZ-2 acts as a secondary protective zone that generally extends upstream of the IPZ-1. The IPZ-2 is defined as the area within and around a surface water body that may contribute water to an intake within a time of travel of 2 hours (the time determined by water treatment plant operators to be sufficient to responding to a contamination event). An IPZ-3 is a protective zone where early warning activities such as monitoring may be effective and is defined as the area within each surface water body that may contribute water to the associated intake.

There are no IPZ-1 and IPZ-2 within the Study Areas A and B; the closest IPZ-1 and IPZ-2 are located approximately 18 km west of Study Area A and 10 km east of Study Area B. An IPZ-3 is present in the central portion of Study Area A and eastern portion of Study Area B (see **Exhibit 4-1**; MECP 2020a).

Wellhead Protection Areas (WHPA) are those delineated around groundwater wells and are based on the length of time it takes for water to move from the ground surface underground to the well. WHPA-A is the area within a 100-m radius from the wellhead and is considered the most vulnerable for groundwater intakes. WHPA-B is the area within which the time of travel within the aquifer to the well is up to and including 2 years (not including WHPA-A). WHPA-C is the area where travel time to the well is up to and including 5 years (not including WHPA-B and WHPA-A) and WHPA-D is the area where travel time is up to and including 25 years (not including WHPA-C, WHPA-B and WHPA-A; Trent Conservation Coalition Source Protection Region, 2014).

The Colborne Supply Wells are located approximately 300 m south of Highway 401 off Purdy Road and east of Big Apple Drive in Study Area A (see **Exhibit 4-1**). There is a WHPA-A around the two wells, with WHPA-B, WHPA-C and WHPA-D delineated to the north of the wells. In Study Area B, there is a WHPA-A around three wells at the Brighton Well Supply Field, approximately 600 m south of Highway 401 on the west of County Road 26. WHPA-B, WHPA-C and WHPA-D are delineated to the north of the well field (see **Exhibit 4-1**).

4.1.8.2 MECP Water Well Records

The review of the Ministry of the Environment, Conservation and Parks (MECP) water well records (WWRs) indicates that the Study Area A is underlain by a layer of topsoil, ranging in thickness from 0.30 to 1.83 m. Underlying the topsoil, there is a layer of clay ranging from 1.82 to 3.05 meters below the ground surface (mbgs) or elevations of 180.0 to 161.9 meters above sea level (masl). A sand lens is present within the clay layer with a

thickness of 0.9 to 3.7 m. Layers of alternating silty clay and sandy silt till are present from depths 3.7 to 93.2 mbgs (172.00 to 113.69 masl). Topsoil is present in Study Area B, with a varying thickness of 0.2 to 1.2 m. Alternating layers of sandy silt and clayey silt till are present from 1.2 to 68 mbgs (elevations of 179.90 to 103.92 masl; MECP 2020b).

A search of the MECP Water Well Information System (WWIS) identified 223 records of water wells present within Study Area A. The well records were obtained through an MECP database search (December 2020).17 of the wells were listed as abandoned or altered. Of The remaining 206 well locations, eight wells were identified to exhibit flowing artesian conditions (MECP, 2020b). Detailed well records are included in Appendix A of the GAR (**Appendix E**).

A search of the MECP WWIS identified 69 records of water wells present within Study Area B. The well records were obtained through an MECP database search (December 2020). Seven of the wells were listed as abandoned. The remaining 62 well locations, two wells were identified to exhibit flowing artesian conditions (MECP, 2020b). Detailed well records are included in Appendix A of the GAR (**Appendix E**).

4.1.8.3 Permits To Take Water

Under Section 34 of the *Ontario Water Resources Act* (OWRA), the MECP requires ground and/or surface water users who are taking higher volumes of water (>50,000 L/day) to obtain a Permit to Take Water (PTTW) or Environmental Activity and Sector Registry (EASR). There are two active PTTWs in Study Area A. In Study Area B, there is one active PTTW (MECP, 2020c). Details can be found in **Exhibit 4-18** below.

Exhibit 4-18: Summary of 2020 PTTW Records

Permit Number	Study Area	Permit Holder Name	Purpose	Expiry Date	Source	Maximum L/day
1418-B6BMSH	A	Fidelity Engineering and Construction Inc.	Dewatering Construction	December 20, 2020	Ground Water	5,124,500
8612-BNENBH	A	The Corporation of the Township of Cramahe	Municipal	April 6, 2030	Ground Water	3,283,200
3210-9P3LCQ	B	The Corporation of the Municipality of Brighton	Water Supply	October 15, 2024	Ground Water	2,151,360

4.1.8.4 Water Well Survey

To evaluate the impacts of construction activities related to replacement / rehabilitation of structures to groundwater users in the Study Areas, a water well survey was completed between October 5 and 28, 2020. The water well survey included carrying out well survey interviews via phone and collecting water samples for participating well owners in the Study Areas A and B. In total, 11 properties were visited in the Study Areas. Interviews were carried out at six properties where seven wells were present. Water levels were measured at five wells during well surveys since not all wells were accessible or in use at the time of the survey work.

The groundwater sampling results have shown that three out of six wells have concentration of sodium above the 20 mg/L, a health-related parameter for people on sodium restricted diets. Presence of Total Coliform bacteria was identified in the well water at two properties. The presence of bacteria in water may be due to a combination of well maintenance issues and well head conditions.

Residents reported water quality issues for hardness, iron, and presence of sediment at two properties.

The majority of residents interviewed indicated that their wells had enough water for their needs. Property owners at one property noted that they would like for their well to provide more water for their supply needs.

4.1.9 Fluvial Geomorphology

A Fluvial Geomorphology Assessment was conducted in support of this project and is available in **Appendix F**.

The Study Area is located in a rural area with natural areas, watercourses, and wetlands, interspersed by residential and agricultural uses. There are four structural culvert replacements proposed in the Study Area, all of which convey the Biddy Creek. The surficial geology of the Study Area consists of foreshore basinal deposits with modern alluvial deposits, organic deposits, littoral foreshore deposits, and stone-poor, carbonate-derived silty to sandy till. The Study Area's topography ranges from 175 masl to 225 masl.

The approach to the fluvial geomorphology assessment included a review of fisheries, drainage, and hydrology assessments, obtaining historical aerial images to create a composite figure of watercourse alignments, completing a site visit and Rapid Geomorphic Assessment (RGA) form, reviewing relevant guidance documents, completing a 100-year erosion rate assessment, and a meaner belt assessment.

4.1.9.1 Fluvial Geomorphology Assessment

Channel width was estimated from aerial imagery of the Study Area collected for the years 1929 to 2018. Since 1929, the Study Area has remained a rural setting with natural and agricultural uses. The Highway 401 corridor was added to the Study Area between 1948 and 1962. Based on the composite (**Exhibit 4-19**), the watercourse channel has been fairly consistent between 1929 and 2018 with some slight fluctuations within an approximately 50m width.

During the site visit on June 9th, 2021, the composition of the watercourse stream bed was recorded and consisted of clay and silt, sand, gravel, cobbles, and boulders. Wetted and bankfull measurements were also taken. Wetted widths and depths ranged from 1 m to 5.3 m and 0.03 m to 0.9 m, respectively. Bankfull widths and depths ranged from 1.8 m to 6.3 m and 0.1 m to 1 m, respectively. Both streambed composition and wetted and bankfull measurements made during this site visit were comparable to the results of the Fisheries Assessment. A Rapid Geomorphic Assessment was also conducted which found that all culverts were found to be in regime, except for the downstream culvert south of Highway 401, Culvert 21-473, which was classified as transitional. No excessive erosion was observed during field inspections.

Lateral (extension) and down-valley (translation) 100-year erosion rates were calculated based on the methodology presented in the Toronto Region Conservation Authority's Crossing Guidelines for Valley Corridors (2015). Erosion rates were measured for four meanders due to the close proximity of the four water crossings. The lateral migration values ranged from approximately 17 m to 32 m and the down-valley migration values ranged from approximately 42 m to 60 m. Based on these findings, the 100-year extension / translational erosion rate for the watercourse at the four structural culverts was determined to be 39 m.

A meander belt assessment was completed in accordance with Parish Geomorphic (2004) Belt Width Delineation Procedures – Accurate Quantification I for a simple meander pattern in a partially confined valley setting. Based

on the figure of compiled aerial imagery outlining the watercourse (**Exhibit 4-19**), the meander belt and meander axis was outlined. Using the Parish Geomorphic (2004) equation for when no change in hydrology is anticipated, and the meander belt is greater than 50 m to calculate the final belt width. From the compiled aerial imagery, the average belt width was determined to be 71 m with the exclusion of some outliers. Based on the maximum field bankfull widths ranging from 1.8 m to 7 m, the calculated average field bankfull width is 4.4 m and observed no shift in the belt axis from the historical aerial assessment. The final belt width for the watercourse at the four structural culverts was determined to be 75 m.

N
W E
S

LEGEND

- CULVERT
- 2018 WATERCOURSE
- 2004 WATERCOURSE
- 1995 WATERCOURSE
- 1987 WATERCOURSE
- 1976 WATERCOURSE
- 1967 WATERCOURSE
- 1962 WATERCOURSE
- 1948 WATERCOURSE
- 1929 WATER COURSE

0 145 290 580
METRES

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
1. BASEMAP: NATIONAL AIRPHOTO LIBRARY
2. COORDINATE SYSTEM: NAD 1983 UTM ZONE 18N

Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Compiled Historical Watercourses

Exhibit
4-19

4.1.10 Air Quality

An Air Quality Impact Assessment (AQIA) Report was prepared in support of this Project and is available in **Appendix G**. The background air quality in the Study Area has been described by considering regional concentrations based on publicly available historical ambient air monitoring data and represents the existing conditions of air quality before the implementation of the proposed Project. Sources contributing to the existing air quality conditions include industrial activities, roadways, long-range transboundary air pollution, and small regional sources.

Based on existing ambient data presented in **Appendix G**, the existing air quality is good as the air quality criteria, with the exception of Benzo(a)pyrene (B(a)P), are met for the indicator contaminants selected for this assessment. The available background B(a)P data is limited and is consistent with levels founds across Ontario (Tevlin et al. 2020).

4.1.10.1 Sensitive Receptors

As outlined in the MTO Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Project (May 2020) (MTO Guide), sensitive receptors within 500 m of the preferred alternative were identified in the assessment. The area surrounding the Project is comprised primarily of rural residential, agricultural and open space land use types. Residential receptor areas (on both the south and north sides within 500 m of the preferred alternative) have been identified within the Study Area of the Project, as shown in **Exhibit 4-20**.

Exhibit 4-20: Location of Surrounding Receptors

4.1.10.2 Surrounding Industrial And Commercial Facilities

Nearby industrial facilities have the potential to impact existing air quality conditions surrounding the Study Area. A review of National Pollutant Release Inventory (NPRI) data from 2021, which corresponds to the latest available year with data that has been quality assured by ECCC (Environment and Climate Change Canada), indicates that no major facilities have been identified within the 5 km of Study Area which may contribute to existing air quality conditions. Additional facilities within the Study Area were also identified following review of the Environmental Registry of Ontario (ero.ontario.ca). These facilities operate with an Environmental Compliance Approval (ECA) for air emissions or are registered with the Environmental Activity and Sector Registry (EASR) and would also contribute to existing air quality conditions. Facilities with air emissions surrounding the Study Area are included in **Appendix G**.

4.1.10.3 Existing Vehicle Emissions

There are also several sources of air emissions from vehicular travel in the air quality Study Area. Vehicle emission for the existing (2022) scenario are discussed within the Project emissions section of the AQIA report (**Appendix G**).

4.2 Socio-Economic Environment

4.2.1 Provincial Planning Context

Provincial policy documents provide direction on land use, growth, infrastructure planning, trade, tourism and recreation, and environmental protection, and help dictate municipal planning policy. The following Provincial Plans are applicable to the Study.

4.2.1.1 Growth Plan For The Greater Golden Horseshoe (2020)

In July 2006, the Province released the Growth Plan for the Greater Golden Horseshoe (GGH). The Growth Plan outlined a set of policies for managing growth, development, and guiding planning decisions in the GGH to 2031. This broad-based plan represents a planning vision for the Province of Ontario. The plan outlines a strategy for “Where and How to Grow”, “Infrastructure to Support Growth”, “Protecting What is Valuable”, “Sub-Area Growth Strategies” and “Implementation”.

Since the introduction of the Growth Plan for the Greater Golden Horseshoe in 2006, the region has seen a shift to more compact development patterns, a greater variety of housing options, more mixed-use development in urban growth centres and other strategic growth areas, and greater integration of transit and land use planning.

The Growth Plan for the Greater Golden Horseshoe, 2017, builds upon the success of the initial Growth Plan, 2006 and responds to the key challenges that the region continues to face over the coming decades with enhanced policy directions.

The Growth Plan requires that planning decisions made by the Province, municipalities, and other authorities conform to the policies contained in the Plan. MTO is working to provide for the efficient movement of people and goods within the context of the Province’s Growth Plan. This project supports and aligns with the Growth Plan as per Section 3.2.5 (1):

In planning for the development, optimization, or expansion of existing and *planned corridors* and supporting facilities, the Province, other public agencies, and upper- and single-tier municipalities will:

a) encourage the co-location of linear *infrastructure* where appropriate;

b) ensure that existing and *planned corridors* are protected to meet current and projected needs in accordance with the transportation and *infrastructure* corridor protection policies in the PPS;

c) where applicable, demonstrate through an *agricultural impact assessment* or equivalent analysis as part of an environmental assessment, that any impacts on the *Agricultural System* have been avoided or, if avoidance is not possible, minimized and to the extent feasible mitigated;

d) where applicable, demonstrate through an environmental assessment, that any impacts on *key natural heritage features* in the *Natural Heritage System*, *key hydrologic features* and *key hydrologic areas* have been avoided or, if avoidance is not possible, minimized and to the extent feasible mitigated; and,

e) for existing or *planned corridors* for transportation:

   i) consider increased opportunities for moving people and goods by rail;

   ii) consider separation of modes within corridors; and,

   iii) provide opportunities for inter-modal linkages.

4.2.1.2 Connecting The GGH: A Transportation Plan For The Greater Golden Horseshoe (2022)

In February 2022, the Province Released Connecting the GGH: A Transportation Plan for the Greater Golden Horseshoe to provide a 30-year vision for enhanced mobility within and across the region and Ontario. The Plan builds off of the policies of the Growth Plan by outlining infrastructure, service improvements and policies organized under four inter-related objectives: “Fighting gridlock and improving road performance”, “Getting people moving on a connected transit system”, “Supporting a more sustainable and resilient region”, and “Efficiently moving goods”.

To achieve these objectives, the Plan includes over 100 immediate and near-term actions that the province and its partners are taking, and will take, to make substantial progress towards the 2051 Vision for Mobility. Included in these actions are targeted widenings of highways across the region, including Highway 401. The Plan also recognizes that additional actions may be planned at a local level and beyond 2051.

4.2.2 Municipal Planning Context And Existing And Future Land Use

4.2.2.1 Northumberland County Official Plan (2016)

The Northumberland County Official Plan contains policies and maps, which guide the type and location of land uses in the Region to 2034. Land use categories that are described in words and displayed in maps include: Urban Areas/Rural Settlement Areas, Major Employment Areas, Agricultural Areas, Rural Areas, and Environmental Protection Areas. When viewed as a whole, a framework or regional structure is formed by the land use categories described in the Official Plan. This regional structure is further detailed through the official plans of each of the County’s seven local area municipalities.

Section E2 in the Official Plan notes that one of its objectives is to establish an integrated transportation system that safely and efficiently accommodates various modes of transportation including trains, automobiles, trucks, air, public transit, cycling, and walking. The Plan also seeks to protect transportation corridors to facilitate the development of a transportation system that is compatible with and supportive of existing and future land uses.

4.2.2.2 Municipality of Brighton Official Plan (2020)

The Municipality of Brighton Official Plan is a document whose purpose is to guide and manage development in Clarington to the year 2040. It contains goals and policies to guide the Municipality's decisions on growth, land use, and good design.

Section 7 regarding Transportation Policies in the Official Plan states that travel by means of private vehicle is the predominant means of moving goods and people within the Municipality of Brighton. Accordingly, the road network is deigned to facilitate a satisfactory movement of both people and goods to and from the various land use areas within the Municipality. The Plan also notes that Council will integrate the planning of the road network under its jurisdiction with the existing and proposed network of roads under the jurisdiction of the Province of Ontario and the County of Northumberland which serve the Municipality. The Plan recognizes the importance of public and private parking facilities and further intends that adequate public and private parking be provided to serve the needs of the Town and thereby, ensure the efficient movement of through traffic.

Land use in the Study Area is categorized as Agriculture, Environmental Protection, Rural, Aggregate Resource, and Crownland. The Official Plan Land Use map for the Municipality of Brighton is in **Exhibit 4-21**.

4.2.2.3 Official Plan Of The Township Of Cramahe (2014)

The Official Plan of the Township of Cramahe is a document whose purpose is to guide and manage development in Cramahe to the year 2016. As the Official Plan is currently under review, the Township released a draft Official Plan in May 2018 which states that the updated Official Plan will extend to the year 2036. The Official Plan contains goals and policies to guide the Municipality's decisions on growth, land use, and good design.

Section 7 regarding Transportation states that improvements to roads, such as widening, reconstruction, realignments, turning lanes, and intersection improvements, should be made according to a schedule or priorities established by the various public agencies having jurisdiction over roads. The plan elaborates that in general, priorities should be based on the nature and extent of the safety hazard where one exists and the volume of traffic on the road. These policies have also been adopted in the Township's draft Official Plan.

Land use in the Study Area is categorized as Environmental Protection, Agricultural, Employment Areas, Aggregate Resource, Rural, and Resort. The Official Plan Land Use map for the Township of Cramahe is in **Exhibit 4-22**.

Exhibit 4-21: Municipality of Brighton Official Plan Schedule A – Land Use

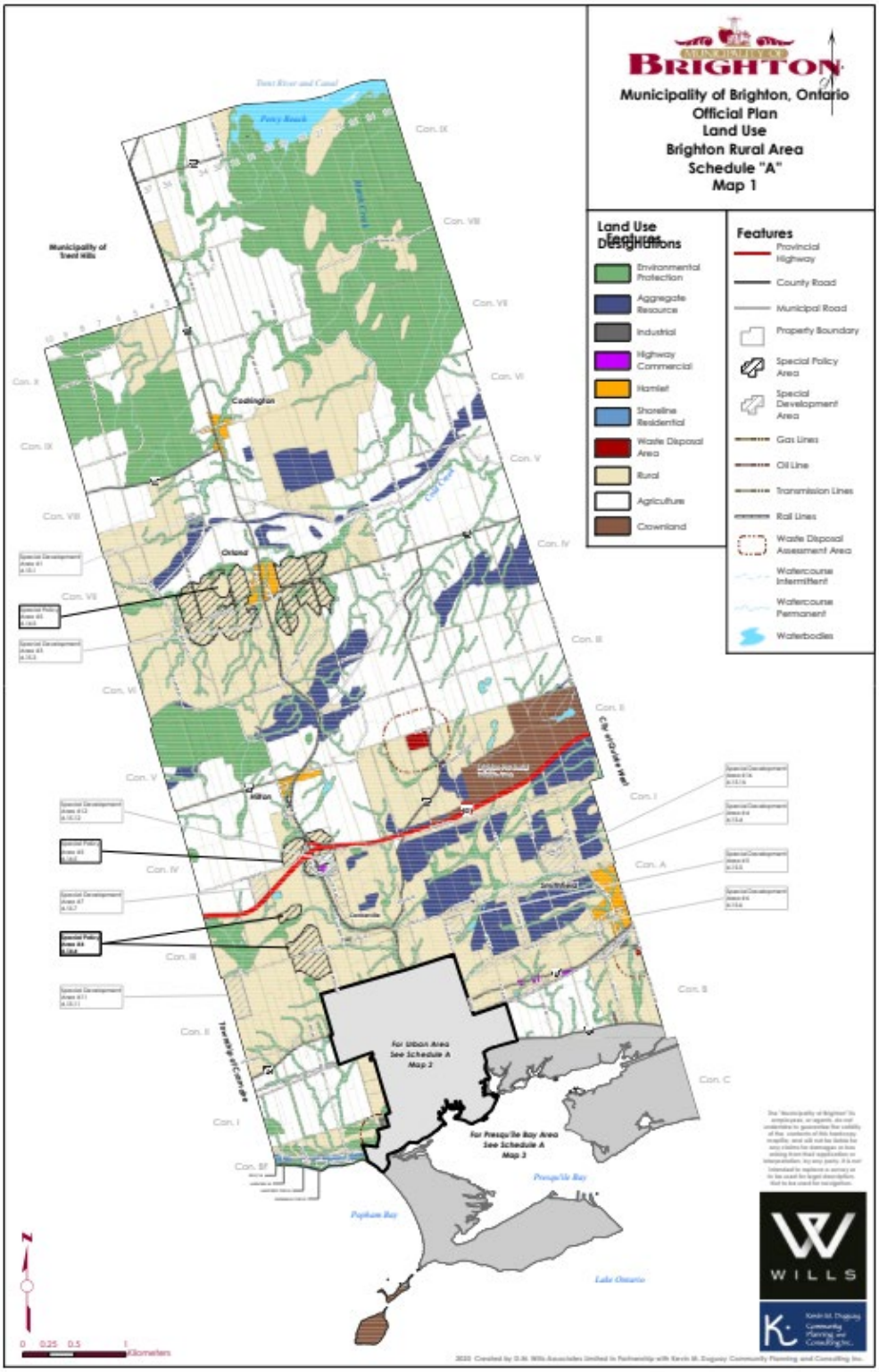
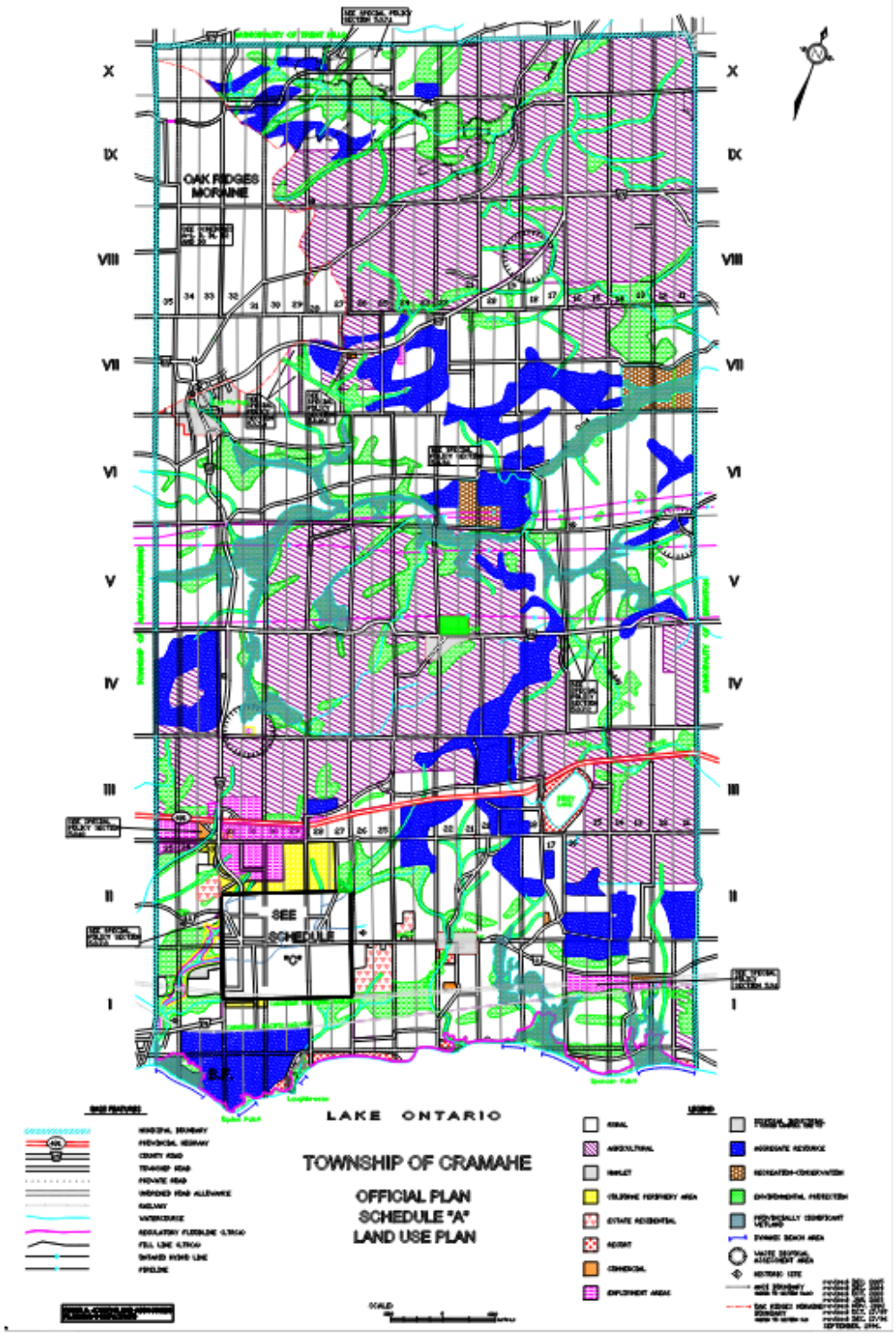


Exhibit 4-22: Township of Cramahe Official Plan Schedule A – Land Use



4.2.3 Land Use

The current land use in the Study Area was observed to be natural areas, open space, rural residential, and light commercial / industrial areas. The land use on either side of Highway 401 was observed to be mostly natural areas. The land use throughout the Study Area is primarily rural residential. Private residences were observed along County Road 26, Telephone Road, McDonald Road, Cochrane Road and Durham Road; light commercial land use was found on County Road 30, and light commercial / industrial land use in the west section at the intersection of Industrial Park Road and Orchard Road.

4.2.4 Landscape Composition

A field investigation was conducted to assess the landscape conditions, the existing vegetation communities, and trees in the Study Area as documented in the Landscape Composition Report provided in **Appendix H**.

Lands within the proposed ROW consists mostly of cultural meadow vegetation which includes field herbs, grasses, and tree and shrub cover. Lands adjacent to the proposed ROW are composed mainly of agricultural uses and deciduous, coniferous, and mixed forest woodlands interspersed by residential properties, roadways, and quarries. Wetlands, shrub thickets, and plantations similarly characterize the Study Area landscape. Within the Study Area, woodlands and wetlands form areas of habitat connectivity south of the highway west of Lake Road, and south of the highway east of Little Lake.

Woodlands in the Study Area were found to be >2 ha and have a continuous canopy, making them likely to be considered significant based on criteria in the MNRF's Natural Heritage Reference Manual, Municipal Plans, and Northumberland County's Official Plan. Additionally, there are significant natural areas and Areas of Natural and Scientific Interest within the Study Area, including Brighton Bluff ANSI, Brighton Provincial Wildlife Area, Mayhew Creek Significant Natural Area, Spring Valley Significant Natural Area, and Biddy Creek Wetland.

The landscape adjacent to Highway 401 possesses a variable topography ranging from gently rolling hills in localized areas to steeper slopes occurring just beyond the ROW. The natural topography of the Study Area is enhanced by vegetative buffers, woodlots, and hedgerows which contribute to significant views and vistas along the ROW, including along Little Lake and minor roads.

4.2.5 Noise

A noise assessment (**Appendix I**) was carried out to review potential noise impacts from proposed improvements along Highway 401 at the adjacent Noise Sensitive Areas (NSAs) in accordance with the MTO "Environmental Guide for Noise", October 2006 (the MTO's guide).

An NSA is defined as a group of noise sensitive land uses with outdoor living areas (OLAs) associated with them. In accordance with the MTO Guide, NSAs are differentiated between two types: Traditional NSAs (e.g. residences) and Special Land Use NSAs (e.g. educational facilities).

Traditional NSAs include:

- Private homes such as single-family residences;
- Townhouses;
- Multiple unit buildings, such as apartments, with OLAs for use by all occupants; and,
- Hospitals and nursing homes where there are OLAs for patients/residents.

The following may also qualify as Special Land Use NSAs if they are part of a community:

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

The project Study Area was established extending 600 metres from the proposed alignments, this area is considered as the Project Noise Limits, and was considered in the assessment for roads between County Road 25 and County Road 30, and for roads between County Road 30 and County Road 40.

NSAs within the Project Noise Limits were identified based on a review of land uses and aerial imagery:

- Areas to the east of County Road 25 (Percy Street) contain sparsely populated residential dwellings to the north and south of Highway 401. The density of dwellings significantly decreases after a 6 km stretch until the County Road 30 intersection.
- From County Road 30 to the end of the Study Area, approximately 400 m west of Christiani Road, the NSAs are scattered along a 4.5 km stretch with all but one located south of Highway 401.

For the purpose of this assessment, 90 properties were considered as a representative receptors of the 305 noise sensitive land uses within the Study Area. The identified noise receptors represent the OLA of the representative dwellings. The location of receptors was determined following the MTO's Guide at 3.0 metres from the façade and at a height of 1.5 metres above the existing grade. The receptor locations are shown in **Appendix I**.

4.2.6 Contaminated Areas

A Contamination Overview Study (COS) was completed in support of this Project (**Appendix J**). For the purpose of the COS, the Study Area includes a 250 m buffer on either side of the centreline of Highway 401, including the commuter parking lot on the southeast corner of Highway 401 and County Road 30, and excludes the area completed in the previous EA in 2005 under GWP 256-98-00 for Highway 401 and the County Road 30 interchange. The COS was intended as a broad level assessment of actual and potential sources of contamination within a given area and is based solely on the current and former land uses/activities within and surrounding the corridor.

Based on the findings of the COS, Areas of Potential Environmental Concerns (APECs) have been identified within the Study Area (see **Exhibit 4-23** to **Exhibit 4-26**). Five areas of high potential for contamination were identified in the Study Area. Two areas of moderate potential for contamination were identified in the Study Area. –All other areas not highlighted in **Exhibit 4-23** to **Exhibit 4-26** indicated land features considered to have low potential for site contamination. The areas are generally classified as natural areas, open space or residential land use, which are not suspected of using chemical compounds harmful to the environment or human health.

LEGEND:

- SITE LIMITS
- 250m STUDY AREA
- WATERBODIES

AREA OF POTENTIAL ENVIRONMENTAL CONCERN

- HIGH
- MEDIUM

0 200 400 600 Metres

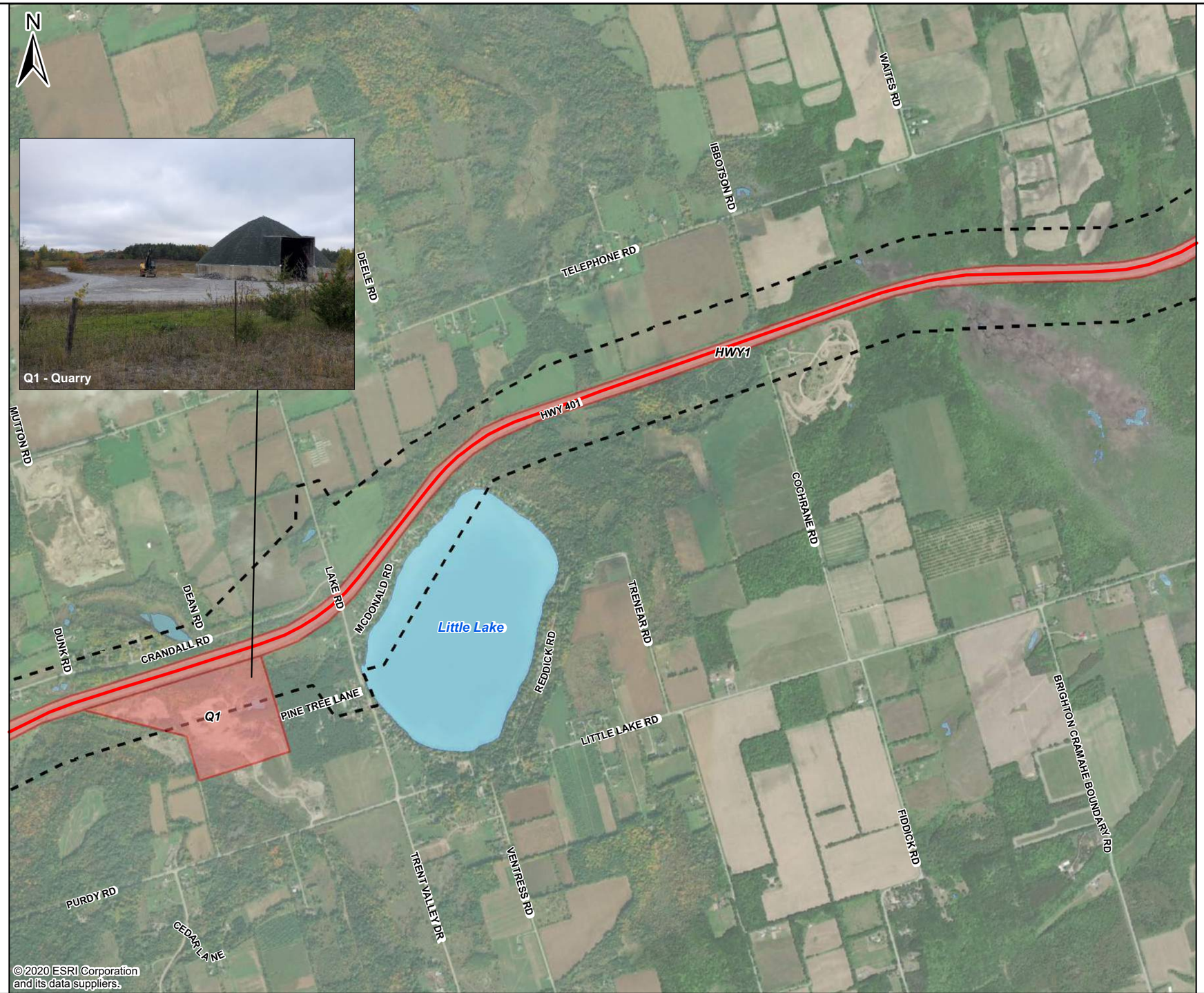
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Areas of Potential Environmental Concern

Exhibit
4-23



LEGEND:

- SITE LIMITS
- 250m STUDY AREA
- WATERBODIES

AREA OF POTENTIAL ENVIRONMENTAL CONCERN

- HIGH
- MEDIUM

0 200 400 600 Metres

Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Areas of Potential Environmental Concern

Exhibit
4-24

LEGEND:

- SITE LIMITS
- 250m STUDY AREA
- WATERBODIES

AREA OF POTENTIAL ENVIRONMENTAL CONCERN

- HIGH
- MEDIUM

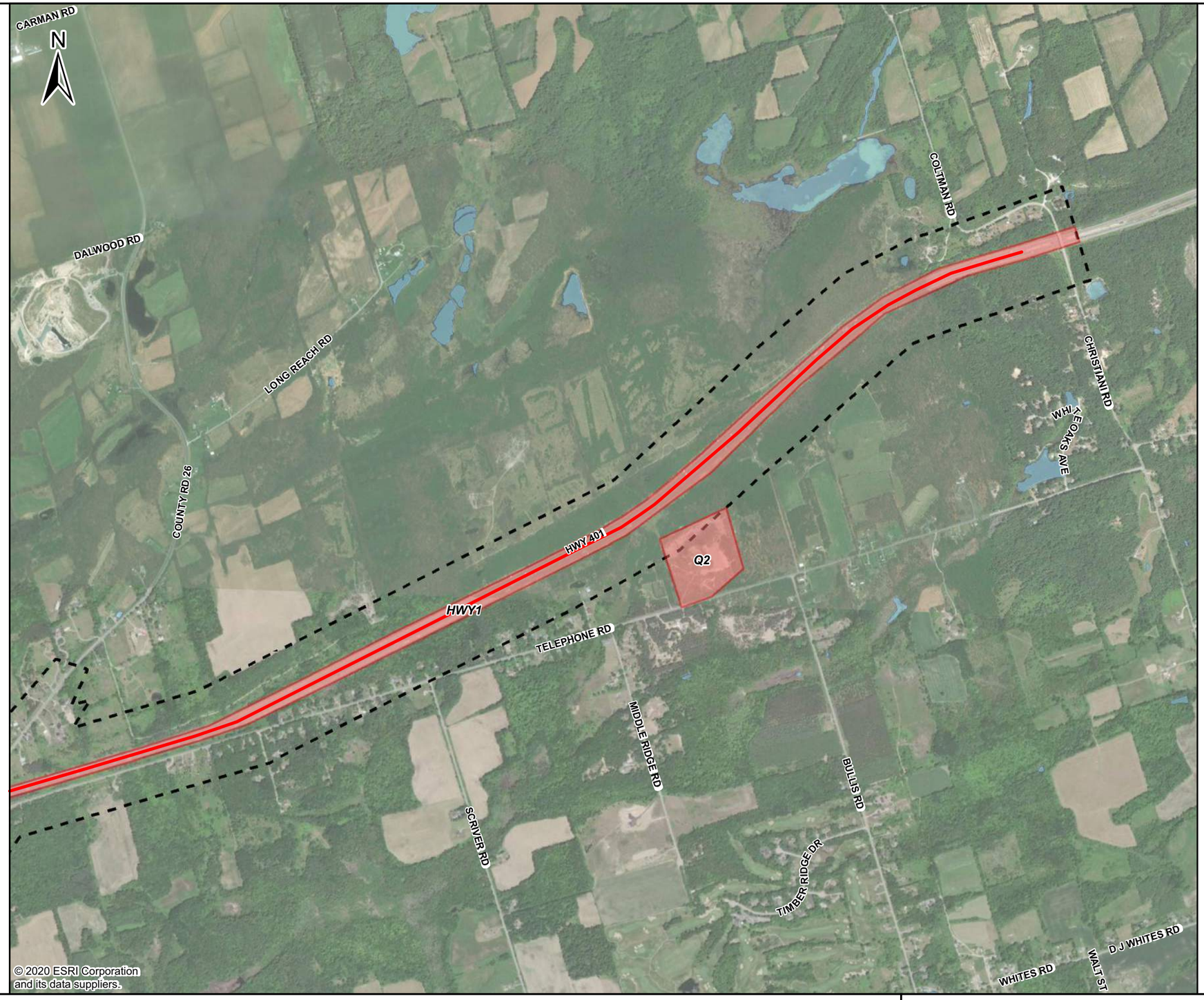
0 200 400 600 Metres

Ontario

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Areas of Potential Environmental Concern

Exhibit
4-25



LEGEND:

- SITE LIMITS
- 250m STUDY AREA
- WATERBODIES

AREA OF POTENTIAL ENVIRONMENTAL CONCERN

- HIGH
- MEDIUM

0 200 400 600 Metres

Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Areas of Potential Environmental Concern

Exhibit
4-26

4.3 Cultural Environment

4.3.1 Archaeology

A Stage 1 Archaeological Assessment was completed (see **Appendix K**) for the Study Area as a part of this project. The property inspection was conducted on November 13th, 2020. The Stage 1 background study determined that the Study Area corridor exhibits high potential for the presence of both pre-contact and historic archaeological resources. Based on the property inspection, archaeological potential has been removed from Highway 401, local roads, and their associated right-of-ways, and building footprints. No further work is recommended for these areas. Archaeological potential is also low in areas of steep slope and low lying and wet areas. These areas have been photo documented and no further archaeological investigation is required. The majority of the Study Area, however, retains high potential for the presence of archaeological resources and a Stage 2 Archaeological Assessment is currently being completed for these areas. **Exhibit 4-27** to **Exhibit 4-38** depict the results of the Stage 1 Archaeological Assessment.

Service Layer Credit Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

HONEY ROAD

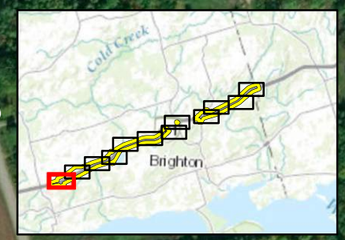
HERLEY ROAD

HIGHWAY 401

PURDY ROAD

DURHAM STREET

PARLIAMENT ROAD



LEGEND

- Photograph Location
- Study Area
- MTO ROW

Results

- Pedestrian Survey at 5 m Interval Required
- Previously Assessed - Further Assessment Required
- Test Pit to Confirm Disturbance Required
- Test Pit at 5 m Interval Required
- Disturbed - No Further Assessment Required
- Previously Assessed - No Further Assessment Required
- Slope > 20° - No Further Assessment Required

N

0 100 200 m

Credits: Land Information Ontario

Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Stage 1 Archaeological Assessment Results

Exhibit
4-27

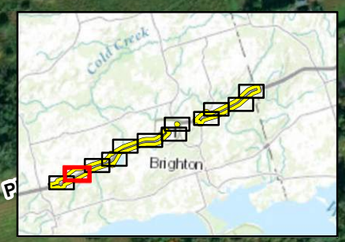
Service Layer Credit Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

SAMIS ROAD

HONEY ROAD

CRANDALL ROAD

HIGHWAY 401



LEGEND

- Photograph Location
- Study Area
- MTO ROW

Results

- Pedestrian Survey at 5 m Interval Required
- Test Pit at 5 m Interval Required
- Disturbed - No Further Assessment Required
- Slope > 20° - No Further Assessment Required

N

0 100 200 m

Credits: Land Information Ontario

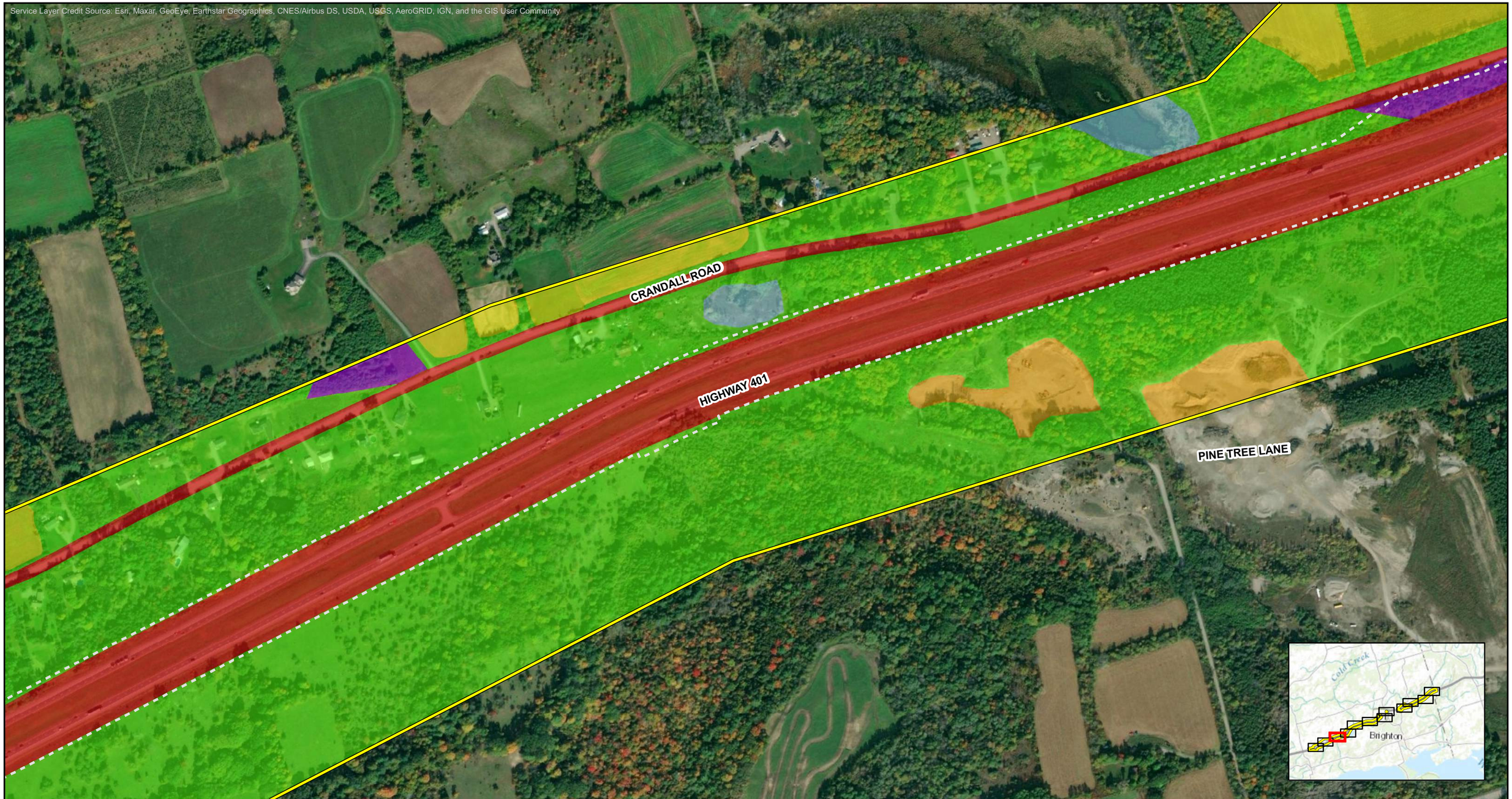
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Stage 1 Archaeological Assessment Results

Exhibit
4-28



LEGEND

- Photograph Location
- Study Area
- MTO ROW

Results

- Pedestrian Survey at 5 m Interval Required
- Test Pit to Confirm Disturbance Required
- Test Pit at 5 m Interval Required
- Disturbed - No Further Assessment Required
- Low and Wet - No Further Assessment Required
- Slope > 20° - No Further Assessment Required

N

0 100 200 m

Credits: Land Information Ontario

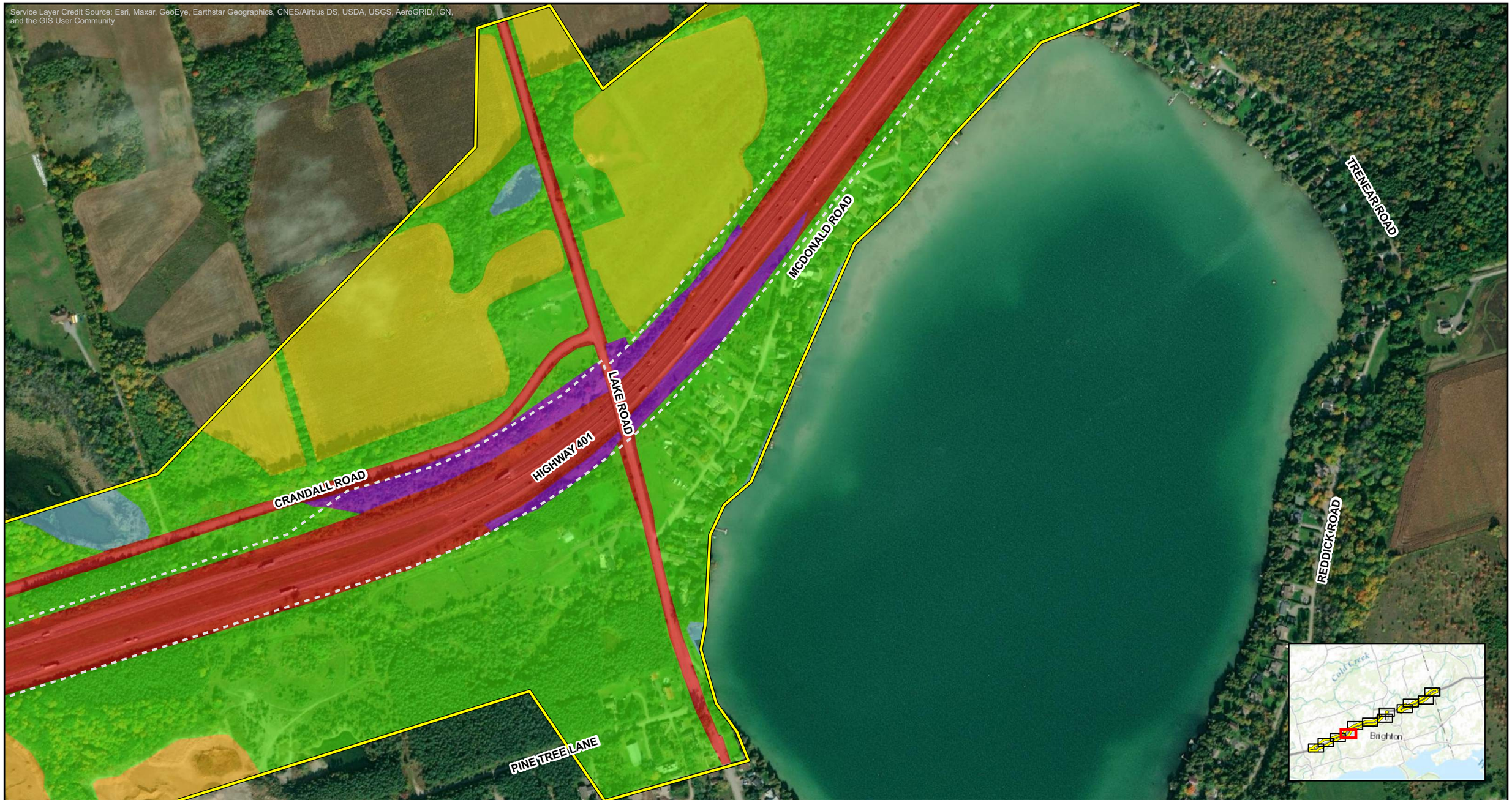
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Stage 1 Archaeological Assessment Results

Exhibit
4-29



LEGEND

- Photograph Location
- Study Area
- MTO ROW

Results

- Pedestrian Survey at 5 m Interval Required
- Test Pit to Confirm Disturbance Required
- Test Pit at 5 m Interval Required
- Disturbed - No Further Assessment Required
- Low and Wet - No Further Assessment Required
- Slope > 20° - No Further Assessment Required

N

0 100 200 m

Credits: Land Information Ontario

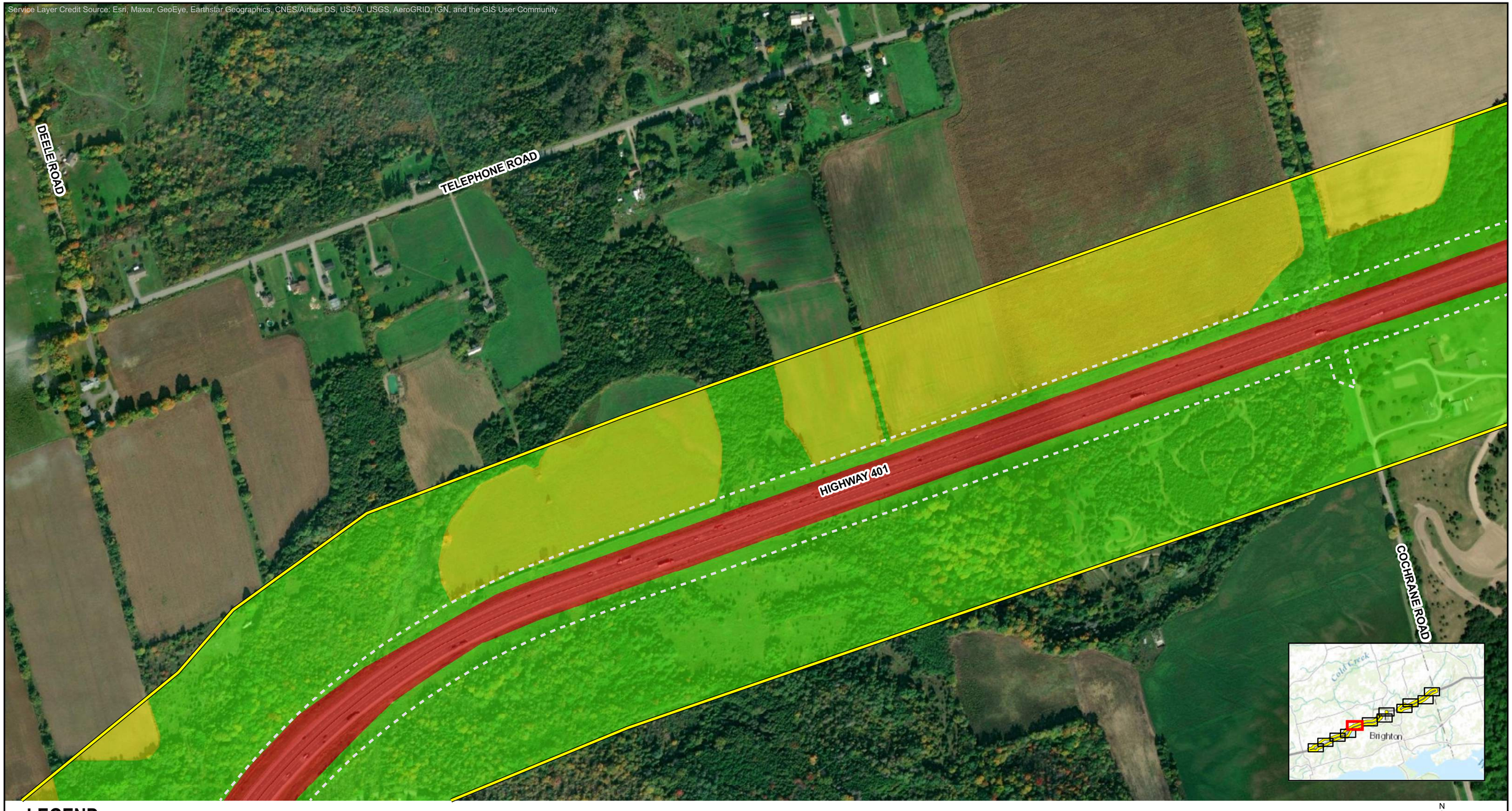
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Stage 1 Archaeological Assessment Results

Exhibit
4-30



LEGEND

- Photograph Location
- Study Area
- MTO ROW

Results

- Pedestrian Survey at 5 m Interval Required
- Test Pit at 5 m Interval Required
- Disturbed - No Further Assessment Required

N

0 100 200 m

Credits: Land Information Ontario

Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Stage 1 Archaeological Assessment Results

Exhibit
4-31

LEGEND

- Photograph Location
- Study Area
- MTO ROW

Results

- Pedestrian Survey at 5 m Interval Required
- Test Pit at 5 m Interval Required
- Disturbed - No Further Assessment Required
- Low and Wet - No Further Assessment Required
- Previously Assessed - No Further Assessment Required

N

0 100 200 m

Credits: Land Information Ontario

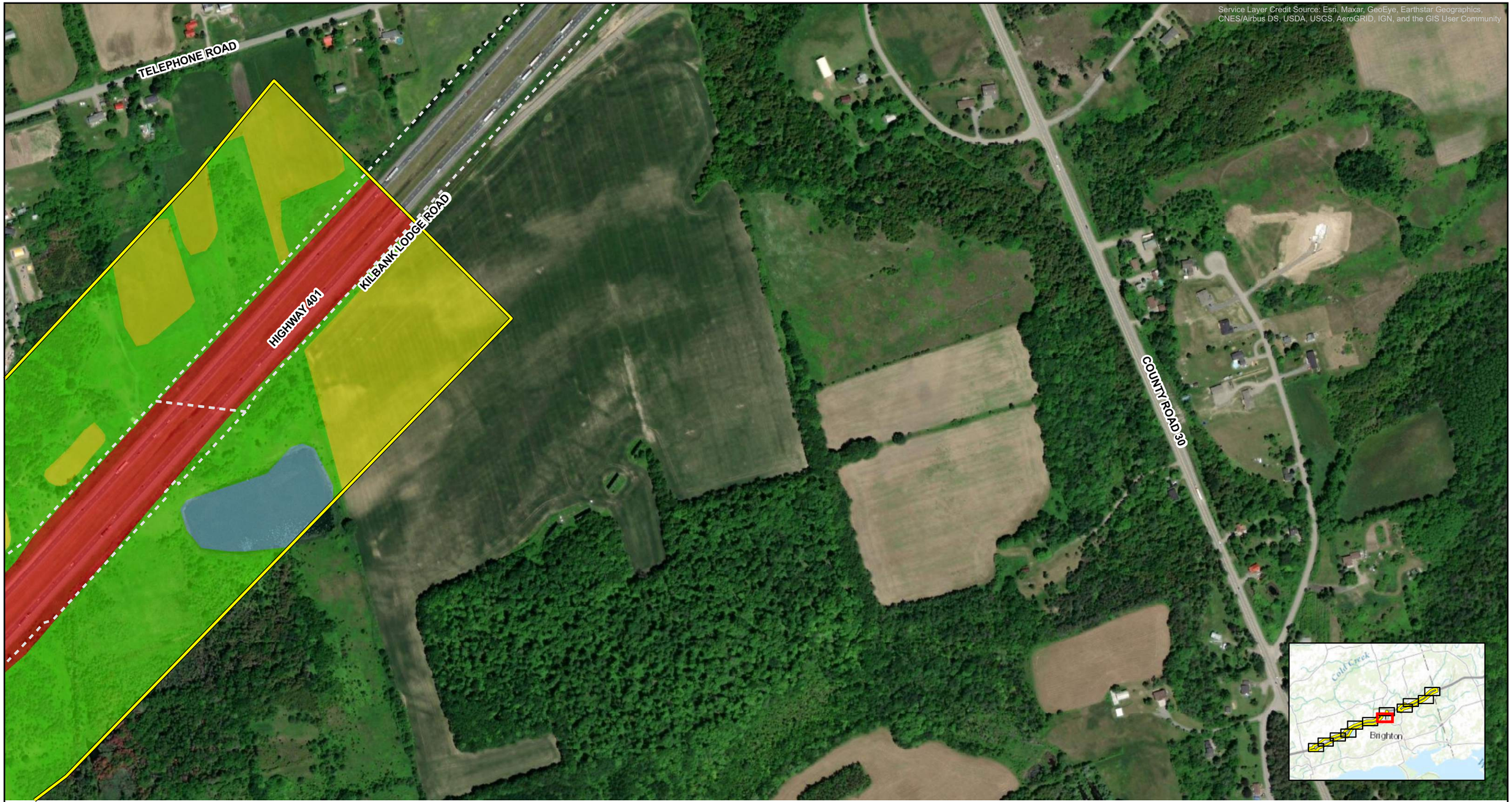
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Stage 1 Archaeological Assessment Results

Exhibit
4-32



LEGEND

- Photograph Location
- Study Area
- MTO ROW

Results

- Pedestrian Survey at 5 m Interval Required
- Test Pit at 5 m Interval Required
- Disturbed - No Further Assessment Required
- Low and Wet - No Further Assessment Required

N

0 100 200 m

Credits: Land Information Ontario

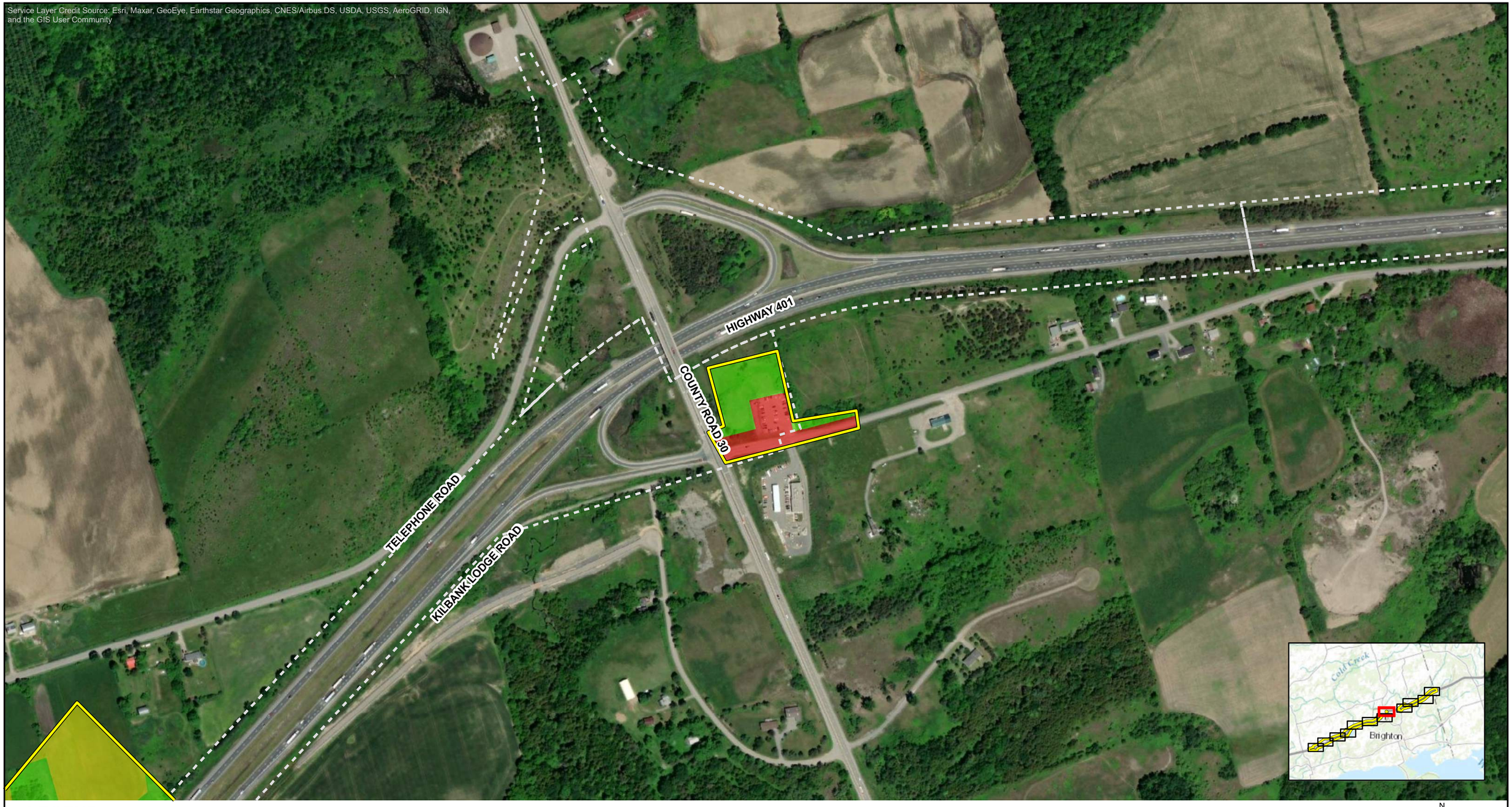
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Stage 1 Archaeological Assessment Results

Exhibit
4-33



LEGEND

- Photograph Location
- Study Area
- MTO ROW

Results

- Pedestrian Survey at 5 m Interval Required
- Test Pit at 5 m Interval Required
- Disturbed - No Further Assessment Required

N

0 100 200 m

Credits: Land Information Ontario

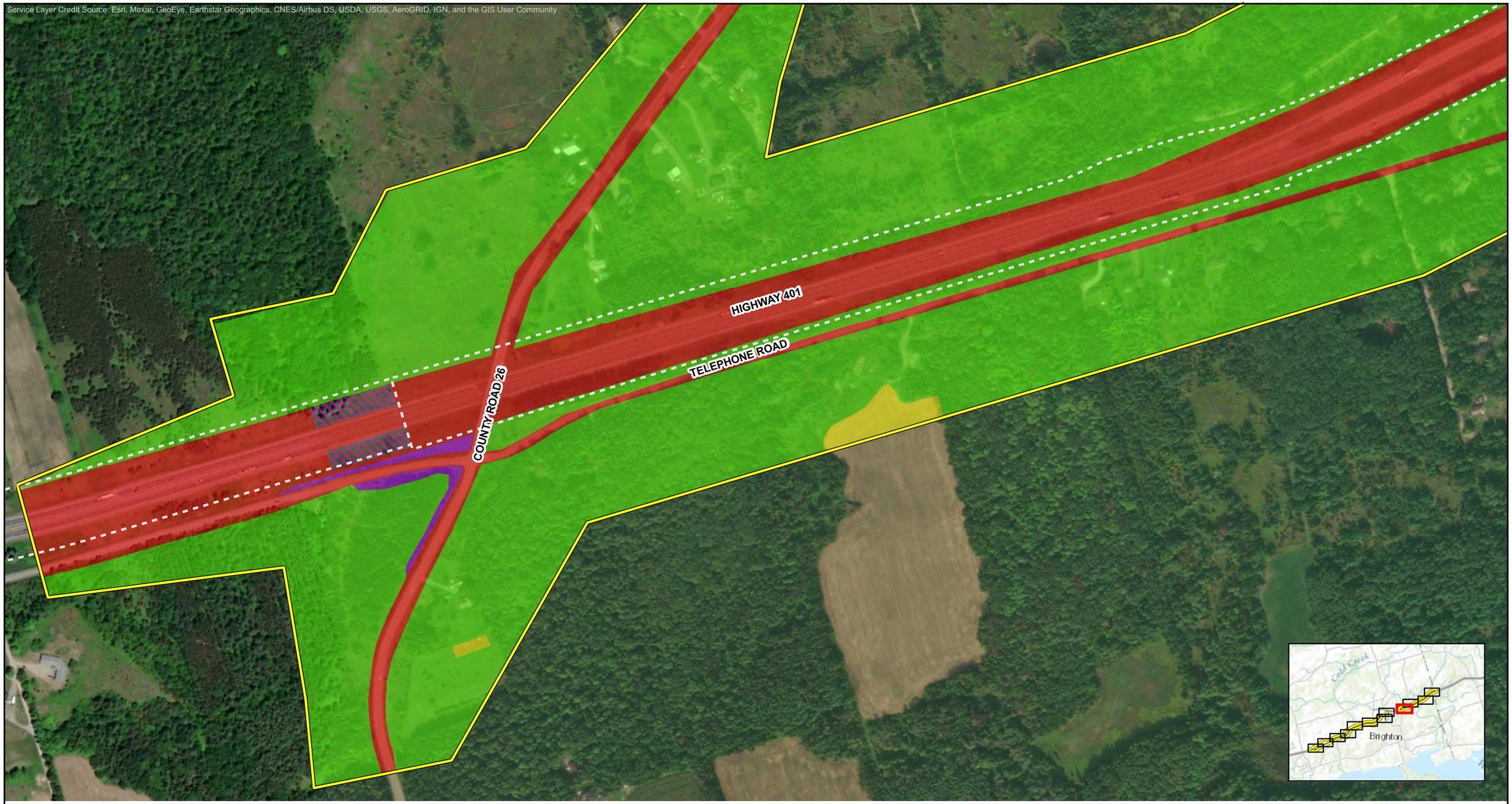
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Stage 1 Archaeological Assessment Results

Exhibit
4-34



LEGEND

- Photograph Location
- Study Area
- MTO ROW

Results

- Pedestrian Survey at 5 m Interval Required
- Test Pit at 5 m Interval Required
- Disturbed - No Further Assessment Required
- Previously Assessed - No Further Assessment Required
- Slope > 20° - No Further Assessment Required

N

0 100 200 m

Credits: Land Information Ontario

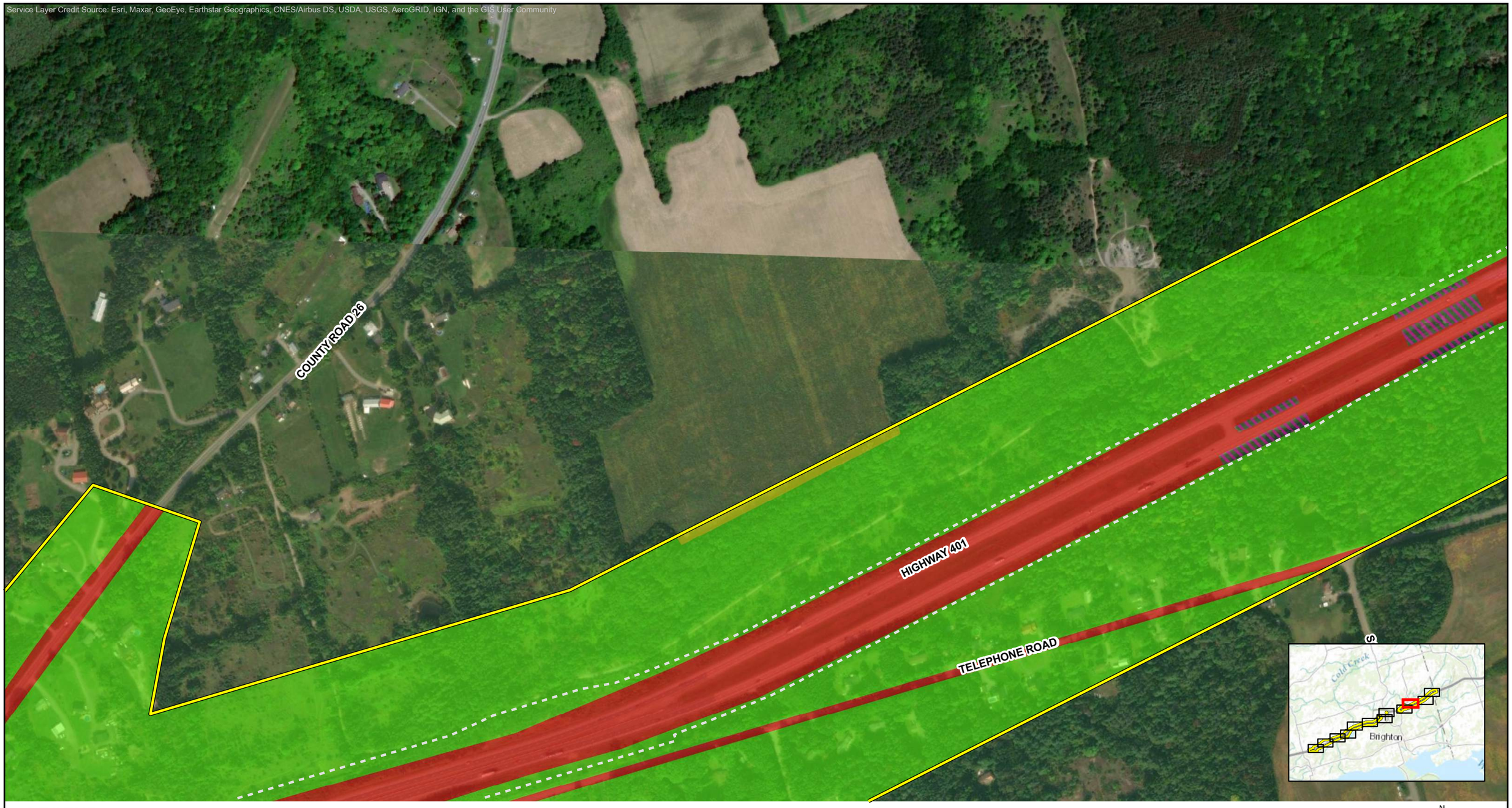
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Stage 1 Archaeological Assessment Results

Exhibit
4-35



LEGEND

- Photograph Location
- Study Area
- MTO ROW

Results

- Pedestrian Survey at 5 m Interval Required
- Test Pit at 5 m Interval Required
- Disturbed - No Further Assessment Required
- Previously Assessed - No Further Assessment Required

N

0 100 200 m

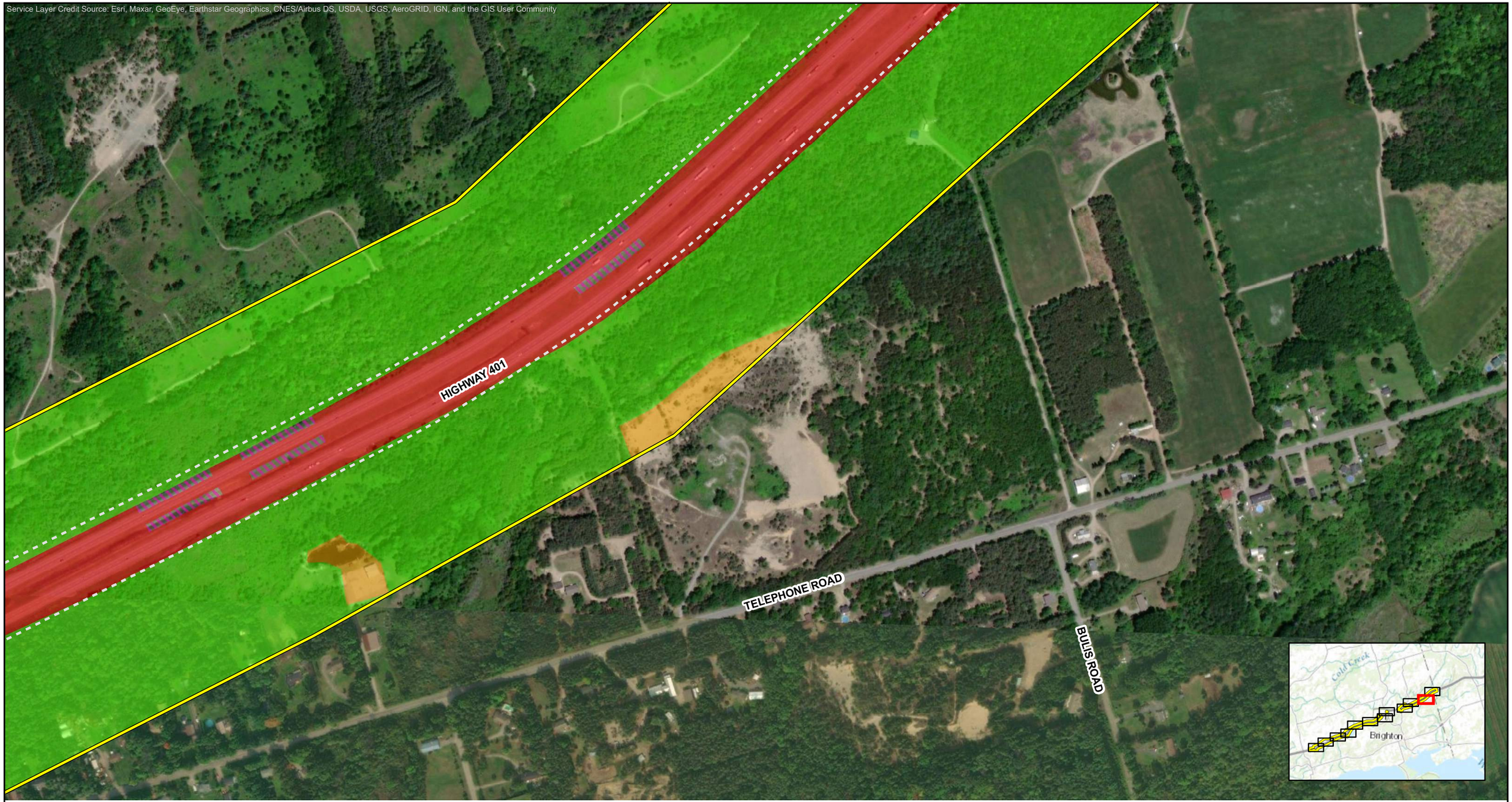
Credits: Land Information Ontario

Ontario

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Stage 1 Archaeological Assessment Results

Exhibit
4-36



LEGEND

- Photograph Location
- Study Area
- MTO ROW

Results

- Pedestrian Survey at 5 m Interval Required
- Test Pit at 5 m Interval Required
- Disturbed - No Further Assessment Required
- Previously Assessed - No Further Assessment Required

N

0 100 200 m

Credits: Land Information Ontario

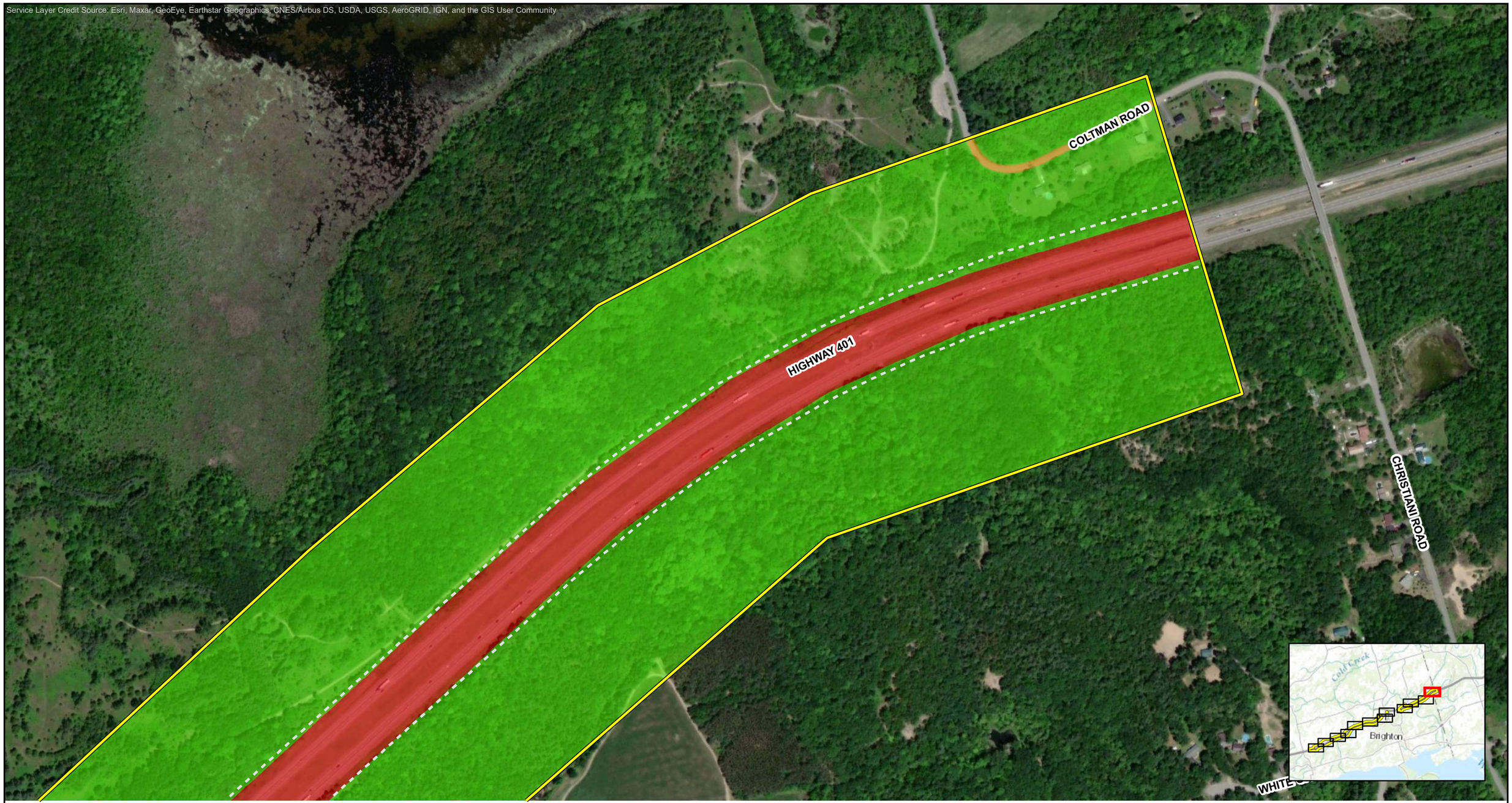
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Stage 1 Archaeological Assessment Results

Exhibit
4-37



LEGEND

- Photograph Location
- Study Area
- MTO ROW

Results

- Pedestrian Survey at 5 m Interval Required
- Test Pit at 5 m Interval Required
- Disturbed - No Further Assessment Required

N

0 100 200 m

Credits: Land Information Ontario

Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Stage 1 Archaeological Assessment Results

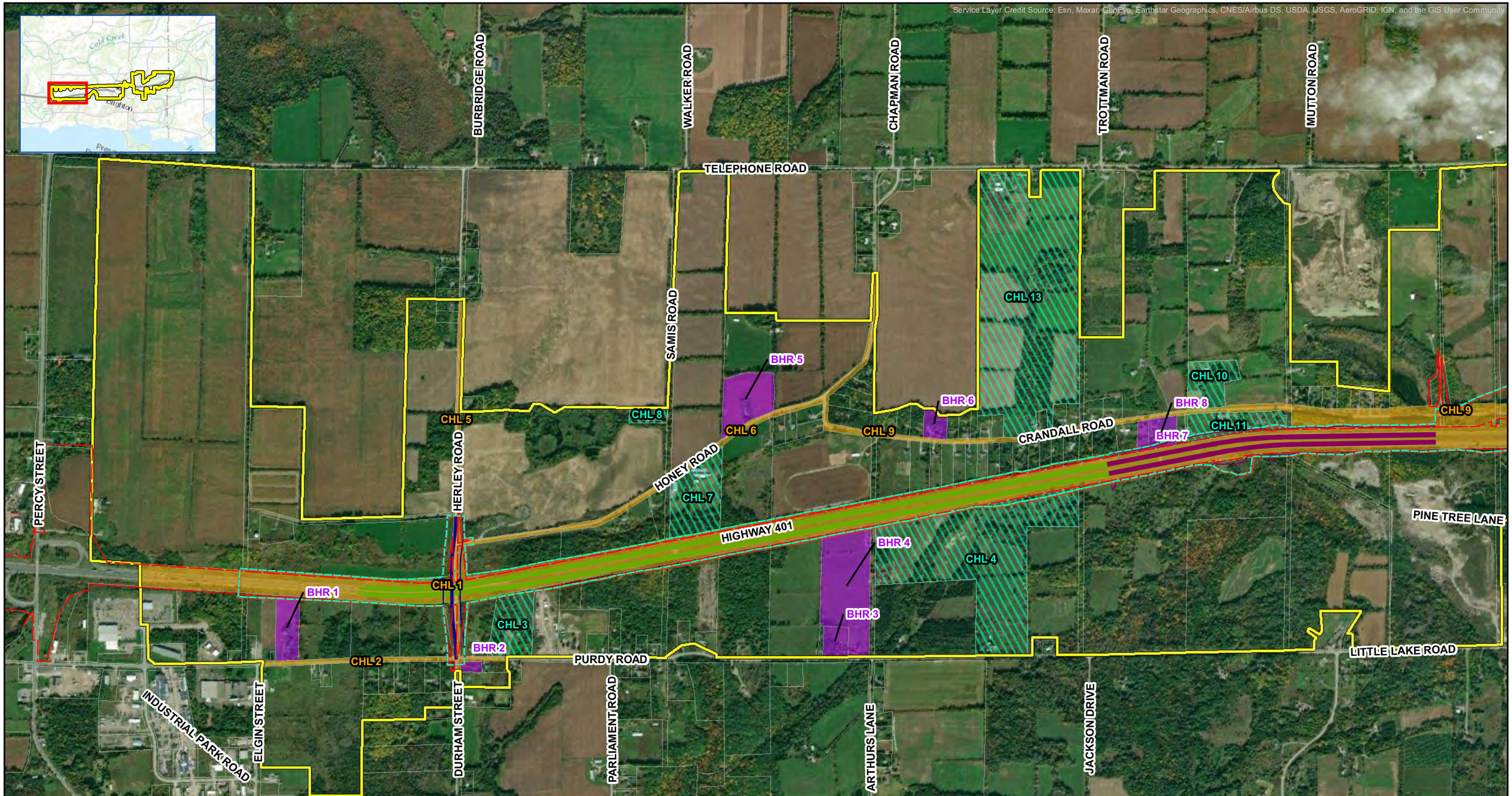
Exhibit
4-38

4.3.2 Built Heritage and Cultural Heritage Landscapes

A Cultural Heritage Resource Assessment Report (CHRAR) was completed to provide preliminary information about built heritage and cultural heritage landscapes within the Study Area (see **Appendix L**). The assessment focused on identifying existing and potential built heritage resources (BHR) and cultural heritage landscapes (CHL), reviewing the background history of the project area, completing a site visit to confirm existing conditions, provide a preliminary impact assessment for BHRs and CHLs within the Study Area, identifying mitigation and/or monitoring for potential impacts and determining whether additional heritage reporting is required. Prior to the field review, available current and historical aerial photographs and maps were reviewed for any potential cultural heritage resources that may be extant in the Study Area. 26 cultural heritage resources (CHRs) were identified within or adjacent to the Study Area as well as eleven built heritage resources (see **Appendix L**). Properties screened for cultural heritage value or interest (CHVI) are shown in **Exhibit 4-39** to **Exhibit 4-49**.

Built heritage and cultural heritage landscape recommendations are detailed in **Section 8.3** and **Appendix L**. Five Cultural Heritage Evaluation Reports (CHERs) were completed for the following properties and results are summarized in **Section 8.3.2** of this TESR:

- 12 McDonald Road
- 318 Lake Road
- 389 Crandall Road
- 439 Crandall Road
- 638 County Road 26



LEGEND

- Study Area
- Property Parcel
- Built Heritage Resource
- Cultural Heritage Landscape - Property
- Cultural Heritge Landscape - Roadscape
- Existing ROW
- Future Property Requirement
- Grading Limits
- Herley Road Alt 1
- Section 2 Alternative 1
- Section 1 Alternative 2

N

0 100 200 400 600 m

Credits: Land Information Ontario

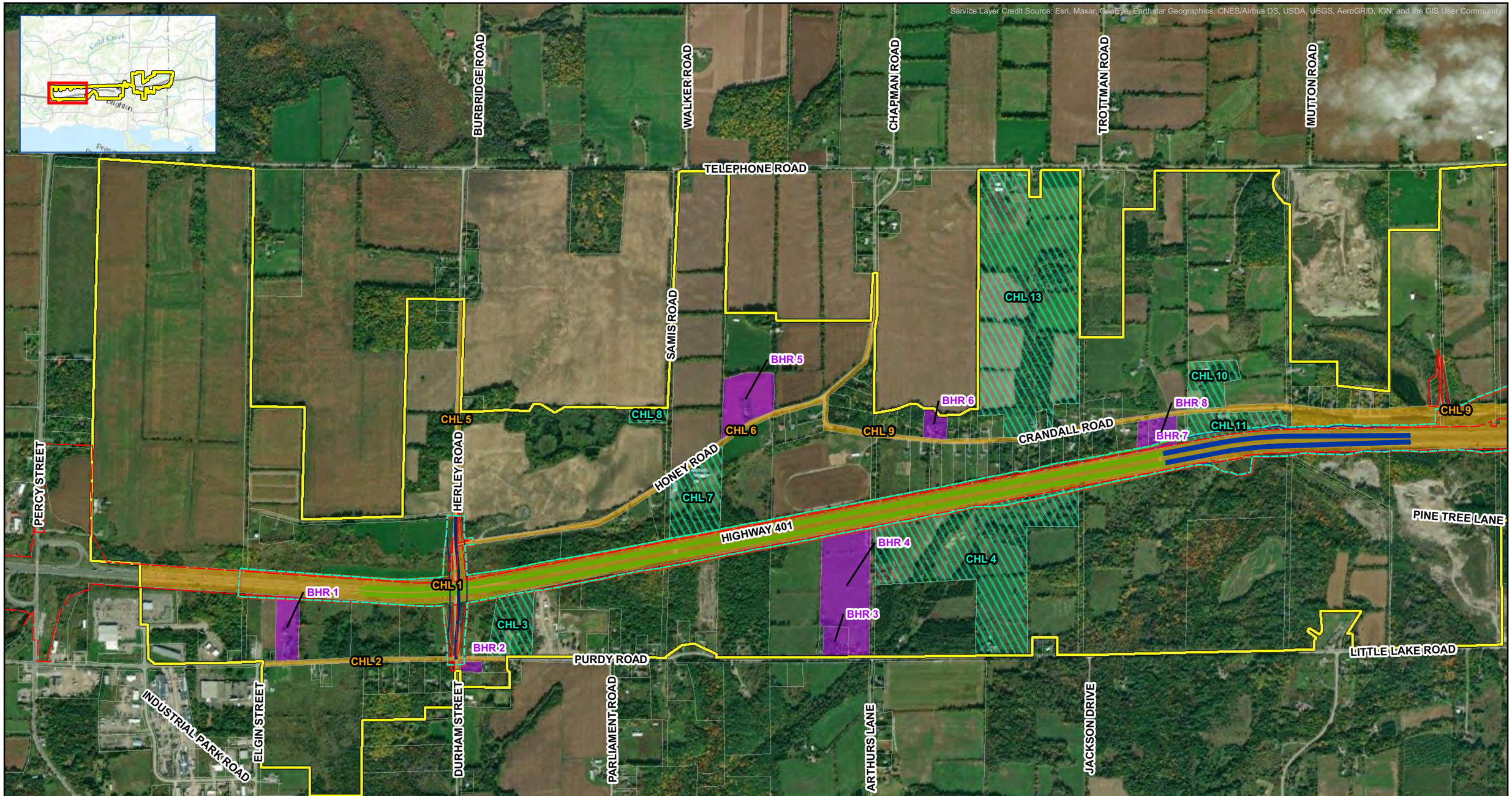
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Properties Screened for Cultural Heritage Value or Interest (CHVI)

Exhibit
4-39



LEGEND

- Study Area
- Property Parcel
- Built Heritage Resource
- Cultural Heritage Landscape - Property
- Cultural Heritge Landscape - Roadscape
- Existing ROW
- Future Property Requirement
- Grading Limits
- Herley Road Alt 2
- Section 2 Alternative 2
- Section 1 Alternative 2

N

0 100 200 400 600 m

Credits: Land Information Ontario

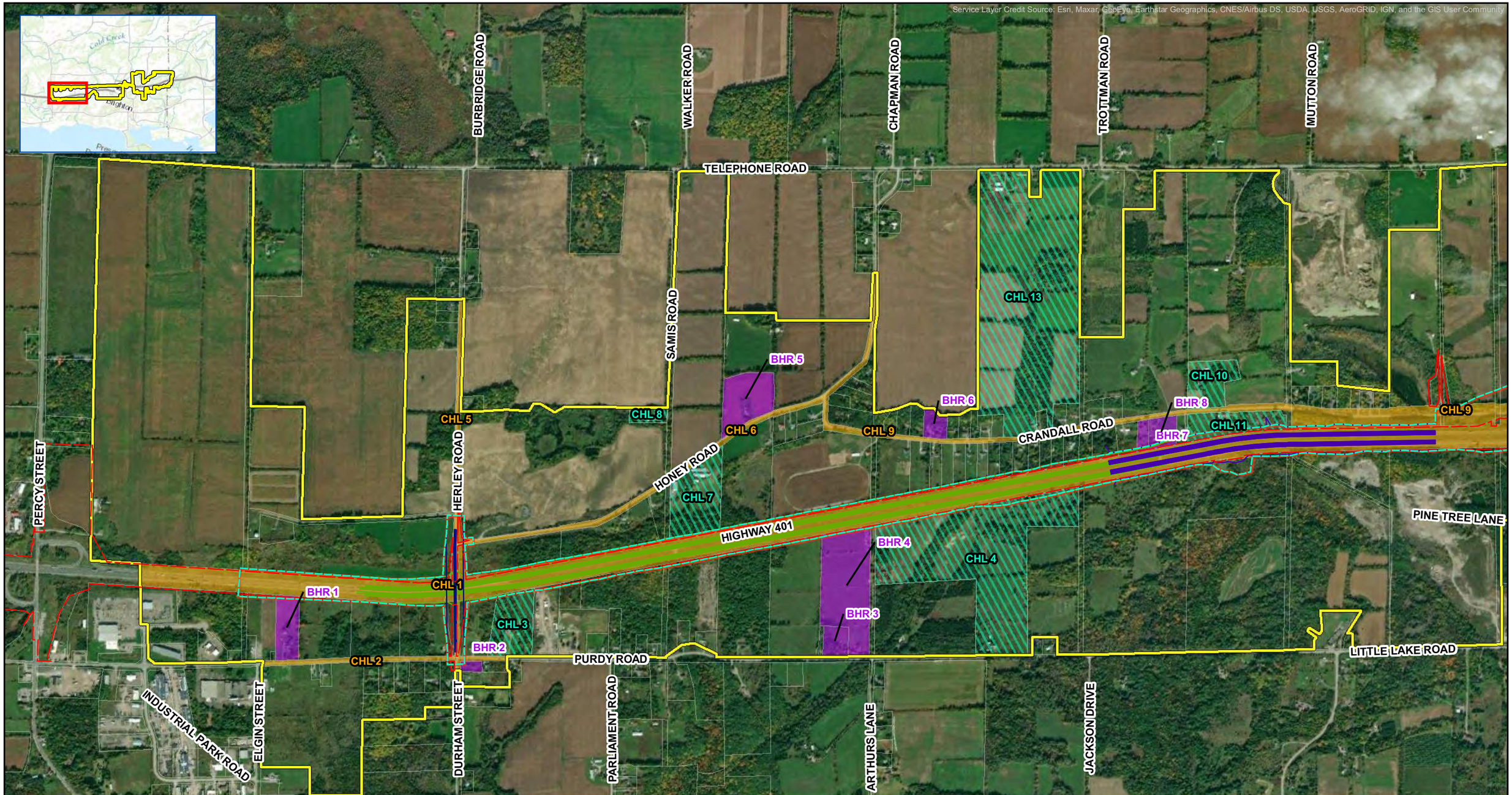
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Properties Screened for Cultural Heritage Value or Interest (CHVI)

Exhibit
4-40



LEGEND

- Study Area
- Property Parcel
- Built Heritage Resource
- Cultural Heritage Landscape - Property
- Cultural Heritge Landscape - Roadscape
- Existing ROW
- Future Property Requirement
- Grading Limits
- Herley Road Alt 3
- Section 2 Alternative 3
- Section 1 Alternative 2

N

0 100 200 400 600 m

Credits: Land Information Ontario

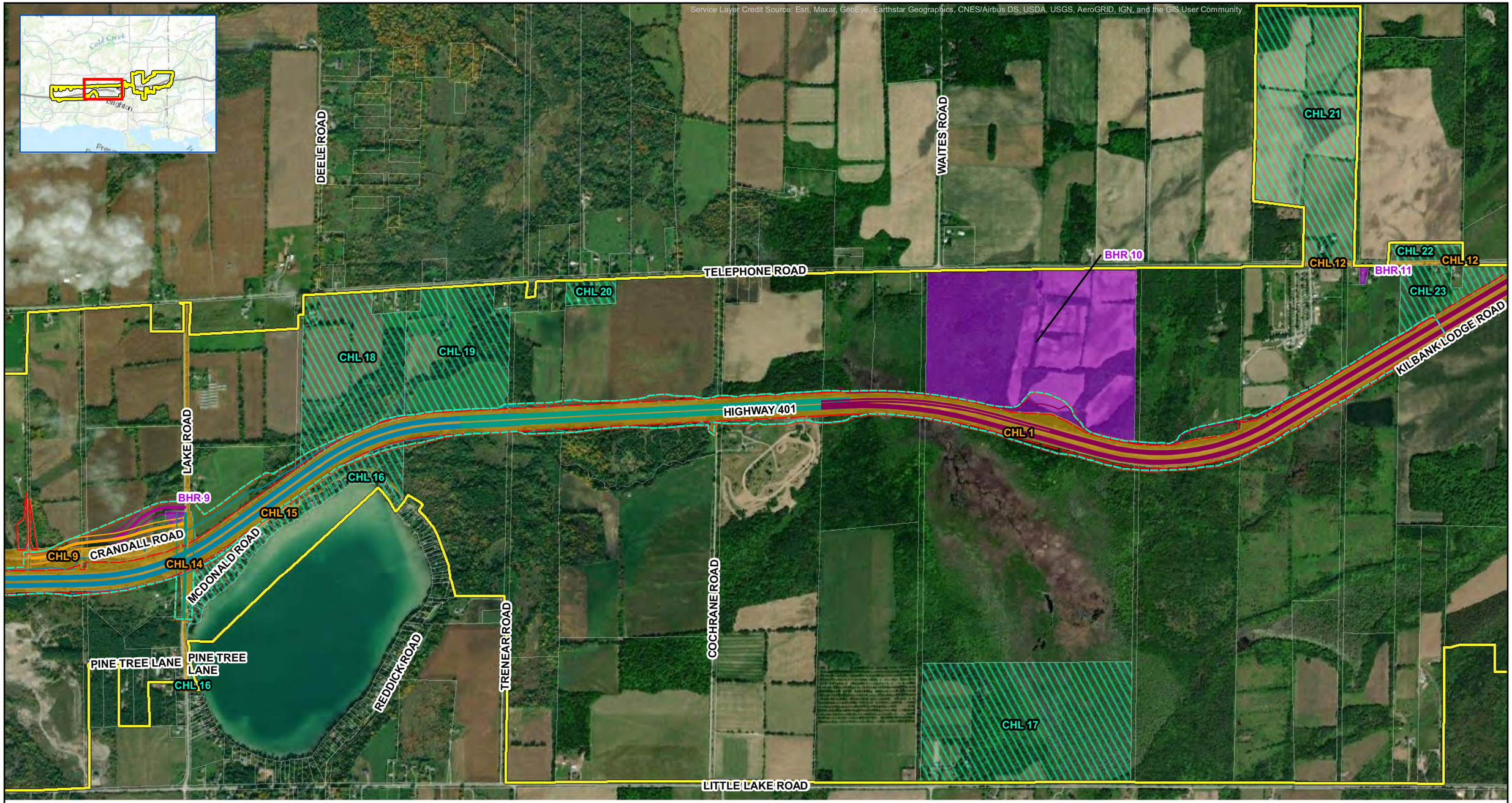
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Properties Screened for Cultural Heritage Value or Interest (CHVI)

Exhibit
4-41



LEGEND

- Study Area
- Property Parcel
- Built Heritage Resource
- Cultural Heritage Landscape - Property
- Cultural Heritge Landscape - Roadscape
- Existing ROW
- Future Property Requirement
- Grading Limits
- Lake Road Alt 3
- Section 5 Alternative 3
- Section 4 Alternative 1
- Section 3 Alternative 1 Crandall Road Alt 3
- Section 3 Alterntaive 1 - Crandall Road Alt 1
- Section 3 Alterntaive 1

N

0 100 200 400 600 m

Credits: Land Information Ontario

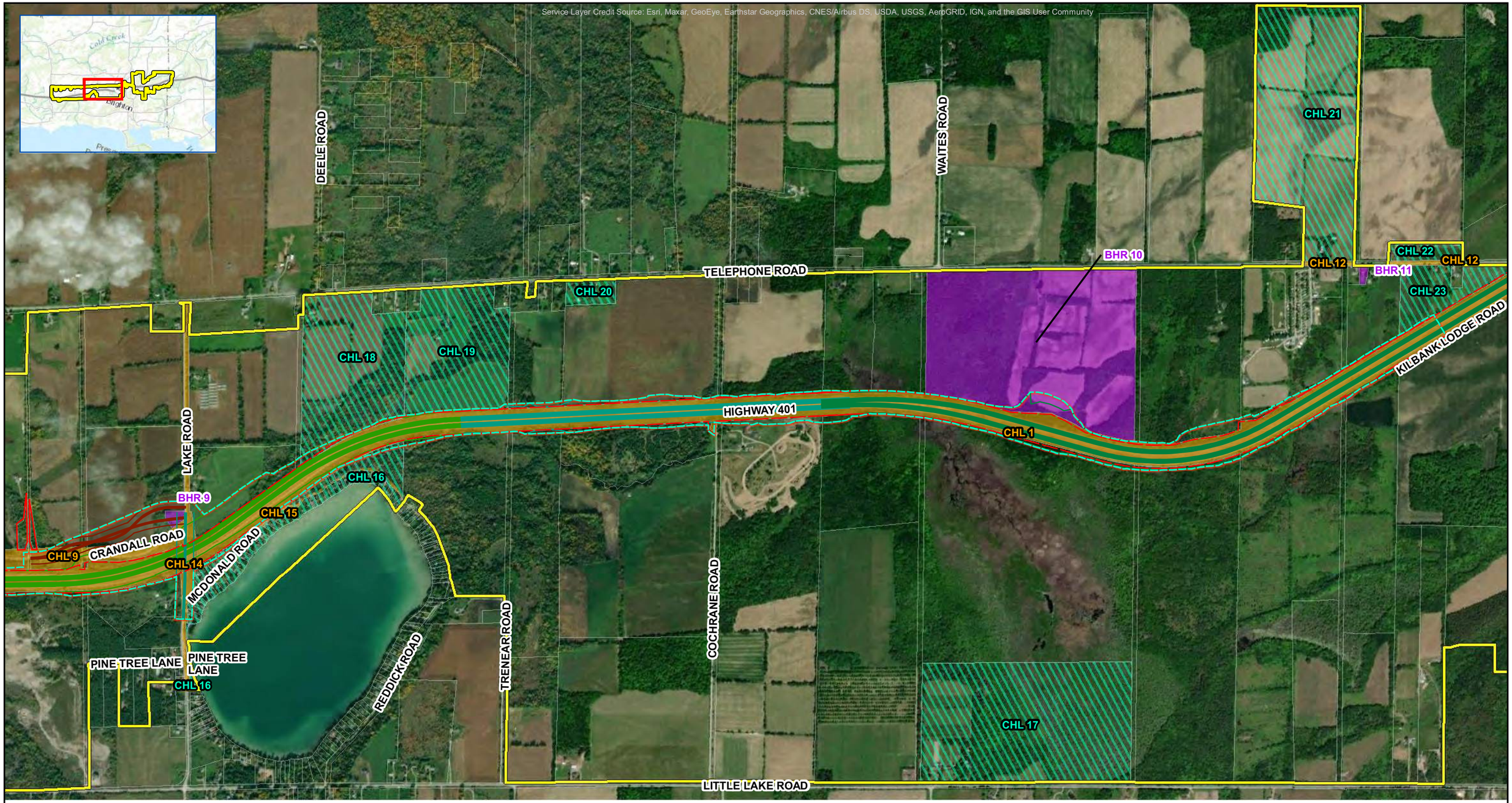
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Properties Screened for Cultural Heritage Value or Interest (CHVI)

Exhibit
4-42



LEGEND

- Study Area
- Property Parcel
- Built Heritage Resource
- Cultural Heritage Landscape - Property
- Cultural Heritge Landscape - Roadscape
- Existing ROW
- Future Property Requirement
- Grading Limits
- Lake Road Alt 3
- Section 5 Alternative 4
- Section 4 Alternative 1
- Section 3 Alternative 2 Crandall Road Alt 2 & 3
- Section 3 Alternative 2

N

0 100 200 400 600 m

Credits: Land Information Ontario

Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Properties Screened for Cultural Heritage Value or Interest (CHVI)

Exhibit
4-43

DEELE ROAD
WAITES ROAD
CHL 21
BHR 10
CHL 22
CHL 12
CHL 12
BHR 11
CHL 23
TELEPHONE ROAD
CHL 20
CHL 18
CHL 19
KILBANK LODGE ROAD
HIGHWAY 401
CHL 1
LAKE ROAD
CHL 16
BHR 9
CHL 15
CRANDALL ROAD
CHL 9
MCDONALD ROAD
CHL 14
COCHRANE ROAD
PINE TREE LANE
PINE TREE LANE
CHL 16
REDDICK ROAD
TRENEAR ROAD
CHL 17
LITTLE LAKE ROAD

LEGEND

- Study Area
- Property Parcel
- Built Heritage Resource
- Cultural Heritage Landscape - Property
- Cultural Heritge Landscape - Roadscape
- Existing ROW
- Future Property Requirement
- Grading Limits
- Lake Road Alt 3
- Section 5 Alternative 4
- Section 4 Alternative 1
- Section 3 Alternative 3 Crandall Road Alt 2 & 3
- Section 3 Alternative 3

N

0 100 200 400 600 m

Credits: Land Information Ontario

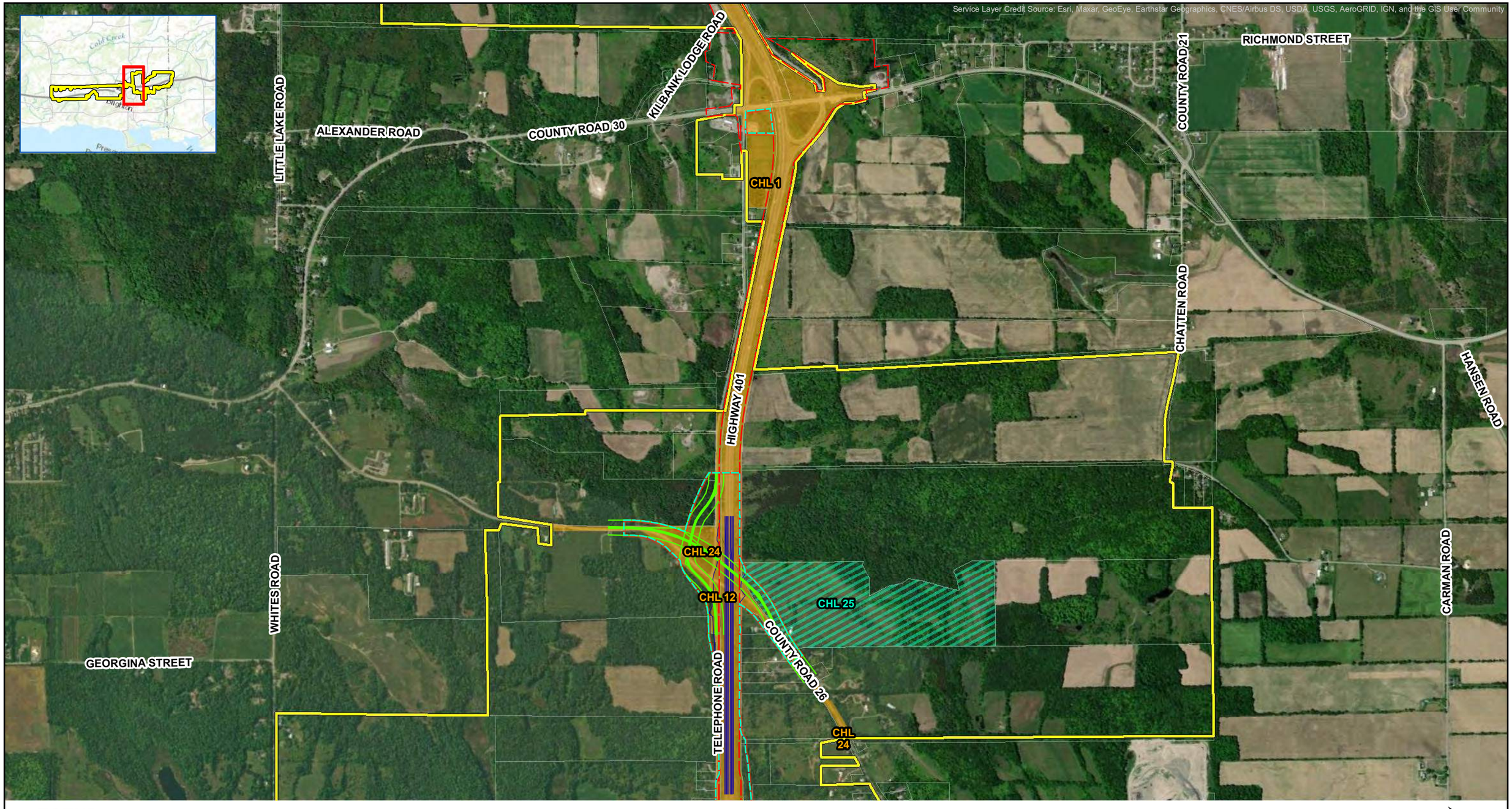
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Properties Screened for Cultural Heritage Value or Interest (CHVI)

Exhibit
4-44



LEGEND

- Study Area
- Property Parcel
- Cultural Heritage Landscape - Property
- Cultural Heritge Landscape - Roadscape
- Existing ROW
- Future Property Requirement
- Grading Limits
- County Road 26 Alt 2
- Section 6 Alternative 1

N

0 100 200 400 600 m

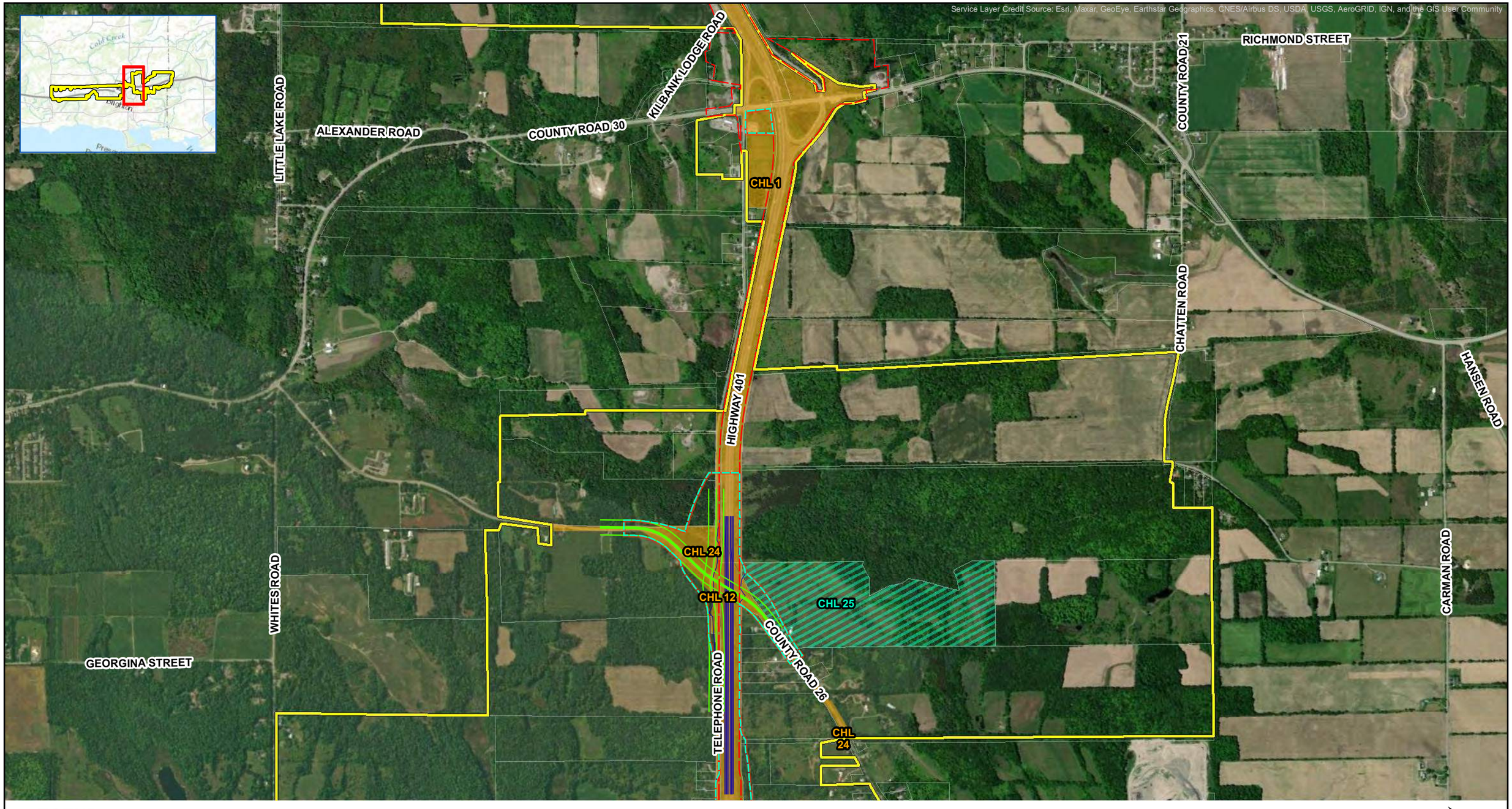
Credits: Land Information Ontario

Ontario

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Properties Screened for Cultural Heritage Value or Interest (CHVI)

Exhibit
4-45



LEGEND

- Study Area
- Property Parcel
- Cultural Heritage Landscape - Property
- Cultural Heritge Landscape - Roadscape
- Existing ROW
- Future Property Requirement
- Grading Limits
- County Road 26 Alt 6 & 7
- Section 6 Alternative 1

N

0 100 200 400 600 m

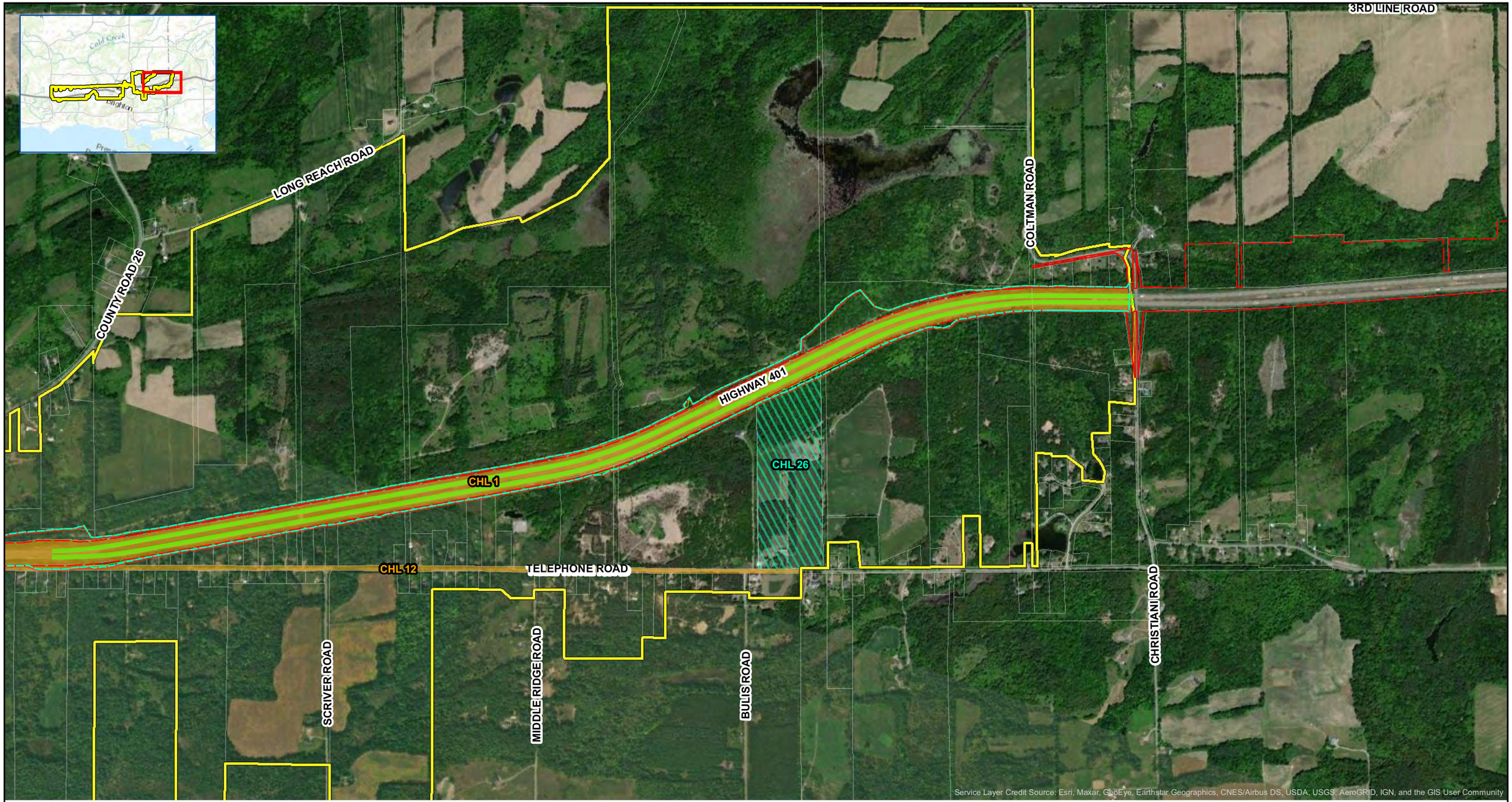
Credits: Land Information Ontario

Ontario

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Properties Screened for Cultural Heritage Value or Interest (CHVI)

Exhibit
4-46



LEGEND

- Study Area
- Property Parcel
- Cultural Heritage Landscape - Property
- Cultural Heritge Landscape - Roadscape
- Existing ROW
- Future Property Requirement
- Grading Limits
- Section 7 Alternative 2

N

0 100 200 400 600 m

Credits: Land Information Ontario

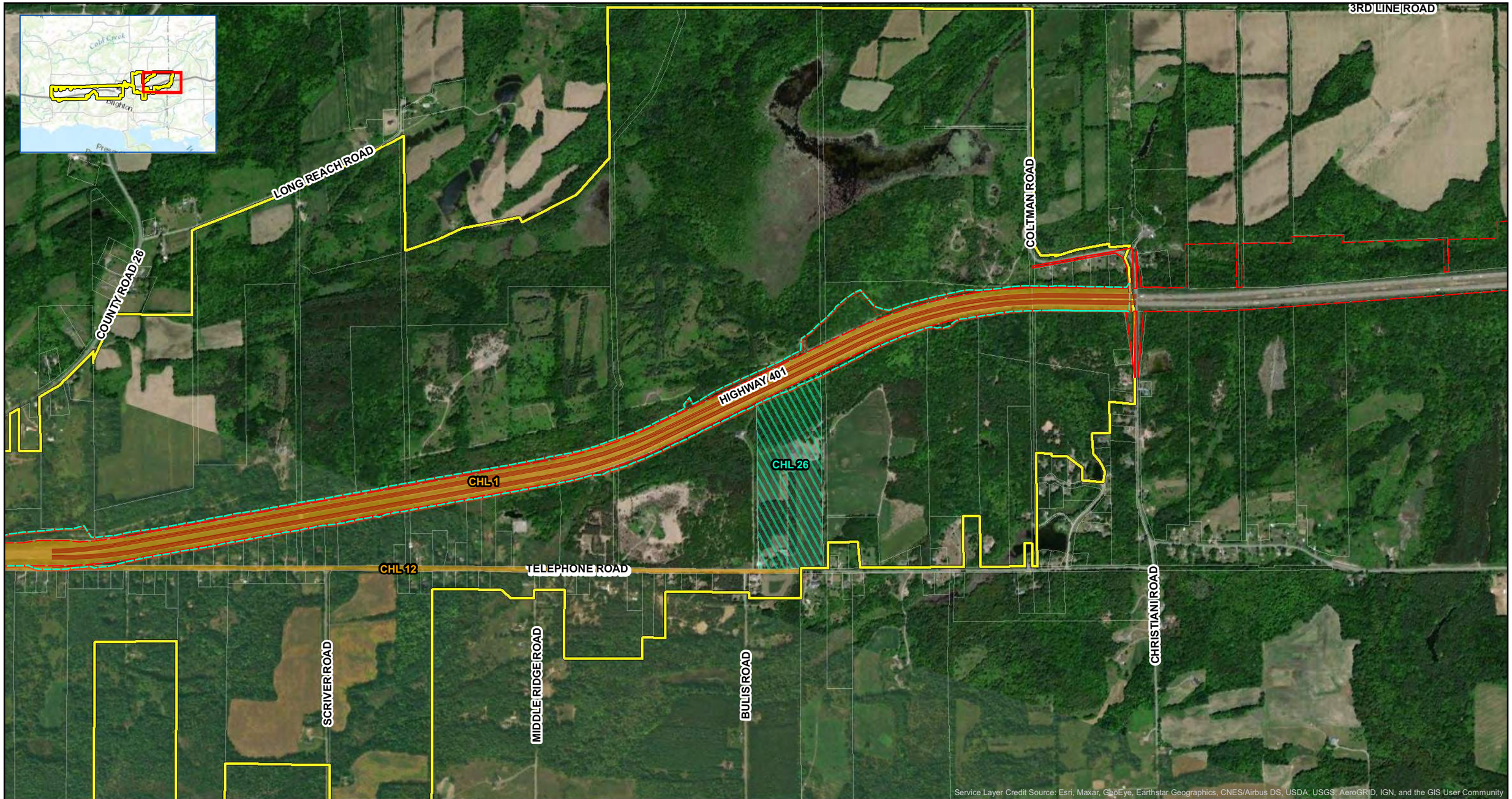
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Properties Screened for Cultural Heritage Value or Interest (CHVI)

Exhibit
4-47



LEGEND

- Study Area
- Property Parcel
- Cultural Heritage Landscape - Property
- Cultural Heritge Landscape - Roadscape
- Existing ROW
- Future Property Requirement
- Grading Limits
- Section 7 Alternative 4

N

0 100 200 400 600 m

Credits: Land Information Ontario

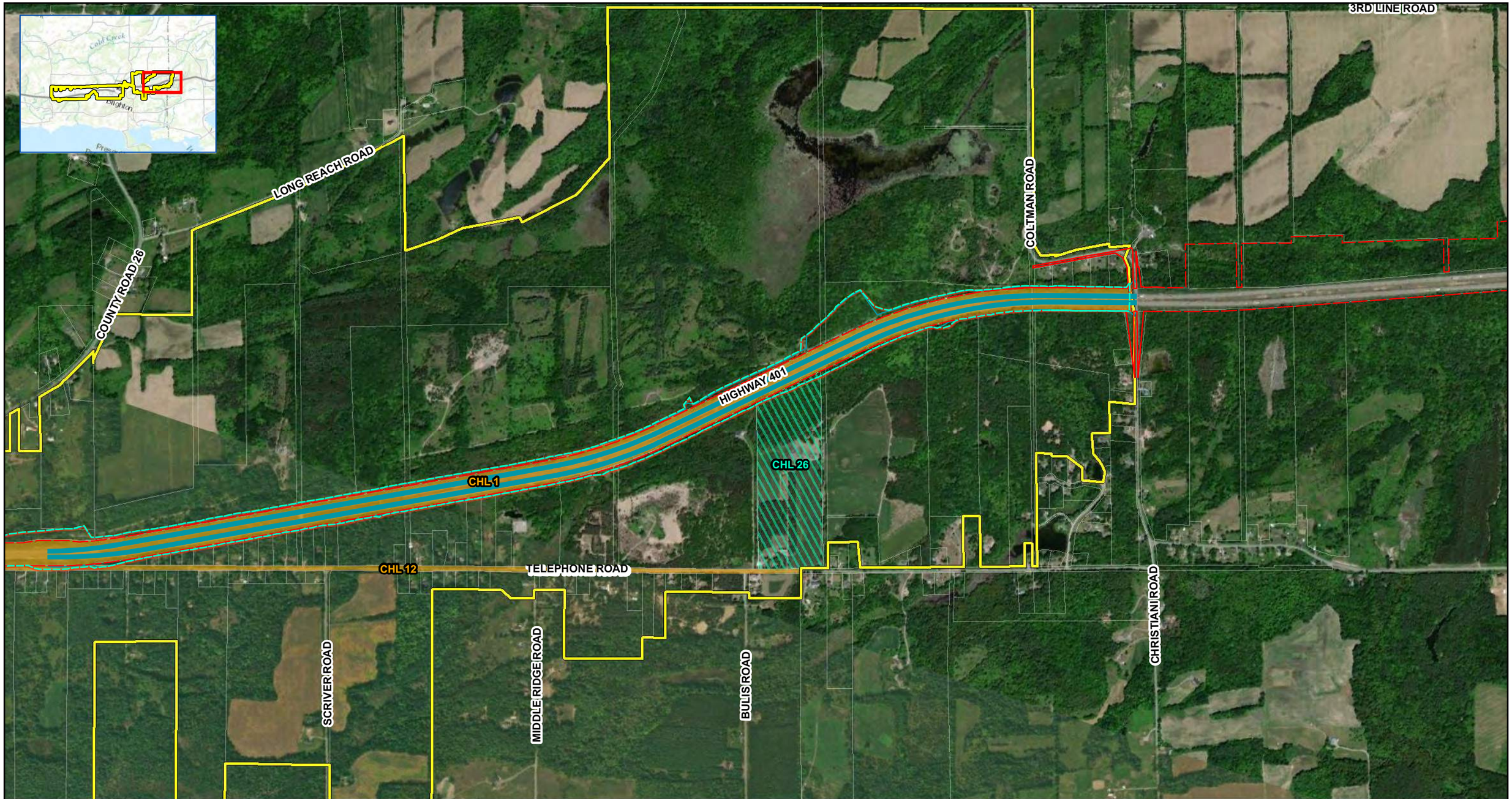
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Properties Screened for Cultural Heritage Value or Interest (CHVI)

Exhibit
4-48



LEGEND

- Study Area
- Property Parcel
- Cultural Heritage Landscape - Property
- Cultural Heritge Landscape - Roadscape
- Existing ROW
- Future Property Requirement
- Grading Limits
- Section 7 Alternative 5

N

0 100 200 400 600 m

Credits: Land Information Ontario

Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Properties Screened for Cultural Heritage Value or Interest (CHVI)

Exhibit
4-49

4.4 Technical Considerations

4.4.1 Existing Road Networks

4.4.1.1 Highway 401

The Study Area includes Highway 401, from approximately 0.8 kilometer east of Percy Street to 0.4 km west of Christiani Road (not including the County Road 30 Interchange). Highway 401 is Ontario's primary east-west freeway, extending from Windsor easterly to the Ontario-Quebec border. Highway 401 in the Study Area provides a connection to Toronto to the west and Kingston to the east. Within the Study Area, Highway 401 has a posted speed of 100 km/h and has four lanes (two lanes in each direction). Existing structures in the study include three underpasses crossing Highway 401 (Herley/Durham Road, Lake Road and County Road 26) and four structural culverts between Lake Road and County Road 30. These structures are aging and approaching the end of their service life. The driver behind this study is to identify Highway 401 corridor improvements that would facilitate the replacement of these structures and accommodate needed infrastructure improvements. There are three emergency median turnarounds within the Study Area, two located between Herley/Durham Road and Lake Road crossings the third is located between County Road 26 and Christiani Road, there is a fourth turnaround located just outside of the east study limits just east of Christiani Road, these turnarounds are shown in **Exhibit 4-50**. The need and justification for this study is further detailed in **Section 3.0**.

In terms of cross-section, Highway 401 within the Study Area currently operates as a four-lane freeway. Through the Study Area, Highway 401 transitions between 10 m closed (barrier in the middle) and 30 m open (i.e., grass median) as shown in **Exhibit 4-50**. Typical Highway 401 cross-sections are illustrated in **Exhibit 4-51** and **Exhibit 4-52**.

Exhibit 4-50: Highway 401 Median Transitions

Exhibit 4-51: Typical Existing Highway 401 Closed Median Cross-Section

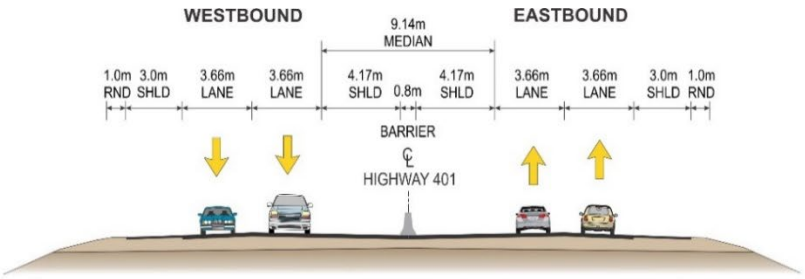
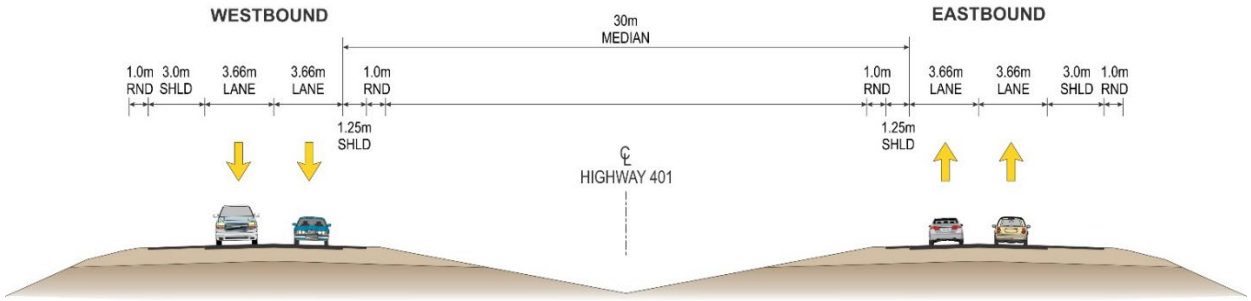


Exhibit 4-52: Typical Existing Highway 401 Open Median Cross-Section



4.4.1.2 Herley / Durham Road Crossing

Herley Road is a rural undivided 2-lane road. The Northumberland County Official Plan Schedule C (2016) identifies Herley Road as a local road. Within the Study Area, Herley Road does not have a posted speed limit; however, immediately south of Purdy Road, Herley Road has a posted speed of 60 km/h in the southbound direction. The Township of Cramahe provided input during the study that Herley Road has a posted speed of 80 km/h.

Within the Study Area, Herley Road is a two-lane local road. On the bridge, the lanes are 4.377 m wide and there are no shoulders. North and south of the bridge, the lanes are approximately 3.5 m wide. North of the bridge, there are unpaved shoulders approximately 1 m to 2 m wide.

4.4.1.3 Lake Road Crossing

Lake Road is a rural, 2-lane undivided road. The Northumberland County Official Plan Schedule C (2016) identifies Lake Road as a local road. Lake Road has a posted speed limit of 40 km/h (identified by the Township of Cramahe By-law # 07-31).

Within the Study Area, Lake Road is a two-lane local road. On the bridge, the lanes are 4.265 m wide with no shoulder and raised concrete 0.915 m wide on both sides. North of the bridge to Crandall Road, the lanes are approximately 4 m wide and there is guiderail located at the edge of a 0.5 m to 1.0 m wide unpaved shoulder. North of Crandall Road, the lanes are approximately 4 m wide and there are no shoulders. South of the bridge the lane widths are approximately 3.0 m to 3.25 m wide. For approximately 115 m south of the bridge up to McDonald Road, there is curb and gutter on both sides of the road. South of McDonald Road, there are unpaved outside shoulder approximately 2 m wide.

4.4.1.4 County Road 26 Crossing

County Road 26 is a rural undivided road. The Northumberland County Official Plan Schedule C (2016) identifies County Road 26 as an arterial road. County Road 26 has a posted speed of 80 km/h.

Within the Study Area, County Road 26 is a two-lane arterial road. On the bridge, the lanes are 4.88 m wide and there are no shoulders. North of the bridge, the lanes are approximately 3.25 m wide. For approximately 140 m north of the bridge, there is curb and gutter and guiderail located at the edge of a 1 m grassy shoulder. Further north, the lanes are approximately 3.5 m wide with 2.5 m partially paved shoulders with a 0.5 m paved width. South of the bridge to Telephone Road, the lanes are approximately 4 m wide and there is curb and gutter and guiderail located at the edge of a 1 m paved shoulder. South of Telephone Road, the lanes are approximately 3.5 m wide and there are unpaved shoulders 2.5 m to 3.0 m wide.

4.4.1.5 Municipal Roads

4.4.1.5.1 Crandall Road

Crandall Road is a two-lane, paved rural local undivided (RLU) road. Crandall Road extends from Lake Road on the east, runs along the north side of Highway 401, and curves northwards slightly to intersect Honey Road on the west.

There is no posted speed limit on Crandall Road. The Township of Cramahe provided input during the study that Crandall Road has a posted speed of 80 km/h.

4.4.1.5.2 McDonald Road

McDonald Road is an unpaved private rural local undivided (RLU) road that provides access to properties located on Little Lake. McDonald Road is located south of Highway 401, extending easterly off of Lake Road to wrap around Little Lake. As McDonald Road curves southerly around Little Lake, it is renamed to Trenear Road.

There is a posted speed limit of 20 km/h at the entrance of McDonald Road from Lake Road.

4.4.1.5.3 Telephone Road

Telephone Road is a two-lane, paved local undivided road (RLU). Telephone Road is an east-west road. It runs north of Highway 401 between Herron Road on the west, which is outside of the study limits, to County Road 30 on the east. East of County Road 30, Telephone Road continues to run east-west on the south side of Highway 401 from County Road 30 on the west to Christiani Road on the east. On either side of County Road 26, Telephone Road runs parallel to Highway 401 in very close proximity to the highway. Telephone Road has a posted speed of 60 km/h and a design speed of 70 km/h.

4.4.1.5.4 Honey Road

Honey Road is a two-lane, paved rural local undivided (RLU) road. Honey Road extends from Herley/Durham Road on the east, runs along the north side of Highway 401, then curves northwards to intersect perpendicular to Telephone Road. Crandall Road intersects Honey Road where it begins to curve northwards. There is no posted speed limit on the road.

4.4.2 Active Transportation

Lake Road is part of the existing Presqu'ile Promise cycling route identified in the Northumberland County Cycling Master Plan (July 2012). Per Northumberland County's 2017 Transportation Master Plan, Lake Road is a proposed signed bike route, with implementation proposed in the short term (0-5 years).

Telephone Road approximately 1.7 km to the north of Highway 401 and King Street East approximately 2.25 km to the south of Highway 401, are both part of existing and proposed cycling routes. Telephone Road and King Street East are part of the cycling routes identified in the Northumberland County Cycling Master Plan (July 2012), and King Street East is part of the Waterfront Trail. Telephone Road is a proposed signed bike route and King Street East is a proposed signed bike route with sharrow along the stretch perpendicular to Herley Road, with implementation proposed in the short term (next 0-5 years).

Counts of pedestrian and cyclists were completed on the Crossing Roads in summer and fall of 2020, the total counts are summarized in **Exhibit 4-53** below.

Exhibit 4-53: Summary of Pedestrian and Cycling Counts on Crossing Roads, Summer / Fall 2020

Collection Time	Herley / Durham Road		Lake Road		County Road 26	
	Bicycle	Pedestrian	Bicycle	Pedestrian	Bicycle	Pedestrian
2020 Summer (weekday)	0	2	6	1	1	1
2020 Summer (weekend)	4	0	7	0	1	0
2020 Fall (weekday)	5	0	0	0	0	2
2020 Fall (weekend)	0	4	2	4	1	3

4.4.3 Median Cross Overs

There are three median cross overs within the study limits; two are located between Herley Road and Lake Road and one between County Road 26 and Christiani Road. The location of the median cross overs are shown in **Exhibit 4-50**.

With the long distance between interchanges, 12.5 km between Percy Street & County Road 30 and 12.4 km between County Road 30 & County Road 40, the median cross overs are important to provide emergency and maintenance services intermediate locations where they can turn around.

The minimum median width required in order to accommodate a median cross over is 15 m.

4.4.4 Carpool Lot

There is one existing carpool lot within the study limits at County Road 30. The carpool lot is currently accessed off of Telephone Road on the south side of the interchange just east of County Road 30. The carpool currently has approximately 45, including 2 accessible spaces.

4.4.5 Existing Structures

The following sections provide further detail regarding the existing structures within the Study Area. All structures were built around the same time (1950s-1960s) and are aging. By the project horizon, the structures are anticipated to need replacement.

4.4.5.1 Herley / Durham Road Underpass

The existing bridge was constructed in 1958. It is a three-span bridge consisting of cast-in-place reinforced concrete multi-cell box beams. The overall length of the structure is 71.018 m with a span arrangement of 14.630 m – 33.528 m – 12.802 m from north to south. The structure spans Highway 401 at the centre span and is skewed at an angle of approximately 6º degrees to the centreline of Highway 401, with square end abutments and piers.

The overall width of the structure is 9.754 m with PL-2 box beam railings on both sides. The travelled deck width between curbs is 8.754 m which accommodates one lane and shoulder in each direction. The existing deck has an asphalt wearing surface with waterproofing membrane. Drainage ducts are located at the low points of the boxes and outlet adjacent to the south pier. The north and south abutments are conventional reinforced concrete abutments supported on steel H-piles. There is concrete slope paving in front of both abutments.

4.4.5.2 Lake Road Underpass

The existing bridge was constructed in 1959. It It is a three-span structure consisting of reinforced cast-in-place concrete voided slab with five (5) boxes. The structure articulation includes fixed connection at the south abutment, steel rocker bearings at the north abutment and pier columns with hinged connections at both the underside of superstructure and top of the footing. The overall length of the structure is 87.115 m with a span arrangement of 24.384 m – 36.271 m – 15.240 m from north to south. The structure spans Highway 401 at the centre span and is skewed at an angle of approximately 26.95 degrees.

The overall width of the structure Is 10.36 m with steel handrails mounted on concrete curbs on both sides. The travelled deck width between curbs is 8.53 m which accommodates one lane in each direction. The existing deck has an asphalt wearing surface with waterproofing system.

4.4.5.3 County Road 26 Underpass

The existing bridge was constructed in 1965. It is a four-span structure consisting of cast-in-place reinforced concrete deck slab on precast prestressed AASHO Type III concrete girders. The overall length of the structure is 79.553 m with a span arrangement of 12.649 m – 23.012 m – 23.012 m – 12.649 m from north to south. The structure spans Highway 401 at the two centre spans and is skewed at an angle of approximately 31 degrees.

The overall width of the structure is 10.36 m with PL-2 concrete parapet walls with railings on both sides. The travelled deck width between parapet walls is 9.762 m, which accommodates one lane and shoulder in each direction. The existing deck has an asphalt wearing surface with waterproofing membrane.

4.4.5.4 Structural Culverts

4.4.5.4.1 Culvert 5.0 km west of County Road 30 (Site No. 21X-0471C0)

The existing structure was constructed in 1958. It is a single span reinforced concrete box culvert with a span of 4.3 m, a rise of 2.4 m, and a total length of 60.00 m. There is approximately 3.0 m of earth fill above the culvert. The structure was constructed on a 20º skew to the northeast quadrant, with square ends. According to the original drawings, the inlet is set at an elevation of 170.85 m, the outlet is set at an elevation of 170.69 m, and the slope of the structure is 0.25%. The top slab thickness is 279 mm, the wall thickness is 356 mm, and the haunch dimension is 279 mm. The culvert upstream end is at the south and the downstream end is at the north.

4.4.5.4.2 Culvert 4.5 km west of County Road 30 (Site No. 21X-0472C0)

The existing structure was constructed in 1958. It is a single span reinforced concrete box culvert with a span of 4.3 m, a rise of 2.4 m, and a total length of 87.00 m. There is approximately 8.0 m of earth fill above the culvert. The structure was constructed on a 25º skew to the northwest quadrant, with square ends. According to the original drawings, the inlet is set at an elevation of 169.40m, the outlet is set at an elevation of 169.00 m, and the slope of the structure is 0.50%. The top slab thickness is 394 mm, the wall thickness is 521 mm, and the haunch dimension is 394 mm. The culvert upstream end is at the south and the downstream end is at the north.

4.4.5.4.3 Culvert 4.0 km west of County Road 30 (Site No. 21X-0473C0)

The existing structure was constructed in 1958. It is a single span reinforced concrete box culvert with a span of 4.3 m, a rise of 2.4 m, and a total length of 77.00 m. There is approximately 5.0 m of earth fill above the culvert. The structure was constructed on a 30º skew to the northeast quadrant, with square ends. According to the original drawings, the inlet is set at an elevation of 179.16m, the outlet is set at an elevation of 178.40 m, and the slope of the structure is 1.0%. The top slab thickness is 356 mm, the bottom slab thickness is 432 mm, the wall thickness is 457 mm, and the haunch dimension is 356 mm. The culvert upstream end is at the north and the downstream end is at the south.

4.4.5.4.4 Culvert 3.0 km west of County Road 30 (Site No. 21X-0474C0)

The existing structure was constructed in 1958. It is a single span reinforced concrete box culvert with a span of 4.3 m, a rise of 2.4 m, and a total length of 73.20 m. There is approximately 1.0 m of earth fill above the culvert. The structure was constructed on a 30º skew to the northwest quadrant, with square ends. The slope of the structure is 0.15%. The top slab thickness is 279 mm, the wall thickness is 356 mm, and the haunch dimension is 279 mm. The culvert upstream end is at the south and downstream end is at the north.

4.4.6 Existing Traffic Conditions

A detailed Traffic Operation Study was undertaken to assess the existing traffic operations in the Study Area. This study included traffic data collection and analysis of traffic operations and collision data. Further details are included in the Traffic Analysis Report in **Appendix M**.

4.4.6.1 Traffic Data Collection

The following data was collected:

- Highway 401 Mainline Traffic Volumes (2016): MTO provided the 2016 Automatic Traffic Record (ATR) for mainline sections of Highway 401 over spring, summer and fall.
- Highway 401 Ramp Traffic Volumes (2020): The Highway 401 ramp counts were collected by ATR in the Fall of 2020 over 24 hours and 7 days of a week.
- Crossing Road Traffic Volumes (2020): Vehicular, cyclist and pedestrian counts were obtained across 3 roadways over Highway 401 (Herley Road, Lake Road and County Road 26). The vehicular traffic counts were collected in Fall of 2020 over 24 hours for 7 days of a week. The cyclist and pedestrian counts were collected during summer and fall of 2020 for a period of 10 hours over a typical weekday and a weekend.

4.4.6.2 Highway 401 Existing Traffic Conditions

To determine the current traffic operating conditions on Highway 401 (mainline) the level of service (LOS) was assessed for basic freeway segments along the mainline. Level of service is a measure of traffic density and is mechanism used to determine how well a transportation facility is operating from a traveler's perspective.

Typically, six levels of service are defined, and each level is assigned a letter designation from A to F. LOS A represents free flow conditions and LOS F indicates unstable traffic operations with high delays. LOS A to D are considered to be acceptable operating conditions, while LOS E and F reflect congestion and operating conditions at or near capacity (LOS E) or over capacity (LOS F). LOS E and F typically represent undesirable operating conditions.

Level of service analysis was conducted for the Mainline of Highway 401 for the two segments from County Road 25 & County Road 30 and County Road 30 and County Road 40. The LOS are summarized in **Exhibit 4-54** for the two Highway 401 segments under different peak hour conditions. The peak-direction LOS analysis indicated that Highway 401 is currently operating with a LOS A during AM peak hour and LOS A to B during the PM peak hour. The weekend peak hour operation is the most critical, with LOS D. Overall, Highway 401 is operating at acceptable levels of service under the existing traffic demands.

Exhibit 4-54: Existing (2020) Highway 401 Mainline (LOS) Performance

Travel Demand Period	Season	Highway 401 Segment	
		County Road 25 to County Road 30	County Road 30 to County Road 40
AM Peak Hour, Peak-Direction	Fall	A	A
	Summer	A	A
PM Peak Hour, Peak – Direction	Fall	A	B
	Summer	B	B
Weekend Peak Hour, Peak-Direction	Fall	D	D
	Summer	D	D

In addition to LOS analysis, a micro-simulation model was used to analyze the existing traffic operations on Highway 401. The outputs of the model were used to develop speed-contour plots, which illustrate the modelled average travel speed for sections of the freeway at five-minute intervals throughout peak traffic periods. Simulated speed plots show that the traffic on the Highway 401 generally operates under free-flow conditions with simulated speeds of greater than 100 km/h during the weekday AM and PM peak hours. Under the weekend peak hour condition, the simulated speeds fall slightly below 100 km/h due to higher traffic demands.

4.4.7 Illumination

Highway 401 within the Study Area is not illuminated. Illumination is provided within carpool lot at the Highway 401/County Road 30 interchange.

4.4.8 Utilities

The following major utilities are located within the Study Area:

- Hydro One
- Enbridge Gas
- Bell Canada

- Cogeco Cable has a proposed crossing of Highway 401 just west of Lake Road.

The improvements proposed as part of this study may conflict with utility infrastructure in the Study Area. Potential utility conflicts are identified as part of this study in **Section 8.4.5** and will be subject to further review in Detail Design.

4.4.9 Drainage and Stormwater Management

WSP conducted a detailed field investigation in May 2021 to inspect and assess the existing highway drainage conditions within the study limits. There is a total of 42 culverts in the Study Area, four of which are structural culverts. The purpose of the drainage component of this assignment is to complete the Preliminary Design for replacement or rehabilitation of structures and for the future widening of Highway 401 with includes the following:

- Verify the existing structural and non-structural culvert conditions and capacities for each culvert
- Analyze the existing storm sewer system
- Evaluate all culverts and storm sewers based on the proposed alternative
- Determine the preliminary stormwater management plan to achieve water quantity and quality control

A summary of the existing drainage conditions are outlined below, further information can be found in the Drainage and Stormwater Management Report in **Appendix D**.

4.4.9.1 Existing Hydraulic analysis

The 50-year storm was used as the design storm and the 100-year storm was used as the check storm for all culverts with a span less than 6 m. The hydraulic analysis involved the comparison of the headwater elevation and the elevation at which water would spill onto the highway. This comparison will determine if the existing culvert meets the freeboard and flood depth design criteria.

There is a total of five existing non-structural culverts that do not meet the design criteria.

4.4.9.2 Stormwater Management

Existing runoff from Highway 401 within the Study Area flows towards the grassed median and side ditches. When a concrete median is present instead of a grassed median, runoff flowing towards the median will be collected through existing catch basins and conveyed to an outlet through existing storm sewers. The outlets discharge to the outer ditches of the highway. The analysis for the existing storm sewers concluded that all existing pipes have at least the minimum velocity of 0.5 m/s.

5.0 ALTERNATIVES AND EVALUATION

A key principle of the Environmental Assessment process is to identify and compare a reasonable range of alternatives to address the stated study problems or opportunities. Alternatives to the Undertaking are defined as *functionally* different ways of addressing the stated problems and opportunities.

In accordance with the Class EA process, the assessment and evaluation of alternatives has been completed to be traceable, replicable, and understandable.

5.1 Alternatives to the Undertaking

The following planning alternatives represent a full range of potential improvements and were assessed as part of this study:

- Do Nothing;
- Transportation Demand Management (TDM);
- Improved/New Provincial Transportation Facility; and,
- Improved Adjacent Road System.

The description and summary of recommendations for each planning alternative is summarized in Exhibit 5-1.

The “Do-nothing” alternative was considered to provide a baseline against which the impacts of other alternatives could be compared. The do-nothing alternative does not address any of the problems or opportunities and was therefore not considered a feasible solution.

Transportation Demand Management (TDM) includes the implementation of measures to sufficiently reduce, shift, or eliminate transportation demand, such that improved transportation infrastructure / operations within the Study Area are not required. TDM strategies do not address the transportation issues and is therefore not considered a feasible alternative.

Improved provincial transportation facilities can address the identified problems and opportunities. Therefore, the preferred planning solution is to implement improvements to provincial transportation facilities in the Study Area.

Exhibit 5-1: Alternatives to the Undertaking

Planning Alternative	Description	Summary of Recommendation
Do Nothing	The bridges, culverts and Highway 401 would remain “as-is”. The structures would be subject to programmed maintenance activities (e.g., rehabilitations).	DO NOT CARRY FORWARD This alternative does not address the transportation issues because the aging bridges and culverts need to be replaced.
Transportation Demand Management (TDM)	TDM strategies reduce overall demands on the highway network by shifting demands to time periods outside of the critical congestion periods, and shift demands to alternative modes of transportation (e.g., public transit, cycling and walking). Measures have been included in the transportation modelling used in this project, based on policy directions within the Provincial Growth Plan.	DO NOT CARRY FORWARD On its own, TDM strategies do not address the transportation issues.
Improved / New Provincial Transportation Facility	Operational and safety improvements to optimize the movement and capacity of people and goods on Highway 401 through the project limits. This alternative includes	CARRY FORWARD This alternative will be carried forward for further consideration.

Planning Alternative	Description	Summary of Recommendation
	replacement of the bridges and culverts, establishing the footprint of the Highway 401 for the interim six lanes and ultimate right lanes and carpool lot.	
Improved Adjacent Road Systems	Widening of adjacent regional and municipal roads would increase overall transportation network capacity yet would not support inter-regional trips.	DO NOT CARRY FORWARD This alternative would not address the transportation issues.

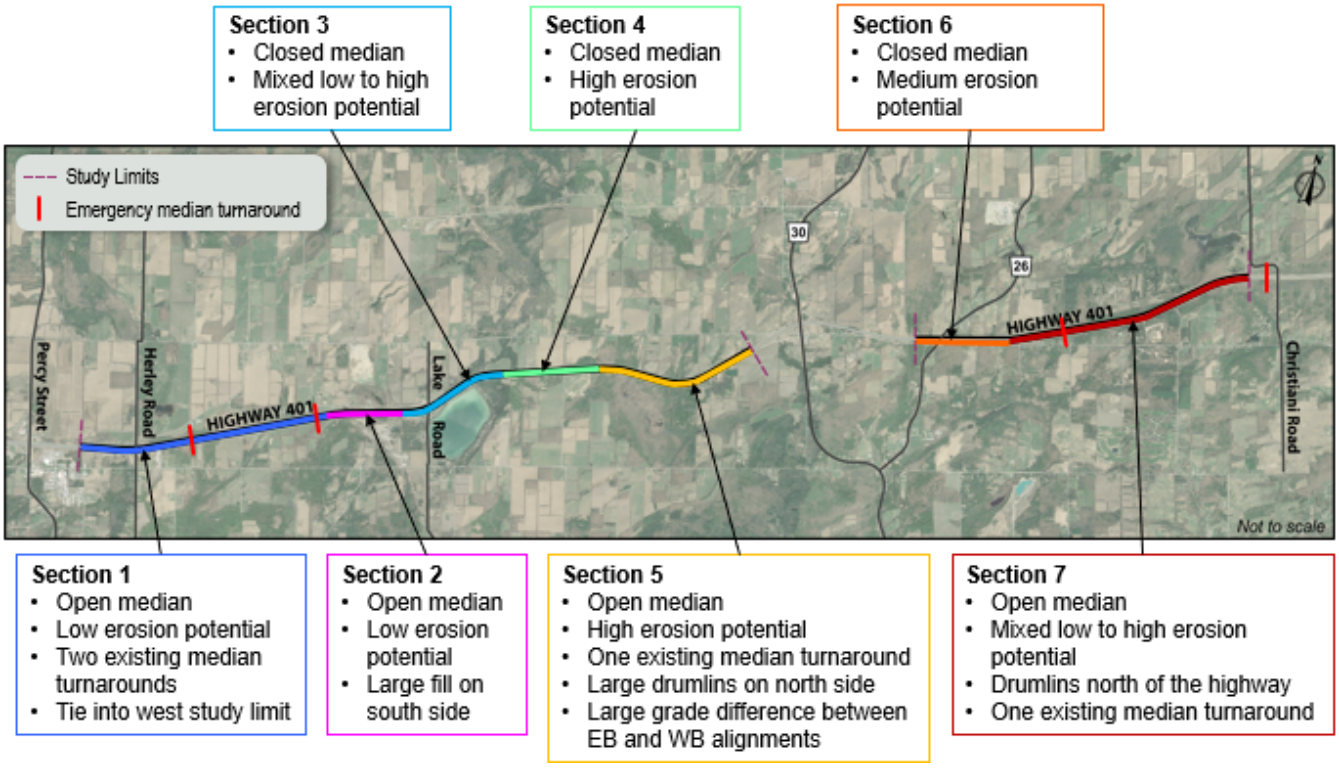
5.2 Long-List of Alternatives Screening

Section 3.0 details the identification of existing conditions, problems and opportunities within the Study Area. From the identification of issues, it was possible to generate Alternative Methods that would meet the existing operational and infrastructural requirements while also accommodating future needs.

The Project Team developed long lists of alternatives for the following:

- Crossing road bridge replacement for each crossing road location (Herley Road, Lake Road and County Road 26);
- Structural culverts in the Study Area; and
- Highway 401 widening. Highway 401 was divided into 7 sections based on the presence of a median, erosion potential of the soil and site conditions as shown in **Exhibit 5-2**. A long list of different alternatives for the 7 sections and future widening of Highway 401 were developed.

Exhibit 5-2: Highway 401 Widening Alternative Sections



Following the development of the long list of alternatives, the Project Team screened each alternative by looking at key advantages and disadvantages to determine if an alternative should be carried forward for further development and analysis. The long-list of alternatives and identified short-list of alternatives were presented at Public Information Centre #1.

The screening of the long-list alternatives is further detailed in the following sections and the evaluation of the short-list of alternatives is detailed in **Section 5.5**.

The screening table of the long-list of alternatives are included in **Appendix N**. The screening of the long-list of alternatives is used to identify a short-list of alternatives. The short-list of alternatives is carried forward and subjected to a detailed evaluation to identify the Technically Preferred Alternative, further detailed in **Section 5.6**.

5.2.1 Highway Widening Alternatives

5.2.1.1 Section 1

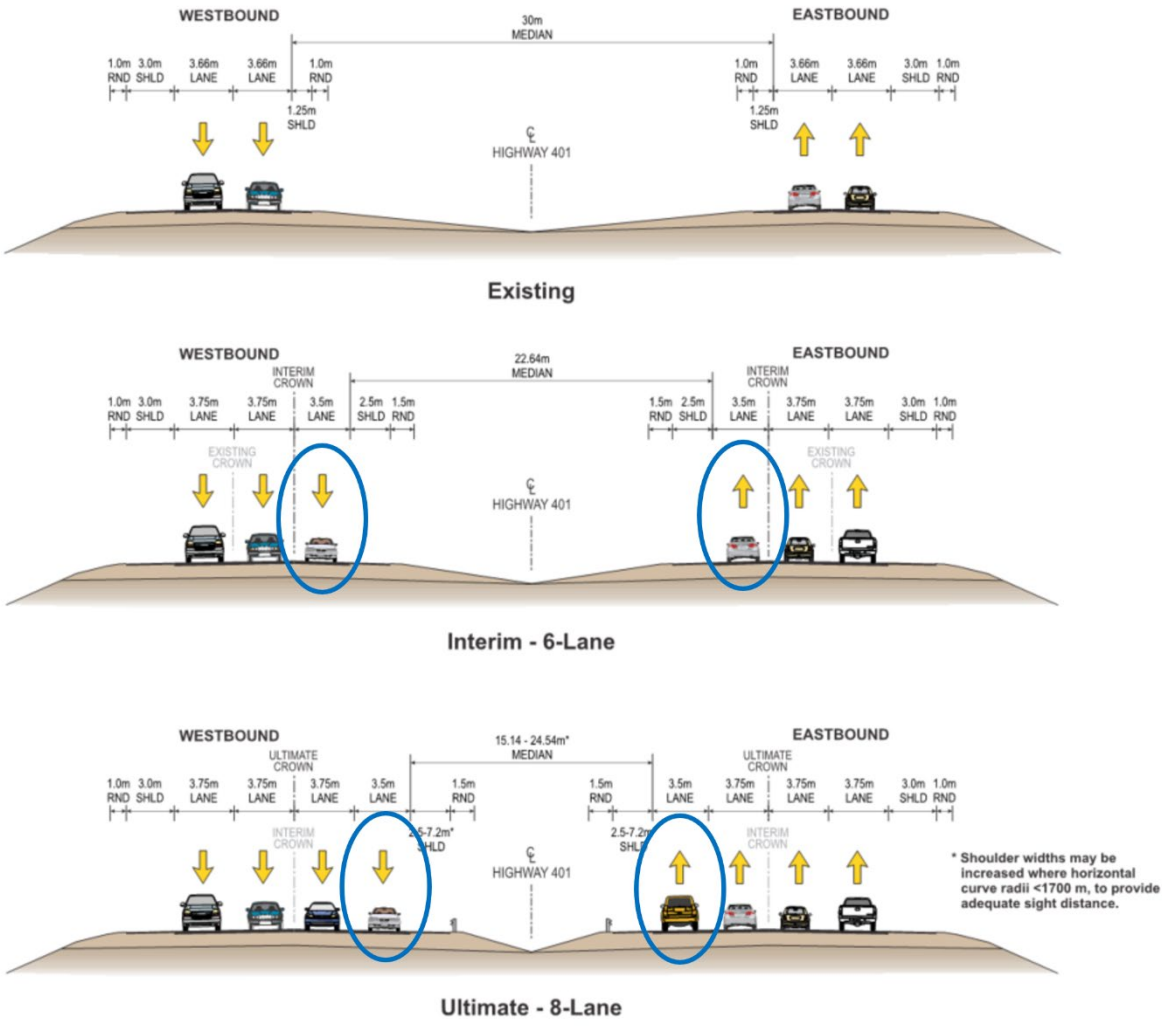
Section 1 is from west study limit to 1.6 km west of Lake Road and includes:

- Alternative 1 – Widen inside only.
- Alternative 2 – Widen inside in the Interim and widen outside in the Ultimate.

Alternative 1 does minimize property and potential environmental impacts, has lower costs than Alternative 2 and minimizes cuts/fills outside of the existing highway footprint but Alternative 1 was not carried forward because double median barriers are required in the Ultimate condition, which are less desirable than an open median and

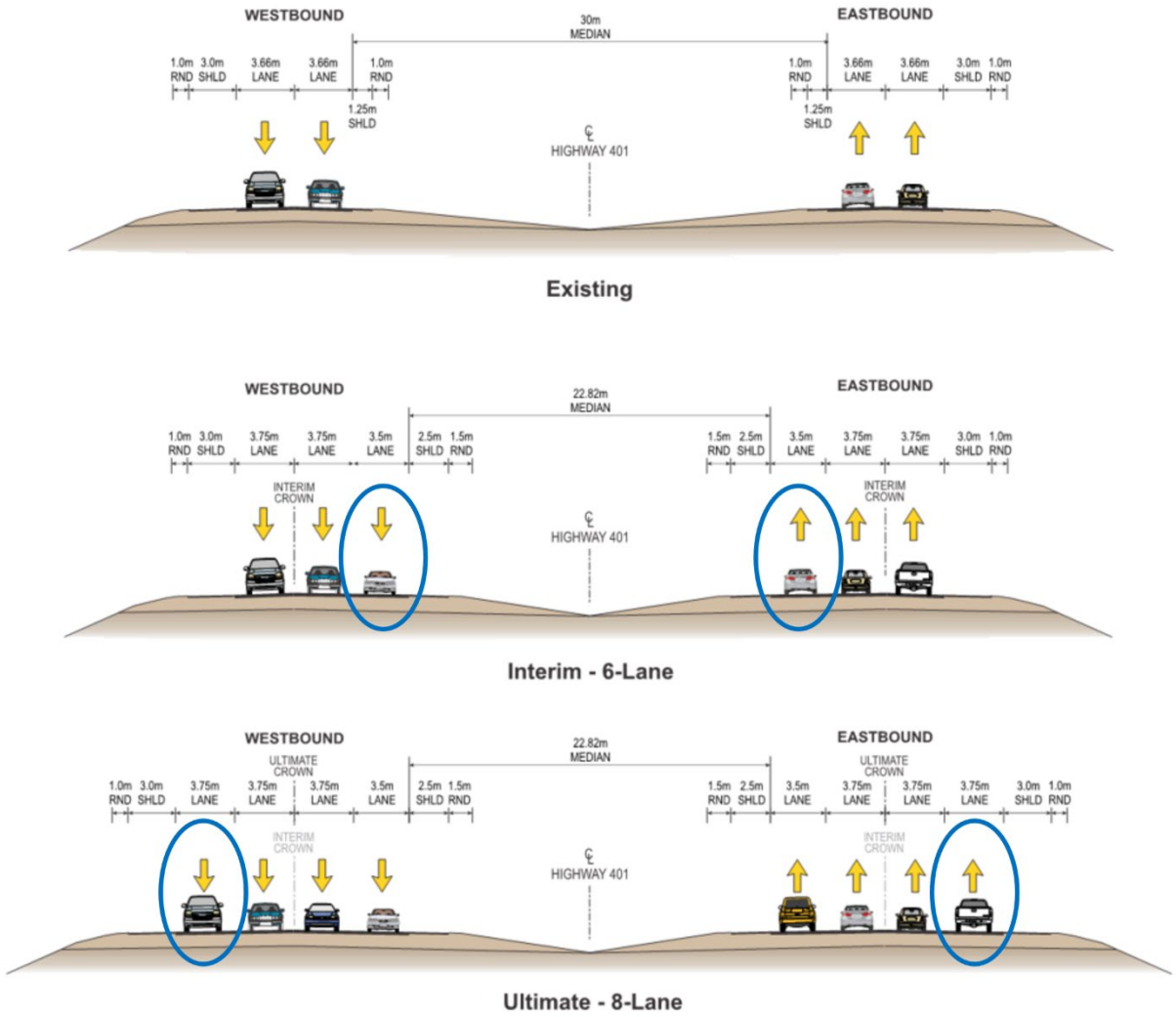
the two existing emergency median turnarounds are precluded in the Ultimate condition. Alternative 1 is illustrated in **Exhibit 5-3**.

Exhibit 5-3: Section 1 – Alternative 1 (Widen inside only)



Alternative 2 was carried forward because it retains the open median in the Ultimate condition (no median barrier is needed) and the two existing emergency median turnarounds can be accommodated. It does have larger potential property and environmental impacts, a higher cost than Alternative 1 and some cuts/fills outside of the existing highway footprint. Alternative 2 is illustrated in **Exhibit 5-4**.

Exhibit 5-4: Section 1 – Alternative 2 (Widen inside in the Interim and widen outside in the Ultimate)



The detailed long-list screening tables are included in **Appendix N**.

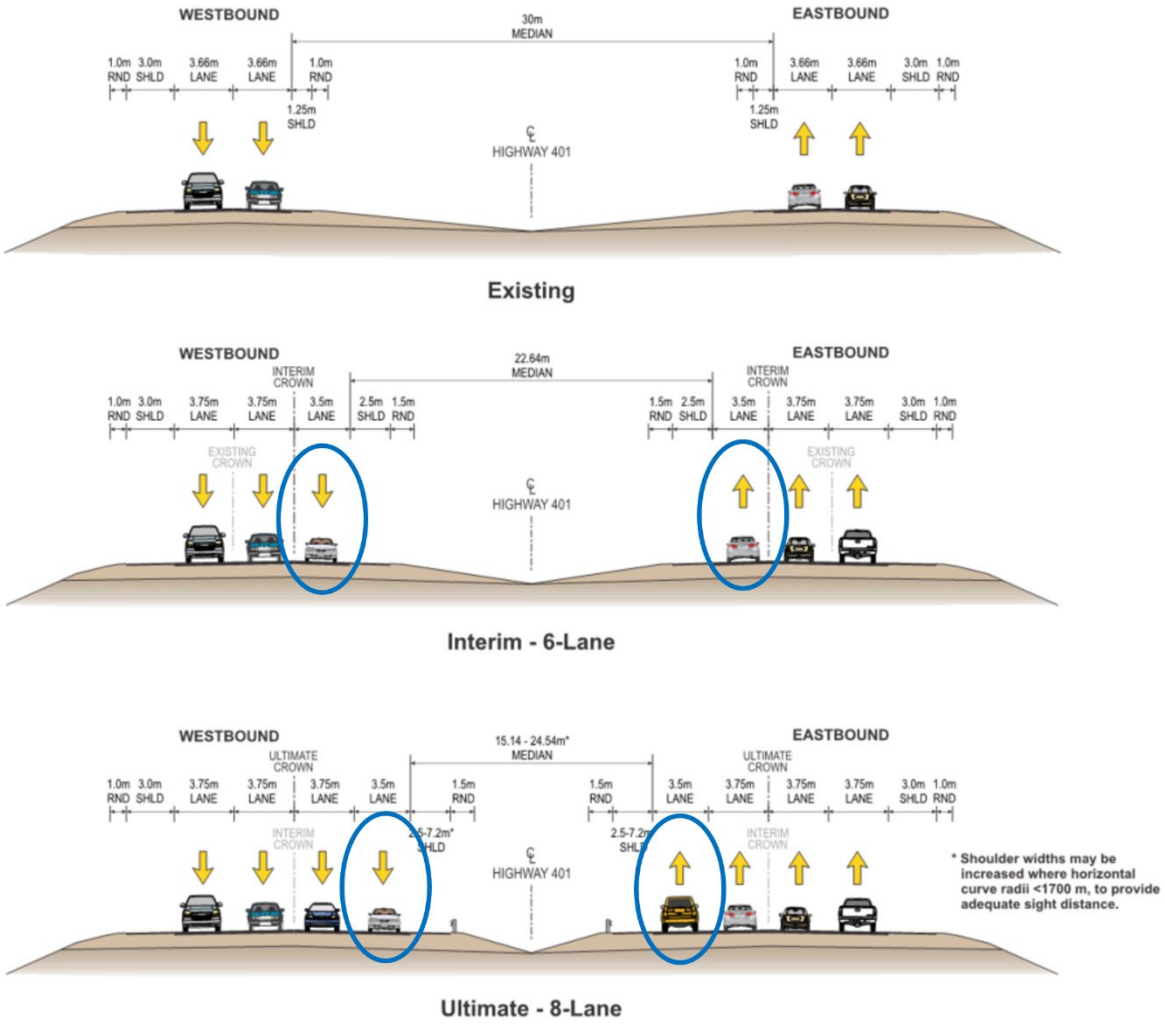
5.2.1.2 Section 2

Section 2 is from 1.6 km west of Lake Road to 0.4 km west of Lake Road and includes:

- Alternative 1 – Widen inside only
- Alternative 2 – Widen inside in the Interim and widen outside in the Ultimate
- Alternative 3 – Widen to the north

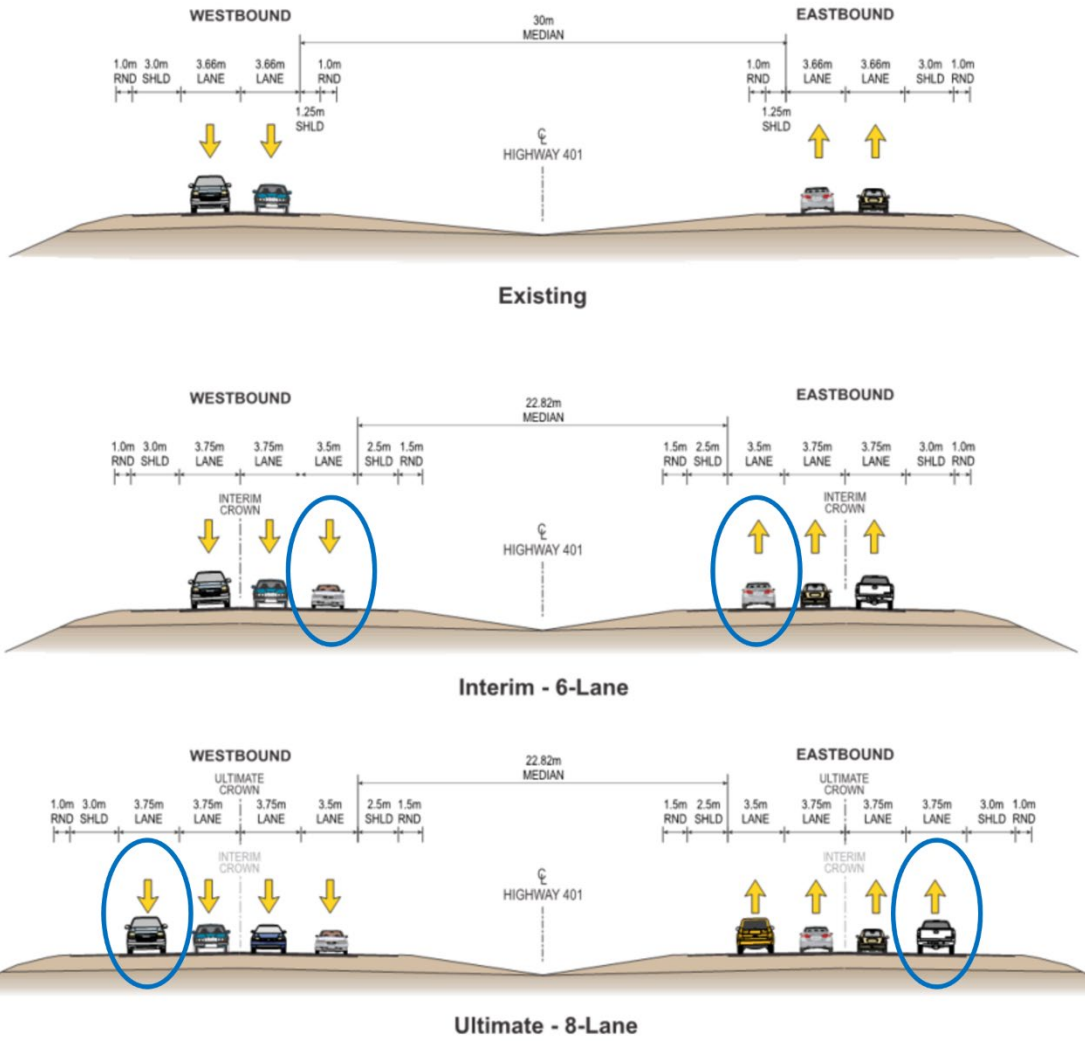
Alternative 1 was carried forward because it carries the lowest cost, minimizes the large fill that would be required south of the highway where there is a large depression in the terrain, and minimizes property and potential environmental impacts. However, Alternative 1 would require double median barriers in the Ultimate condition which are less desirable than an open median. Alternative 1 is illustrated in **Exhibit 5-5**.

Exhibit 5-5: Section 2 – Alternative 1 (Widen inside only)



Alternative 2 was carried forward for further study. It may require a large fill south of the highway, does have moderate potential property impacts, larger potential environmental impacts, higher cost than Alternative 1. However, this alternative retains an open median in the Ultimate condition (no median barriers needed). Alternative 2 is illustrated in **Exhibit 5-6**.

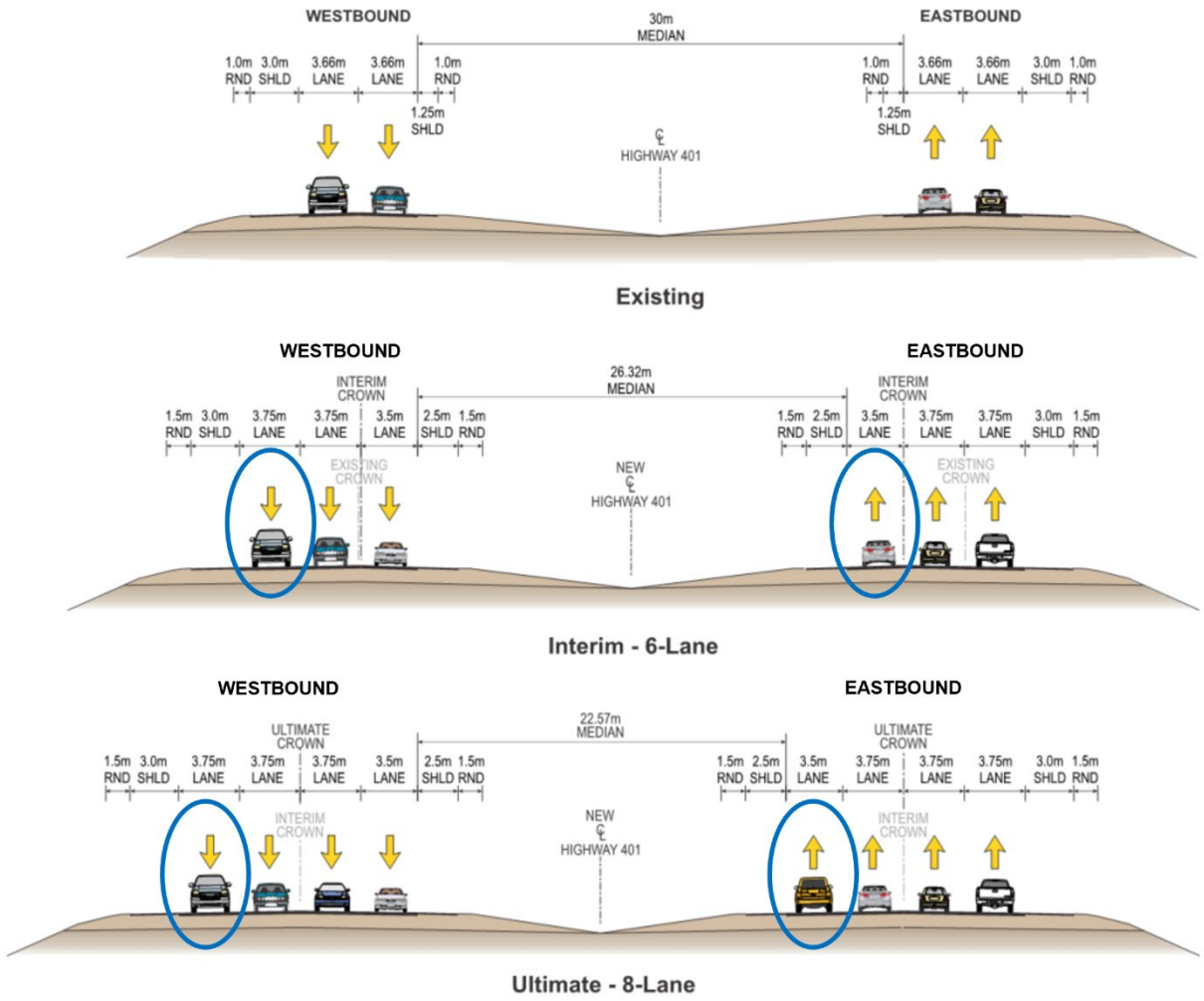
Exhibit 5-6: Section 2 – Alternative 2 (Widen inside in the Interim and widen outside in the Ultimate)



Alternative 3 was carried forward as a it retains an open median in the Ultimate condition (no median barrier needed) and minimizes the large fill in the south. However, this alternative has the largest potential property impacts, larger potential environmental impacts (including wetland impact) and has higher costs than Alternative 1. Alternative 3 is illustrated in **Exhibit 5-7**.

The detailed long-list screening tables are included in **Appendix N**.

Exhibit 5-7: Section 2 – Alternative 3 (Widen to the north)



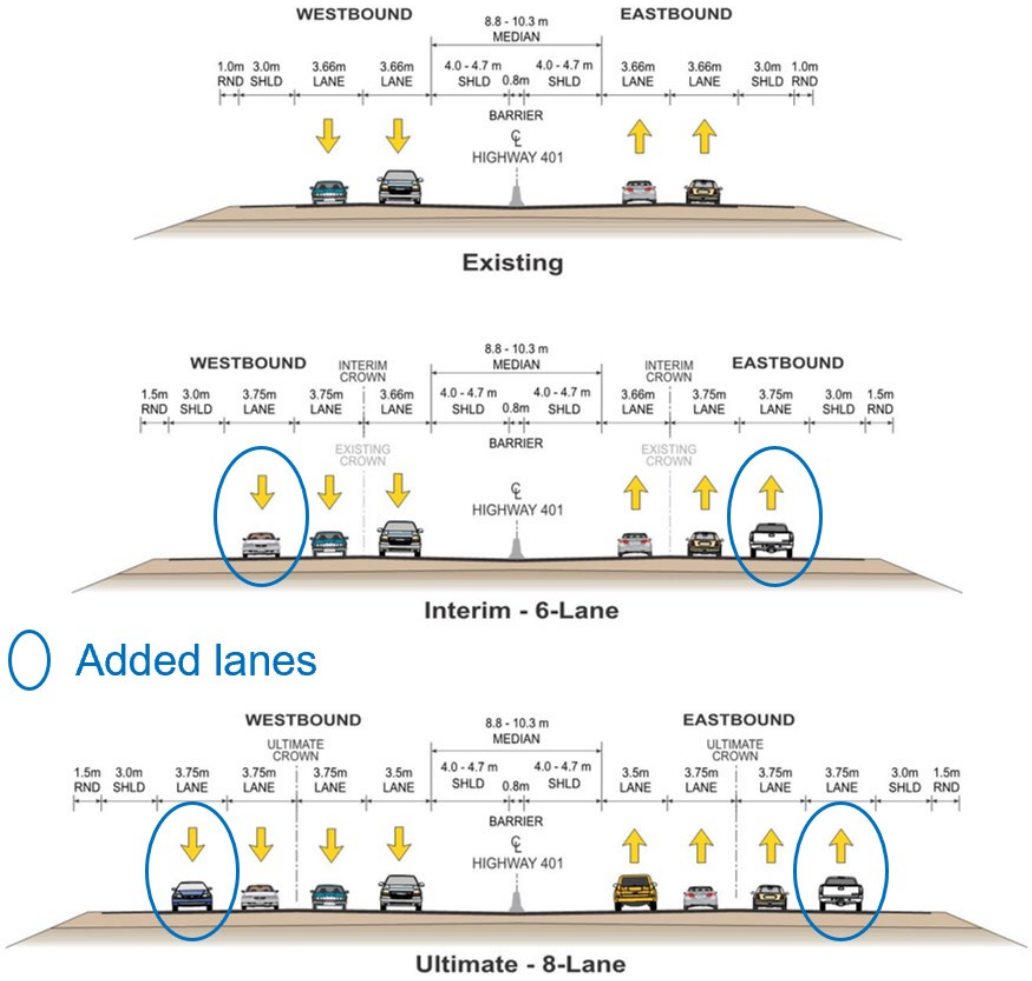
5.2.1.3 Section 3

Section 3 is from 0.4 km west of Lake Road to 1.3 km east of Lake Road and includes:

- Alternative 1 – Widen outside only and widen median shoulders
- Alternative 2 – Widen outside only and realign using two 1200 m radius curves
- Alternative 3 – Widen outside only and realign using two 1700 m radius curves

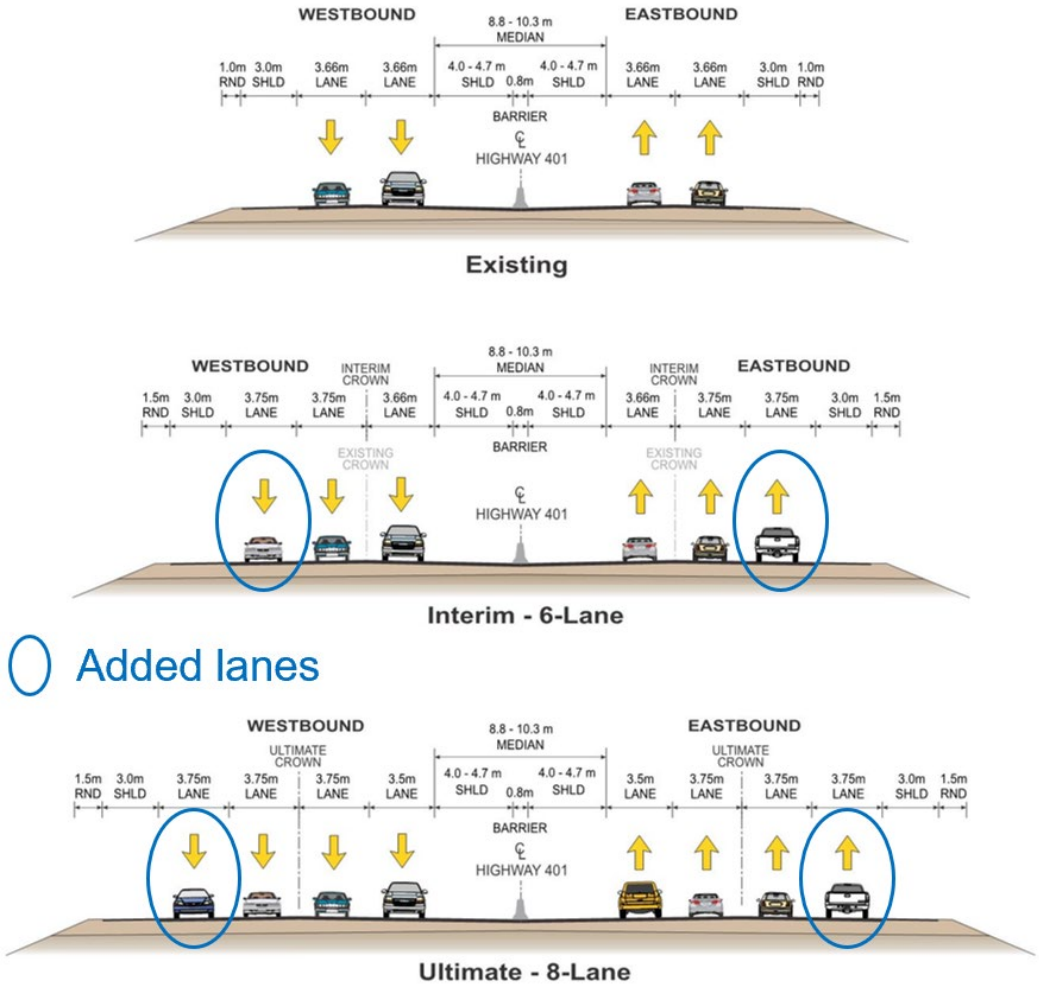
Alterative 1 was carried forward as it improves the sight distance on the curves to the design standard, has relatively low costs, and requires less complex construction than the other alternatives. It also minimizes impacts to property and Crandall Road. Alternative 1 is illustrated in **Exhibit 5-8**.

Exhibit 5-8: Section 3 – Alternative 1 (Widen outside only and widen median shoulders)



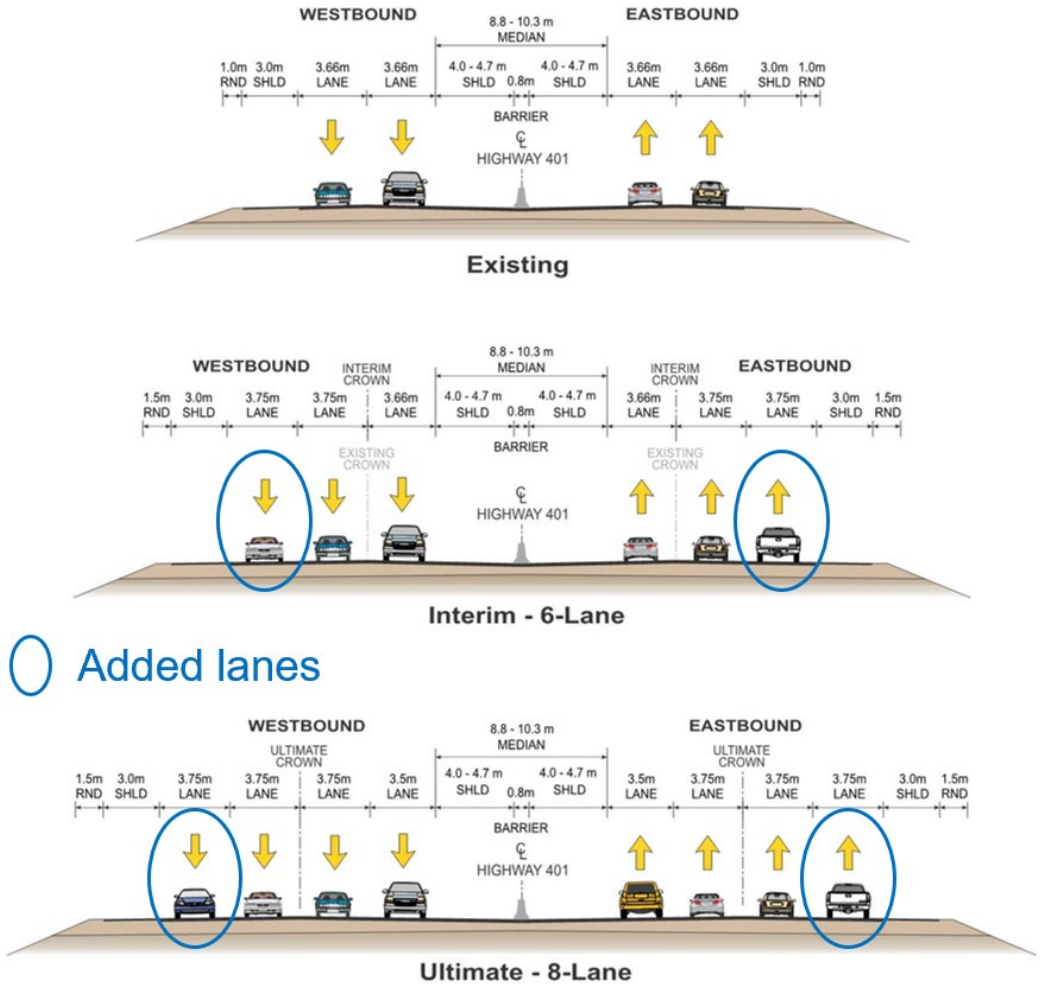
Alternative 2 was carried forward as it improves the existing highway geometry. However, it has greater potential property impacts outside of the ROW, significant realignment of Crandall Road and property impacts on the north side (with greater cost or difficulty to mitigate these impacts), has high costs and high constructability difficulty due to the highway realignment, traffic staging challenges and significant earthworks. Alternative 1 is illustrated in **Exhibit 5-9**.

Exhibit 5-9: Section 3–- Alternative 2 (Widen outside only and realign using two 1200 m radius curves)



Alternative 3 was carried forward as it improves the existing highway geometry to the desirable standard. However, it will require a significant realignment of Crandall Road and property impacts on the north side (with greater cost or difficulty to mitigate these impacts), has greater potential property impacts outside of the existing ROW, has the highest cost and little to no reuse of the existing highway, and has high construction difficulty due to high realignment, traffic staging challenges and significant earthworks. Alternative 2 is illustrated **Exhibit 5-10**.

Exhibit 5-10: Section 3 – Alternative 3 (Widen outside only and realign using two 1700 m radius curves)



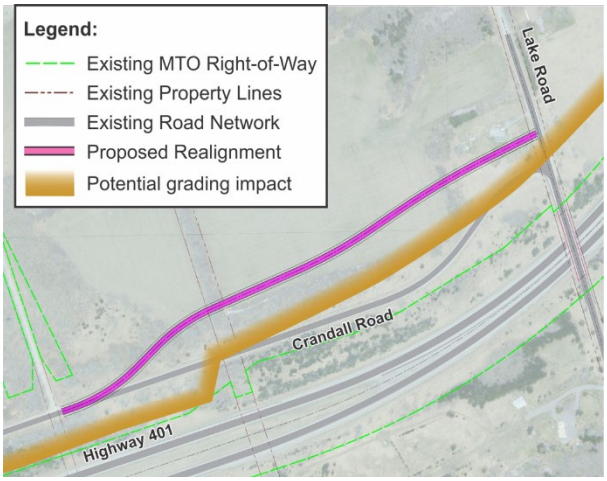
5.2.1.3.1 Crandall Road Realignment Sub-Alternatives

As a result of the highway widening through Section 3 (**Exhibit 5-8** to **Exhibit 5-10**), the existing Crandall Road may be impacted and may require realignment. There are three potential Crandall Road realignments shown in **Exhibit 5-11** and outlined below:

- Sub-Alternative 1 for Section 3 – Alternative 1
- Sub-Alternative 2 for Section 3 – Alternatives 2 and 3
- Sub-Alternative 3 for Section 3 – Alternatives 1, 2, and 3

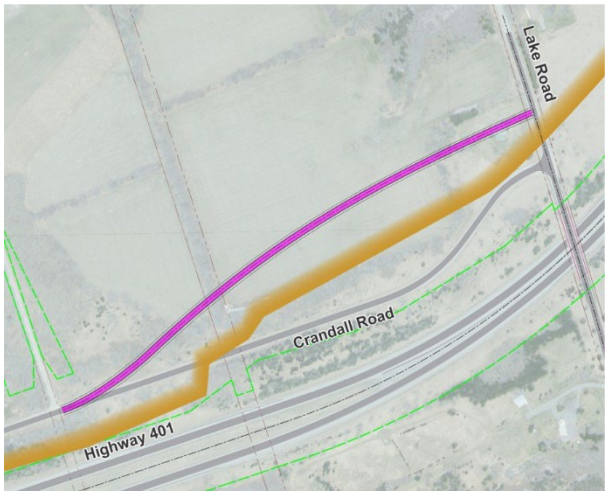
Exhibit 5-11: Crandall Road Realignment Sub-Alternatives for Section 3

Sub-Alternative 1 for Section 3 – Alternative 1



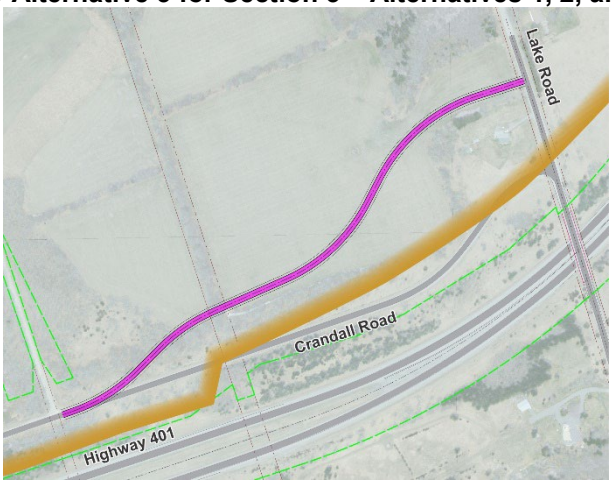
Highway widening may result in grading impacts beyond the existing Crandall Road

Sub-Alternative 2 for Section 3 – Alternatives 2 and 3



Larger Highway 401 realignment results in larger potential grading impacts and Crandall Road realignment

Sub-Alternative 3 for Section 3 – Alternatives 1, 2, and 3



Larger grading / property impacts and Crandall Road realignment than Alternatives 1 and 2

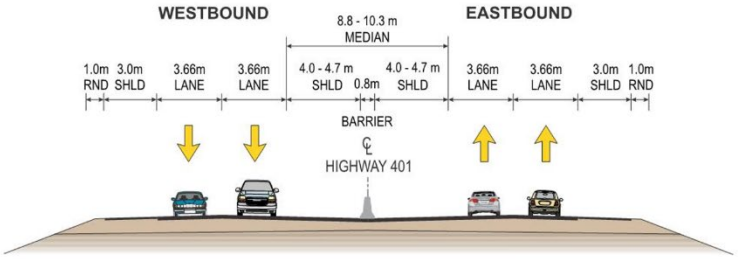
These alternatives were carried forward for further development and underwent further evaluation in combination with the preferred Section 3 Highway 401 widening alternative.

The detailed long-list screening tables are included in **Appendix N**.

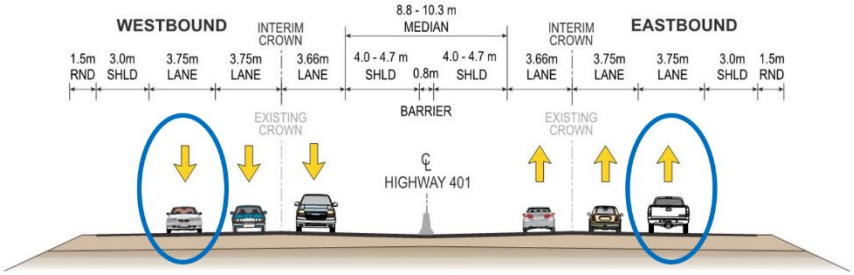
5.2.1.4 Section 4

Section 4 is from 1.3 km east of Lake Road to 2.8 km east of Lake Road. As the existing cross-section is a narrow median with concrete barrier, the only alternative is to widen to the outside (see **Exhibit 5-12**). This alternative is recommended to be carried forward as the preferred alternative.

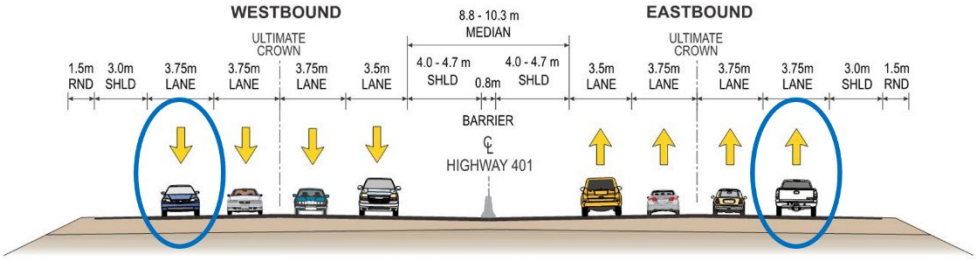
Exhibit 5-12: Section 4 – Alterative 1 (Widen outside only)



Existing



Interim - 6-Lane



Ultimate - 8-Lane

5.2.1.5 Section 5

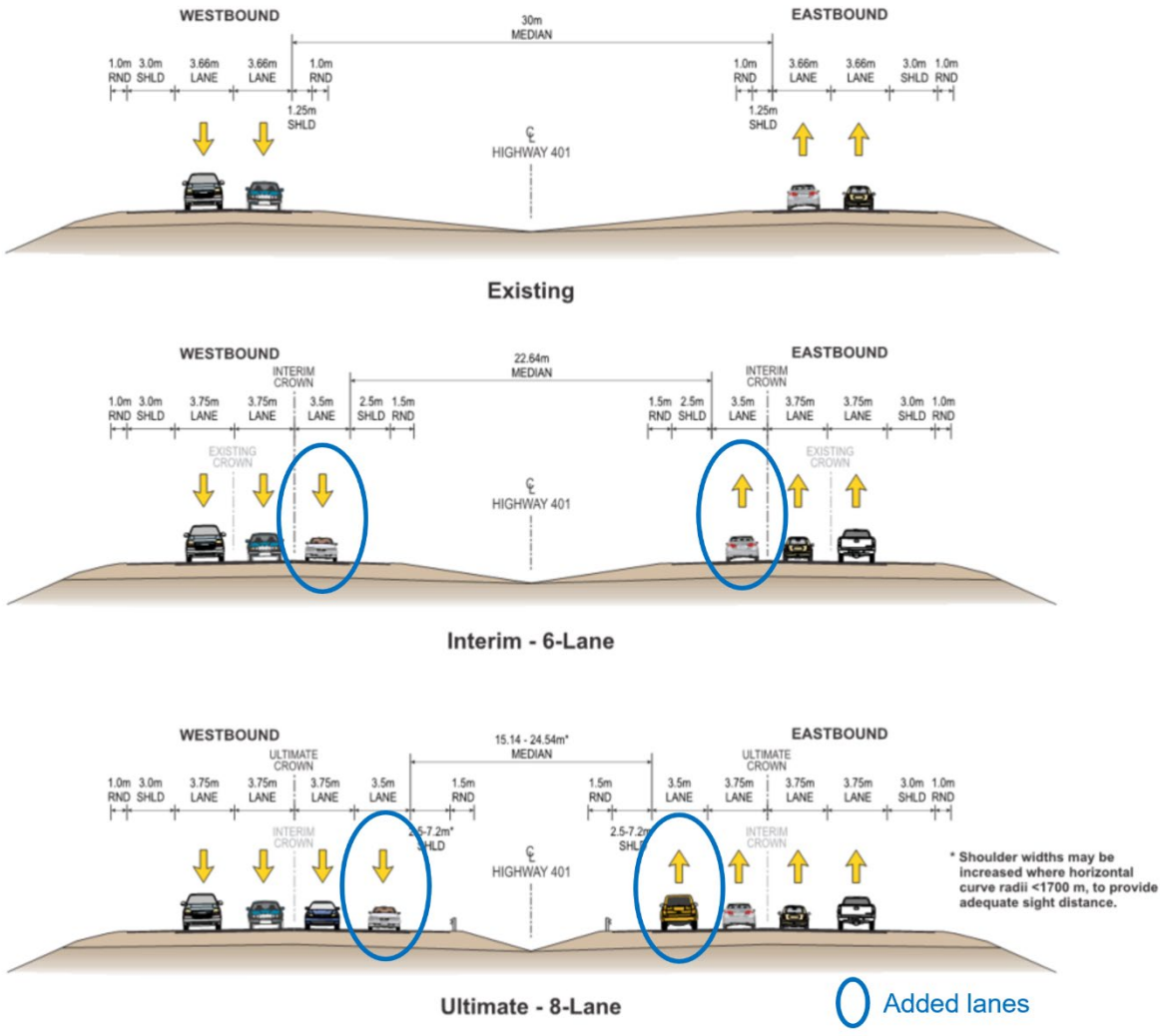
Section 5 is from 2.8 km east of Lake Road to the west study limit of the County Road 30 study (which was completed under a previous EA) and includes:

- Alternative 1 – Widen inside only
- Alternative 2 – Widen inside in the Interim, and widen westbound inside and eastbound outside in the Ultimate
- Alternative 3 – Widen to the south

- Alternative 4 – Widen inside in the Interim and widen outside in the Ultimate

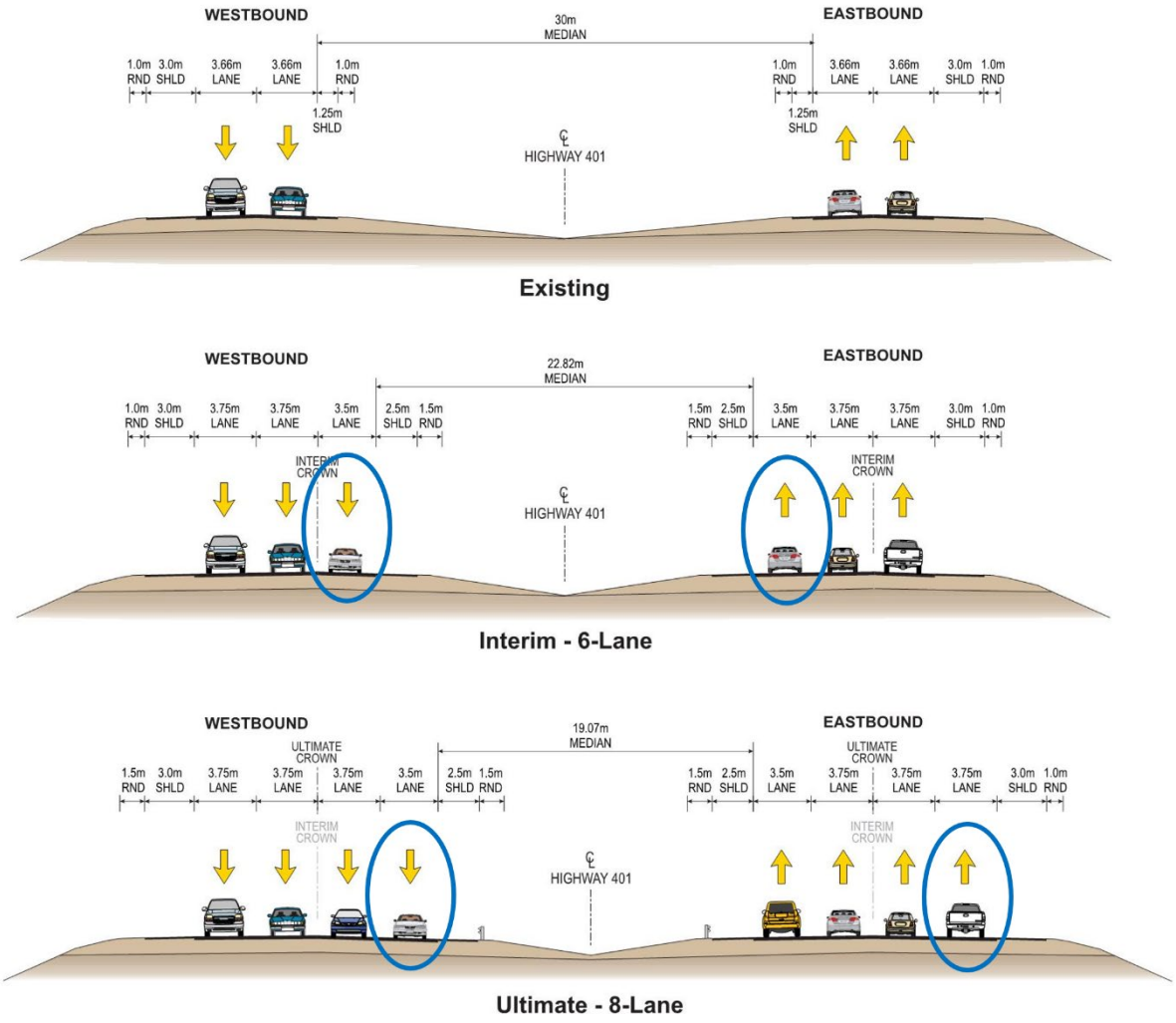
Alternative 1 was recommended to not be carried forward due to double barriers being required in the median which is not desirable from a safety and maintenance perspective. Additionally, a retained wall may be required in the median because there is a large grade difference between the eastbound and westbound traffic and limited space in the median to grade the slop and provide a ditch. Alternative 1 is illustrated in **Exhibit 5-13**.

Exhibit 5-13: Section 5 – Alternative 1 (Widen inside only)



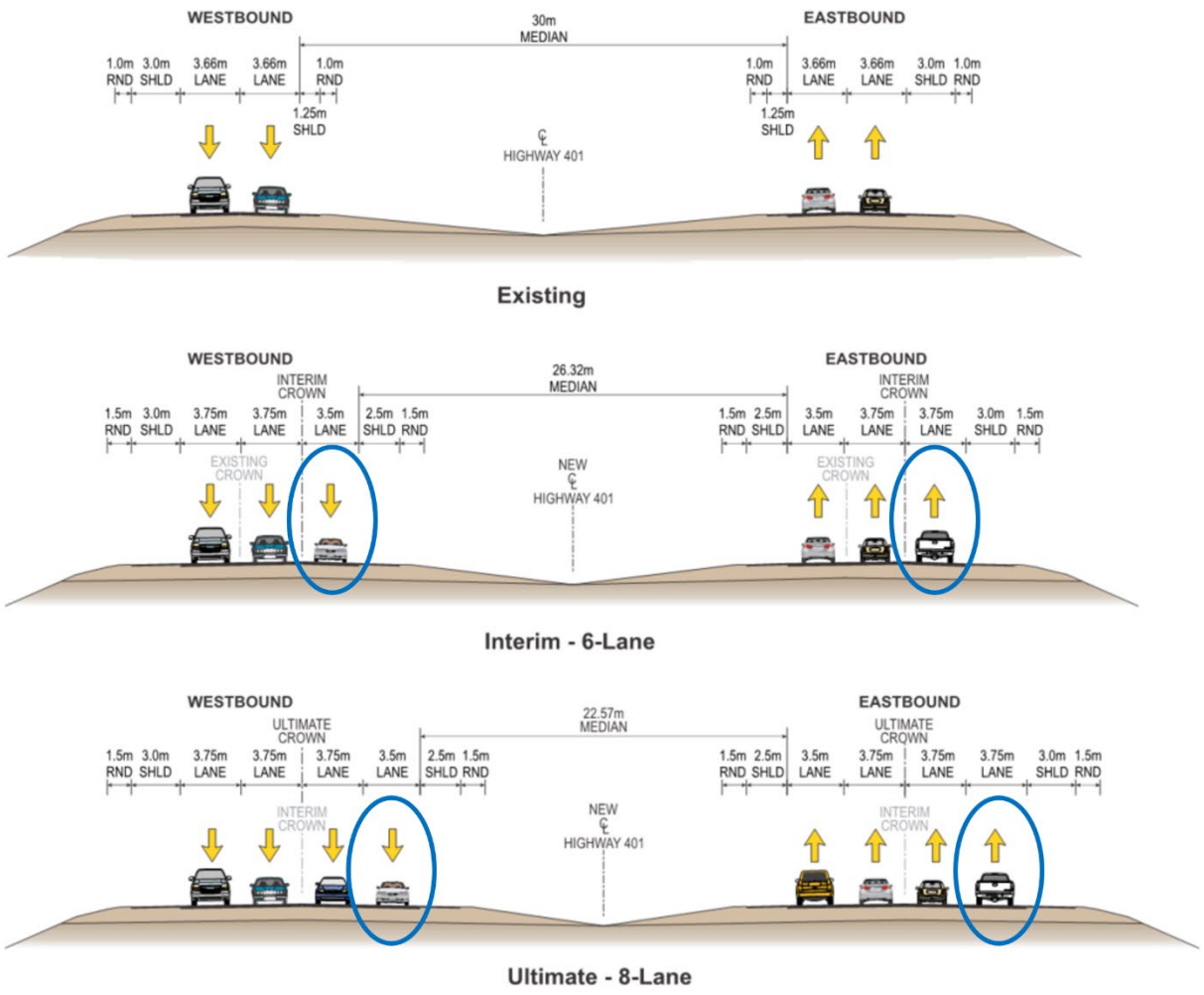
Alternative 2 was recommended to not be carried forward due to double barriers being required in the median, as well as the need for a retaining wall to be able to grade the slope and provide ditching in the median. Alternative 2 is illustrated Exhibit 5-14.

Exhibit 5-14: Section 5 – Alternative 2 (Widen inside in the Interim, and widen westbound inside and eastbound outside in the Ultimate)



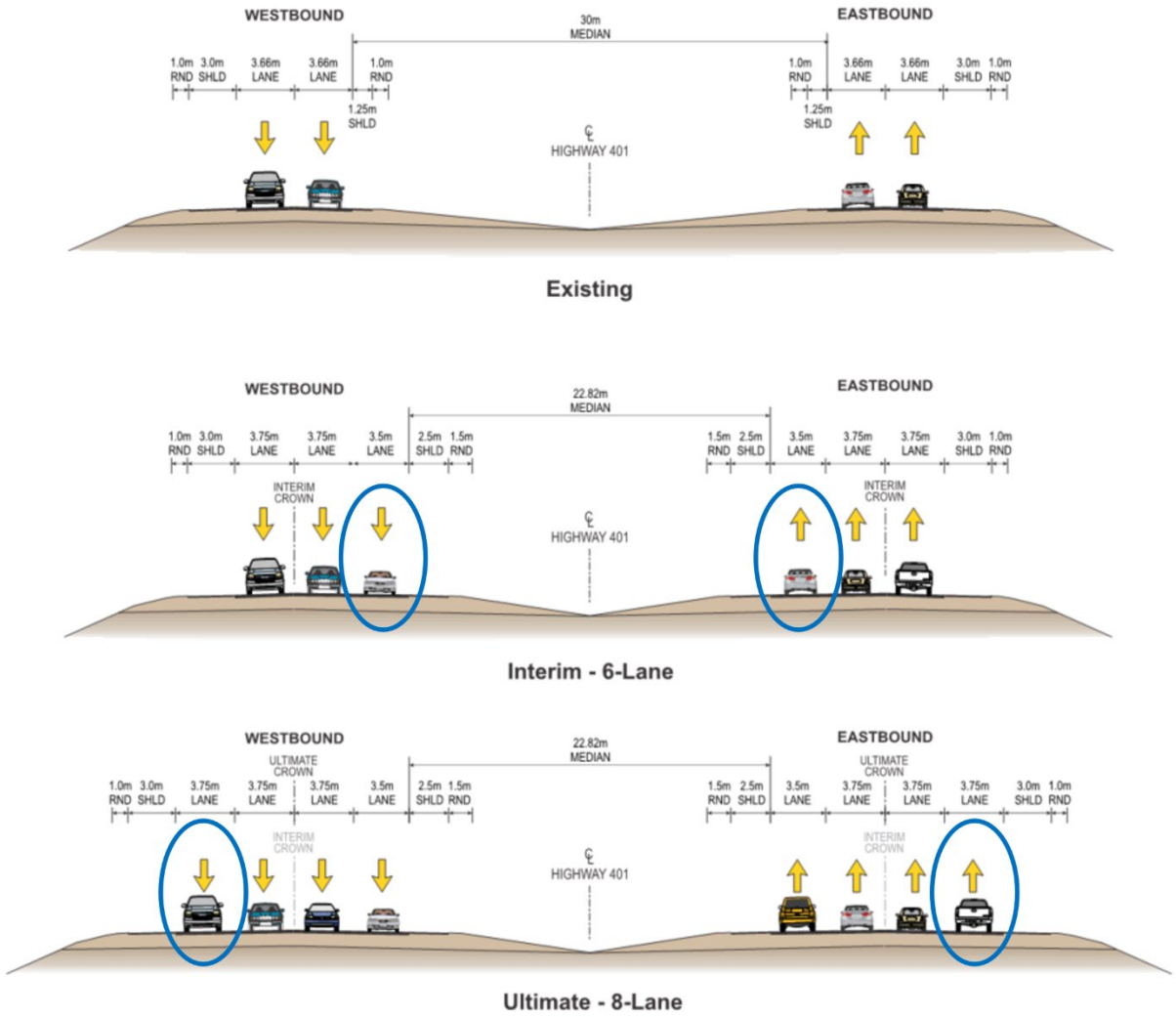
Alternative 3 was carried forward as it retains the open median and minimizes large cuts north of the highway. Alternative 3 is illustrated in **Exhibit 5-15**.

Exhibit 5-15: Section 5 – Alternative 3 (Widen to the south)



Alternative 4 was carried forward as it retains the open median, minimizes impacts south of the highway, and provides the easiest tie in to County Road 30 design (completed under a previous EA). Alternative 4 is illustrated in **Exhibit 5-16**.

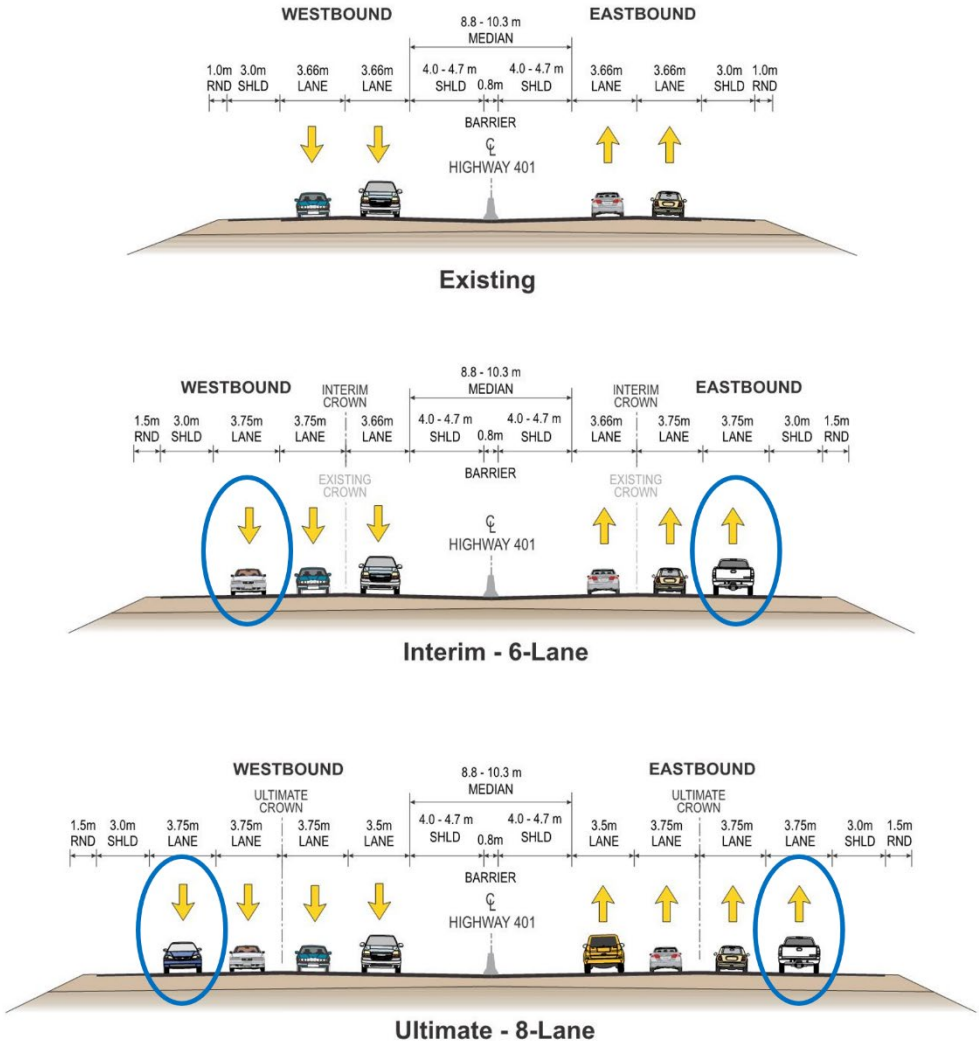
Exhibit 5-16: Section 5 – Alternative 4 (Widen inside in the Interim and widen outside in the Ultimate)



5.2.1.6 Section 6

Section 6 is from County Road 30 east study limit to 1.1 km east of County Road 26. As the existing cross-section is a narrow median with a concrete barrier, the only alternative is to widen to the outside (see **Exhibit 5-17**). This alternative is recommended to be carried forward as the preferred alternative.

Exhibit 5-17: Section 6 – Alternative 1 (Widen outside only)



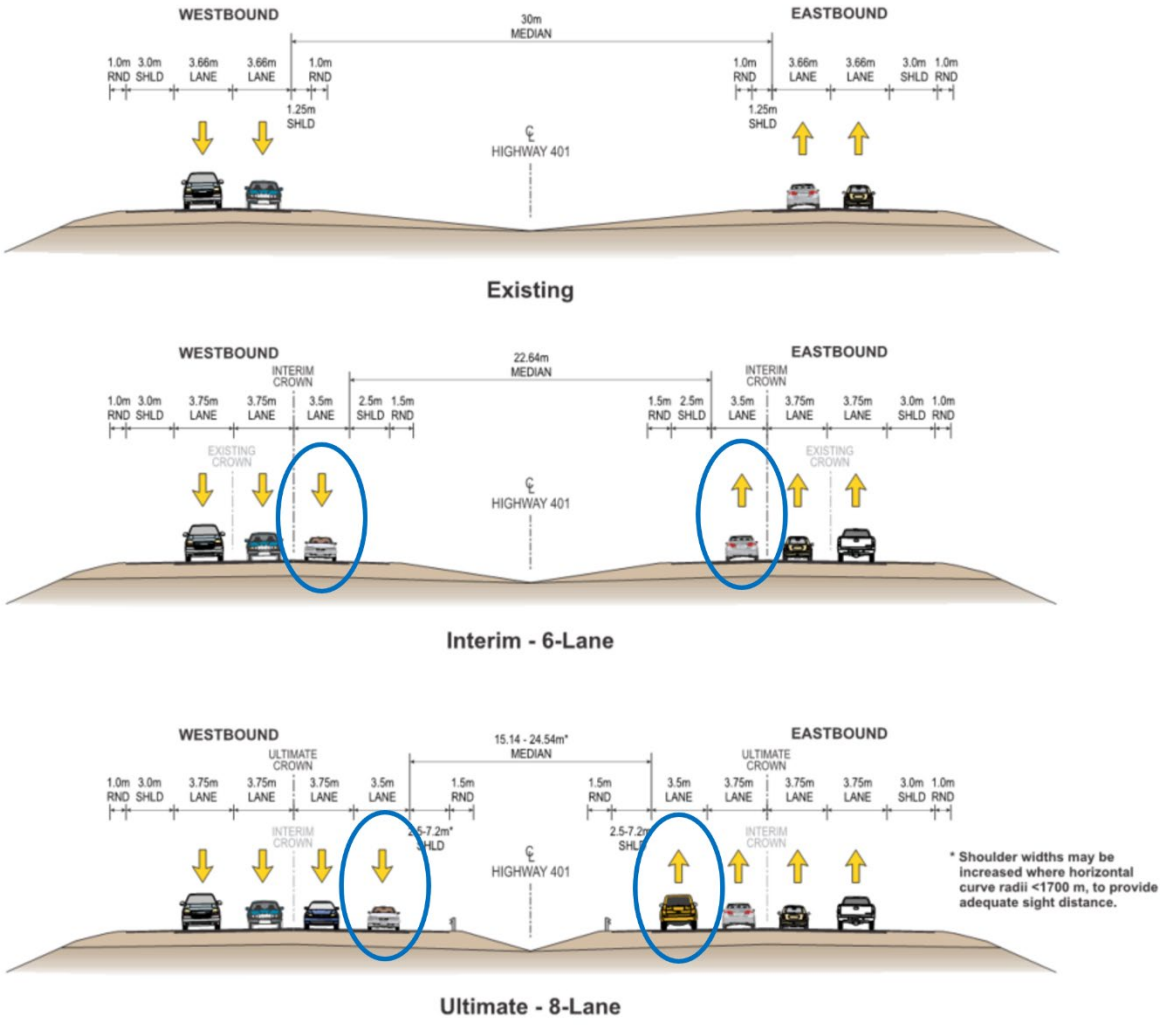
5.2.1.7 Section 7

Section 7 is from 1.1 km east of County Road 26 to the east study limit and includes:

- Alternative 1 – Widen inside only
- Alternative 2 – Widen inside in the Interim and widen outside in the Ultimate
- Alternative 3 – Widen to the south
- Alternative 4 – Hybrid of Alternative 2 and Alternative 1
- Alternative 5 – Hybrid of Alternative 2 and Alternative 3

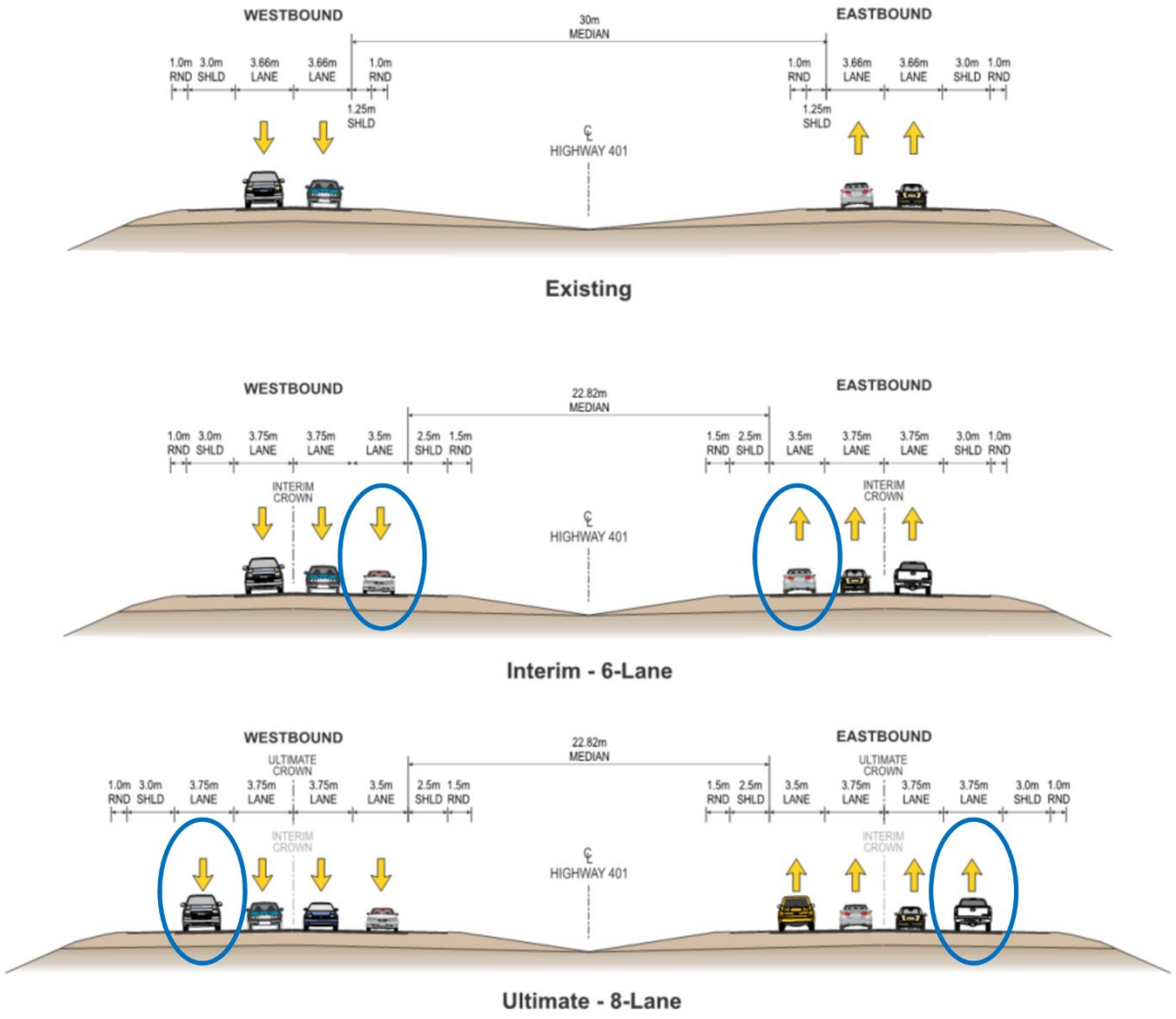
Alternative 1 was not carried forward due to double barriers being required in the median, which is not desirable from a safety and maintenance perspective, and precludes the existing emergency median turnaround in this section. Alternative 1 is illustrated in **Exhibit 5-18**.

Exhibit 5-18: Section 7 – Alternative 1 (Widen inside only)



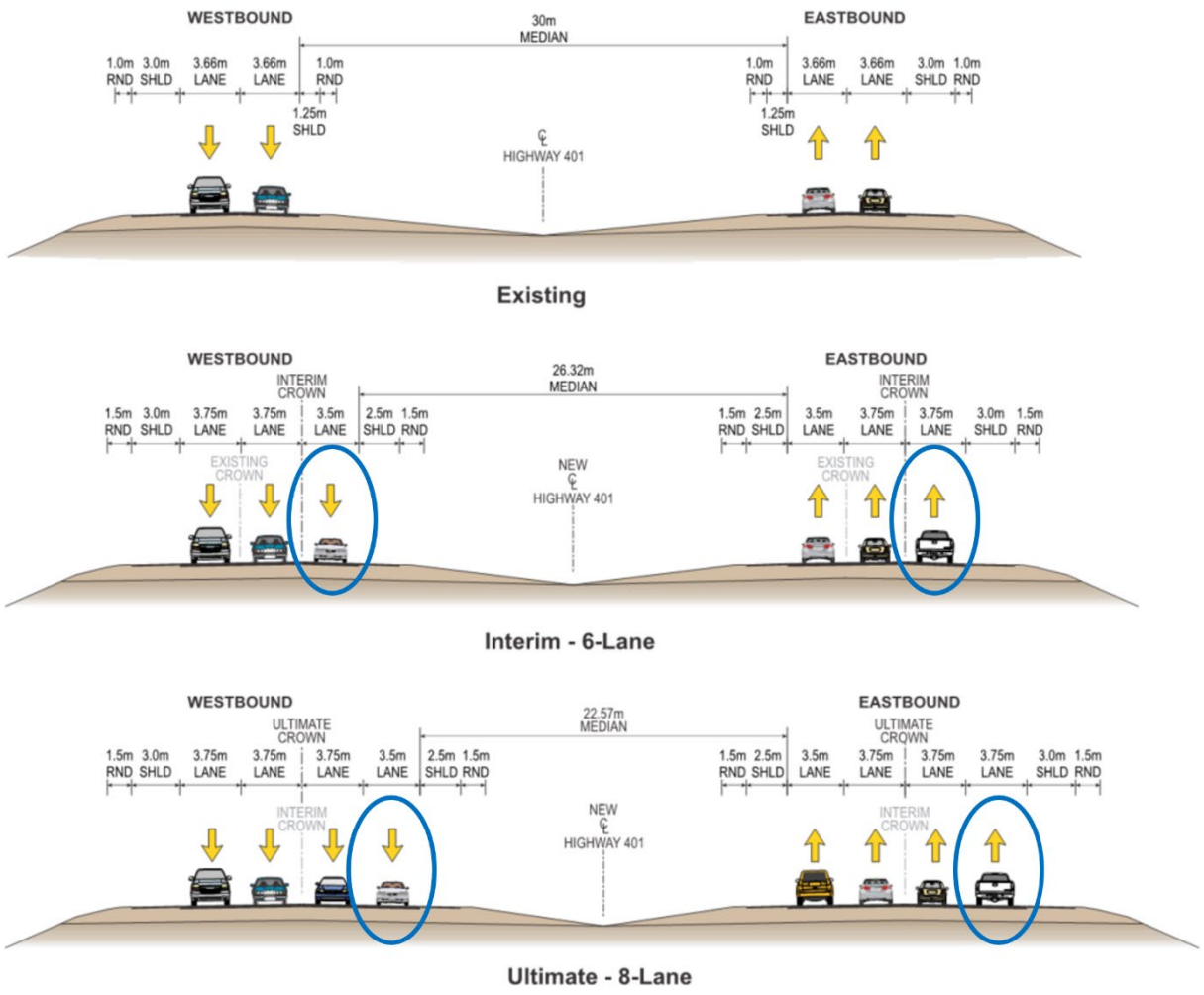
Alternative 2 was carried forward as it retains the open median and can accommodate the existing emergency median turnaround. Alternative 2 is illustrated in **Exhibit 5-19**.

Exhibit 5-19: Section 7 – Alternative 2 (Widen inside in the Interim and widen outside in the Ultimate)



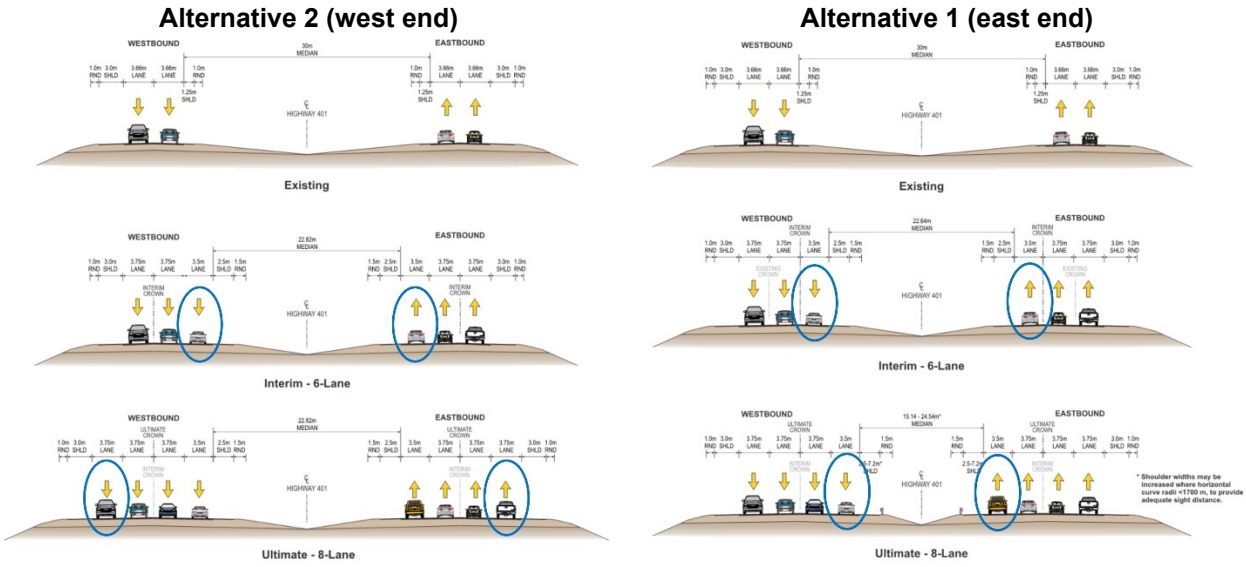
Alternative 3 was not carried forward as it results in significant potential property impacts, potential impacts to the natural environment, and a high cost. Alternative 3 is illustrated in **Exhibit 5-20**.

Exhibit 5-20: Section 7 – Alternative 3 (Widen to the south)



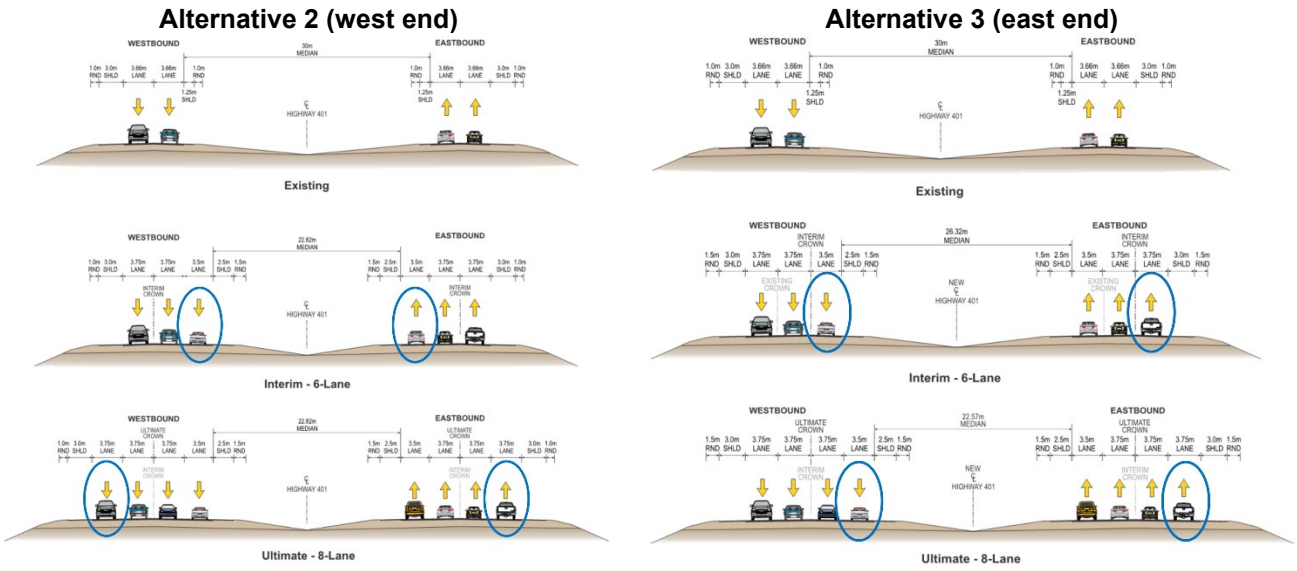
Alternative 4 was carried forward as it minimizes the large cuts north of the highway and median turnarounds can be accommodated. Alternative 4 is illustrated in **Exhibit 5-21**.

Exhibit 5-21: Section 7 – Alternative 4 (Hybrid of Alternative 2 and Alternative 1)



Alternative 5 was carried forward as the open median can be maintained, the median turnarounds can be accommodated, and it minimizes the large cuts north of the highway. Alternative 5 is illustrated in **Exhibit 5-22**.

Exhibit 5-22: Section 7 – Alternative 5 (Hybrid of Alternative 2 and Alternative 3)



5.2.1.8 Summary of Alternatives to be Carried Forward to the Short-List of Alternatives

Below is a summary of the Highway 401 widening alternatives for Sections 1 to 7 that are recommended to be carried forward for further evaluation (**Exhibit 5-23**).

Exhibit 5-23: Summary of Highway 401 Widening Alternatives to be Carried Forward to the Short-List of Alternatives

Section 1	
Alternative 1 – Widen inside only	Alternative 2 – Widen inside in the Interim and widen outside in the Ultimate
Not carried forward	Carried forward as the preferred alternative

Section 2		
Alternative 1 – Widen inside only	Alternative 2 – Widen inside in the Interim and widen outside in the Ultimate	Alternative 3 – Widen to the north
Carried forward	Carried forward	Carried forward

Section 3		
Alternative 1 – Widen outside only and widen median shoulders	Alternative 2A – Widen outside only and realign using two 1200 m radius curves	Alternative 2B – Widen outside only and realign using two 1700 m radius curves
Carried forward	Carried forward	Carried forward

Section 4
Alternative 1 – Widen outside only
Carried forward as the preferred alternative

Section 5			
Alternative 1 – Widen inside only	Alternative 2 – Widen inside in the Interim, and widen WB inside and EB outside in the Ultimate	Alternative 3 – Widen to the south	Alternative 4 – Widen inside in the Interim and widen outside in the Ultimate
Not carried forward	Not carried forward	Carried forward	Carried forward

Section 6
Alternative 1 – Widen outside only
Carried forward as the preferred alternative

Section 7				
Alternative 1 – Widen inside only	Alternative 2 – Widen inside I the Interim and widen outside in the Ultimate	Alternative 3 – Widen to the south	Alternative 4 – Hybrid of Alternative 2 and Alternative 1	Alternative 5 – Hybrid of Alternative 2 and Alternative 3
Not carried forward	Carried forward	Not carried forward	Carried forward	Carried forward

5.2.2 Bridge Replacement Alternatives

5.2.2.1 Herley Road

The Herley Road underpass is located close to the west limits of the Study Area and includes:

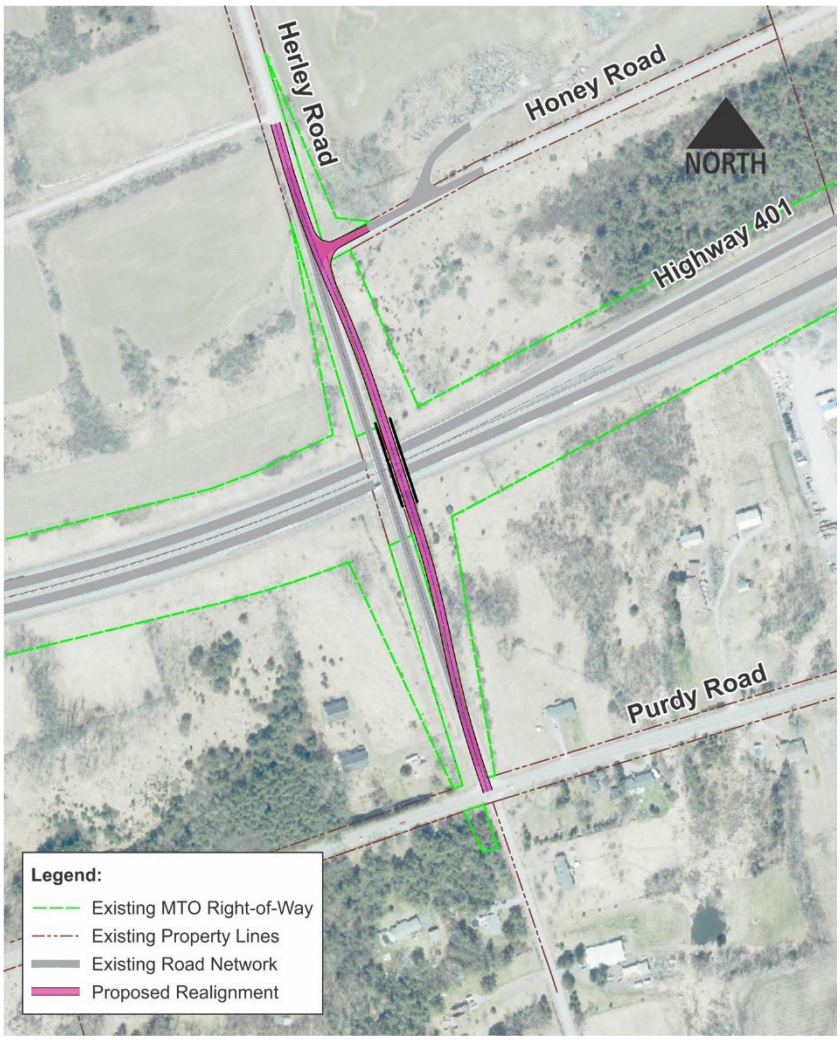
- Alternative 1 – Replace bridge to the west
- Alternative 2 – Replace bridge to the east
- Alternative 3 – Replace bridge on the existing alignment (temporary road closure)
- Alternative 4 – Permanently remove crossing

Alternative 1 was carried forward as it allows Herley Road to reman open during construction. Alternative 1 is illustrated in **Exhibit 5-24**.

Exhibit 5-24: Herley Road Bridge Replacement – Alternative 1 (Replace bridge to the west)

Alternative 2 was carried forward as it allows Herley Road to remain open during construction. Alternative 2 is illustrated in **Exhibit 5-25**.

Exhibit 5-25: Herley Road Bridge Replacement – Alternative 2 (Replace bridge to the east)



Alternative 4 was not carried forward due to travel impacts for emergency services, local residents, and those accessing the water storage tank. Alternative 4 is illustrated in **Exhibit 5-26**.

Exhibit 5-26: Herley Road Bridge Replacement – Alternative 4 (Permanently remove crossing)

The detailed long-list screening tables are included in **Appendix N**.

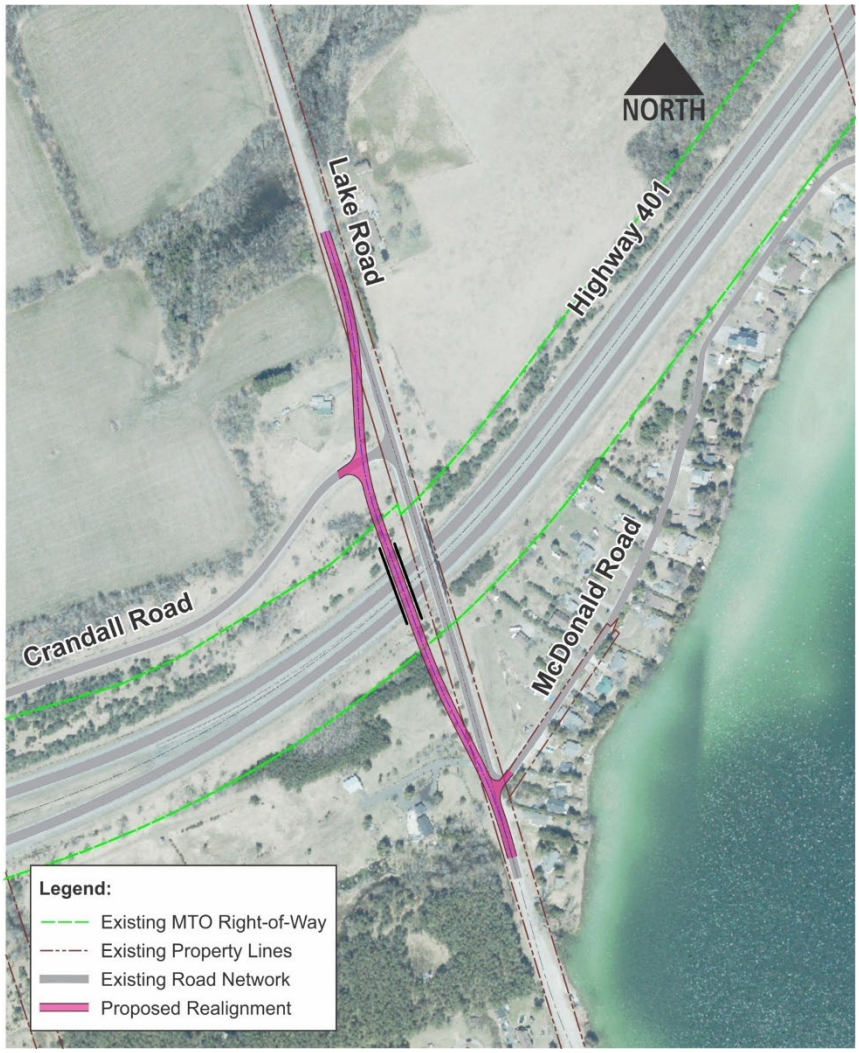
5.2.2.2 Lake Road

The Lake Road underpass is located adjacent to Little Lake and includes:

- Alternative 1 – Replace bridge to the west
- Alternative 2 – Replace bridge to the east
- Alternative 3 – Replace bridge on the existing alignment

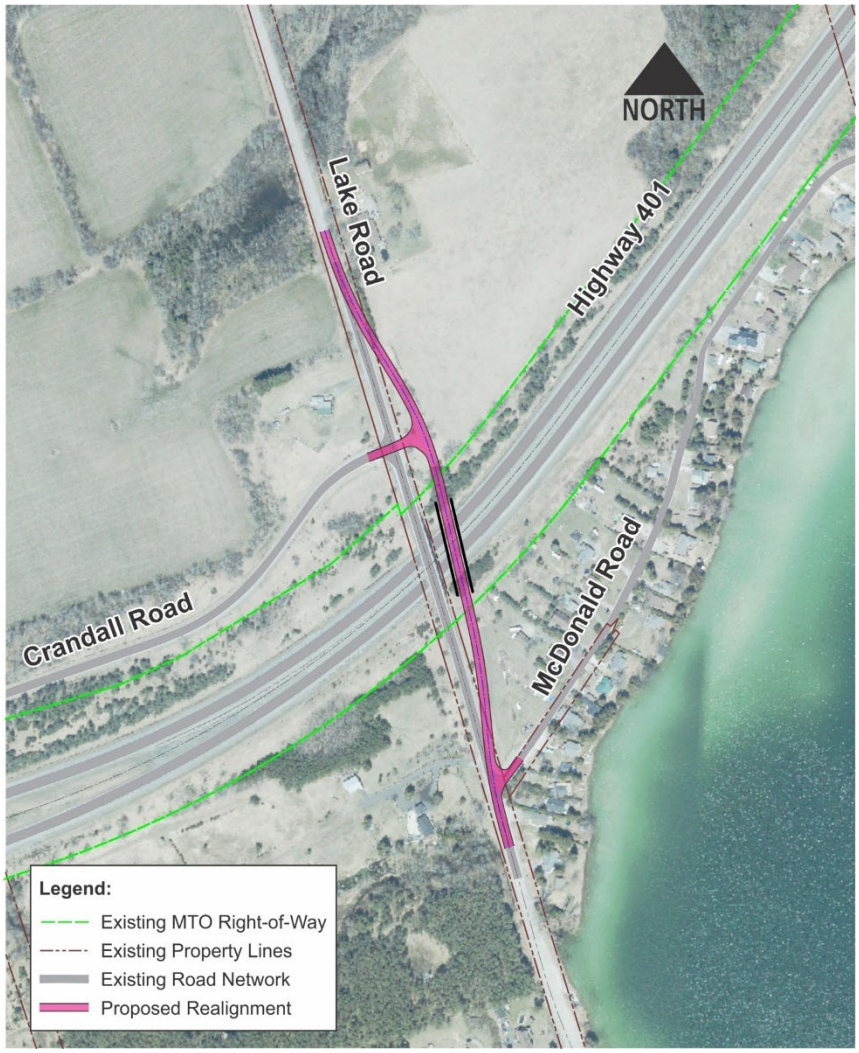
Alternative 1 was not carried forward as it results in property impacts, potential natural environment impacts, a less desirable crossing road geometry, lower compatibility with Highway 401 widening alternatives, and inferior geometry at the Lake Road and Crandall Road intersection. Alternative 1 is illustrated in **Exhibit 5-27**.

Exhibit 5-27: Lake Road Bridge Replacement – Alternative 1 (Replace bridge to the west)



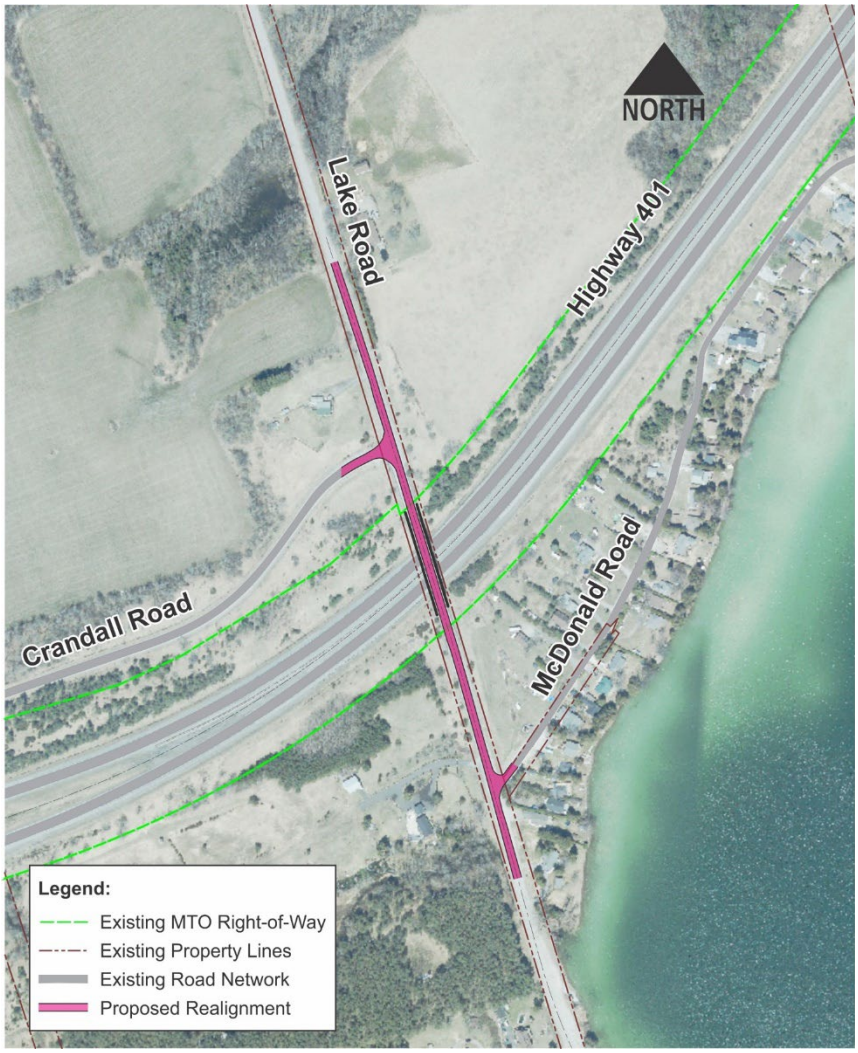
Alternative 2 was not carried forward as it results in property impacts, potential natural environment impacts, a less desirable crossing road geometry, lower compatibility with Highway 401 widening alternatives, inferior geometry at the McDonald Road and Lake Road intersection, and required extension of Crandall Road. Alternative 2 is illustrated in **Exhibit 5-28**.

Exhibit 5-28: Lake Road Bridge Replacement – Alternative 2 (Replace bridge to the east)



Alternative 3 was carried forward as it minimizes property impacts and potential environmental impacts, provides a more desirable crossing road geometry, has higher compatibility with Highway 401 widening alternatives, and maintains existing geometry at the Crandall Road intersection. Alternative 3 is illustrated in **Exhibit 5-29**.

Exhibit 5-29: Lake Road Bridge Replacement – Alternative 3 (Replace bridge on existing alignment)



The detailed long-list screening tables are included in **Appendix N**.

5.2.2.3 County Road 26

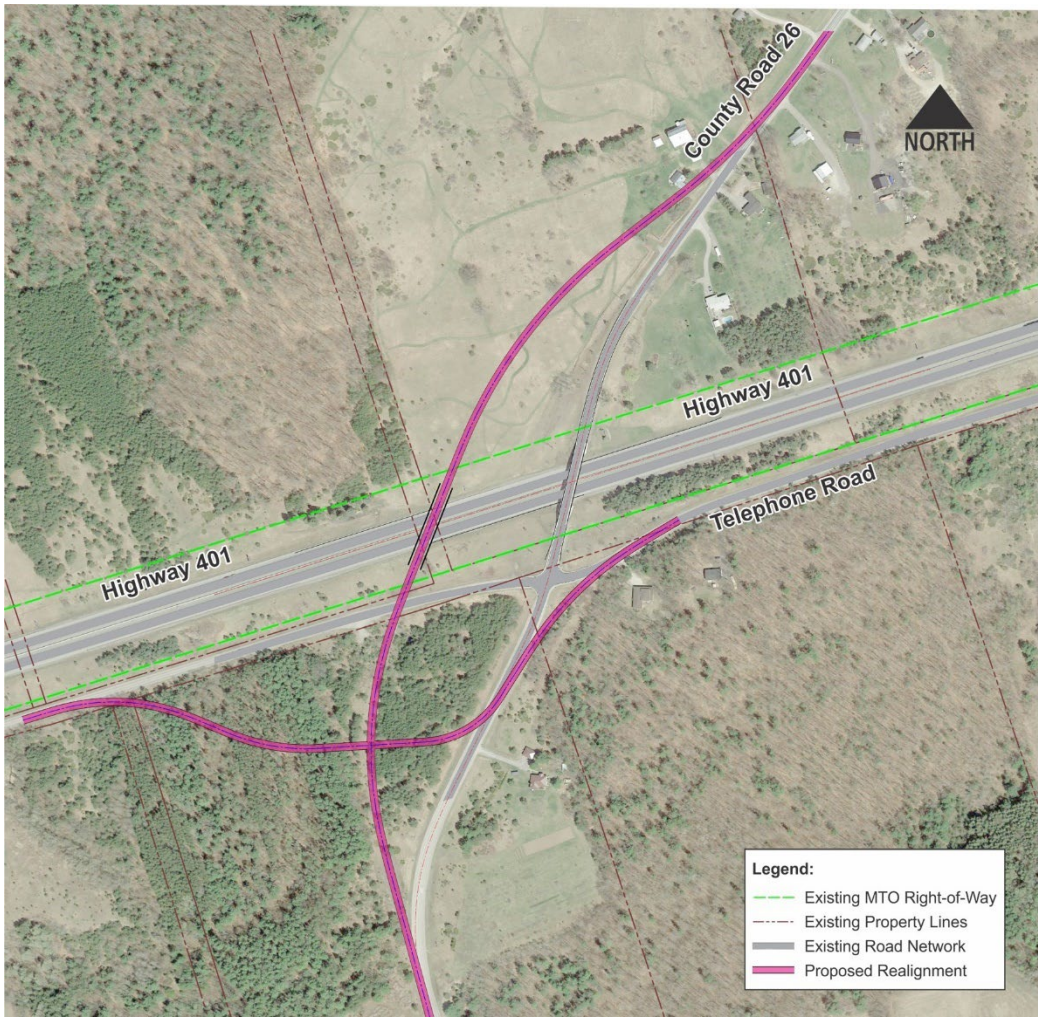
The County Road 26 underpass is located in the eastern limit of the east portion of the Study Area and includes:

- Alternative 1 – Replace bridge to the far west
- Alternative 2 – Replace bridge to the west (intermediate)
- Alternative 3 – Replace bridge to the west (curved structure)
- Alternative 4 – Replace bridge to the west (straight structure)

- Alternative 5 – Replace bridge to the east
- Alternative 6 – Replace bridge on the existing alignment (temporary road closure)
- Alternative 7 – Replace structure on existing alignment (temporary single-lane traffic control)

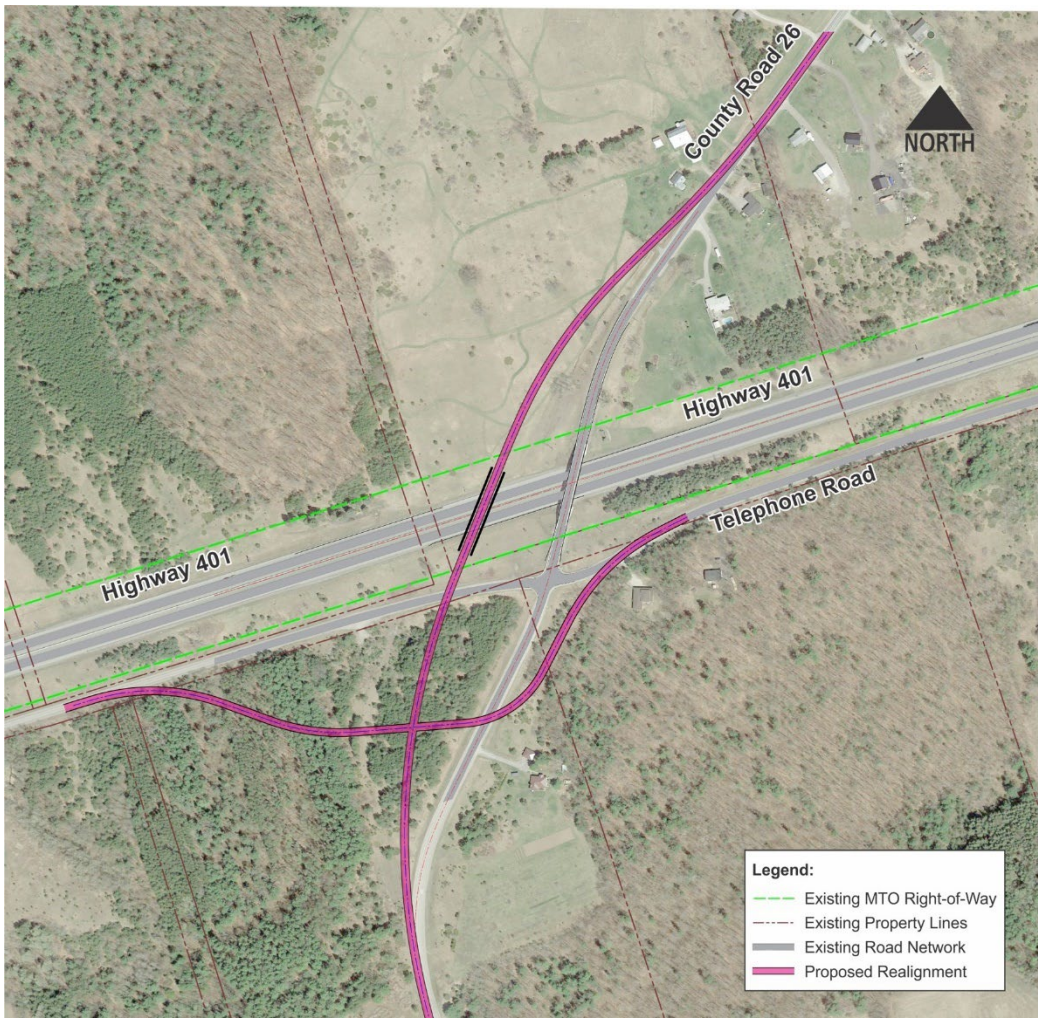
Alternative 1 was not carried forward as it results in significant property impacts on the northwest side of the crossing and has relatively higher costs. Alternative 1 is illustrated in **Exhibit 5-30**.

Exhibit 5-30: County Road 26 Bridge Replacement – Alternative 1 (Replace bridge to the far west)



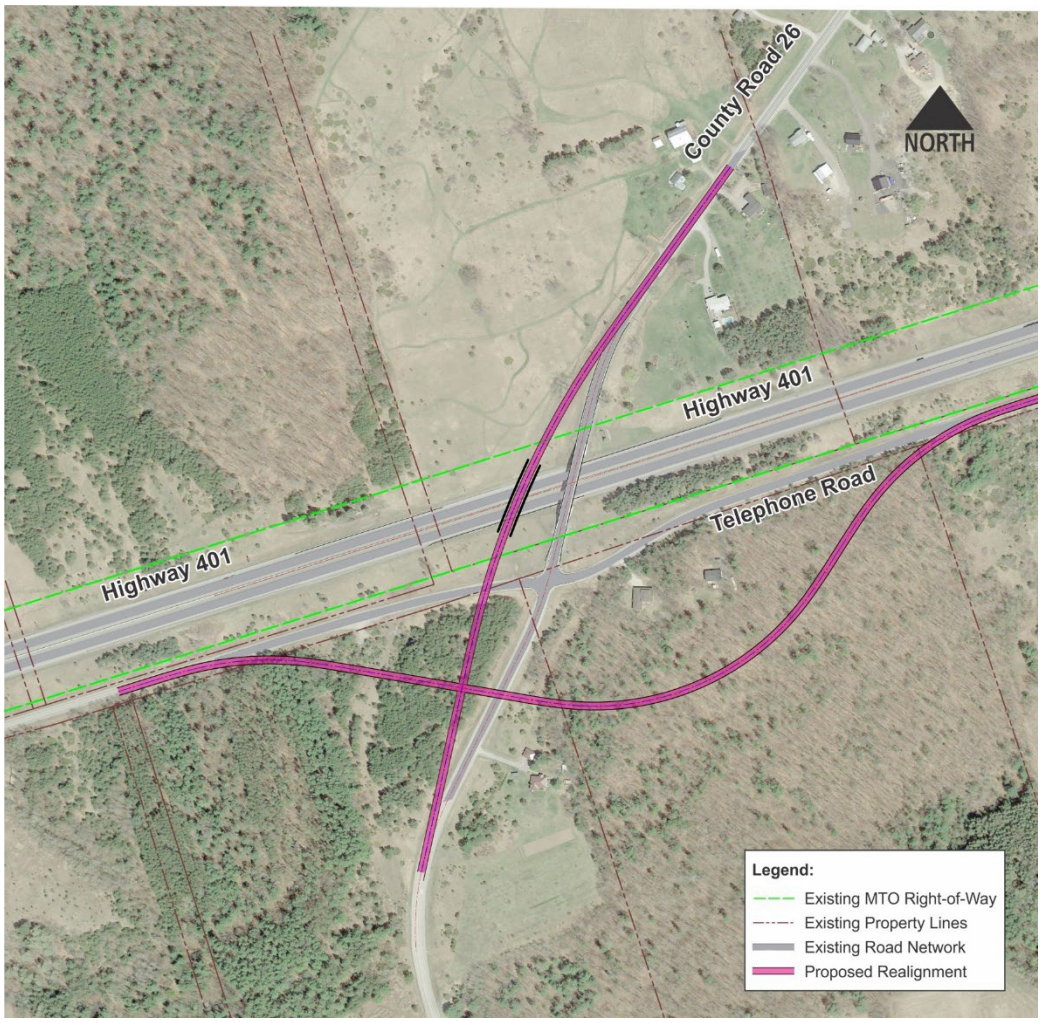
Alternative 2 was carried forward as it allows County Road 16 to remain open during construction, has less property impacts than other alternatives, minimizes the realignment of Telephone Road, and improves the existing horizontal curves. Alternative 2 is illustrated in **Exhibit 5-31**.

Exhibit 5-31: County Road 26 Bridge Replacement – Alternative 2 (Replace bridge to the west [intermediate])



Alternative 3 was not carried forward since the Telephone Road realignment is greater than Alternatives 1 and 2 and has greater environmental impact. It is also moderate in cost relative to other alternatives, and the curved bridge increases the complexity of the design and construction. Alternative 3 is illustrated in **Exhibit 5-32**.

Exhibit 5-32: County Road 26 Bridge Replacement – Alternative 3 (Replace bridge to the west [curved structure])



Alternatives 4 and 5 were not carried forward since the Telephone Road realignment is greater than Alternatives 1 and 2 and has greater environmental impact. It is also moderate in cost relative to the other alternatives. Alternatives 4 and 5 are illustrated in **Exhibit 5-33** and **Exhibit 5-34**, respectively.

Exhibit 5-33: County Road 26 Bridge Replacement – Alternative 4 (Replace bridge to the west [straight structure])

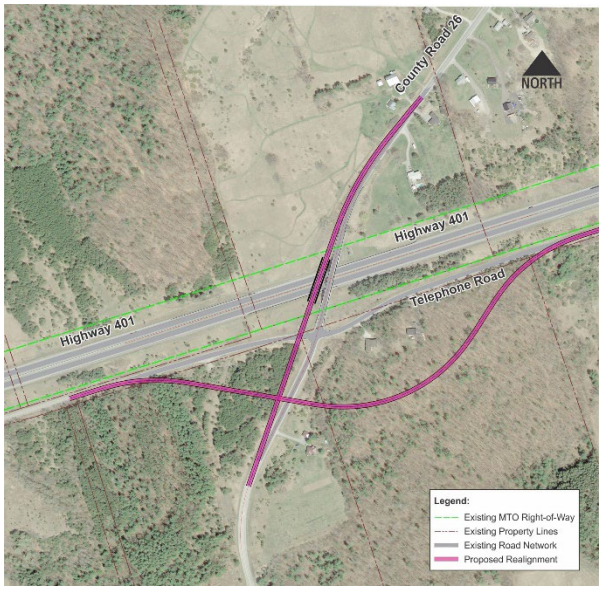
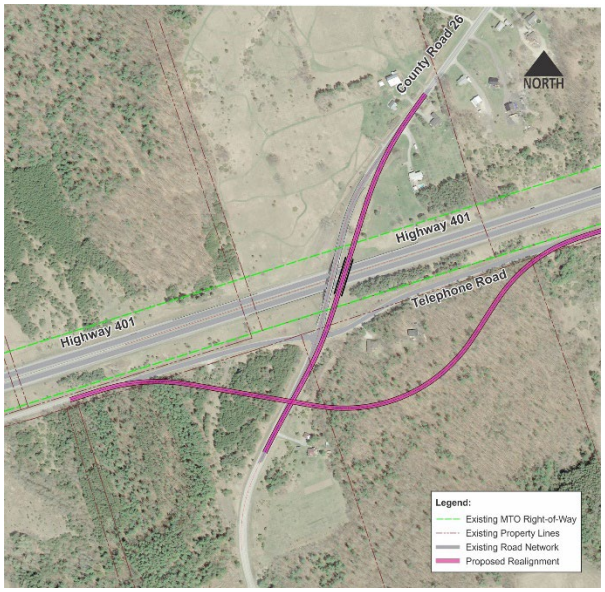
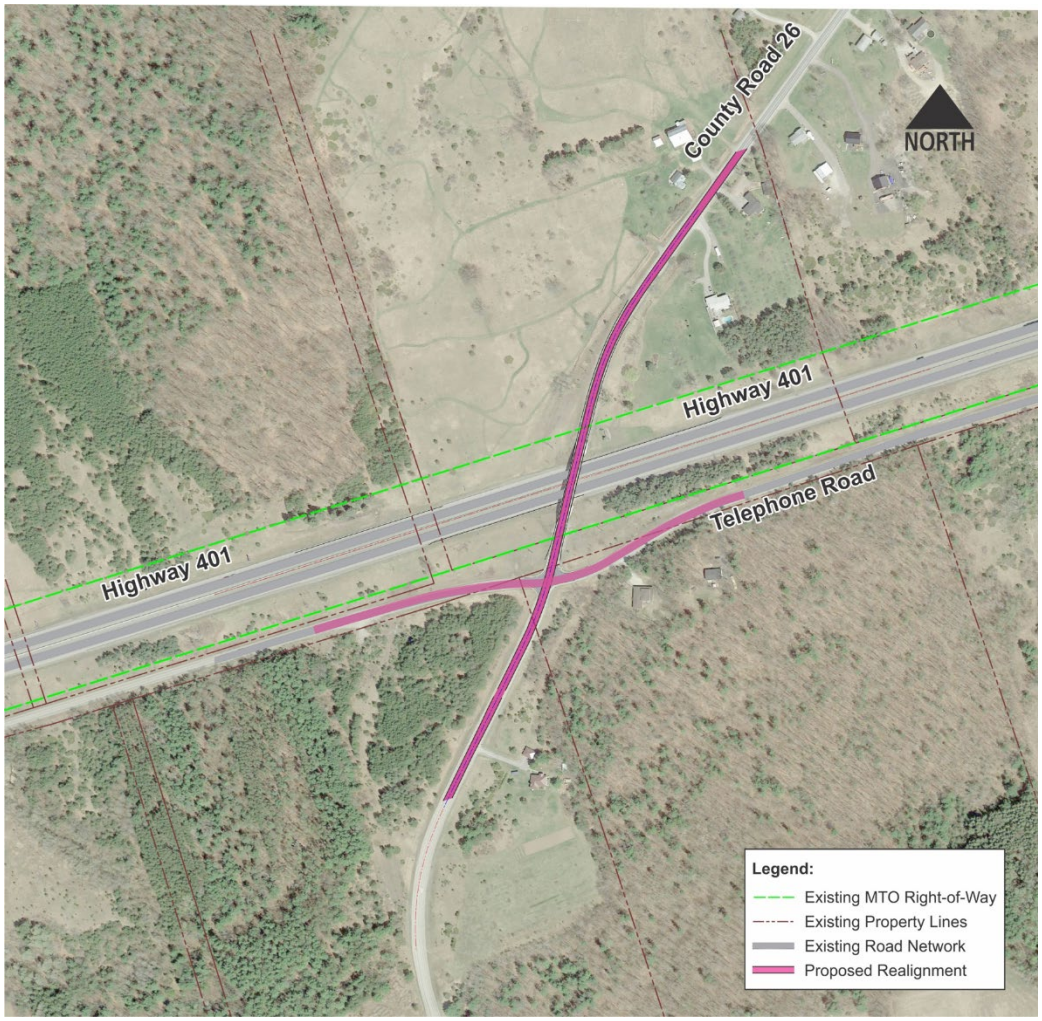


Exhibit 5-34: County Road 26 Bridge Replacement – Alternative 5 (Replace bridge to the east)



Alternative 6 was carried forward as it maintains the existing alignment of Telephone Road and minimizes potential environmental impacts and property impacts. Alternative 6 is illustrated in **Exhibit 5-35**.

Exhibit 5-35: County Road 26 Bridge Replacement – Alternative 6 (Replace bridge on existing alignment [temporary road closure])



Alternative 7 was carried forward as it allows County Road 26 to remain open during construction, maintains the existing alignment of Telephone Road, and minimizes potential environmental and property impacts. It also has a relatively low cost compared to the other alternatives. Alternative 7 is illustrated in **Exhibit 5-36**.

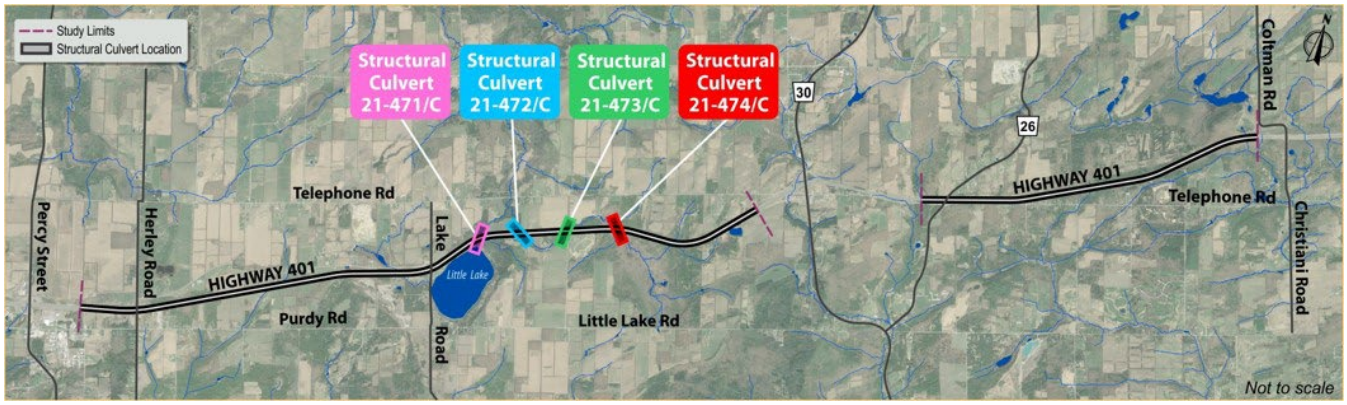
Exhibit 5-36: County Road 26 Bridge Replacement – Alternative 7 (Replace structure on existing alignment [temporary single-lane traffic control])

The detailed long-list screening tables are included in **Appendix N**.

5.2.3 Culvert Replacement Alternatives

There are four structural culverts crossing Highway 401 between Lake Road and County Road 30 (see **Exhibit 5-37**). All culverts require replacement since they are approaching the end of their service life. New culverts will be compatible with future Highway 401 widening. Culvert sizes and staging details will be confirmed as the study progresses, however it is anticipated that all Highway 401 lanes will be maintained during the majority of construction.

Exhibit 5-37: Culvert Replacement Locations



Three alternatives for replacing the existing culverts were developed and include:

- Alternative 1 – Replace with culvert (open cut), which involves opening the ground to the depth required to replace the culvert
- Alternative 2 – Replace with culvert (trenchless method), which involves using a machine to cut a hole underground horizontally without disturbing the ground surface
- Alternative 3 – Replace with bridge

All three alternatives were carried forward for further consideration.

5.3 Identification of Short-List of Alternatives

5.3.1 Highway 401 Widening Alternatives

Below is a summary of the Highway 401 widening alternatives for Sections 1 to 7 that are recommended to be carried forward for further evaluation (**Exhibit 5-38**).

Exhibit 5-38: Summary of Highway 401 Widening Alternatives to be Carried Forward to the Short-List of Alternatives

Section 1	
Alternative 1 – Widen inside only	Alternative 2 – Widen inside in the Interim and widen outside in the Ultimate
Not carried forward	Carried forward as the preferred alternative

Section 2		
Alternative 1 – Widen inside only	Alternative 2 – Widen inside in the Interim and widen outside in the Ultimate	Alternative 3 – Widen to the north
Carried forward	Carried forward	Carried forward

Section 3		
Alternative 1 – Widen outside only and widen median shoulders	Alternative 2 – Widen outside only and realign using two 1200 m radius curves	Alternative 3 – Widen outside only and realign using two 1700 m radius curves
Carried forward	Carried forward	Carried forward

Section 4
Alternative 1 – Widen outside only
Carried forward as the preferred alternative

Section 5			
Alternative 1 – Widen inside only	Alternative 2 – Widen inside in the Interim, and widen WB inside and EB outside in the Ultimate	Alternative 3 – Widen to the south	Alternative 4 – Widen inside in the Interim and widen outside in the Ultimate
Not carried forward	Not carried forward	Carried forward	Carried forward

Section 6
Alternative 1 – Widen outside only
Carried forward as the preferred alternative

Section 7				
Alternative 1 – Widen inside only	Alternative 2 – Widen inside in the Interim and widen outside in the Ultimate	Alternative 3 – Widen to the south	Alternative 4 – Hybrid of Alternative 2 and Alternative 1	Alternative 5 – Hybrid of Alternative 2 and Alternative 3
Not carried forward	Carried forward	Not carried forward	Carried forward	Carried forward

5.3.2 Bridge Replacement Alternatives

Below is a summary of the bridge replacement alternatives for Herley Road, Lake Road and County Road 26 that are recommended to be carried forward for further evaluation (**Exhibit 5-39**).

Exhibit 5-39: Summary of Bridge Replacement Alternatives to be Carried Forward to the Short-List of Alternatives

Herley Road			
Alternative 1 – Replace to the west	Alternative 2 – Replace to the east	Alternative 3 – Replace on existing alignment	Alternative 4 – Permanently remove crossing
Carried forward	Carried forward	Carried forward	Not carried forward

Lake Road		
Alternative 1 – Replace to the west	Alternative 2 – Replace to the east	Alternative 3 – Replace on existing alignment
Not carried forward	Not carried forward	Carried forward

County Road 26						
Alternative 1 – Replace to the far west	Alternative 2 – Replace to the west (intermediate)	Alternative 3 – Replace to the west (curved bridge)	Alternative 4 – Replace to the west (straight bridge)	Alternative 5 – Replace to the east	Alternative 6 – Replace on existing alignment (temporary road closure)	Alternative 7 – Replace on existing alignment (temporary single-lane traffic control)
Not carried forward	Carried forward	Not carried forward	Not carried forward	Not carried forward	Carried forward	Carried forward

5.3.3 Culvert Replacement Alternatives

Below is a summary of the culvert replacement alternatives that were recommended to be carried forward for further evaluation (**Exhibit 5-40**).

Exhibit 5-40: Summary of Culvert Replacement Alternatives to be Carried Forward to the Short-List of Alternatives

Alternative 1 – Replace with culvert	Alternative 2 – Replace with culvert (trenchless method)	Alternative 3 – Replace with bridge
Carried forward	Carried forward	Carried forward

5.4 Development of the Short-List of Alternatives

5.4.1 Highway 401 Widening – Additional Sub-Alternatives

As part of the development of the alternatives, additional sub-alternatives were developed for Sections 2, 3, 5 and 7 for Highway 401 in addition to the base alternatives as presented in **Exhibit 5-38**. After a review of the additional sub-alternatives the final alternatives to be carried forward for further evaluation for Sections 2. 3. 5 and 7 are summarized in **Exhibit 5-41** and detailed further below.

Exhibit 5-41: Summary of Alternatives/Sub-Alternatives Carried Forward for Evaluation

Section 2			
Alternative 1A – Widen inside only and maintain a 15 m median with double steel-beam guiderail with a retaining wall on the north side	Alternative 1B – Widen to the Inside only and reduce the median to a closed 7.5 m median	Alternative 2 – Widen inside in the Interim and widen outside in the Ultimate	Alternative 3 – Widen to the north
Not Carried Forward	Carried Forward	Carried forward	Carried forward

Section 3					
Alternative 1A – Widen outside only and widen median shoulders (no retaining walls)	Alternative 1B – Widen outside only and widen median shoulders (no retaining walls)	Alternative 2A – Widen outside only and realign using two 1200 m radius curves (no retaining walls)	Alternative 2B – Widen outside only and realign using two 1200 m radius curves (with retaining walls)	Alternative 3A – Widen outside only and realign using two 1700 m radius curves (no retaining walls)	Alternative 3B – Widen outside only and realign using two 1700 m radius curves (no retaining walls)
Not Carried Forward	Carried forward	Carried forward	Not Carried Forward	Carried forward	Not Carried Forward

Section 5					
Alternative 1 – Widen inside only	Alternative 2 – Widen inside in the Interim, and widen WB inside and EB outside in the Ultimate	Alternative 3A – Widen to the south (no retaining wall)	Alternative 3B – Widen to the south (with retaining wall)	Alternative 4A – Widen inside in the Interim and widen outside in the Ultimate (no retaining wall)	Alternative 4B – Widen inside in the Interim and widen outside in the Ultimate (with retaining wall)
Not Carried Forward	Not Carried Forward	Not Carried Forward	Carried forward	Not Carried Forward	Carried forward

Section 7							
Alternative 1 – Widen inside only	Alternative 2A – Widen inside in the Interim and widen outside in the Ultimate (no retaining wall)	Alternative 2B – Widen inside in the Interim and widen outside in the Ultimate (with retaining wall)	Alternative 3 – Widen to the south	Alternative 4A – Hybrid of Alternative 2 and Alternative 1 (no retaining wall)	Alternative 4A – Hybrid of Alternative 2 and Alternative 1 (with retaining wall)	Alternative 5A – Hybrid of Alternative 2 and Alternative 3 (no retaining wall)	Alternative 5B – Hybrid of Alternative 2 and Alternative 3 (with retaining wall)
Not Carried Forward	Not Carried Forward	Carried forward	Not Carried Forward	Not Carried Forward	Carried forward	Not Carried Forward	Carried forward

5.4.1.1 Section 2

For Section 2 an additional sub-alternative was reviewed for Alternative 1A, which included reviewing this alternative to maintain a 15 m median with double steel-beam guiderail with a retaining wall on the north side to mitigate impacts to properties on the north. Alternative 1B was the original alternative that was previously reviewed with is reduce the median to a 7.5 m closed median with barrier wall. After a review of these two alternatives only Alternative 1B was carried forward for evaluation as there are significant maintenance concerns with both the retaining wall and the double steel beam guiderail barrier.

5.4.1.2 Section 3

Within this section of Highway 401, there are multiple constraints and challenges, including:

- Closed median section, constraining the future highway widening to the outside;
- Large drumlin on north side, with varying low to high erosion potential;
- Crandall Road runs parallel and in close proximity to Highway 401 on top of the embankment on the north side;
- Numerous residential properties bordering Little Lake are in close proximity to Highway 401 on the south side;
- Two existing horizontal curves, each with an 873 m existing radius. Widened median shoulders will be required to provide sight distance past the median barrier wall.

There are three short-listed alternatives for future highway widening through Section 3, as presented at Public Information Centre #1:

- Alternative 1: Widen outside only and widen median shoulders (maintain existing alignment);
- Alternative 2: Widen outside only and realign using two 1200 m radius curves; and
- Alternative 3: Widen outside only and realign using two 1700 m radius curves.

For all of the short-listed alternatives, the highway will be widened to the outside since this is a closed median section. Since this area is constrained by residential properties and natural features, the future highway widening

alternatives have some significant impacts. To mitigate potential impacts to properties, significant cuts into the drumlin, and potential road realignment, sub-alternatives for each of the three Alternatives were reviewed:

A. No retaining wall (base case); and

B. With retaining wall

For Alternative 1 the sub-Alternative 1B (with retaining walls on the north and south sides) was carried forward for further evaluation as the retaining walls would significantly reduce earthworks and property impacts.

For Alternative 2 and 3, the sub-Alternative A (no retaining wall) as the wall height would be substantial which would increase the complexity of the construction and the additional cost (for both construction and maintenance) does not provide significant benefits (without the wall the property impacts to the south are minimal).

5.4.1.3 Section 5

On the north side of Highway 401 in Section 5, there are two large drumlins and the soil has high erosion potential. Highway 401 uses a horizontal curve with a radius of 873 m in this location. To provide the required stopping sight distance on the curve, a wide right shoulder will be required on the westbound side.

For the two short-listed Alternatives in this Section (Alternatives 3 and 4), to mitigate significant cuts into the drumlin, sub-alternatives for each of the two Alternatives were reviewed:

A. No retaining wall (base case); and

B. With retaining wall

For both Alternatives 3 & 4 the sub-Alternative B (with retaining wall) was carried forward for further evaluation as this alternative avoids large cuts into the highly erodible soils and potential environmental impacts.

5.4.1.4 Section 7

Near the east study limit on the north side of Highway 401 there are multiple constraints, including:

- Large drumlin on north side, with high erosion potential;
- Brighton Provincial Wildlife Area;
- Area of Natural and Scientific Interest (ANSI);
- Wooded and wetland area;
- Property owned by MNRF and Ministry of Infrastructure; and
- 1st Avenue (sideroad) parallel and in close proximity to the highway

For the two short-listed Alternatives in this Section (Alternatives 2, 4 & 5), to mitigate significant cuts into the drumlin, sub-alternatives for each of the three Alternatives were reviewed:

A. No retaining wall (base case); and

B. With retaining wall

For all Alternatives the sub-Alternative B (with retaining wall) was carried forward for further evaluation as this alternative avoids significant property requirements, large cuts, impacts to the Brighton Wildlife Area and ANSI, and sideroad impacts with a relatively small retaining/toe wall.

5.5 Evaluation of Short-List Alternatives

In accordance with the MTO Class EA process, the assessment and evaluation of planning and preliminary design alternatives must be traceable, replicable and understandable. The short-list of alternatives assessment and evaluation must also integrate public and agency input, as well as MTO design standards and applicable policies and guidelines through the assessment and evaluation process.

The evaluation process included the following steps:

- **Identified the evaluation criteria** established through public input, similar projects, provincial guidelines, and existing conditions (see **Exhibit 5-42**).
- **Assigned a weight factor to each criterion** that best reflects its relative importance.
- **Evaluated the short-list of alternatives** by calculating the sum of the weighted scores providing a total score for each alternative. This is the basis of ranking the alternatives and identifying the Recommended Plan.
- The **highest scoring alternative** was selected as the Recommended Plan.

This approach is supported by evaluation tables utilizing specialists input to assess the relative differences between the alternatives (see **Appendix O**). The selection of the Recommended Plan included:

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

Stakeholders were provided an opportunity to provide comments on the factors that were used in the evaluation of the short-listed alternatives at PIC #1. The criteria and indicators used to evaluate the alternatives is presented in **Exhibit 5-42**.

Exhibit 5-42: Short-List Evaluation Factors and Criteria

Criteria	Indicator
Natural Environment	▪ Fish and Fish Habitat ▪ Terrestrial Ecosystems ▪ Designated Natural Areas, including Environmentally Sensitive Areas (ESAs), Areas of Natural and Scientific Interest (ANSI), and Provincially Significant Wetlands (PSWs). ▪ Contamination

Criteria	Indicator
	▪ Excess Soil Management ▪ Erosion and Sediment Control ▪ Surface Water & Drainage ▪ Groundwater
Cultural Environment	▪ Archaeology ▪ Built Heritage Resources and Cultural Heritage Landscapes ▪ Impacts to Indigenous lands
Socio-Economic Environment	▪ Property & Access ▪ Noise ▪ Community Facilities ▪ Recreation and Tourism Features ▪ Air Quality and Climate Change ▪ Agricultural Resources ▪ Approved Local, Regional and Provincial Plans and Policies
Transportation / Technical Considerations	▪ Traffic Operations and Geometry ▪ Constructability ▪ Construction Staging ▪ Maintenance
Cost	▪ Cost Estimate (Parametric)

As discussed previously, the Project Team developed a number of alternatives for:

- The Highway 401 widening;
- The bridge replacements for each crossing road location (Herley Road, Lake Road and County Road 26); and,
- The structural culvert replacements.

5.5.1 Highway 401 Widening

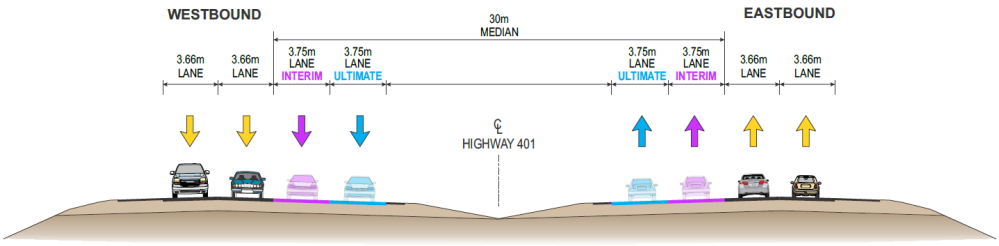
Through the long-list screening process, Sections 1, 4, and 6 has preferred alternatives (see **Section 5.2.1**). The following sections outline the evaluation process for Sections 2, 3, 5 and 7.

5.5.1.1 Section 2

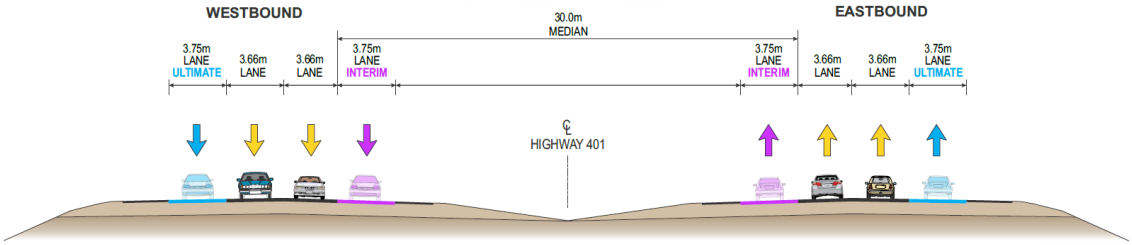
From the long-list screening (**Section 5.2.1** for details), three alternatives were carried forward to the short-list. The short-listed alternatives are illustrated in **Exhibit 5-43**, and a summary of the assessment is provided in **Exhibit 5-44**. The summary provides an overview of the key differentiating factors between the alternatives. The assessment and evaluation of the alternatives is detailed in **Appendix O**. Alternative 3 was recommended as the preferred alternative for Section 2.

Exhibit 5-43: Section 2 – Short-List of Alternatives

S2-1 Widen inside only



S2-2 Widen inside in the Interim and outside in the Ultimate



S2-3 Widen to the north

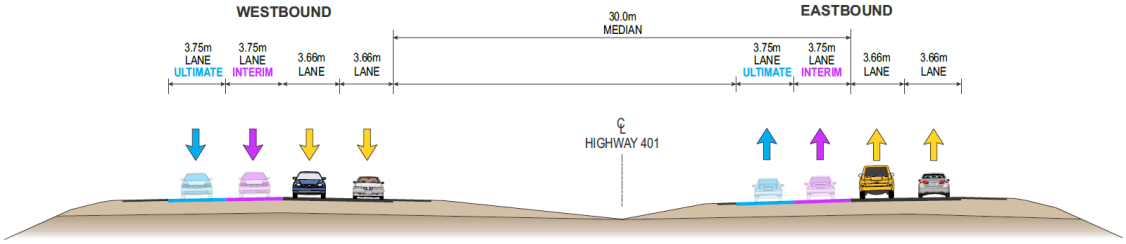


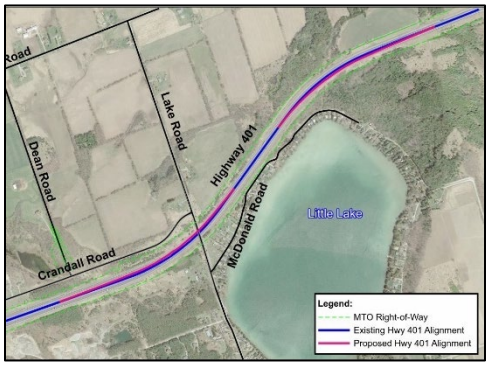
Exhibit 5-44: Section 2 – Summary of Evaluation

Criterion	Alternatives			Key Benefit / Disadvantage
	S2-1 Widen inside only	S2-2 Widen inside and outside	S2-3 Widen to the north	
Natural Environment				There is no preference between the alternatives. There are small differences in the woodland and wetland removals, but the differences are minor.
Cultural Environment				There is no significant difference in the archaeological potential of the alternatives. All alternatives require further archaeological investigation.
Socio-Economic Environment				S2-1 minimizes property impacts, although there are mitigation options to reduce property impacts of other alternatives. Air quality impacts are similar for all alternatives, but S2-1 has the lowest potential to increase emissions.
Technical / Transportation				S2-3 maintains an open median, does not require large fills in the valley on the south, minimizes potential utility impacts, and has the lowest estimated construction cost.
Recommendation				

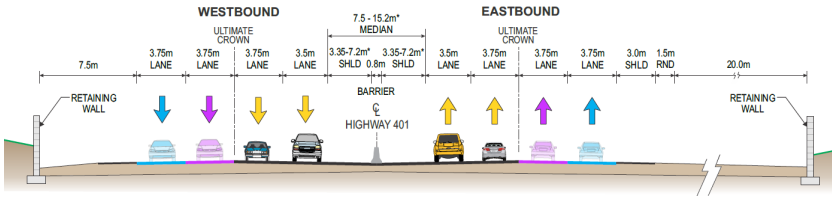
5.5.1.2 Section 3

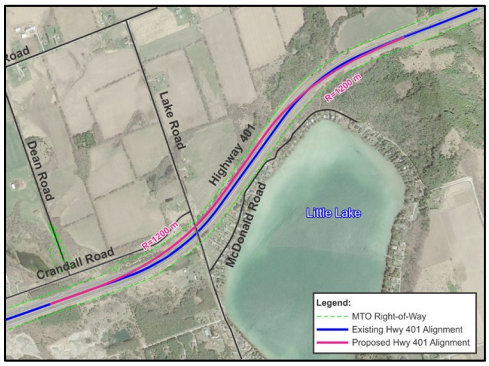
From the long-list screening (**Section 5.2.1** for details), three alternatives were carried forward to the short-list. The short-listed alternatives are illustrated in **Exhibit 5-45**, and a summary of the assessment is provided in **Exhibit 5-46**. The summary provides an overview of the key differentiating factors between the alternatives. The assessment and evaluation of the alternatives is detailed in **Appendix O**. Alternative 2 was recommended as the preferred alternative for Section 3.

Exhibit 5-45: Section 3 – Short-List of Alternatives

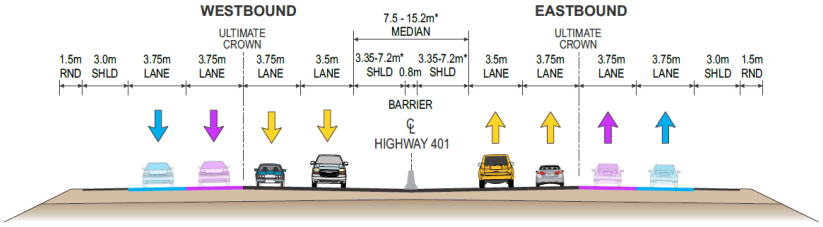


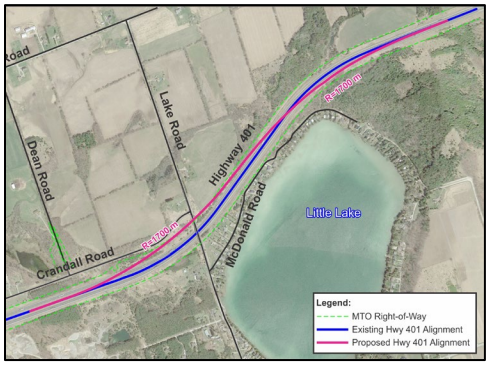
S3-1 – Widen outside only and widen median shoulders (maintain existing alignment)





S3-2 – Widen outside only and realign using two 1200 m radius curves





S3-3 – Widen outside only and realign using two 1700 m radius curves

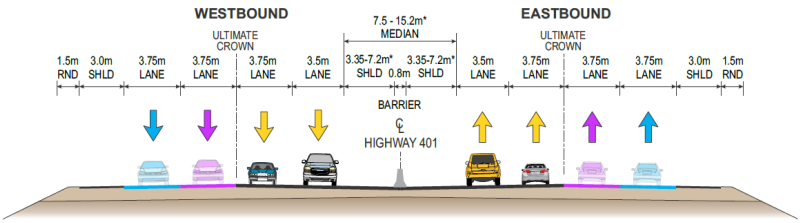


Exhibit 5-46: Section 3 – Summary of Evaluation

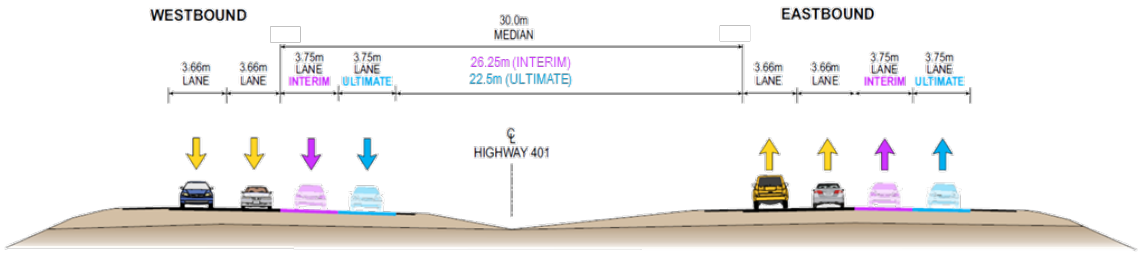
Criterion	Alternatives			Key Benefit / Disadvantage
	S3-1 Maintain existing alignment	S3-2 Realign with R=1200 curves	S3-3 Realign with R=1700 curves	
Natural Environment				S3-1 reduces the impacts to SAR habitat and minimizes large cuts, although retaining walls are required.
Cultural Environment				S3-1 has impacts to 2 Cultural Heritage Landscapes. There is no significant difference in archaeological potential of the alternatives and all alternatives will require further investigations.
Socio-Economic Environment				S3-2 has the least property impacts and realigns the highway further from sensitive noise receptors, although it does impact more agricultural land than S3-1.
Technical / Transportation				S3-1 is preferred since it improves the existing highway geometry, has better constructability than S3-2, and has fewer maintenance requirements than S3-1.
Recommendation				

5.5.1.3 Section 5

From the long-list screening (**Section 5.2.1** for details), two alternatives were carried forward to the short-list. The short-listed alternatives are illustrated in **Exhibit 5-47**, and a summary of the assessment is provided in **Exhibit 5-48**. The summary provides an overview of the key differentiating factors between the alternatives. The assessment and evaluation of the alternatives is detailed in **Appendix O**. Alternative 4 was recommended as the preferred alternative for Section 5.

Exhibit 5-47: Section 5 – Short-List of Alternatives

S5-3 Widen to the south



S5-4 Widen inside in the Interim and outside in the Ultimate

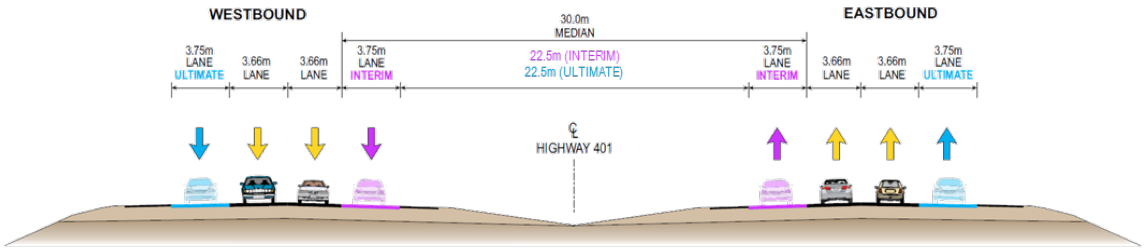


Exhibit 5-48: Section 5 – Summary of Evaluation

Criterion	**Alternatives**		**Key Benefit / Disadvantage**
	S5-3 Widen to the south	S5-4 Widen inside (interim) & outside (ultimate)	
Natural Environment			No preference in alternatives; there may be small differences in the lengthening of the structural culvert that may affect wildlife passage (turtles) opportunity and it is a slightly greater impact in Alternative S5-4 than S5-3.
Cultural Environment			No preference as both alternatives impact cultural heritage landscape due to property taking/grading. There is no significant difference in the archaeological potential of the alternatives.
Socio-Economic Environment			No preference in a preferred alternative since the property impacts are similar and no noise sensitive receptors in this section. Slight preference in S5-3 for Air Quality since it has the lowest potential to increase emissions.
Technical / Transportation			S5-4 is preferred since it is easier to tie in this alternative to the County Road 30 design at the project study limit.
Recommendation			

5.5.1.4 Section 7

From the long-list screening (**Section 5.2.1** for details), two alternatives were carried forward to the short-list. The short-listed alternatives are illustrated in **Exhibit 5-49**, and a summary of the assessment is provided in **Exhibit 5-50**. The summary provides an overview of the key differentiating factors between the alternatives. The assessment and evaluation of the alternatives is detailed in **Appendix O**. Alternative 2 was recommended as the preferred alternative for Section 7.

Exhibit 5-49: Section 7 – Short-List of Alternatives

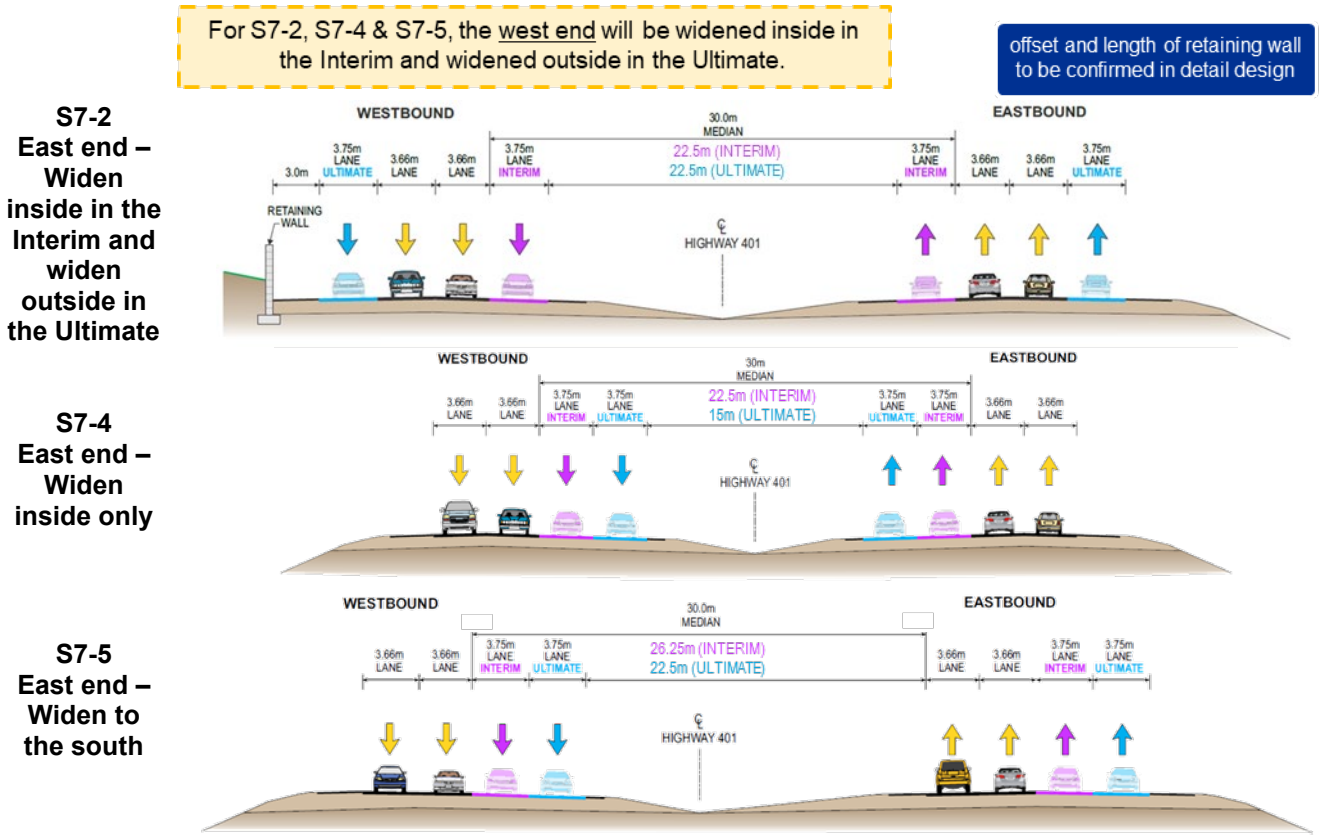


Exhibit 5-50: Section 7 – Summary of Evaluation

Criterion	Alternatives			Key Benefit / Disadvantage
	S7-2 East End: Widen inside (Interim) & outside (Ultimate)	S7-4 East End: Widen inside only	S7-5 East End: Widen to the south	
Natural Environment				No preference amongst the three alternatives. Alternative S7-2 has slightly greater potential impacts to three low-sensitivity watercourses.
Cultural Environment				No preference as all alternatives impact cultural heritage landscape due to property taking/grading. All alternatives have the same archaeological potential.
Socio-Economic Environment				Alternative S7-4 is slightly preferred from an Air Quality perspective. The property impacts are similar for all alternatives.
Technical / Transportation				Alternative S7-2 is preferred since it maintains an open median, is easiest to tie into the widening strategy to the west and at the east limit.
Recommendation				

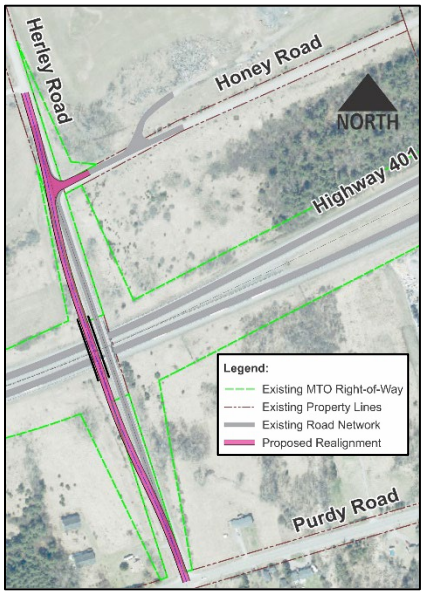
5.5.2 Bridge Replacement

5.5.2.1 Herley Road

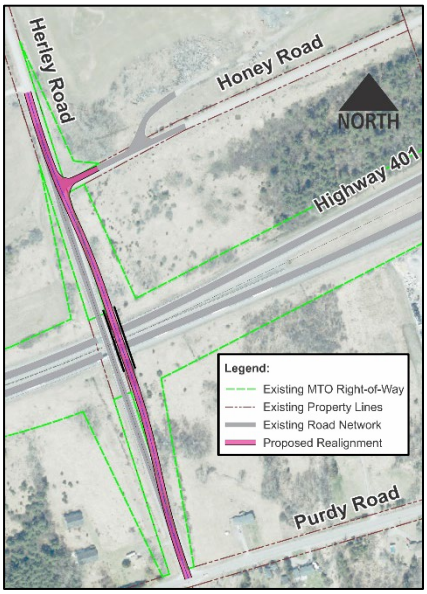
From the long-list screening (**Section 5.2.2** for details), three alternatives were carried forward to the short-list. The short-listed alternatives are illustrated in **Exhibit 5-51**, and a summary of the assessment is provided in **Exhibit 5-52**. The summary provides an overview of the key differentiating factors between the alternatives. The assessment and evaluation of the alternatives is detailed in **Appendix O**. Alternative 3 was recommended as the preferred alternative for the Herley Road bridge.

Exhibit 5-51: Herley Road Bridge – Short-List of Alternatives

H-1: Replace bridge to the west



H-2: Replace bridge to the east



H-3: Replace bridge on existing alignment (traffic detoured during construction via Lake Road or Percy Street)

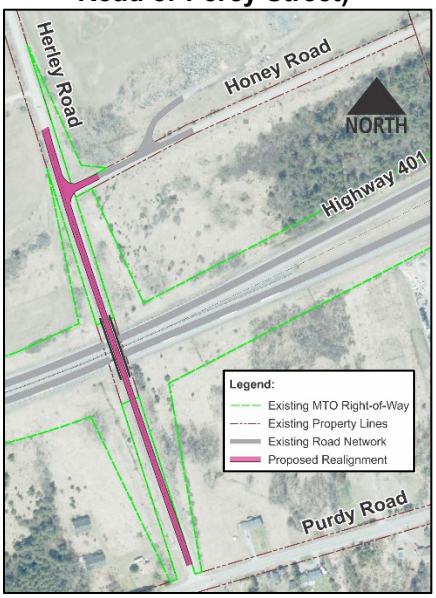


Exhibit 5-52: Herley Road Bridge – Summary of Evaluation

Criterion	Alternatives			Key Benefit / Disadvantage
	H-1 Replace bridge to the west	H-2 Replace bridge to the east	H-3 Replace bridge on existing alignment (temporary road closure)	
Natural Environment				No preference amongst the alternatives. H-3 does have a slightly lesser area of impact to potential breeding habitat for Eastern Meadowlark/ Bobolink.
Cultural Environment				No preference as all alternatives have the same archaeological potential. H-3 is slightly preferred since there are no impacts to any cultural resources or landscapes.
Socio-Economic Environment				H-3 is preferred since it has the greatest potential to mitigate property impacts. Alternative H-3 also has the lowest potential to increase emissions.
Technical / Transportation				Alternatives H-1 and H-3 are equally preferred. H-1 allows Herley Road to remain open during construction while H-3 has ideal geometry and lowest cost.
Recommendation				

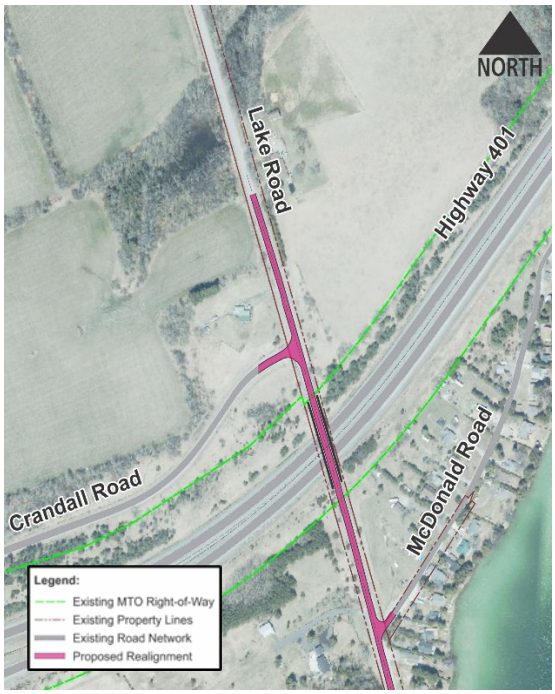
5.5.2.2 Lake Road

From the long-list screening (**Section 5.2.2** for details), only one alternative was carried forward and therefore Alternative 3 (L-3) is recommended as the preferred alternative for the Lake Road bridge (**Exhibit 5-53**). Below details Alternative 3 (L-3):

- Proposed signed bike route (Northumberland Transportation Master Plan 2017)
- Realignment of Crandall Road may be required.
- L-3 is preferred due to fewer property and environmental impacts and is compatible with future Highway 401 widening.
- Limited traffic inconvenience in this area with full closure due to low traffic volumes.

Exhibit 5-53: Lake Road Bridge – Preferred Alternative

L-3: Replace bridge on existing alignment (road closed during construction with detour via Herley Road or County Road 30)

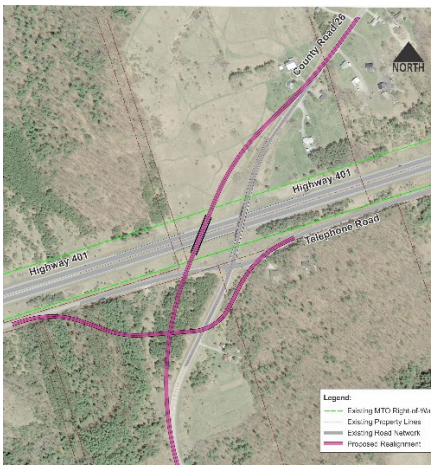


5.5.2.3 County Road 26

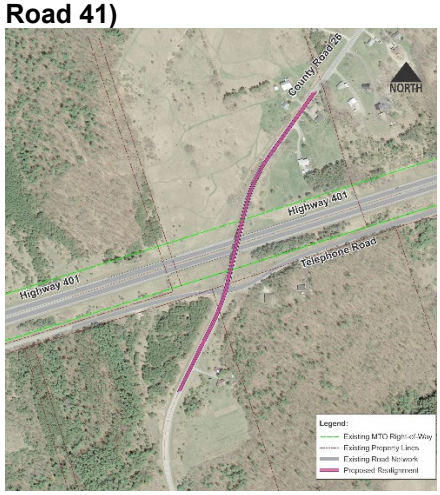
From the long-list screening (**Section 5.2.2** for details), three alternatives were carried forward to the short-list. The short-listed alternatives are illustrated in **Exhibit 5-54**, and a summary of the assessment is provided in **Exhibit 5-55**. The summary provides an overview of the key differentiating factors between the alternatives. The assessment and evaluation of the alternatives is detailed in **Appendix O**. Alternative 6 was recommended as the preferred alternative for the County Road 26 bridge.

Exhibit 5-54: County Road 26 Bridge – Short-List of Alternatives

C-2: Replace bridge to the west (intermediate)



C-6: Replace bridge on existing alignment (road closed during construction with detour via County Road 30 and County Road 41)



C-7: Replace bridge on existing alignment (temporary single-lane traffic control)

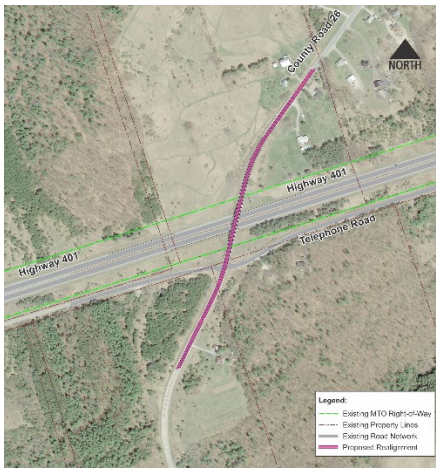


Exhibit 5-55: County Road 26 Bridge – Summary of Evaluation

Criterion	Alternatives			Key Benefit / Disadvantage
	C-2 Replace bridge to the west (intermediate)	C-6 Replace bridge on existing alignment (temporary closure)	C-7 Replace bridge on existing alignment (temporary single-lane traffic closure)	
Natural Environment				Alternatives C-6 and C-7 are equally preferred since Alternative C-2 has greater impacts to potential breeding habitat for SAR and a greater amount of vegetation removal.
Cultural Environment				No preference; all alternatives require property taking/grading for a potential cultural heritage landscape and a CHER was completed for 638 County Road 26 and an HIA is required.
Socio-Economic Environment				C-6 and C-7 are equally preferred since they both have less severe and small impacted area to private properties.
Technical / Transportation				C-2 and C-6 are equally preferred. C-2 uses a new alignment and has the simplest construction staging. C-6 has better constructability and lowest cost.
Recommendation				

5.5.3 Culvert Replacement

From the long-list screening (**Section 5.2.3** for details), three alternatives were carried forward to the short-list. A summary of the assessment is provided in **Exhibit 5-56**. The summary provides an overview of the key differentiating factors between the alternatives. The assessment and evaluation of the alternatives is detailed in **Appendix O**. Alternative 1 was recommended as the preferred alternative for the culvert replacements.

Exhibit 5-56: Culvert Replacement – Summary of Evaluation

Alternative 1 – Replace with culvert (open cut)	Alternative 2 – Replace with culvert (trenchless method)	Alternative 3 – Replace with bridge
Advantages ▪ Can maintain existing channel alignment ▪ Ideal for low fill locations	**Advantages** ▪ Can reduce construction staging impact on traffic ▪ Ideal for high fill locations ▪ Can easily maintain existing channel flows during construction	**Advantages** ▪ Ideal for high fill locations ▪ Can maintain existing channel alignment ▪ Potentially less environmental impacts ▪ Can easily maintain existing channel flows during construction
Disadvantages ▪ Potential for long construction duration ▪ Staging challenges due to high traffic volumes ▪ Existing channel flows harder to maintain during construction	**Disadvantages** ▪ Higher cost for larger culvert sizes; ▪ Not ideal in poor ground conditions; ▪ Requires channel realignment; ▪ Potentially greater environmental impacts due to staging areas; ▪ Not ideal for low fill locations (won't work for 2 of the 4 culverts).	**Disadvantages** ▪ Higher cost; ▪ Longer construction duration.
Recommendation Carried forward as the preferred alternative	**Recommendation** Not Carried Forward	**Recommendation** Not Carried Forward

5.6 Identification and Summary of Technically Preferred Alternative

As detailed in **Section 5.5**, the assessment and evaluation of the short-list of alternatives identified the following as the technically preferred alternative:

Highway 401 Widening

- Section 1: Alternative 2 – Widen inside in the interim and widen outside in the ultimate
- Section 2: Alternative 3 – Widen to the north
- Section 3: Alternative 2–- Realign with R-1200 curves
- Section 4: Alternative 1–- Widen outside only

- Section 5: Alternative 4 – Widen inside (interim) and outside (ultimate)
- Section 6: Alternative 1 – Widen outside only
- Section 7: Alternative 2 – East end: Widen inside (interim) and outside (ultimate)

Bridge Replacement

- Lake Road Bridge: Alternative L-3 – replace bridge on existing alignment (road closed during construction with detour via Herley Road or County Road 30).
- Herley Road Bridge: Alternative H-3 – Replace bridge on existing alignment (temporary road closure)
- County Road 26: Alternative C-6 – Replace bridge on existing alignment (temporary closure)

Culvert Replacements

- Culvert Replacements: Alternative 1 – Replace with culvert (open cut)

The preferred alternative was presented at PIC #2. The preferred alternative was further progressed and developed in the preliminary design phase.

6.0 CONSULTATION

Consultation is an integral component of the study. It provides opportunities for two-way communication between the Project Team and interested stakeholders. Consultation activities provide a forum to identify potentially significant environmental issues early in the decision-making process and ensures that they are given appropriate consideration. Throughout the study, the Project Team contacted the following individuals and organizations to provide feedback: External agencies (including Provincial and Federal Ministries and Agencies and Conservation Authorities); the Municipality of Brighton; the Township of Cramahe; the City of Quinte West; Northumberland County; Indigenous Communities; major utilities and railway companies; and members of the public (including affected land and business owners, community / interest groups and the general public).

Throughout the study, stakeholders were engaged through a variety of forums and activities, including:

- The Project Website (https://highway401colbornebrighton.ca/);
- Two Public Information Centres (PICs);
- Meetings with External Agencies, municipalities, and others;
- Direct contact with the Project Team via mail, email, phone, fax, or online web form; and,
- Newspaper advertisements (for Study Commencement, each PIC, and for the filing of the TESR).
    - Digital newspaper advertisement on www.northumberlandnews.com for two weeks for the filing of the TESR as the previously used newspapers are no longer in circulation.

The purpose of this section is to outline the consultation activities undertaken, identify the key issues raised, and indicate how they were resolved.

Copies of study notification materials are included in **Appendix P** and copies of consultation event materials (including comment sheets, PIC summary reports and displays) are provided in **Appendix Q**.

6.1 Public Consultation

6.1.1 Project Mailing List

At the onset of the Study, a contact list was developed to include provincial and federal agencies, municipalities, elected officials, Indigenous Communities, adjacent property owners, other interest groups and potentially interested stakeholders that may hold interest in the Study. As the Study progressed, the contact list was updated to ensure that all identified interested parties received study notifications.

In July 2020, notification letters announcing the Study Commencement were distributed by direct mail and email to the contacts on the project mailing list. A Study Commencement Notice was also posted on the project website and published in local newspapers as follows:

- *Brighton Independent* on August 6, 2020
- *Northumberland News* on August 6, 2020
- Project website on July 24, 2020

6.1.2 Project Website

The project website (https://highway401colbornebrighton.ca/) was launched to coincide with the Study Commencement in July 2020 and has remained active throughout the study. The website provided an opportunity for the public and stakeholders to review up-to-date study information, download study materials and reports and contact the Project Team through the project email address (project-team@highway401colbornebrighton.ca) which was provided on the “Contact Us” page. The “Contact Us” page also included a webform feature, where comments could be entered and sent directly to the Project Team at any time during the study. The website was regularly updated with project updates and consultation event materials.

6.1.3 Consultation Events

Public and stakeholder consultation events were held at key project milestones as follows:

- Public Information Centre #1 – April 21, 2021
- Public Information Centre #2 – May 31, 2023

Public Information Centres (PICs) are informal meetings where area residents, interested stakeholders, agencies and Indigenous Communities are provided an opportunity to review planning and project information, identify concerns and provide input to the Project Team.

6.1.3.1 Public Information Centre #1 (April 21, 2021)

In light of COVID-19 and associated physical distancing requirements, Public Information Centre (PIC) #1 was held exclusively online via the project website (http://www.highway401colbornebrighton.ca/). The purpose of the PIC was to provide an overview of the existing conditions (environmental, transportation and structural), problem/ opportunities, alternatives, evaluation process and next steps in the Class EA process.

A Notice of PIC #1 was posted on the project website and published in April 2021 for the date of April 21, 2021. The Notice of PIC #1 was subsequently sent as follows:

- *Brighton Independent* on April 15, 2021
- *Northumberland News* on April 15, 2021
- Project website on April 6, 2021

Provincial (MPPs) politicians with ridings in the Study Area were sent PIC notification letters via mail on April 6, 2020. Initial Notification letters were distributed by direct mail or e-mailed to contacts on the study mailing list on April 13, 2021, including government agencies (federal and provincial), Indigenous Communities, local municipalities, emergency service providers, utility service providers and interested stakeholder groups.

In addition, a copy of the PIC notice was mailed directly to approximately 2414 adjacent property owners in the Study Area via Canada Post bulk mail.

Representatives from agencies, including the Ministry of Natural Resources and Forestry, Curve Lake First Nation, and the Ontario Trucking Association attended the PIC. As of July 2023, the 3-part video of the PIC presentation reported the following audience views:

Part 1 – Study Introduction	83 views
Part 2 – Alternatives Screening Process and Highway 401 Future Widening Alternatives	82 views
Part 3 – Bridge Replacement Alternatives, Detour Options, Culvert Replacement Alternatives, and Evaluation Process	58 views

19 attendees submitted comments at the PIC or via mail, email, telephone, fax, or the webform after the event. **Exhibit 6-1** summarizes the most frequent comments provided and outlines how they were addressed.

Exhibit 6-1: Key Comments from PIC #1 – May 21, 2021

Comment Received	Comment Response
Impact to local sideroad (Telephone Road)	Concern about impact to local sideroad (Telephone Road) due to the widening of Highway 401.
Property impacts	Concerns related to property impacts along Telephone Road, McDonald Road (Little Lake properties), and Purdy Road, and to Ummati Cemetery (west of Lake Road).
Noise impacts / mitigation measures	Concerns related to the increased noise generated by the increased traffic flow due to the widening of the Highway 401 and inquiries related to whether noise mitigation measures, such as sound barrier walls or berms) will be installed.
Wildlife mortality	Concern related to small wildlife mortality caused by the concrete dividers between the eastbound and westbound lanes (i.e. inability to cross the existing Highway 401).

6.1.3.2 Public Information Centre #2 (May 31, 2023)

PIC #2 was held as a 'drop-in' style, open house format at the Keeler Centre in Colborne, Ontario on May 31, 2023. The purpose of PIC #2 was to provide an opportunity to review the evaluation of alternatives and the preferred Preliminary Design, along with anticipated environmental impacts and proposed mitigation strategies.

The Notice of PIC #2 was posted on the project website and published through local newspapers, as follows:

- *Brighton Independent* on May 18, 2023
- *Northumberland News* on May 18, 2023
- Project website on May 12, 2023

Provincial (MPPs) politicians, with ridings in the Study Area, were sent PIC #2 notification letters via mail on May 9, 2023.

Notification letters were distributed by direct mail or e-mailed to contacts on the study mailing list on May 16, 2023, including government agencies (federal and provincial), Indigenous Communities, local municipalities, emergency service providers, utility service providers and interested stakeholder groups. In addition, a copy of the PIC #2 notice was mailed directly to approximately 2844 adjacent property owners in the Study Area. The Municipality of Clarington also provided property owner addresses for the Study Area and those properties received a notice as well.

A preview session took place from 3:00 p.m. to 4:00 p.m. for invited Indigenous Communities, agencies and interested stakeholders, while a public session occurred from 4:00 p.m. to 8:00 p.m. Project Team members were available to discuss the project one-on-one with the attendees.

Of the 55 people who attended the PIC, 45 chose to sign in. Representatives from agencies, including the Ministry of Natural Resources and Forestry, the Ministry of Citizenship and Multiculturalism, the Township of Cramahe, and Northumberland County attended the PIC.

A total of 27 comments were received either at PIC #2 or via mail, email, telephone, fax, or the webform after the event. **Exhibit 6-2** outlines the most frequent comments provided and how these were addressed by the Project Team.

Exhibit 6-2: Key Comments from PIC #2 – June 30, 2023

Comment Received	Comment Response
Impact to local sideroad (Telephone Road)	Concern about impact to local sideroad 7 Telephone Road) due to the widening of Highway 401.
Property Impacts	Concerns related to property impacts along Crandall Road and Durham Street, as well as over loss of access to Little Lake.
Noise impacts / mitigation measures	Concerns related to the increased noise generated by the increased traffic flow due to the widening of the Highway 401, including effects on wildlife.
Wildlife mortality	Concern related to small wildlife mortality caused by the concrete dividers between the eastbound and westbound lanes (i.e. inability to cross the existing Highway 401).

Comment Received	Comment Response
Highway closures	Concerns related to the timing and frequency of construction and closure activities during the project's lifespan.
Impacts to water	Concerns over potential effects of the project on drainage and wells.

6.2 External Agency and Stakeholder Consultation

Federal and Provincial agencies, local municipalities, utilities service providers and stakeholder interest groups were notified at the beginning of the study via letter and email in July 2020, informing them of the study and soliciting their comments. The following agencies, municipalities, businesses and other stakeholders were consulted with during the Study:

Provincial Agencies

- Ministry of Environment, Conservation and Parks
- Ministry of Agriculture, Food and Rural Affairs
- Ontario Provincial Police
- Ministry of Natural Resources and Forestry
- Ministry of Citizenship and Multiculturalism
- Infrastructure Ontario
- Ministry of Municipal Affairs and Housing

Emergency Services

- Brighton District Fire Department
- Northumberland County Ambulance and Paramedic Services
- Quinte West Fire and Emergency Services
- Lower Trent Conservation Authority

Potentially Interested Stakeholders

- Ontario Cycling Association
- Ontario Federation of Snowmobile Clubs
- Ontario Federation of Agriculture
- National Farmers Union–- Ontario
- The Big Apple
- Brighton / 401 KOA Holiday
- Ontario Trucking Association
- Trenton ONroute
- Northumberland Central Chamber

Municipalities

- Municipality of Brighton
- Township of Cramahe
- Northumberland County
- City of Quinte West

Schools/School Boards

- Kawartha Pine Ridge District School Board
- Peterborough Victoria Northumberland and Clarington Catholic District School Board
- Algonquin & Lakeshore Catholic District School Board
- Conseil des écoles publique "Est de "Ontario
- Conseil des écoles catholiques du Centre-Est
- Student Transportation Services of Central Ontario
- Hastings and Prince Edward District School Board
- Tri-Board Student Transportation

A summary of external agency participation is provided in **Exhibit 6-3**. The comments in **Exhibit 6-3** are grouped by agency. Relevant correspondence is included in **Appendix Q**, which is shown in chronological order.

The Project Team met with various stakeholders several times to provide information and updates as well as to seek input and respond to questions and comments. Notes of all meetings are on file with MTO. A summary of the agency and stakeholder meetings is provided in **Exhibit 6-4**. Refer to **Appendix R** for copies of the meeting minutes with all stakeholders consulted throughout this study.

Exhibit 6-3: Summary of External Agency Correspondence

Agency / Participant	Comment Received	Action Taken / Response
Provincial Government Agencies		
Ministry of Natural Resources and Forestry	Expressed concern over the project's impacts to the Brighton Provincial Wildlife Area and the Brighton Bluffs ANSI. Requested further consultation with MNRF by the Project Team to discuss alternatives on Sections 6 and 7. Inquired about how proposed highway expansions would affect the Brighton Provincial Wildlife Area. Offered to provide advice on designing culvert replacement to allow for wildlife passage. Requested shapefiles showing expansion plans in the area of the Brighton Provincial Wildlife Area.	Indicated that Project Team will consult with MNRF before a preferred option is selected. Provided the Recommended Plan and the Terrestrial Existing Conditions Report detailing potential impacts to the Brighton Provincial Wildlife Area. Provided a shapefile detailing expansion plan in the area of the Brighton Provincial Wildlife Area. Invited MNRF to attend PIC #2.
Ministry of Citizenship and Multiculturalism	Informed the Project Team that responsibilities of administering the *Ontario Heritage Act* related to cultural heritage have been transferred from the Ministry of Tourism, Culture and Sport to the Ministry of Citizenship and Multiculturalism. Provided contact information for Project Team to send any notices, reports, and documentation to. Requested an update on the status of technical cultural heritage studies, including archaeological assessment and the Cultural Heritage Resources Report.	Updated contact list. Stage 1 Archaeological Assessment Report, Cultural Heritage Resource Assessment Report, and Cultural Heritage Evaluation Reports were completed in support of this study. The Stage 1 Archaeological Assessment Report PIF is P1078-0081-2020.
Regional / Municipal Agencies and Emergency Services		
Northumberland OPP	Indicated that would attempt to attend Municipal Advisory Committee meeting #2	No further action required.
Office of MP Philip Lawrence	Indicated that MP Lawrence would be unable to attend PIC #2 and requested notes/minutes. Indicated that a staff member would attempt to attend.	Provided a link to the project website with material from PIC #2 for review.
Mayor Mandy Martin, Township of Cramahe	Shared a letter from Cramahe Council regarding support towards recognizing the state of the Township's current Emergency Detour Routes (EDRs).	A meeting was held between MTO and the Township of Cramahe on June 15, 2023 with the purpose of discussing concerns related to the existing Highway 401 EDRs and possible solutions. As a next step, the Township of Cramahe is to propose alternate EDRs for eastbound and westbound traffic to MTO for their analysis and consideration.
Joel Schriver, Township of Cramahe	Expressed interest in seeing the EDR route prioritized.	Noted by the Project Team.
Other Interested Parties/Stakeholders		
Ontario Trucking Association	Indicated support for the project. Indicated that the Project Team should consider the needs of commercial vehicle activity in its plans, including ensuring adequate vertical and horizontal clearances, adequate shoulder space, that interchange redesigns take into consideration the activity of long combination vehicles (LCV), advanced notice of closures through fixed and variable messaging signage, sufficient space for trucks to adjust to construction, sufficient lighting, and that exit and entrance ramps are not closed during construction and that truck traffic can be accommodated during construction.	Indicated that the Ministry of Transportation is committed to improving the highway network by using the best construction practices and the most up to date provincial standards and specification. Indicated that the Ministry is using the design study in part to understand the needs for LCV accommodation. Indicated that highway shoulders are being designed to MTO design standards. Indicated that considerations of lighting will be addressed in the construction staging plans and the Detail Design phase, the timing of which is currently unknown. Directed to the 511 website to provide information on closures and delays.

Exhibit 6-4: Key External Agency and Stakeholder Meetings

Key External Agency / Stakeholder	Meeting Date	Meeting Purpose
Municipal Advisory Committee Meeting #1 (MTO Corridor, MTO Environmental, MNRF, OPP, Northumberland County, Cramahe, Brighton, Quinte West, Lower Trent Conservation Authority)	December 9, 2020 & February 27 2023	The Project Team provided an overview of the project background, scope and schedule. Discussions were held regarding the Study Area and key issues as well as the Preliminary Alternatives.
Municipality of Cramahe	January 26, 2021	The Project Team provided an overview of the project background, scope and schedule. Discussions were held regarding the Study Area and key issues as well as the Preliminary Alternatives and crossing roads.
Quinte West	April 5, 2021	The Project Team provided an overview of the project background and schedule. The Project Team also discussed future widening of Highway 401, crossing road bridge replacements, Highway 401 detours for bridge demolition, and property impacts.
Municipality of Brighton	April 6, 2021	The Project Team provided an overview of the project background and schedule. The Project Team also discussed future widening of Highway 401, crossing road bridge replacements, Highway 401 detours for bridge demolition, and property impacts.
Northumberland County	April 8, 2021	The Project Team provided an overview of the project background and schedule. The Project Team also discussed future widening of Highway 401, crossing road bridge replacements, Highway 401 detours for bridge demolition, and property impacts.
Township of Cramahe	April 13, 2021	The Project Team provided an overview of the project background and schedule. The Project Team also discussed future widening of Highway 401, crossing road bridge replacements, Highway 401 detours for bridge demolition, and property impacts.
Township of Cramahe	June 6, 2022	The Project Team provided an overview of the project background and process as well as key milestones and a summary of consultation activities. The Project Team also discussed the alternatives and preferred alternative at Lake Road.
Township of Cramahe	April 25, 2023	The Project Team provided an overview of the project background and schedule as well as key consultation milestones and completed and in progress environmental studies. The Project Team also discussed the future widening of Highway 401, crossing road bridge replacements, crossing road structures proposed cross-sections, Highway 401 detours for bridge demolition, carpool lot improvements, and anticipated property impacts.
Municipality of Brighton	May 1, 2023	The Project Team provided an overview of the project background and schedule as well as key consultation milestones and completed and in progress environmental studies. The Project Team also discussed the future widening of Highway 401, crossing road bridge replacements, crossing road structures proposed cross-sections, Highway 401 detours for bridge demolition, carpool lot improvements, and anticipated property impacts.
Northumberland County	May 1, 2023	The Project Team provided an overview of the project background and schedule as well as key consultation milestones and completed and in progress environmental studies. The Project Team also discussed the future widening of Highway 401, crossing road bridge replacements, crossing road structures proposed cross-sections, Highway 401 detours for bridge demolition, carpool lot improvements, and anticipated property impacts.
Municipal Advisory Committee Meeting #2 (MNRF, OPP, Northumberland County, Cramahe, Brighton, Lower Trent Conservation Authority)	February 27, 2023	The Project Team provided an overview of the project background, scope and schedule. Discussions were held regarding the Study Area and key issues as well as the Preliminary Alternatives, bridge and culvert replacements, emergency median turnarounds, detour routes for bridge demolition and construction, and carpool lot improvements.

6.2.1.1 Indigenous Communities Engagement

Indigenous Communities were contacted by the Project Team at key milestones throughout the study process. The following Communities received study commencement, PIC notifications and notification of TESR completion:

- Alderville First Nation
- Hiawatha First Nation
- Mississaugas of Scugog Island First Nation
- Williams Treaties First Nations
- Kawartha Nishnawbe First Nation
- Curve Lake First Nation
- Chippewas of Rama First Nation
- Beausoleil First Nation
- Mohawks of the Bay of Quinte
- Métis Nation of Ontario

Letters were sent by MTO to all the above-mentioned Indigenous Communities and groups to inform them of the completion of the study. MTO will continue to engage with Indigenous Communities in subsequent design stages. A summary of correspondence received from Indigenous Communities is provided in **Exhibit 6-5**.

Exhibit 6-5: Summary of Comments Received from Indigenous Communities

Indigenous Community	Comment Received	Comment Response
Curve Lake First Nation	Provided a letter detailing Curve Lake First Nation's response to the project. Indicated that the project is situated on the Traditional Territory of Curve Lake First Nation. Provided a link to Curve Lake First Nation's Consultation and Accommodation Standards. Requested a summary statement of how the project will address impacts to drinking water, endangerment of fish and wild game, impact on Aboriginal heritage and cultural values, and impacts on endangered species, lands, and savannas. Indicated expectation to be notified immediately should burial or archaeological sites be found. Requested a meeting with the Project Team to discuss the potential impacts. Requested to be engaged with at Stage 1 of the archaeological assessment and all phase of the project.	Provided a letter in response to Curve Lake First Nation's requests. Summarized the mitigation measures that will likely be implemented during the Detail Design for drinking water, fish and fish habitat, species at risk and wildlife, and lands. Indicated that the contract will include provisions to stop work and undertake actions in accordance with the *Ontario Heritage Act* and *Cemeteries Act* should archaeological resources or human remains be encountered during construction. Indicated that MTO will continue to engage with Curve Lake First Nation throughout the project.
Hiawatha First Nation	Thanked the Project Team for updates provided on the project.	Indicated that the Project Team will continue to engage with Hiawatha First Nation.

7.0 RECOMMENDED PLAN

7.1 Description of Recommended Plan

The Recommended Plan is shown in **Appendix A**. The study limits on Highway 401 extend from 0.8 km east of Percy Street to 0.4 km west of Christiani Road (not including the County Road 30 Interchange). Highway 401 has three overpasses within the study limits, at Herley / Durham Road (Site # 21-294), Lake Road (Site # 21-295) and County Road 26 (Site # 11-164). As all structures within the study limits were initially constructed in the 1950s-1960s, they are approaching the end of their lifespan and replacement of all structures will be required by the project horizon. The recommended plan includes:

- All required structural replacements and improvements at the existing crossing.
- All crossing roads (Herley/Durham Road, Lake Road and County Road 26) will be replaced on the existing alignment with slight profile changes at all crossings to accommodate improved vertical clearance.
- All four structural culverts within the Study Area will require replacement.
- Highway 401 widening to an interim 6-lanes and ultimate 8-lanes to ensure that the structures can accommodate future Highway 401 expansion.
- Realignment of Highway 401 to improve the existing curve at Lake Road.
- Realignment of Crandall Road north of Highway 401 at Lake Road to accommodate the Highway 401 alignment shift and future widening.
- Commuter parking lot expansion of the existing carpool lot at Highway 401 and County Road 30.
- Drainage and stormwater improvements.
- Illumination improvements.
- Relocation of impacted utilities.

The improvements will require property acquisition; the Recommended Plan shows the property requirements for both the interim (6-lane) and ultimate (8-lane) improvements. Currently these improvements are not included in the MTO's 5-year Capital plan. While the structures could be replaced alone, it is assumed some Highway 401 widening would be required to replace the structures in order to accommodate traffic staging during construction. Highway 401 widening will be subject to provincial priorities and funding.

7.1.1 Highway 401

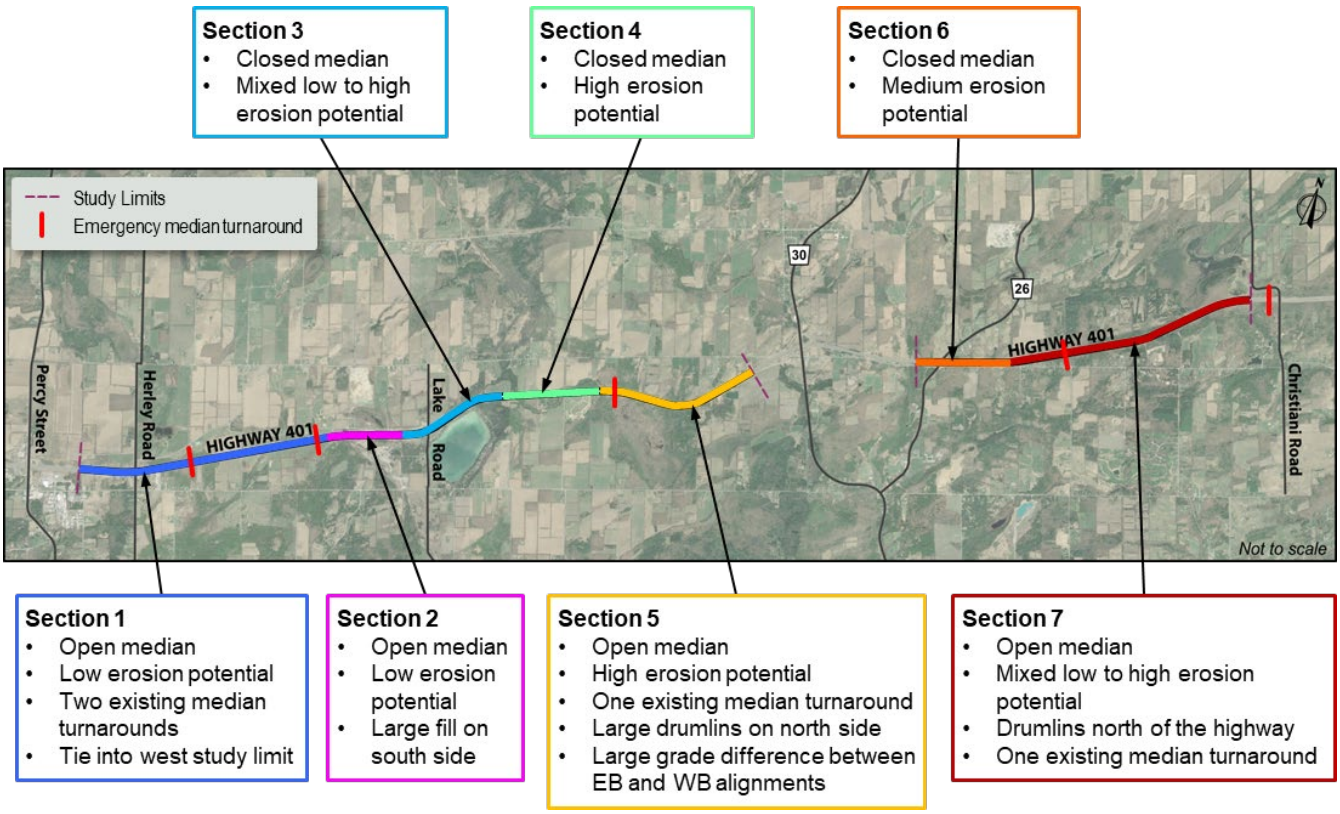
The proposed improvements to the Highway 401 corridor will accommodate a widening of the highway platform from the existing four lanes to future six- and eight-lane conditions and will also include horizontal improvements at one location. The proposed Highway 401 is detailed in the Preliminary Design Plates of the eight-lane configuration, included in **Appendix A**. The plates show the property requirements for both the six and eight lane widenings. The property requirements at the crossing roads will be required for the replacement of the overpass structures at each location.

7.1.1.1 Highway 401 Cross-Section

The proposed Highway 401 corridor improvements will accommodate for the future Highway 401 expansion by ensuring all replacement structures will have span widths that accommodate the future cross-sections.

As presented in **Section 5.0** for evaluation purposes, Highway 401 Study Area was divided into seven sections based on key features and site conditions within each highway section. **Exhibit 7-1** shows the location of each of the seven sections and a summary of the features of each section.

Exhibit 7-1: Highway 401 Sections



In the six-lane (interim) condition, the lane widths will similarly be to MTO standards; however, the median width will vary between 7.5 m and 22.8 m, meeting or exceeding the minimum median width per MTO standards. A summary of the proposed widening for each of the Highway 401 Sections is presented in **Exhibit 7-2**.

The proposed Highway 401 cross-sections are illustrated in **Exhibit 7-3** to **Exhibit 7-9**.

Exhibit 7-2: Summary of Highway 401 Widening

Section #	Median Type	Recommended Widening	
		6-lane	8-lane
1	Open	Widen to inside	Widen to outside
2	Open	Widen to the north	Widen to north
3	Closed	Widen to the outside*	Widen to the outside*
4	Closed	Widen to the outside	Widen to the outside
5	Open	Widen to the inside	Widen to the outside
6	Closed	Widen to the outside	Widen to the outside
7	Open	Wide inside	Widen Outside

Section 3 also includes horizontal alignment improvement which results in alignment shift to the north at Lake Road.

Exhibit 7-3: Highway 401 Section 1, Existing and Proposed Cross-Sections

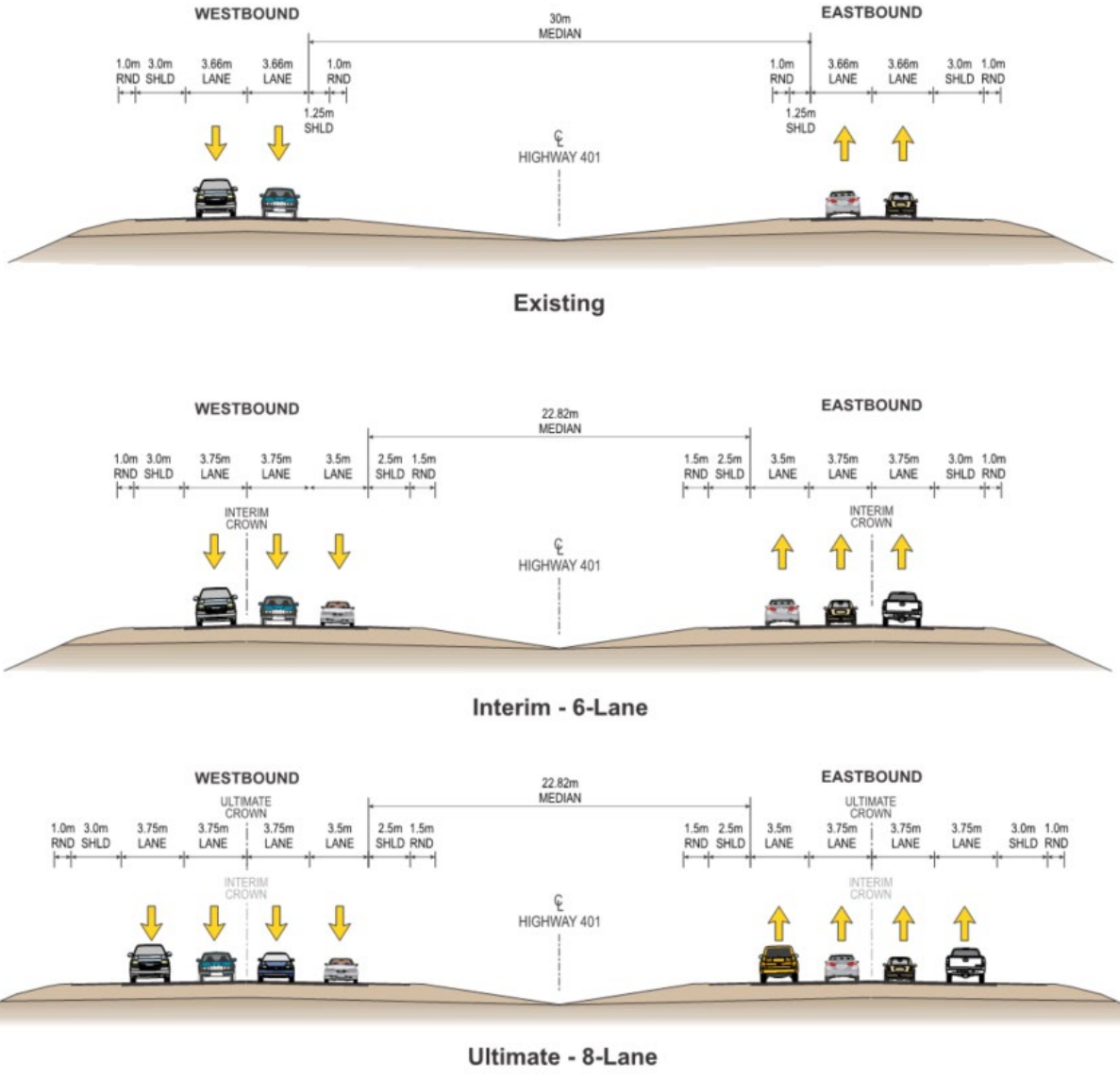


Exhibit 7-4: Highway 401 Section 2, Existing and Proposed Cross-Sections

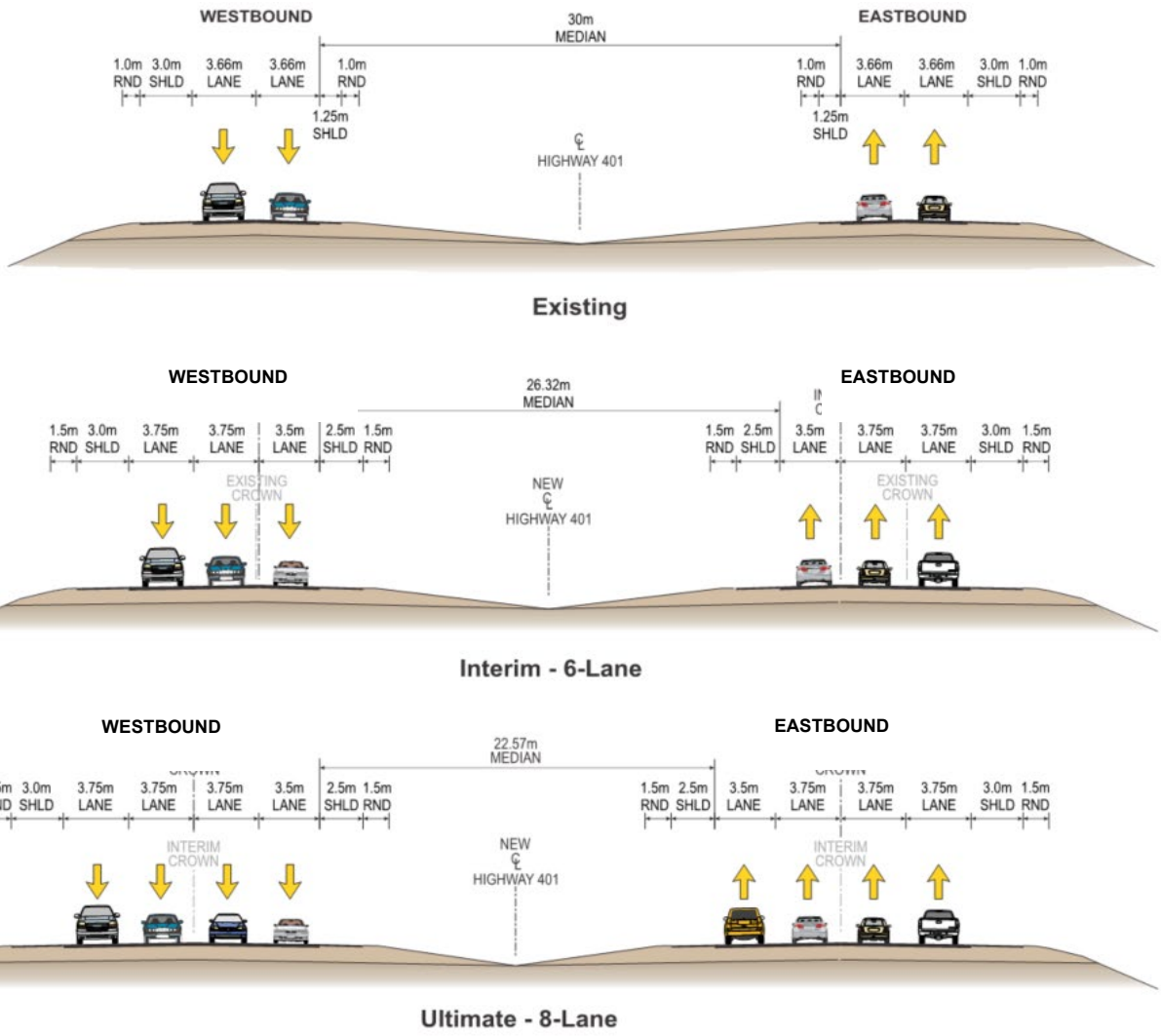
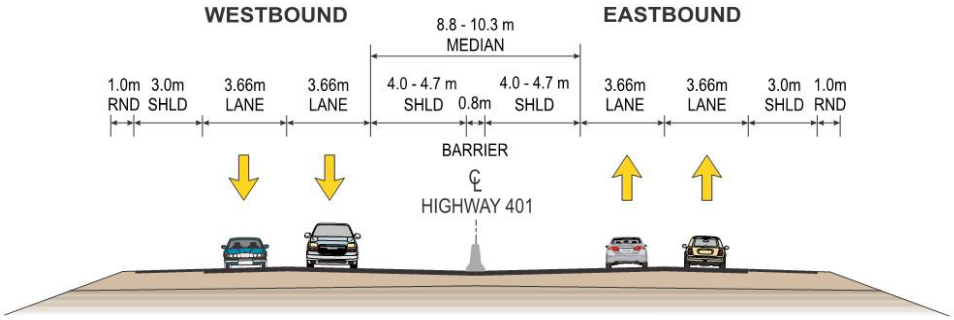
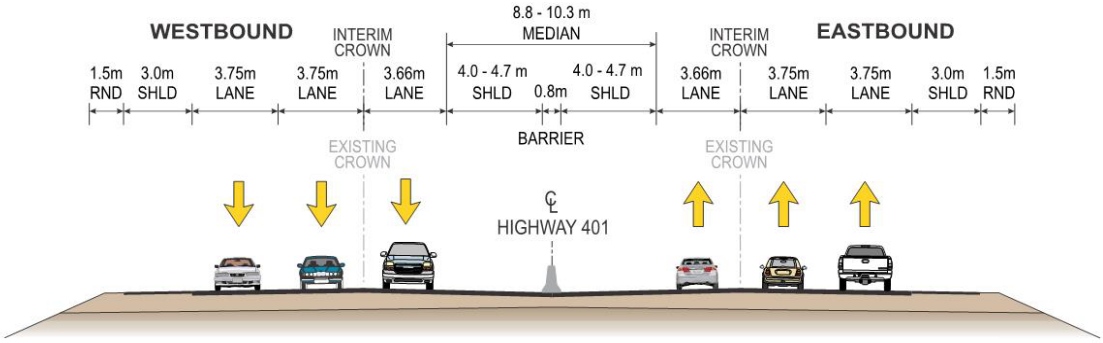


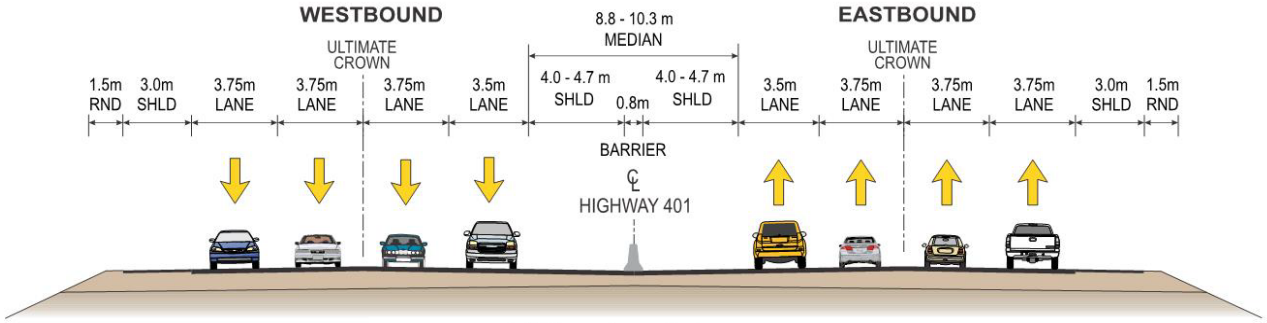
Exhibit 7-5: Highway 401 Section 3, Existing and Proposed Cross-Sections



Existing

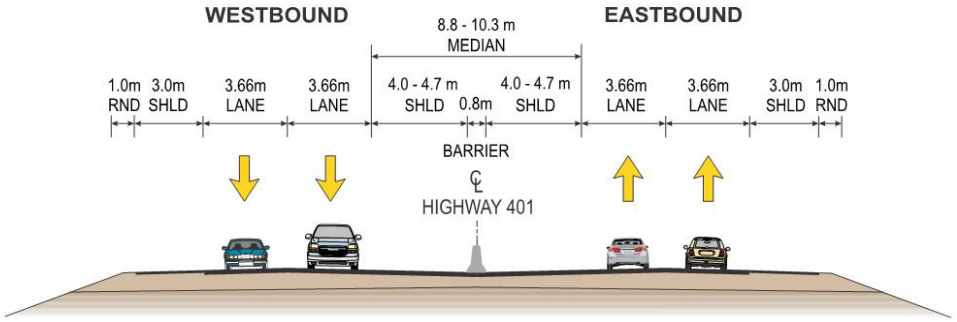


Interim - 6-Lane

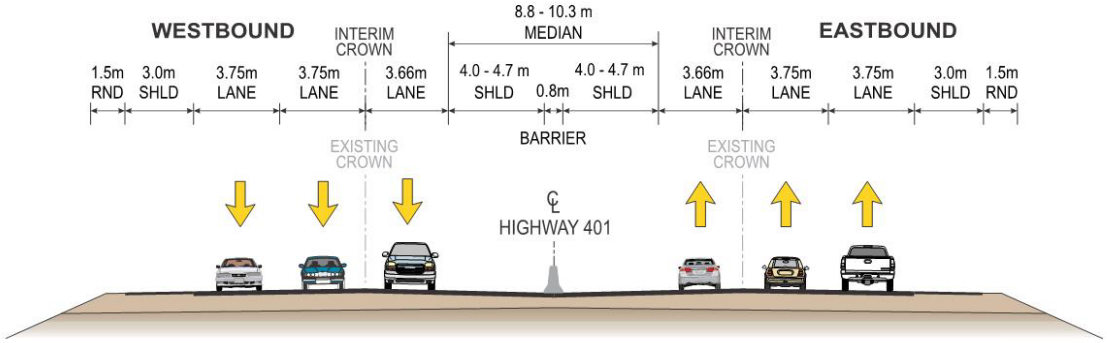


Ultimate - 8-Lane

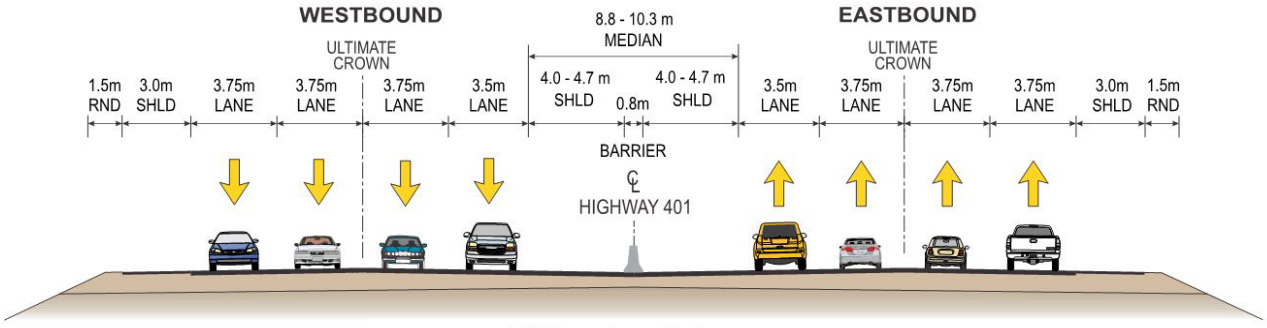
Exhibit 7-6: Highway 401 Section 4, Existing and Proposed Cross-Sections



Existing

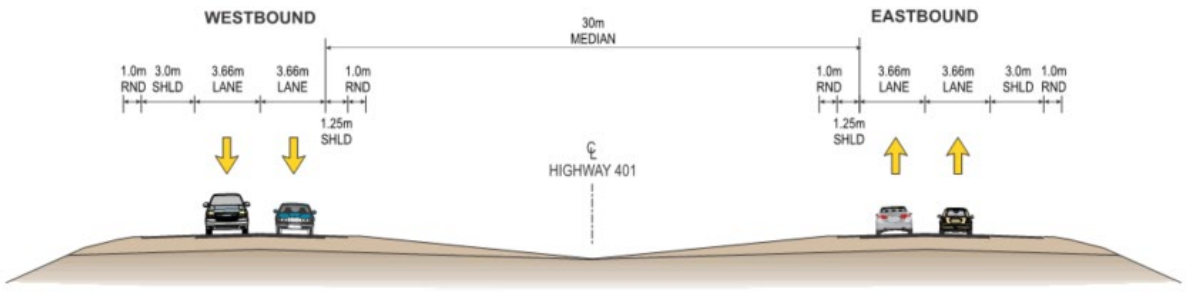


Interim - 6-Lane

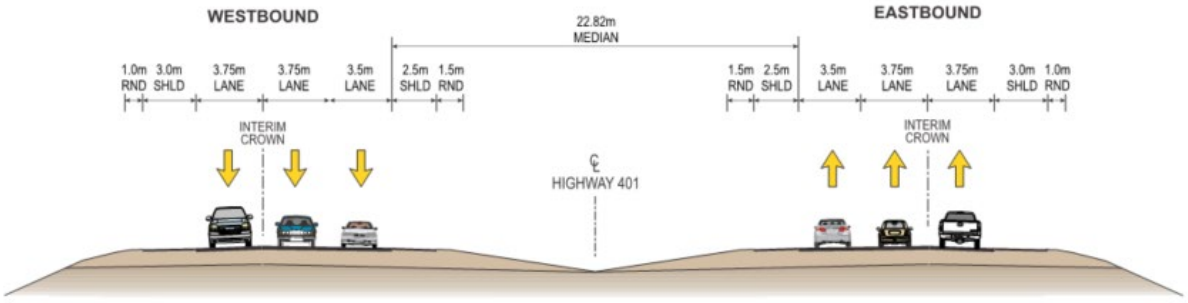


Ultimate - 8-Lane

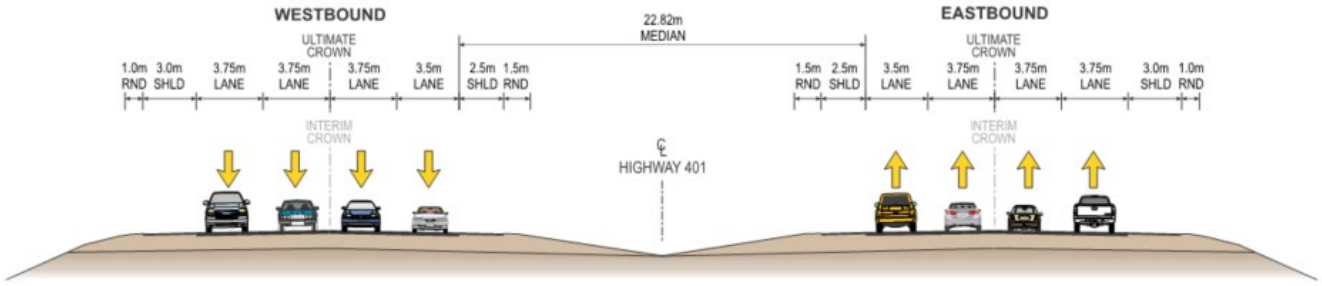
Exhibit 7-7: Highway 401 Section 5, Existing and Proposed Cross-Sections



Existing

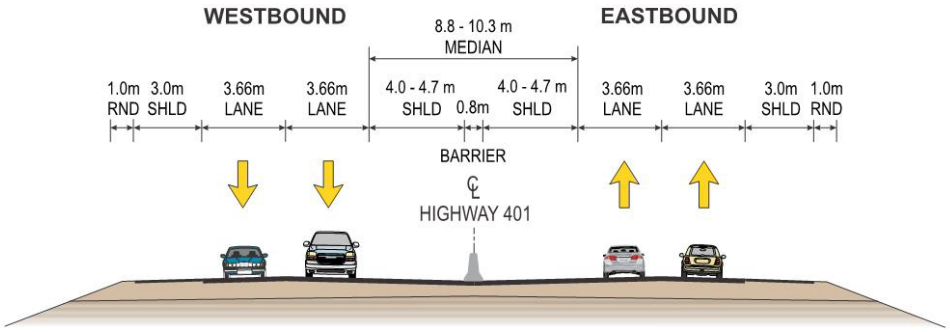


Interim - 6-Lane

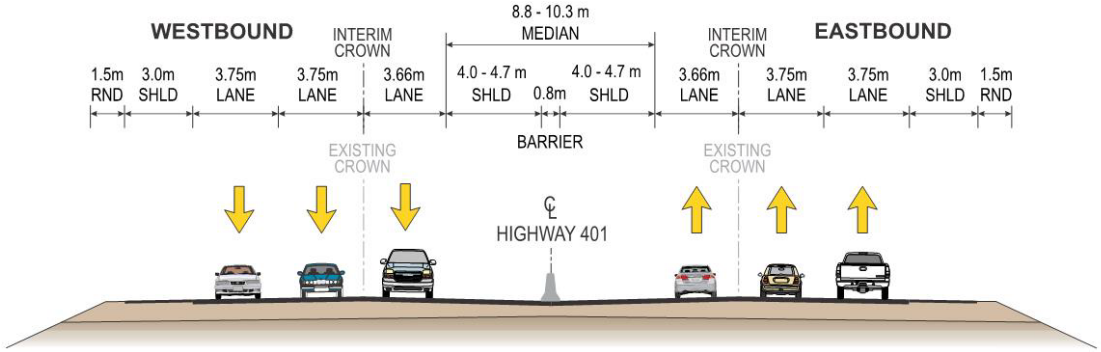


Ultimate - 8-Lane

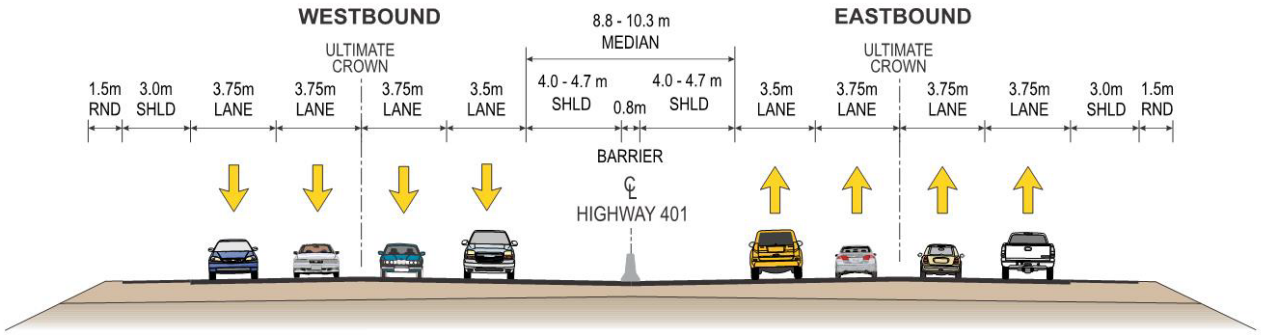
Exhibit 7-8: Highway 401 Section 6, Existing and Proposed Cross-Sections



Existing

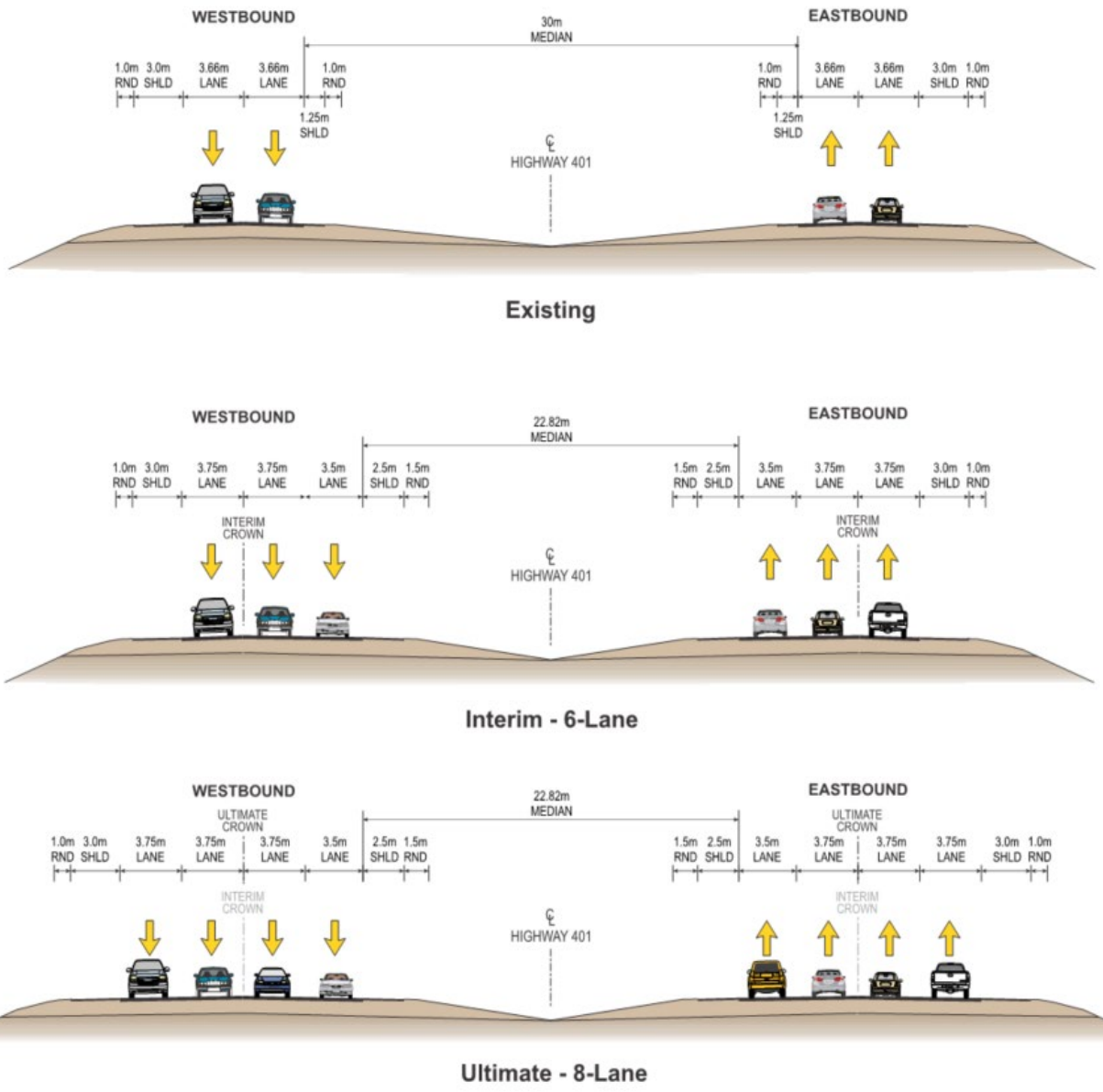


Interim - 6-Lane



Ultimate - 8-Lane

Exhibit 7-9: Highway 401 Section 7, Existing and Proposed Cross-Sections



7.1.2 Herley / Durham Road Crossing

Herley / Durham Road is a rural undivided, 2 lane road that crosses Highway 401 approximately 1.7 km east of Percy Street. The replacement structure is proposed to be at the existing crossing location and as such this will require the closure of Herley / Durham Road during the construction. For further details on staging and detours during construction see **Section 7.9**.

The profile of Herley / Durham Road will be raised to accommodate the longer spans of the structure and to meet desirable vertical clearance over Highway 401. There may be a very slight impact to Honey Road due to the profile raise, resulting in very minor grade raise at the intersection.

The proposed cross-section along the section of Herley Road that will be reconstructed will be consistent with the proposed bridge cross-section which includes two 3.5 m lanes with 1.7 m shoulders.

7.1.3 Lake Road Crossing

Lake Road is a rural undivided, 2 lane road that crosses Highway 401 approximately 6.2 km east of Percy Street. The replacement structure is proposed to be at the existing crossing location and as such this will require the closure of Lake Road during the construction. For further details on staging and detours during construction see **Section 7.9**.

The profile of Lake Road will be raised to accommodate the longer spans of the structure and to meet desirable vertical clearance over Highway 401.

The proposed cross-section along the section of Lake Road that will be reconstructed will be consistent with the proposed bridge cross-section which includes two 3.5 m lanes with 1.7 m shoulders.

7.1.4 County Road 26 Crossing

County Road 26 is a rural undivided, 2 lane road that crosses Highway 401 approximately 2.2 km east of County Road 30. The replacement structure is proposed to be at the existing crossing location and as such this will require the closure of County Road 26 during the construction. For further details on staging and detours during construction see **Section 7.9**.

The profile of County Road 26 will be raised to accommodate the longer spans of the structure and to meet desirable vertical clearance over Highway 401. This will result in grade raise of Telephone Road in the vicinity of the County Road 26 and Telephone Road intersection.

The proposed cross-section along the section of County Road 26 that will be reconstructed will be consistent with the proposed bridge cross-section which includes two 3.5 m lanes with 1.7 m shoulders.

7.1.5 Local Roads

7.1.5.1 Crandall Road

Crandall Road is a rural undivided, 2 lane road that is north of and runs parallel to Highway 401. Crandall Road is approximately 3 km long and connects Honey Road to Lake Road. Crandall Road will require realignment for a length of approximately 6 km from Lake Road westward in order to accommodate the Highway 401 localized realignment and future widening.

7.1.5.2 McDonald Road

McDonald Road is an undivided, private 2-lane road that is south of and runs parallel to Highway 401 for approximately 1 km around Little Lake from Lake Road to where it then becomes Trenear Road.

There should be no impacts to McDonald Road as Highway 401 is being shifted to the north and Lake Road profile raise does not extend to McDonald Road.

7.1.5.3 Telephone Road

Telephone Road is an undivided, 2-lane road that is parallel to Highway 401. Telephone Road is north of Highway 401 from west of Percy Street to County Road 30. At County Road 30 Telephone Road is south of Highway 401 continuing to beyond the study limits.

Telephone Road profile will need to be raised to match the County Road 26 raised profile in the vicinity of the County Road 26 and Telephone Road intersection.

7.1.5.4 Honey Road

Honey Road is a 2-lane undivided road that is parallel to Highway 401 from Herley / Durham Road for approximately 1.6 km to where it intersects Crandall Road and then it swings north for approximately 1 km to intersect Telephone Road. There may be a slight profile raise required at the Honey Road and Herley / Durham Road intersection to accommodate the profile raise on Herley / Durham Road.

7.1.6 Active Transportation

Currently the only existing or proposed Cycling and Pedestrian facilities within the study limits is that Lake Road is considered a Signed Bike Route as part of Northumberland's Transportation Master Plan (TMP) (2017) and the Cycling Master Plan (CMP) (2014). According to these plans, a "Signed Bike Route", in rural areas, are roads with low traffic and can be shared by adult bicyclists and motorists without the need for extra space or facility construction for bicyclists. The TMP/CMP have identified Lake Road for signing improvements only, with no recommendation for road widening to accommodate pedestrians and cyclists. MTO will be providing 1.7 m shoulders on all crossing road structures which will exceed the requirements outlined in the TMP/CMP and are wider than the shoulders on the existing structures.

7.1.7 Median Cross Overs

There are three existing emergency median cross overs within the Study Area; all three of these cross overs will be maintained for both the interim (6 lane) and ultimate (8 lane) configurations. The location of the median cross overs are shown on **Exhibit 7-1** and in the Preliminary Design Plates in **Appendix A**.

7.1.8 Proposed Carpool Lot improvements

Expansion of the existing carpool lot in the southeast quadrant of the County Road 30 interchange is proposed as part of this study: The design has been progressed only for the purposes of preliminary design and EA approval. Final design will be confirmed in Detail Design.

The carpool lot is on MTO-owned property and it does not require additional property outside of the MTO existing right-of-way to accommodate the proposed expansion. The carpool lot design will be confirmed in Detail Design.

The existing carpool lot has 45 existing spaces, the proposed expansion footprint shown on the preliminary design plates in **Appendix A** accommodates up to an additional 75 spaces (to be confirmed in Detail Design).

7.2 Proposed Drainage and Stormwater Management Plan

A Drainage and Stormwater Management Plan has been completed and is included in **Appendix D**. The below section summarises the proposed drainage conditions for the Highway 401 Study Area.

7.2.1 Culvert Requirements

For the preliminary design, headwalls are proposed for 26 culvert ends that are located within the proposed grass median. Culverts will require extension to accommodate the future highway widening. Further ditching and median design and analysis will be carried out in the Detail Design phase, which includes the possibility of wingwalls being required for the culvert ends located in the side ditching.

Eleven of the non-structural culverts are proposed for replacement. Two were recommended to be replaced from the previous Culvert Condition review in 2015 (by others). Five require replacement in order to meet the design

criteria under existing conditions and the last four require replacement because the existing size does not meet the design criteria under proposed conditions.

All proposed structural culverts meet relevant design criteria and have a lower observed water level compared to existing conditions due to the flattening of the proposed culvert to better follow the watercourse slope and increased width of culvert.

Under the Detail Design phase, detailed area survey should be obtained to refine the watercourse tie-in design.

7.2.2 Proposed Drainage Patterns

Under proposed drainage conditions, two additional lanes will be constructed either within the outer grassed ditch or one lane will be added on the inside shoulder while the other will be added on the outside shoulder. The proposed cross-section of the highway will include four lanes and shoulders on each of the eastbound and westbound lanes.

In most areas of the proposed design, runoff from the two inner lanes and median shoulders will be captured by catch basins. In some other areas of the proposed design, runoff from all four lanes and median shoulders or just the median shoulders will be collected by catch basins. Runoff that is not being captured by the catch basins will sheet flow to the highway outer ditches and ultimately flow to either municipal drains or a watercourse.

Proposed storm sewer networks will be discharging to the highway outer ditches through storm sewer outlets. The existing drainage pattern will be maintained and the existing storm sewer outlets will be utilized whenever possible in the areas of the study limits that are not being realigned. In the one small section that is proposed to be realigned, a new storm sewer network will need to be installed. Another small section will also need to add a new storm sewer network, as the grassed median is being proposed to change into a concrete median.

7.2.3 Proposed Stormwater Sewer Design

Existing storm sewers and outlets are utilized where applicable. In some sections, the existing storm sewer size will need to be increased due to the increase in catchment size. The slope and spacing are proposed to stay the same as the existing.

7.2.4 Preliminary Stormwater Management Strategy

MTO is committed to minimizing increases in stormwater peak flows up to the pre development 100-year storm at all outlets from the MTO ROW to minimize the risk to downstream riparian landowners due to the added impervious land use from the proposed highway widening.

Based on the pre-post comparison there is a total increased flow of 25% due to an increase in impervious area of 62% of 32 ha from existing conditions across the full study limit. This is based on the ultimate conditions of full highway widening within the study limits.

Storage will be provided in the roadside ditches in the form of grassed swales with rock check dams depending on the available space and previously identified drainage issues. Grassed swales with a bottom width of 1 m, a 6:1 foreslope, and a 3:1 backslope was assessed and the required ditch length to provide adequate quantity control throughout the project area is 8816 m, split between the 13 outlet control points.

For this project, quality control will be provided in the form of enhanced grassed swales with rock check dams.

7.3 Future Traffic Conditions

A traffic analysis was conducted as part of this study to assess the proposed improvements, and is further detailed in the Traffic Analysis Report included in **Appendix M**.

A level-of-service (LOS) analysis was conducted to assess the existing and future traffic conditions and potential future needs for further widening to eight lanes. The existing LOS is outlined in **Section 4.4.4**, the future conditions are outlined in the sections below.

7.3.1 Level-of-Service Analysis

- In 2031 the “do-nothing” scenario, Highway 401 is anticipated to operate a LOS of C or better during both the AM and PM peak hours. The weekend peak hour operation is the most critical and the corridor operates with a LOS of D and E during the fall and summer months respectively.
- In 2041, “do-nothing” scenario, Highway 401 is anticipated to operate at a LOS of C or better during both the AM and PM peak hours, similar to the 2031 do-nothing scenario. The LOS degrades during the weekend peak hours given the high volume of traffic. The highway segments are anticipated to operate at capacity (LOS E) during fall and the highway capacity is exceeded under the summer conditions (operating at LOS F).
- In 2031 the 6-lane widening scenario the Highway 401 mainline continues to operate at LOS A or B during the weekday peak hours (similar to the existing conditions), and vehicles travel at the highway posted speed. With widening of Highway 401, the LOS improves under the weekend conditions from LOS D to LOS C.
- In 2041 the 6-lane widening scenario the Highway 401 mainline operates at LOS C or better under the 2041, 6-lane widened scenario. The LOS during the weekday peak hours is anticipated be LOS B or better similar to the existing conditions. The LOS improves during the weekend peak hours from LOS D to LOS C with widening of the highway from 4 lanes to 6 lanes, and vehicles travel at freeflow speed.

7.3.2 Travel Times and Speed

- Under the 2031 “do nothing “Highway 401 generally operates under free-flow conditions with simulated speeds of greater than or slightly below 100 km/h during the weekday AM and PM peak hours. Under the weekend peak hour condition, the simulated speeds fall slightly below 100 km/h due to high traffic demand.
- Under the 2041 “do nothing” Highway 401 mainline travel times (obtained from the simulation models) increase across all time periods leading to lower operating speeds. The operating speed remain near the posted speed limit (100 km/h) under the weekday conditions. The operating speed reduces to 92-95 km/h during weekends in the westbound direction due to high volume of traffic volume. The eastbound operating speed is slightly greater (compared to the westbound operating speed) since the eastbound traffic volumes are approximately equivalent to 70% of the westbound volumes.
- Under the 2031, 6-lane scenario, vehicles travel at the posted speed limit of 100 km/h. The greatest improvement in the operating speed corresponds to the weekend conditions where the mainline vehicular demands are the highest. During weekend conditions, the speed of traffic is similar to the weekday conditions for most segments, apart from the speed of westbound traffic, which is reduced to 90-100 km/h near the end of the weekend peak hour period.
- Under the 2041, 6-lane scenario vehicles travel at or near the posted speed limit, and the greatest increase in the operating speed corresponds to the weekend conditions where the mainline vehicular demands are the

highest. The highway operating speed reduces to 90-100 km/h near the end of the weekend peak hour period in the westbound direction since it is the critical time period and direction of travel.

7.4 Structures

Within the Study Area, the Recommended Plan includes the replacement of three of the existing road bridges over Highway 401 (Herley/Durham Road, Lake Road and County Road 26)) and the replacement of four existing structural culverts. Locations of the structures are detailed in the Preliminary Design Plates, included in **Appendix A**. A summary of the proposed bridges and culverts is provided in the following sections. **Section 4.4.5** provides an overview of the existing structures within the Study Area.

As described in **Section 3.0**, the Highway 401 infrastructure through the study corridor is aging and this includes the existing crossing road and Highway 401 structures. These structures are nearing the end of their service lives and will require rehabilitation and / or replacement in the coming years. As structures have a lifespan of minimum 75 years, it is necessary to ensure the structures can accommodate future Highway 401 expansion projects. As such, there was a need for any replacement crossing road structures to have spans that accommodate a widened Highway 401, particularly at the interchanges, to ensure that the proposed design permits the freeway network to keep operating efficiently into the future.

7.4.1 Herley / Durham Road Underpass

The replacement Herley / Durham Road underpass will be located along the same alignment as the existing bridge. The replacement bridge will have a longer span and a thicker substructure (deck and girders) compared to the existing bridge due to the need to accommodate a wider Highway 401.

The proposed replacement structure will be a two-span underpass (33.0 m – 31.0 m from north to south). The proposed bridge will be 11 m wide with a 10.4 m wide deck which will accommodate two 3.5 m lanes of Herley / Durham Road and 1.7 m shoulders.

7.4.2 Lake Road Underpass

The replacement Lake Road underpass will be located along the same alignment as the existing bridge. At this crossing location Highway 401 alignment is proposed to have a curve improvement resulting in a shift of the Highway 401 alignment to the north at the location of Lake Road underpass. This bridge has been identified as needing earlier replacement than the other two bridges in the Study Area and may require replacement prior to the widening of Highway 401, as such the preliminary bridge includes this consideration with a design that can span both the existing Highway 401 lanes and the future lanes that will be shifted to the north. The exact span arrangement will be determined during Detail Design.

The proposed replacement structure will be a three-span underpass (20.0 m – 32.0 m – 35.0 m from south to north). The proposed bridge will be 11 m wide with a 10.4 m wide deck which will accommodate two 3.5 m lanes of Lake Road and 1.7 m shoulders.

7.4.3 County Road 26 Underpass

The replacement County Road 26 underpass will be located along the same alignment as the existing bridge. The replacement bridge will have a longer span and a thicker substructure (deck and girders) compared to the existing bridge due to the need to accommodate a wider Highway 401.

The proposed replacement structure will be a two-span underpass (34.8 m – 34.9 m from north to south). The proposed bridge will be 11 m wide with a 10.4 m wide deck which will accommodate two 3.5 m lanes of County Road 26 and 1.7 m shoulders.

7.4.4 Structural Culverts

The Recommended Plan includes the replacement of four structural culverts located between Lake Road and County Road 30. **Exhibit 7-10** provides a summary of the proposed structural culverts and their locations are detailed in the Preliminary Design Plates included in **Appendix A**.

Exhibit 7-10: Proposed Structural Culverts

ID	Location	Length (m)	Span (m)	Height (m)	Structure Type
21X-0471/C0	5.0 km west of County Road 30	87.7	4.8	2.4	Concrete precast box culvert
21X-0472/C0	4.5 km west of County Road 30	104.0	4.8	2.4	Concrete precast box culvert
21X-0473/C0	4.0 km west of County Road 30	99.8	4.8	2.4	Concrete precast box culvert
21X-0474/C0	3.0 km west of County Road 30	112.91	4.8	2.4	Concrete precast box culvert

7.4.5 Retaining Walls

There are three retaining walls identified as part of the recommended plan. All proposed retaining walls are to be proposed along the north (westbound) ultimate shoulder; two are located just east of the County Road 30 interchange and the third retaining wall is located just west of the east study limits. These retaining walls have been proposed in order to limit the disturbance of the highly erodible soils along the existing embankments on these sections of Highway 401. It is also recommended to purchase the property above the two retaining walls east of County Road 30 to ensure that there is no disturbance of these soils in the future.

7.5 Foundations

Preliminary foundations investigations were carried out for seven structures in the Study Area, including: Herley / Durham Road Underpass, Lake Road Underpass, County Road 26 Underpass and the four structural culverts.

7.6 Pavement

A Preliminary Pavement Design Report has been completed as part of this study. Pavement rehabilitation and new construction throughout the Study Area will be completed, with details to be confirmed in Detail Design.

7.7 Landscape Plan

A Preliminary Landscape Plan (**Appendix H**) has been developed to restore disturbed areas and enhance natural features within the Study Area. In general, the objectives of the Landscape Plan are to: ensure all disturbed areas are restored following construction and provide forest edge management to restore disturbed forest and protect forest interior. The Landscape Plan will be refined and further developed during Detail Design.

7.8 Utilities

The existing utilities within the Study Area are further detailed in **Section 4.4.6**. The utility infrastructure confirmed within the Study Area include Bell Canada, Hydro One. During the study Cogeco cable has proposed new underground infrastructure in the vicinity of Lake Road and the project team has provided input, based on the design available at the time, in order to ensure the cable won't be impacted by future works. As previously mentioned in this report, the key driver behind this study is the need to replace the structures as they are reaching the end of their service life. These infrastructure improvements are subject to provincial priorities and funding, and as utility infrastructure is continually upgraded and expanded, it is recommended utilities be further reviewed and confirmed during Detail Design and closer to the time of construction. **Exhibit 7-11** details the anticipated impacts and / or potential utility relocation requirements due to the Recommended Plan.

Exhibit 7-11: Summary Utility Impacts and/or Potential Relocations

Utility	Impact and/or Potential Relocation
Bell Canada	Bell Canada has a cable that is just inside the existing ROW south of Highway 401. This cable runs from the west study limits for approximately 4.2 km. This cable may be impacted due to the widening. Bell Canada has a cable that runs parallel, and to the west of , Herley Road. This cable may require relocation.
Hydro One	Hydro One poles located along Herley Road, Lake Road, County Road 26 and Telephone Road 200 m either side of County Road 26 will need to be relocated.
Enbridge Gas	No Enbridge gas lines will be impacted by the proposed works.

7.9 Construction Staging

Construction staging will be a key consideration to be refined during Detail Design in consultation with local municipalities. The following summarizes key items of the staging / bridge demolition approach.

- For the vast majority of the construction duration, traffic will be maintained on Highway 401;
- Short-term disruptions and closures will be required in some locations to implement improvements;
- Where possible, disruptions will occur at off-peak times;
- New road crossing bridges will be constructed on the same alignment and as such closure of the crossing throughout the demolition and construction;
- Rolling closures likely required on Highway 401 for girder hoisting;
- Highway 401 bridge demolitions will require detours. The final detour approach will be confirmed in Detail Design;
- Emergency vehicle access will need to be confirmed in subsequent design phases.

More detail pertaining to the Highway 401 widening and staging, bridge demolitions, and culvert replacements is provided in the following sections.

7.9.1 Crossing Road Bridge Demolitions

The three crossing road bridges at Herley Road, Lake Road and County Road 26 will need to be demolished prior to the construction of the new replacement bridges. A summary of the detour requirements is summarized below and the proposed demolition detour routes are shown in **Exhibit 7-12** and **Exhibit 7-13**.

- Detour Highway 401 traffic onto Emergency Detour Route (EDR) for bridge demolition and girder placement of new bridges.
- Due to the bridge type, each structure must be demolished all at once.
- Not feasible to detour within the highway right-of-way, so traffic must be detoured onto EDR.
- Estimated 12–18-hour off-peak closure of Highway 401 for each demolition.
- Police-assisted traffic control.
- Herley / Durham Road and Lake Road bridge demolitions will not occur at the same time.
- Timing of the bridge replacements and the number/duration of overnight closures will be confirmed during the Detail Design phase (timing is currently unknown).

Exhibit 7-12: Proposed Herley Road and Lake Road Demolition Detour Route

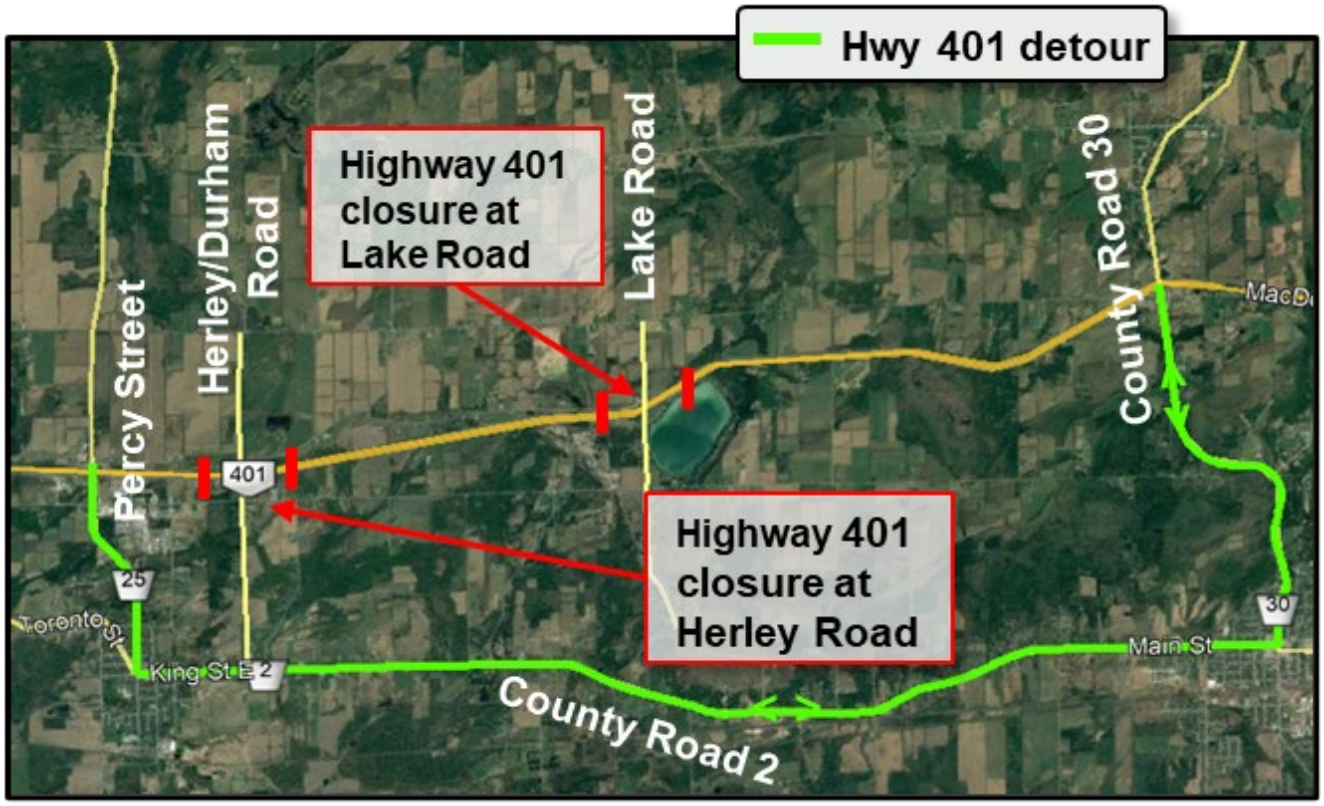


Exhibit 7-13: Proposed County Road 26 Demolition Detour Route

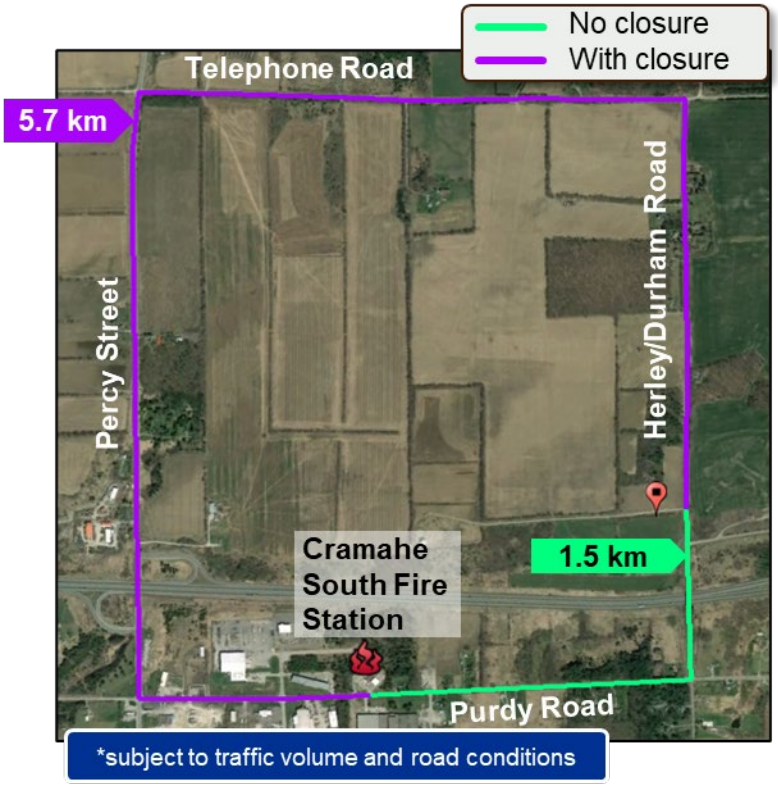
7.9.2 Crossing Road Detours for Fire Response

Each of the crossing roads will be closed for the duration of demolition and construction since the replacement bridges will be at the same location as the existing bridges. The exact detour routes will be determined during Detail Design, below is a summary of the distances and potential detour routes for fire response at each of the crossing roads.

7.9.2.1 Herley / Durham Road

The shortest detour for emergency services to reach properties to the north of Highway 401 with Herley / Durham Road closed is via Percy Street. The maximum additional travel distance for the Cramahe South Fire Station would be 4.2 km and the local detour from Herley Road south to north is approximately via Percy Street and Telephone Road. The detour route is shown in **Exhibit 7-14**.

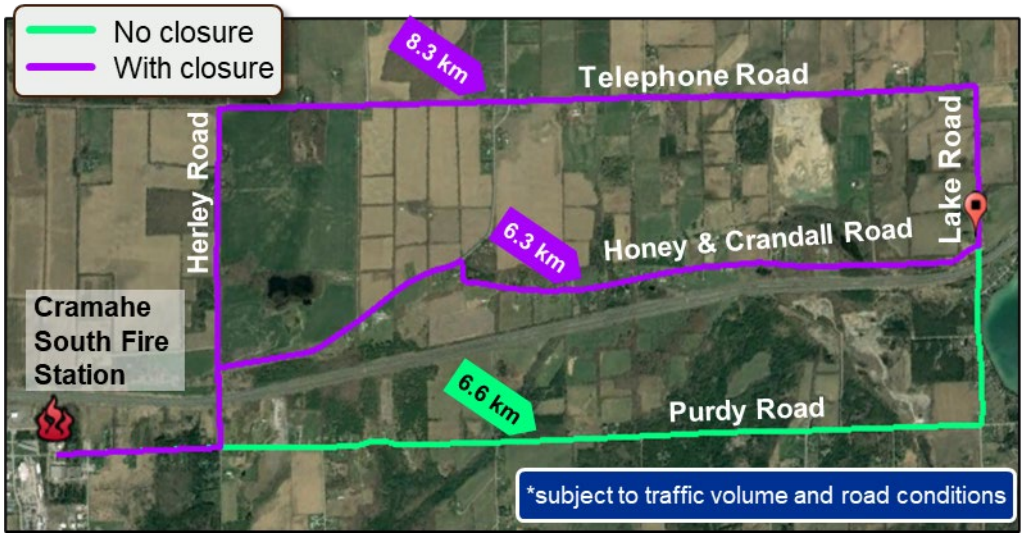
Exhibit 7-14: Fire Route Response Detour for Herley /Durham Road closure



7.9.2.2 Lake Road

The shortest detour for emergency services to reach properties to the north of Highway 401 with Lake Road closed is via Herley Road, Honey Road and Crandall Road which would add 0.3 km to route along Purdy Road. The maximum additional travel distance for the Cramahe South Fire Station would be an additional 1.7 km if the detour route were via Herley Road and Telephone Road. The potential detour routes are shown in **Exhibit 7-15**.

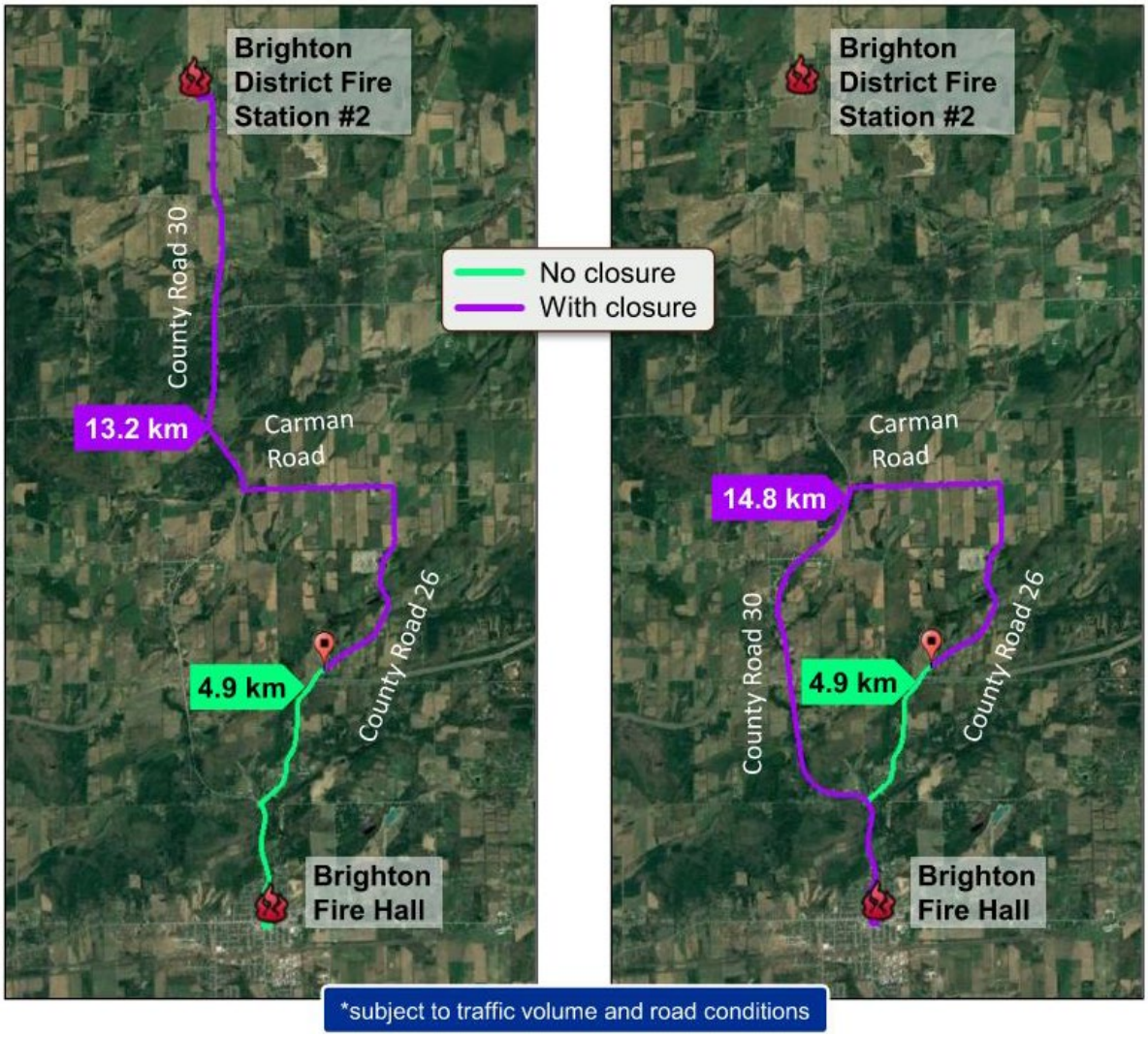
Exhibit 7-15: Fire Response Detour for Lake Road



7.9.2.3 County Road 26

There are two fire stations that could respond to emergencies along County Road 26. The detour for Brighton Fire Hall would be via County Road 30 to Carmen Road. The maximum additional distance that the Brighton Fire Hall would need to travel to respond to emergencies just north of Highway 401 on County Road 26 during the closure is approximately 10 km, for a total distance of 14.8 km. The Brighton District Station #2 would have to travel 1.6 km less than the detour from Brighton Fire Hall. The emergency routes are shown in **Exhibit 7-16**.

Exhibit 7-16: Fire Response Detour for County Road 26



7.9.3 Highway 401 Staging

The following section describes the Highway 401 construction staging approach. The existing structure span widths do not accommodate a widening of Highway 401, and so the mainline improvements will only occur either in tandem or after the corridor structural replacements.

There will be several approaches to widening, depending on the direction of widening in each Highway 401 section. The following approaches are summarized in **Exhibit 7-17** below.

Exhibit 7-17: Staging Approach for Highway 401

Section #	Recommended Widening		Staging Concept	
	6-lane	8-lane	6 lane	8 lane
1, 7	Widen to inside	Widen to outside	Traffic is shifted to the outside using part of the outside shoulder for traffic while the new inside lane is constructed.	Traffic is shifted to the inside using part of the inside shoulder for traffic while the new outside lane is constructed.
2	Widen to the north	Widen to north	Traffic is shifted to the south (to the outside on the eastbound lanes and the inside on the westbound lanes) utilizing the shoulder while the new lane is constructed.	Traffic is shifted to the south (to the outside on the eastbound lanes and the inside on the westbound lanes) utilizing the shoulder while the new lane is constructed.
3*, 4, 5, 6	Widen to the outside*	Widen to the outside*	Traffic is shifted to the inside using part of the inside shoulder for traffic while the new outside lane is constructed.	Traffic is shifted to the inside using part of the inside shoulder for traffic while the new outside lane is constructed.

*With the exception for the area that includes the curve correction (in the vicinity of Lake Road) where for the 6 lane construction, traffic will be maintained on the existing highway, the new alignment will be constructed and then traffic will be shifted on the new alignment once completed.

7.10 Illumination Improvements

There is no existing illumination within the Study Area. The Recommended Plan includes illumination improvements, including:

- The west section of the Study Area (0.8 km east of Percy Street to County Road 30 Interchange) did not meet the warrant for illumination.
- The warrants analysis for the full lighting of the east section resulted in an “optional“ lighting warrant. Conventional lighting is the preferred lighting alternative and is recommended for the full continuous lighting of Highway 401 from County Road 30 to the east limit of the study. However, since the full illumination warrant is optional, the implementation of these warrants will be further reviewed by MTO against the availability of funds, and other priorities, when the widening of the highway occurs in the future.

The illumination requirements are recommended to be reviewed in Detail Design and closer to the time of construction.

7.11 Property Requirements

In order to implement the Recommended Plan, there are impacts to property that is privately owned as well as municipally owned (Cramahe Township / Township of Brighton / Northumberland County). The property requirements for both the interim (6 lane) and ultimate (8 lane) are illustrated in the Preliminary Design Plates, included in **Appendix A**.

Efforts have been made to minimize the property required. A total of 88 residential/commercial properties and 37 municipal/government properties will be impacted by the proposed improvements for 8 lane widening and a total of 37 residential/commercial properties and 19 municipal/government properties.

Additional temporary property impacts that may be required in order to facilitate construction (e.g., through easement or Temporary Limited Interest) will be identified during Detail Design.

Negotiations with property owners will be carried out by the MTO Property Section to negotiate the acquisition or temporary use of property prior to tendering the project for construction.

8.0 POTENTIAL ENVIRONMENTAL IMPACTS, PROPOSED MITIGATION AND COMMITMENTS TO FUTURE WORK

This section focuses on the direct and indirect environmental impacts associated with the Study. It also describes the proposed mitigation measures that will be implemented to minimize the impacts. Mitigation includes planning decisions, design features, construction requirements and construction constraints.

The key to ensuring effective environmental quality control and risk management during the project is the development and proactive implementation of an approach that:

- Identifies the environmental sensitivities;
- Presents the environmental protection measures in a way that can be translated into contractual requirements and for which compliance can be verified; and,
- Includes a monitoring program that verifies that the environmental protection measures are being implemented and are effective.

The mitigation measures are outlined in this report in **Exhibit 8-15** and will be refined as the preliminary design is developed and re-assessed in the future Detail Design phase. 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 contract documents in the Detail Design phase.

8.1 Natural Environment

8.1.1 Vegetation

8.1.1.1 Potential Impacts

Direct Impacts

Encroachment of the new ROW limits on both sides of Highway 401 will directly impact areas of cultural vegetation of relatively minor ecological value and small isolated groupings of trees. Notably, removals will directly impact the edge of woodlands and habitat of Butternut (*Juglans cinerea*; Tree B03), adjacent wetlands and vegetation within the Brighton Provincial Wildlife Area ANSI.

The proposed work will require the removal or disturbance of cultural roadside vegetation, including cultural meadow (CUM1-1), cultural savannah (CUS), cultural thicket (CUT), cultural woodland (CUW), and cultural plantation (CUP), which are primarily comprised of introduced species and non-native species. These vegetation types are associated with disturbance and are considered lower quality ecosystem types. These vegetation types

can quickly re-establish post-disturbance and general stabilization and revegetation without further mitigation is required.

Vegetation removal is planned to occur within some treed habitat. In the southwest quadrant of the Herley Road underpass, an approximately 50 m edge of a Dry - Fresh Black Locus Deciduous Forest (FODM4-11) is to be removed and the southeast quadrant of the underpass, approximately 100 m of the edge of Dry - Fresh Poplar Deciduous Forest (FOD3-1) is proposed for removal. North and south of Highway 401 east of Herley Road the edges of Deciduous Forest (FOD; approximately 500 m) and Mixed Forest (FOM; approximately 300 m) are identified for removal. Approximately 90 m of the edge of Dry - Fresh White Birch - Poplar - Conifer Mixed Forest (FOM5) is proposed for removal south of Highway 401 adjacent to the property at 856 Purdy Road.

Between Highway 401 and Crandall Road, approximately 160 m of Coniferous Forest (FOC) edge and an approximate 100 m length of edge of a Dry - Fresh Sugar Maple Deciduous Forest (FOD5-1) will be impacted. In the same area but on the south side of Highway 401 approximately 400 m of FOD5-1 edge will be impacted.

A 180 m long edge of Scotch Pine Coniferous Plantation (CUP3-3) north and south of Highway 401 west of Lake Road will also be removed. A length of approximately 530 m of FOD habitat north of Highway 401 (east of Dean Road and south of Crandall Road continuing north of Crandall Road) is proposed to be impacted by the proposed highway widening in addition to a proposed road connecting Crandall Road to Lake Road. East of Lake Road and north of Highway 401, a 140 m long portion of FOD is proposed for removal. The edges of a FOD and a Dry - Fresh Red Cedar Coniferous Forest (FOC2-1) approximately 200 m in length east of Cochrane Road and south of Highway 401 are proposed to be impacted. The area of removal within the edge of the FOC2-1 habitat includes the regionally rare Eastern Red Cedar (*Juniperus virginiana*).

The edges of Cattail Mineral Shallow Marsh drainage ditches (MAS2-1) and Common Reed Graminoid Mineral Meadow Marsh (MAMM1-12) and adjacent moist coniferous forest and coniferous swamp habitat east of Little Lake north and south of Highway 401 will also be disturbed by culvert lengthening along Biddy Creek and associated tributaries. The vegetation along the edges of the MAS2-1 habitat and Alder Mineral Thicket Swamp (SWT2-1) within the non-provincially significant wetland and unevaluated wetland surrounding Biddy Creek east of Cochrane Road may be impacted as a result of highway widening and grading into wetland habitat. However, disturbance is expected to be isolated to the edges and the hydrology of the creek should be maintained.

Two sections of retaining wall on the north side of the highway at approximate stations (10+690 to 11+050; 11+340 to 11+680) will impact plantation (CUP3-3). This habitat type is common within the Study Area and there were no significant species present. Across from this area on the south side of the highway the edge of SWC (Coniferous Swamp) and SWM4-1 (White Cedar-Hardwood Mixed Organic Swamp) over a distance of approximately 700 m will be impacted.

Impacts to vegetation communities along Telephone Road east of County Road 26 and south of the highway include widening into CUP, CUT, CUW and FOD communities as well as within an approximate length of 100 of the northwest corner of Dry - Fresh Red Oak Deciduous Forest (FOD1-1) habitat. Further, encroachment within and along approximately 340 m of edge habitat of CUP3-3 north of Highway 401 may occur.

Approximately 400 m of the edge of FOD may be impacted by construction of a retaining wall on the north side of the highway in the area of the Brighton Provincial Wildlife Area.

Approximately 740 m of the edge of mature FOD5-1 habitat south of the Brighton Provincial Wildlife Area south of Highway 401 may be impacted by the proposed widening and grading works.

These removals will create new woodland edge, which may result in negative impacts on retained woodlands. Negative impacts may include:

- Greater light and wind penetration resulting in changes to microclimate (e.g., warmer temperatures, decreased soil moisture), potentially leading to plant desiccation;
- Increased susceptibility to windthrow and sunscald;
- Loss of plant and wildlife habitat at the edge;
- Tree crown and root damage and / or stress from construction equipment and / or grading;
- Susceptibility to invasion by non-native species; and,
- Loss of native seed bank.

A majority of the areas proposed for encroachment are of low ecological significance as they are culturally influenced and / or contain a high abundance of invasive and non-native species. No other further direct impacts to rare or sensitive flora species are expected. No rare vegetation community types are present within or adjacent to the ROW. The majority of the vegetation removal will occur directly at the edge and thus creates a minimal impact.

Invasive Species

Invasive Common Reed (*Phragmites australis* ssp. *australis*) was found within marsh drainage ditches (MAMM1-12). Disturbance to this community type is expected with grading activities adjacent to culverts. There is a high risk of spreading this invasive species to other wetland communities if machinery or workers are allowed to enter these areas.

8.1.1.2 Mitigation Measures

Recommended measures for mitigating effects to the local vegetation communities and their associated habitat functions include the following:

- Minimize the extent of vegetation removal and damage within construction access, work and staging areas, particularly adjacent to woodland or wetland habitat. These areas will be clearly identified in the Contract documents, and then delineated in the field using erosion and sediment control fencing. Erosion and sediment control fencing will be maintained throughout the construction period.
- Re-stabilize and re-vegetate exposed soil surfaces as soon as possible, using native seed mixes where possible. Native seed mixes to be appropriate to site conditions.
- Plant shrubs and trees at new forest edge where tree removal has occurred.
- Ensure that machinery arrives on site in a clean condition and is maintained free of invasive species and noxious weeds.
- Conduct vehicle maintenance and fueling at the designated and properly contained maintenance areas in the works yards or at commercial garages located well away from retained vegetation areas.

8.1.1.3 Commitments to Future Work

- At Detail Design complete vegetation surveys of properties that were not accessible for this preliminary design study. Surveys to include ELC and species composition and to identify any SAR plant species.
- Re-stabilize and re-vegetate exposed soil surfaces as soon as possible, using native seed mixes where possible. Native seed mixes to be appropriate to site conditions.
- Investigate opportunity to plant shrubs and trees where new forest edge has been created. The purpose of the plantings would be to minimize effects such as wind exposure, drying forest soils that could extend into the forest. Planting species will be native to the region, and planting species and location of plantings will be determined during Detail Design.

8.1.2 Wildlife and Wildlife Habitat

8.1.2.1 Potential Impacts

Potential impacts on wildlife habitat are similar to those discussed for vegetation (i.e., direct / indirect impacts to habitat – removals, fragmentation, etc.).

Direct Impacts

The largest areas of vegetation removal include cultural meadow (CUM1-1), cultural thicket (CUT), cultural woodland (CUW) and cultural plantation (CUP) communities which are primarily composed of introduced species or non-native weed species.

- Mortality. Moderate – wildlife mortality may occur during construction, particularly during vegetation removal and grubbing.
- Movement opportunities. Minimal – loss of small areas of cultural / disturbed vegetation in the meadow and plantations. Potential movement area for urban tolerant species, but no defined wildlife movement areas recorded. Movement areas in the woodland, tributary corridors will be retained. Generally, mobile wildlife will move away from construction activity and based on the project setting, can retreat away from the corridor into the adjacent habitat and landscape.
- Habitat for SAR wildlife. Low – the majority of works will occur within the ROW and minimal removal will occur on the edge of vegetation types loss (approximately 10-20 m). Small amount of meadows within the ROW for Monarch. Given the level of disturbance, non-native species and fragmentation, meadows within the ROW are generally poor-quality habitat. There is a diversity of deciduous, mixed and coniferous forest habitat present, which may provide suitable SAR bat maternity habitat or breeding habitat for Eastern Wood-pewee. Edges of these forest communities will be removed in some areas, however forest communities are very common and widespread in the greater landscape. Edges of pastures and meadows may be removed, temporarily displacing Eastern Meadowlark.
- Habitat for area-sensitive birds. Low – some species require large areas of suitable habitat for long term population survival and are sensitive to habitat fragmentation. Four area-sensitive birds, Black-throated Green Warbler, Ovenbird, Red-breasted Nuthatch and Veery were recorded during the 2021 field surveys. These species nest in the interior of mature forest and require at least 10-70 hectares of forest.
- Pileated Woodpecker Nest Cavity Trees. Low – cavity nest trees used by the Pileated Woodpecker are now protected as a Schedule 1 bird species under the recent modernization regulations to the *Migratory Birds*

Convention Act (MBCA). Removals at the edge of a few treed habitats could include potential nest cavity trees. A survey of potential trees needs to be carried out to identify if any are impacted and a permit required under the MBCA.

Indirect Impacts

There is potential for indirect impacts to wildlife habitat as a result of construction and changes to hydrology.

- Construction-related impacts. These are generally limited to temporary disturbances to edge habitats during construction such as noise-related effects to wildlife inhabiting adjacent lands. Potential for sedimentation and contamination are addressed by erosion and sediment control (ESC) measures.
- Hydrology. Potential impacts to retained wetland habitats as the result of culvert replacement should have no significant hydrological changes that may impact wildlife habitat (e.g., amphibian breeding in wetlands).

8.1.2.2 Mitigation Measures

The mitigation measures outlined above are designed to minimize effects to vegetation and protect adjacent vegetation areas, which in turn protect the associated wildlife habitat functions. However, it is also necessary to ensure the protection of breeding birds according to the *Migratory Birds Convention Act* (MBCA), as well as other wildlife that may nest or otherwise use areas where construction is proposed. Wildlife-specific mitigation measures are outlined below:

Migratory Birds

As noted, nesting migratory birds are protected under the MBCA. In order to protect nesting migratory birds, in accordance with the MBCA, the following mitigation measures should be implemented:

- Ensure that timing constraints are applied to avoid vegetation clearing (including grubbing and removal of trees, shrubs, plants, grasses and brush piles) and construction during the breeding bird season (April 1 to August 31). It should be noted that occasionally bird species will precede (e.g., mid-March) or exceed (e.g., September) the approximate breeding bird season window.
- The Contractor shall not destroy active nests (nests with eggs or young birds) of protected migratory birds. If active bird nests are encountered, the Contract Administrator must be contacted.
- If a nesting migratory bird is identified within or adjacent to the construction site and the construction activities are such that continuing construction in that area would result in a contravention of the MBCA all activities will stop and the Contract Administrator will contact the MTO Environmental Planner to discuss mitigation options.
- No removal of a Schedule 1 (MBCA) bird nest and associated vegetation/structure that it is found.

Other Wildlife

The following measures are recommended for the protection of wildlife:

- Wildlife incidentally encountered during construction shall not knowingly be harmed and shall be allowed to move away from the construction area on its own.
- In the event that an animal encountered during construction does not move from the construction zone and construction activities are such that continuing construction in the area would result in harm to the animal, all activities that could potentially harm the animal will cease immediately and the Contract Administrator will be notified.

- In the event that an injured animal is encountered in the construction zone, all activities that could potentially harm the animal will cease immediately and the Contract Administrator will be notified. The Contract Administrator will immediately contact a Wildlife Custodian (authorized under the Fish and Wildlife Conservation Act) to provide care for the animal. A list of authorized Wildlife Custodians, their locations and their specialties is available at https://www.ontario.ca/page/find-wildlife-rehabilitator.

Wildlife Passage and Wildlife Enhancement Opportunities

Although the current study involves widening an existing highway, new construction always presents the opportunity to improve the permeability of roadways to local wildlife and thereby reduce wildlife-vehicle collisions and the isolation of wildlife habitat. It is recommended that opportunities for improving wildlife passage through enhanced wildlife crossing structures be considered during Detail Design.

Potential wildlife enhancement considerations include:

- Installing rock piles, logs and stumps to provide cover, nesting and basking habitat for snakes and small mammals.
- Supplemental planting / seeding of native vegetation, specifically vegetation that attracts wildlife (e.g., milkweed for Monarch and berry-producing shrubs for forage [e.g., serviceberries, elderberry, nannyberry, sumac, dogwood, etc.]).
- Construction of turtle nesting habitat away from the highway at suitable locations to reduce the use of the highway shoulder as a nesting habitat.

8.1.2.3 Commitments to Future Work

- Conduct survey of woodland habitat in areas that are identified for tree removal to identify the presence of Pileated Woodpecker nest cavity trees and other locations where the project may impact the nesting habitat of other Schedule 1 species.
- Conduct breeding bird surveys in locations where access to property was not granted at the time of this preliminary design study.
- Review opportunities for improving wildlife passage through replaced structural culverts. This would relate to turtles and medium size mammals. Also examine opportunities for installing directional fencing in the local area of new structural culverts.

8.1.3 Species At Risk

8.1.3.1 Potential Impacts

Butternut

Three potential Butternuts (Endangered) (Trees B01 to B03) were identified:

- Tree B01 was noted on private property along the edge of mixed forest (FOM) north of Crandall Road. B01 was approximately 10 cm in diameter-at-breast height (DBH) and was situated approximately 160 m northwest of the edge of proposed impacts.
- Tree B02 was observed west of Lake Road within the right-of-way at the edge of the Maple Mineral Deciduous Swamp (SWD3). B02 was comprised of three stems measuring 8, 7, and 2 cm in DBH. Tree B02 was approximately 100 m northwest of the edge of proposed impacts. Therefore, impacts to the critical

root zones and the immediate adjacent areas (25 m radius centered on the trunk) of Trees B01 and B02 are not anticipated.

- Tree B03 was located within deciduous forest (FOD) within the Brighton Provincial Wildlife Area and was located just north of 1st Avenue. B03 was approximately 20 cm in DBH and was situated approximately 20 m from the edge of proposed impacts. Therefore, proposed impacts along Highway 401 may encroach within the 25 m radius critical root zone and immediately adjacent area surrounding B03.

Butternut Health Assessments were not completed for these trees. No other SAR flora were observed within the project limits.

Barn Swallow

Four Barn Swallows (Special Concern) were observed flying overhead at a horse farm on Crandall Road. The property contains at least one structure with suitable nesting habitat, approximately 200 m north of the proposed impacts. There will be no direct impacts to residential buildings and structures from the proposed works. This species may also nest beneath bridges or culverts in the Study Area. There is potential for the proposed works to impact nesting habitat for Barn Swallow if nests are built within the structural culverts proposed for rehabilitation during the year of construction.

Eastern Meadowlark

Evidence of 'possible' breeding as two Eastern Meadowlark (Threatened) males were observed singing in suitable habitat on adjacent properties, outside of the Study Area. There are five properties with potentially suitable grassland habitat where the construction footprint and/or the ultimate MTO ROW encroaches into the habitat. The habitat areas are shown in Appendix F of **Appendix B**. Beginning from the west side:

1) Annual row crop north of Highway 401 and west of Herley Road. Although the habitat within the Study Area is small it is connected to open agricultural lands which may support use of this smaller area. Replacement of the Herley Road structure may encroach into the edge of the habitat;

2) Annual row crop immediately east of Lake Road, that extends southerly to the highway and separated from the highway by a narrow length of tree cover. In this area widening will intrude into the edge of the habitat and the ultimate MTO ROW will extend well into habitat. Depending on how the MTO ROW is maintained it may either support or remove this habitat type;

3) Dry-moist old field meadow north of Highway 401 and west of Biddy Creek crossing 1, none or minimal works on the edge of potential nesting habitat;

4) North of Highway 401 and east of Biddy Creek crossing 1, none or minimal works on the edge of potential nesting habitat but the ultimate MTO ROW will extend a short distance into this area; and,

5) Dry-moist old field meadow north of Highway 401 and west of County Road 26; the potential impact relates to maintenance measures of the ultimate MTO ROW. Eastern Meadowlark were recorded within the Study Area, however, no target surveys were conducted.

Eastern Wood-pewee

Evidence of 'possible' breeding as two Eastern Wood-pewee (Special Concern) males were observed singing in suitable habitat, one north of Highway 401 within the Coniferous Plantation in Brighton Provincial Wildlife Area and the other north of Highway 401 west of Lake Road in the Maple Mineral Deciduous Swamp. The majority of

suitable woodlands such as Brighton Provincial Wildlife Area will be retained with only minor edge removals. No impacts are anticipated to this species with the implementation of timing windows for tree removals (i.e., no removals during the breeding bird season April 1 to August 31). The forested habitat surrounding the highway is not unique or limited in the local or broader landscape.

Monarch

Four Monarchs (Special Concern) were recorded foraging throughout the Study Area. This species would be expected to occur as a visitant throughout the site, with life-cycle processes occurring wherever the larval food plant, milkweed, is found. Suitable Monarch habitat will be removed within the ROW, however other suitable habitat will remain as well as other surrounding habitats where milkweed occurs. Availability of suitable habitat within the local landscape is not a limiting factor for this species.

Snapping Turtle

One adult Snapping Turtle (Special Concern) was observed dead on the westbound highway shoulder north of Little Lake. There is potential habitat present along the adjacent tributaries and wetlands. These aquatic habitats will be retained. There is potential for Snapping Turtle encounters during construction in terrestrial areas adjacent to wetlands and watercourses, especially during the nesting season. Furthermore, in-water works have the potential to impact hibernating turtles, depending on timing of works.

Potential SAR Fauna and SAR Fauna Habitat

There is moderate to high potential for an additional 10 SAR fauna to occur within the project limits and be impacted by the proposed works, including: Bobolink, Olive-sided Flycatcher, Red-headed Woodpecker, Wood Thrush, Eastern Small-footed Myotis, Little Brown Myotis, Northern Myotis, Tri-coloured Bat, Blanding's Turtle and Northern Map Turtle. *Potential* habitat is not protected by the Ontario *Endangered Species Act* (ESA) or the federal *Species at Risk Act* (SARA); rather, the species must be recorded in a given area in order for the associated habitat to be protected. Follow-up would only be required if one of these species is observed during Detail Design or new records are provided by the MECP/ECCC at that time.

There will be tree removals and encroachment within four forested habitats: Dry - Fresh Black Locust Deciduous Forest (FODM4-11), Dry - Fresh Sugar Maple Deciduous Forest (FOD5-1), Deciduous Forest (FOD) and Dry - Fresh Red Oak Deciduous Forest (FOD1-1). These areas have potential bat habitat, which may result in the loss of bat maternity habitat and result in harm or mortality to adult bats and their young. Removal of trees may also impact SAR bird nests and young. Impacts to bats and birds can be mitigated through timing windows for tree removals.

8.1.3.2 Mitigation Measures

10 SAR have reasonable potential to occur within the work area and therefore there is some risk of harm to these species. Only Endangered and Threatened species have legal protection under the provincial ESA 2007 and the federal SARA 2002. To protect these species and any other SAR generally, the following mitigation measures will be implemented and specified within the Contract documents.

SAR Generally:

Awareness and Encounter protocols will be implemented within the Contract documents and specifications to identify the potential for SAR to be encountered during construction and the procedures to be followed in the event of an encounter. All on-site personnel must be made aware of the potential presence of SAR and the protection afforded under the ESA (2007) and SARA (2002), prior to conducting any work on the site.

In the event that a SAR or possible SAR encountered during construction does not move from the construction zone and construction activities are such that continuing construction in the area would result in harm to the animal, all activities that could potentially harm the animal will cease immediately and the Contract Administrator will be notified. The Contract Administrator or Environmental Inspector will then contact the MTO Environmental Planner for direction, as these animals are protected under the ESA (2007) and SARA (2002).

All disturbed areas will be restored to pre-construction conditions.

SAR Vegetation:

- In accordance with the regulations of Ontario's ESA (2007), O. Reg. 230/08A, any potential Butternuts observed must be assessed to determine whether the trees are hybrids or pure Butternuts.
- A Butternut Health Assessment (BHA) is to be conducted for the one tree in the Brighton Provincial Wildlife Area may be impacted by the proposed works. The Butternut Health Expert (BHE) report must be submitted to the MECP for approval.

SAR Insects:

- Restore disturbed meadow areas using Native Grass and Forb Mix – Well Drained. This seed mix contains Common Milkweed which supports Monarch breeding.

SAR Birds:

- Adhere to mitigation measures for MBCA compliance to avoid impacts to SAR bird species potentially nesting in the work area or vicinity (i.e., Barn Swallow, Eastern Meadowlark, Eastern Wood-pewee, Red-headed Woodpecker, Wood Thrush)
- If a Barn Swallow nest is encountered in a structure which occurs within proximity to the work zone, a 10 m buffer will be implemented around the structure to avoid harassment to Barn Swallows until the young have fully fledged or the nest is no longer active (to be determined by a qualified avian biologist)

SAR Bats:

- No tree removals shall be completed during the bat breeding season (i.e., April 1 to September 30)

SAR Turtles:

- In order to prevent SAR turtles from entering the construction zone, temporary exclusion fencing should be installed to isolate the work areas adjacent to wetlands and watercourses prior to the start of construction. Locations include: C3 Little Lake Tributary and the large Cattail Mineral Shallow Marsh east of Cochrane Road. Fencing should be paige-wire backed and follow the OMNR Best Practices Technical Guide for Reptile and Amphibian Exclusion Fencing (https://www.ontario.ca/page/reptile-and-amphibian-exclusion-fencing). Temporary exclusion fencing can be combined with erosion and sediment control fencing, following the OMNR Best Practices Technical Guide
- In the event that a SAR turtle is encountered while nesting, all activities within 30 m shall cease until the turtle has finished nesting and left the area on its own accord (this may take several hours). Any SAR turtle nests laid within the construction zone shall be protected with a 10 m buffer and an MNRF authorized local wildlife rehabilitator shall be contacted immediately (https://www.ontario.ca/page/find-wildlife-rehabilitator) to relocate the nest to a suitable location outside the construction zone or collect the nest for ex situ incubation under an approved permit.

A review of updated SAR lists (under SARA and Species at Risk in Ontario [SARO]), SAR guidelines and policies, and additional agency consultation will be required at Detail Design to confirm SAR approvals and mitigation requirements.

8.1.3.3 Commitments to Future Work

- Conduct species specific surveys for Eastern Meadowlark/Bobolink in areas identified as potential habitat and where highway widening will result in the removal of habitat.
- Conduct survey of woodland habitat in areas that are identified for tree removal to identify the presence of snag trees that could be used as maternity roost habitat for SAR bats and any potential areas that could be used by Eastern Small-footed Bat. MTO to identify the requirement for acoustic surveys of any locations where a density of snag trees are found that would warrant further survey.
- Conduct survey of suitable woodland habitat for the presence of Butternut in areas that were not accessible during the preliminary design study. The extent of the survey should be based on identification of the 25 m critical root zone of a tree.
- Conduct a Butternut Health Assessment for the tree found in the area of the Brighton Provincial Wildlife Area and for any additional trees found in the Detail Design study.

8.1.4 Fish and Fish Habitat

A preliminary impact assessment was completed for the high level preliminary proposed works at each of the nine watercourses and one waterbody that support fish use directly and indirectly within 30 m of the highway corridor. Smithfield Creek Tributary (C9) and Mayhew Creek Tributary 1, 2, and 3 (C10, C11, and C12) have been assessed under a separate project. The information provided represents the potential proposed works at each location based on the design that was available for review at the time of preparation of the Fish and Fish Habitat Existing Conditions and Preliminary Impact Assessment Report (**Appendix C**). However, a formal impact assessment will need to be completed once detailed works are finalized, during Detail Design, at each of the crossing locations that support fish (directly or indirectly) to determine if review by DFO is required.

The proposed highway works include a two-phased approach. The interim phase will have highway widening from four to six lanes within the median of the highway. The ultimate phase will have additional lanes added to the outside of the existing road alignment (north and south) for a total of eight lanes (four in each direction).

The interim and ultimate phases will require that the existing culverts either be extended or replaced with longer culverts to accommodate the new lanes in each direction. Culvert replacement over extension will be determined if the hydraulic assessment indicates a deficiency in flow conveyance or capacity, the culvert is in poor condition, there are perched or buried culverts that cannot convey fish passage, or where extensions will increase the velocities through the culvert that surpass the swimming speeds for the target fish in the watercourses. Culvert extension will only be considered for watercourses where fish passage is not an issue, and where the existing culvert is in good shape and has sufficient capacity to convey the expected flows from the additional lanes.

Whether the culvert is being replaced or extended, the result will be new locations for the inlets and outlets. Minor channel modifications will be required to transition the new culvert ends smoothly with the upstream and downstream adjacent channel reaches to avoid creation of barriers/knick points, or exacerbation of erosion through poor flow angles into and out of the culverts. In some instances, scour rock protection may be required at the new culvert ends to support a smooth transition and protect the culverts from future scouring concerns.

Effort will be made during Detail Design to maintain an open section in the median for each of the watercourses supporting fish crossed by the highway. This daylighting will help maintain/enhance fish passage opportunities through the study corridor. Perched culverts will be replaced with culverts embedded within the channel to improve fish passage where appropriate.

Diversion channels may be used to maintain fish passage and access through the highway right-of-way during construction to avoid long term impacts on fish movement and access to habitat that supports a critical life cycle function (i.e., spawning areas).

Each replacement culvert will be designed generally using MTO's Watercourse Crossing Guideline WC-12 to ensure that flow and fish passage are considered at each crossing location. Where feasible the replacement culverts will have an opening that spans the bankfull width of the channel to avoid impacting flow conveyance. A low flow channel designed with substrates sized to remain in place through reasonably expected flow events will be included for all culvert crossings conveying a watercourse that supports fish directly. The culverts will also be sized to ensure that expected flows do not surpass the swim speeds for the target fish known to use the watercourses. The Detail Design team should work directly with an aquatic biologist to ensure that fish passage and habitat needs are included in the replacement culvert designs.

The channel tie-ins and median openings will be designed using natural channel design principles to replace/replicate habitat being impacted by the new culverts to support fish use generally within the highway corridor and to remain stable following construction.

8.1.4.1 Potential Impacts

There are a number of watercourse crossings within the Study Area that support fish either directly or indirectly through conveyance of nutrient and allochthonous inputs to a receiving watercourse that supports fish downstream. As such, the proposed works for the highway widening through the study limits have the potential to impact fish and fish habitat through alteration of habitat structure and cover. Specifically:

- Longer culverts (either through extensions or replacements) will result in additional enclosure of channel and fish habitat, reducing solar and allochthonous inputs to the channel, potentially impacting fish habitat and use of the habitat for the life cycle functions it supports.
- Culvert extensions and longer culverts have the potential to result in increases in velocity through the corridor that may impact fish use and passage through the crossing unless properly designed.
- Installation of rock scour protection will result in a change in the substrates and habitat supporting fish, transitioning the channel sections into and out of the culvert, and altering potential food sources.
- Temporary diversion channels and by-pass pumping have the potential to temporarily impact fish passage and access to habitat upstream of the highway, as well as increase potential for sediment release to the receiving watercourse/body.
- Due to proximity to the widened lanes, and to avoid tight angles into and out of the highway corridor, some channel section may require realignment. These realigned sections will provide limited fish habitat until they are established, and the benthic organisms recolonize, and also increase the potential for sediment release to the receiving watercourse/body downstream.

There are also a number of constructions related works that have the potential to impact fish and fish habitat indirectly (i.e., de-watering of construction footprint, road grading and ditching), however these impacts are expected to be mitigated through implementation of standard construction related mitigation measures.

8.1.4.2 Design Consideration Tables

The following Design Consideration Tables (**Exhibit 8-1** to **Exhibit 8-3**) identify the project-specific design considerations. Watercourse crossings were grouped on fish habitat use (indirect and direct fish habitat) and the presence of sensitive species (i.e., Brook Trout).

Exhibit 8-1: MTO Design Consideration Table (C1 - Indirect fish habitat)

Factors to Consider	Design Considerations Provided by the Fisheries Assessment Specialist	Describe How Each Factor Was Addressed Through Design
In-water Works Timing Window	Confirmed with the MNRF that the waterbodies are considered coldwater. Timing Window where work can occur is July 1st – September 30th (no in-water or near water works permitted between October 1st and June 30th or any given year). Although these culverts do not support fish directly through the highway corridor, the timing window should be adhered to so as to protect the downstream fishery during important life cycle stages.	[only filled in during Detail Design]
Flows and Allochthonous Inputs	Based on current fieldwork, fish passage is not a requirement at these crossing. If the culverts require replacement, the design should consider appropriately sized culverts for hydraulic capacity, maintaining flow and allochthonous inputs to fish habitat further downstream, appropriate embedment to ensure smooth transitions to prevent erosion, undermining of the culverts and the transport of sediment downstream.	
Significant Fish Habitat	None at the culverts. C1 drains to Colborne Creek with permanent flow ~ 1 km downstream which supports migratory trout and Bridle Shiner (Special Concern – no provincial or federal species or habitat protection).	
Constraints and Opportunities	Receiving watercourse is defined as coldwater. Design of the highway drainage should consider measures to avoid altering the thermal regime (e.g., stormwater design should consider suitable thermal mitigation measures to cool the runoff prior to entering the watercourse).	
Other Considerations	Works at these culverts should consider future erosion concerns. Culverts should be sized to avoid creation of scour pools and bank erosion downstream. Scour protection should be considered at the culvert ends to avoid future erosion and scour that may release sediment to the receiving watercourse/body downstream.	

Exhibit 8-2: MTO Design Consideration Table (C2, C7 - Direct fish habitat, non-migratory fish)

Factors to Consider	Design Considerations Provided by the Fisheries Assessment Specialist	Describe How Each Factor Was Addressed Through Design
In-water Works Timing Window	Confirmed with the MNRF that the waterbodies are considered coldwater. Timing Window where work can occur is July 1st-September 30th (no in-water or near water works permitted between October 1st and June 30th or any given year).	[only filled in during Detail Design]
Fish Passage	Generalist, non-migratory fish species present. Intermittent flow or low flow in the Fall. If the culverts require replacement, the design should consider appropriately sized culverts for hydraulic capacity and meeting the MTO WC-12 Design Standards for Fish Passage through Culverts. Replacement culverts should be sized to ensure that the velocities do not increase to a point that the swim speeds of the target species are surpassed, thereby creating fish passage concerns. Scour protection will be installed where needed to ensure a smooth transition of the culverts with adjacent channel features to avoid creation of knick points or lips that would impact fish passage. Where feasible an open median will be considered between culverts for the east and west bound lanes to provide daylighting to support fish habitat and migration through the highway corridor.	
Constraints and Opportunities	C2 has water pooling inside the culvert potentially stranding fish. If culvert is replaced, meeting the MTO WC-12 Design Standards for Fish Passage through Culverts will provide opportunities to provide refuge for fish during periods of stagnant/low flow. Groundwater upwellings (watercress, iron staining, watercress) to be protected (C7). Thermal Sensitivity These watercourses are defined as coldwater. Design of the highway drainage should consider measures to avoid altering the thermal regime (e.g., stormwater design should consider suitable thermal mitigation measures to cool the runoff prior to entering the watercourse).	
Other Considerations	Open bottom culverts may be a consideration when replacing culverts on watercourses with ground water seepage within the highway crossing to support the local habitat that has been established with the ground water inputs.	

Exhibit 8-3: MTO Design Consideration Table C3 (21-471/C), C4 (21-472/C), C5 (21-474/C – Direct fish habitat with migratory trout)

Factors to Consider	Design Considerations Provided by the Fisheries Assessment Specialist	Describe How Each Factor Was Addressed Through Design
In-water Works Timing Window	Confirmed with the MNRF that the waterbodies are considered coldwater. Timing Window where work can occur is July 1st - September 30th (no in-water or near water works permitted between October 1st and June 30th or any given year).	[to be filled in during Detail Design]
Fish Passage	Migratory fish present: Brook Trout (confirmed in Fall surveys), Brown Trout (MNRF). Design shall avoid disturbing spawning areas; fish passage should maintain access to spawning areas by following MTO's WC-12 Design Standard for fish passage (i.e., design should span bankfull width, with new culverts embedded 300 mm or 10%, minimum, with a low flow channel through the culvert that match the existing channel bed elevations to ensure smooth transition). Natural channel designs should be completed by a fluvial geomorphologist. Build replacement culverts on the same alignment as existing to avoid unnecessary realignments to tie the culverts into the channel unless minor modification would help address erosion and flow concerns. Replacement culverts should be sized to ensure that the velocities do not increase to a point that the swim speeds of the target species are surpassed, thereby creating fish passage concerns. Scour protection will be installed where needed to ensure a smooth transition of the culverts with adjacent channel features to avoid creation of knick points or lips that would impact fish passage. Where feasible an open median will be considered between culverts for the east and west bound lanes to provide day lighting to support fish habitat and migration through the highway corridor.	
Significant Fish Habitat*	High potential spawning habitat for trout up and downstream of C4, C5 and C6. High potential spawning habitat downstream of C3. Spawning habitat includes areas with rocky substrate (i.e., boulders, cobble, gravel), which are located within the ROW of the crossings. Groundwater upwellings are present, as indicated by iron staining, seepage and watercress. Watercourses are cold, clear and well-oxygenated. The final design and contract should ensure it avoids impacts to these important features, and/or replicates similar habitat in areas impacted through construction. Culvert lengths should be minimized as much as possible to ensure the longer enclosed channel sections do not impact fish migration and movement through the corridor. Headwalls and/or wingwalls (or beveled culverts) should be considered to avoid significantly longer culverts for these sensitive fisheries.	
Constraints and Opportunities	General coldwater stream objectives apply, including promotion of Brook Trout recovery.	

Factors to Consider	Design Considerations Provided by the Fisheries Assessment Specialist	Describe How Each Factor Was Addressed Through Design
	Critical environmentally sensitive areas (spawning habitat) to be avoided. Groundwater upwelling areas (iron staining, seepage, watercress) is to be protected (C3, C4, C5, C6). Thermal Sensitivity These watercourses are defined as coldwater. Design of the highway drainage should consider measures to avoid altering the thermal regime (e.g., stormwater design should consider suitable thermal mitigation measures to cool the runoff prior to entering the watercourse).	
Other Considerations	Open bottom culverts may be a consideration when replacing culverts on watercourses with ground water seepage within the highway crossing to support the local habitat that has been established with the ground water inputs.	

8.1.4.3 Mitigation Measures

Through the assessment of existing conditions and potential impacts, a number of potential design opportunities have been identified that could be used as potential enhancement measures or off-setting measures for the highway widening works. Below is an outline of these potential opportunities that will aid in the maintenance or enhancement of fish passage through the longer highway cross-section including:

- Shorter culvert lengths minimize the impact of solar inputs to the channel. Shorter culverts should be designed, where feasible, using head and/or wingwalls.
- Maintaining a median opening through the corridor either through use of headwalls/wingwalls, culvert beveling or steeper embankment grades. These options will maintain some day-lighting through the longer culverts that will encourage fish passage through the corridor. The median openings should provide some rest area (pools) for fish that are using the culvert for migratory purposes.
- Transitioning the new culvert ends with embedded rock scour protection when possible. The embedded scour protection will provide substrate diversity that will attract benthic macroinvertebrates as a food source but will also protect against future erosion and scouring of the channel that could impact fish passage though creation of perched culverts or barriers.
- Existing perched culverts will be replaced with new culverts that are properly embedded and transitioned smoothly with the adjacent channel features to address existing fish passage issues and ensure new issues do not form.
- Existing eroded banks within the highway corridor will be addressed through redesign of the flow direction, enclosed within the longer culverts, or protected with rock scour protection/bank armouring.
- Diversion channels will be considered for use during culvert replacement works to ensure that fish passage and access to habitat upstream of the crossing is maintained throughout construction. Diversion channels will

be designed using natural channel design principles to mimic habitat conditions in the existing channel to minimize impacts on fish habitat and use during construction.

- The angle at which the channel is entering and leaving the highway corridor will be designed to ensure that there are no concerns for erosion or scouring of culvert ends and banks. If required, minor channel modifications will be designed to smoothly transition flows into and out of the highway corridor that avoids impacts to the adjacent bed and banks. If the alignment cannot be addressed, then bank protection measures (embedded rock) will be considered to avoid exacerbating erosion concerns that would impact downstream habitat (i.e., bury spawning areas).
- The new and replacement culverts will all be designed generally using MTO's WC-12 water crossing standard to avoid impacts to flows and fish passage through the corridor. The culverts will be sized to support the needed hydraulic capacity while also maintaining a velocity suitable for the target fish swim speeds. The culvert capacity will consider the need for low flow channels that will help confine flows to a smaller area to promote fish passage during lower flow events, and the substrates used in the low flow channel design will be sized to stay in place for designed flows. Each replacement culvert will be embedded to address future scour potential, and transition smoothly with adjacent channel sections.

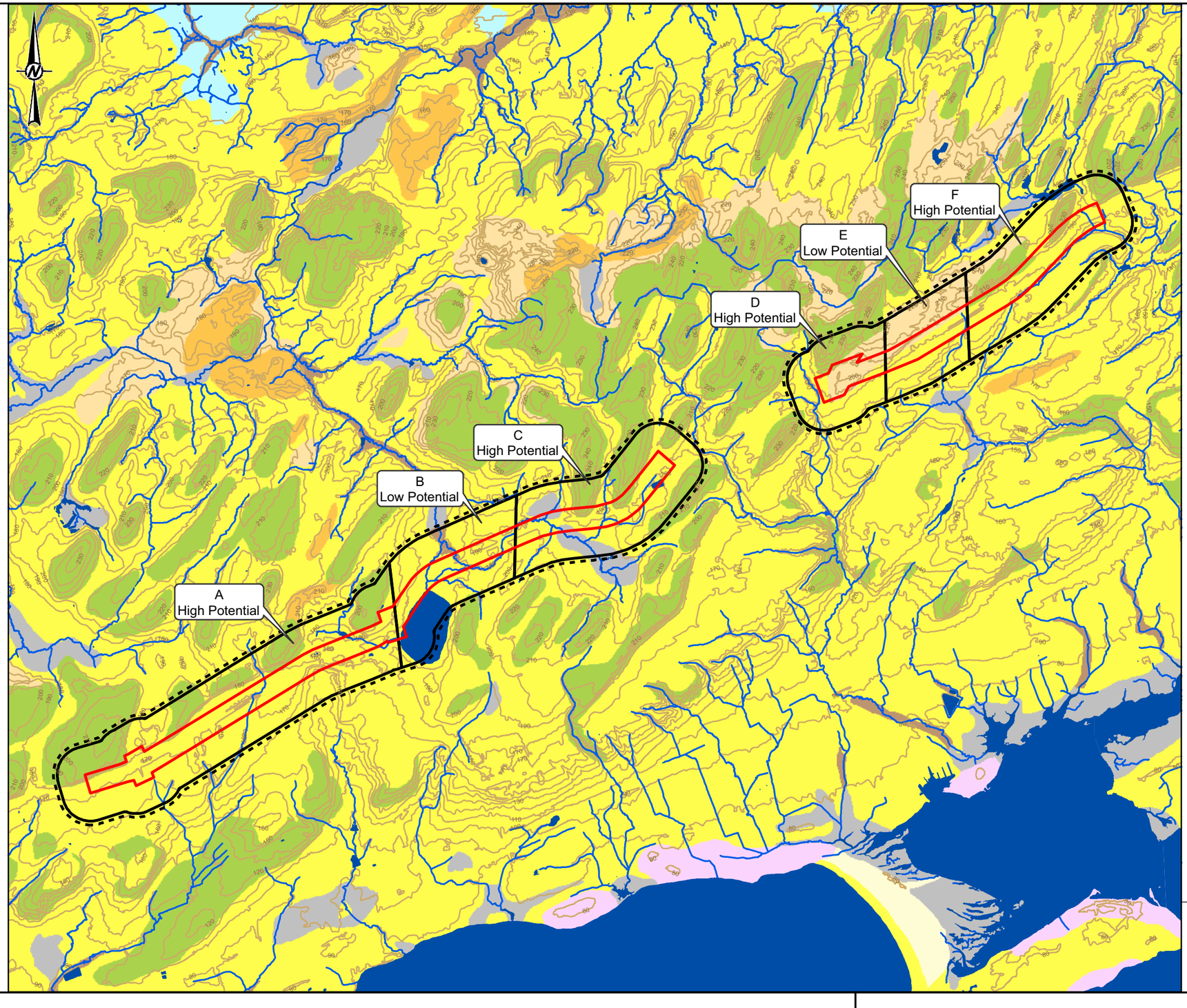
8.1.4.4 Commitments to Future Work

If substantial channel realignments and channel tie-ins beyond MTO's ROW are necessary at the watercourse crossings that support fish, it would be anticipated that a Request for Review be required to identify next steps for Fisheries Act Authorization. It is unknown at this time whether or not an Authorization will be required as it is dependent on the finalization of the proposed works and impacts to fish and fish habitat. Impact assessments will be completed during Detail Design.

8.1.5 Erosion and Sediment Control

An Erosion and Sedimentation Overview Risk Assessment (ESORA) was completed in support of the project (see **Appendix S**). The objective of the ESORA was to provide a preliminary assessment to support future location specific erosion and sediment control assessments.

To complete the ESORA, the Study Area was divided into six polygons of similar characteristics, including geology, topography and natural features (**Exhibit 8-4**). Each polygon was assessed based on the following: Hierarchy of Soil Erodibility; and Erosion Potential Associated with Slope Length, Slope Gradient and Slope Erodibility Rating. Polygons were found to have high to low erosion potential and high potential for consequences given the proximity to numerous waterbodies, watercourses, and wetlands, including Provincially Significant Wetlands. However, the anticipated high potential risk is considered manageable through the implementation of an erosion and sediment control plan, utilizing erosion and sediment control Best Management Practices (BMPs).



N
W
E
S

LEGEND

- 500m STUDY AREA
- SITE BOUNDARY
- EROSION POTENTIAL AREAS
- WATERBODY
- WATERCOURSE
- 10M TOPOGRAPHIC CONTOURS

SURFICIAL GEOLOGY

- 3: PALEOZOIC BEDROCK
- 5B: STONE-POOR, CARBONATE-DERIVED SILTY TO SANDY TILL
- 6: ICE-CONTACT STRATIFIED DEPOSITS
- 6A: IN MORAINES, KAMES, ESKERS AND CREVASSE FILLS
- 7A: SANDY DEPOSITS
- 7B: GRAVELLY DEPOSITS
- 8A: MASSIVE-WELL LAMINATED
- 9B: LITTORAL-FORESHORE DEPOSITS
- 9C: FORESHORE-BASINAL DEPOSITS
- 14B: LITTORAL-FORESHORE DEPOSITS
- 17: EOLIAN DEPOSITS
- 19: MODERN ALLUVIAL DEPOSITS
- 20: ORGANIC DEPOSITS

0 550 1,100 2,200
METRES

REFERENCE(S)
1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS:
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Erosion and Sediment Overview Risk Map

Exhibit
8-4

8.1.5.1 Potential Impacts

Erosion and sediment control measures will be implemented during all phases of construction to prevent sediment-laden runoff from entering any watercourse, private property or other sensitive areas directly from the construction zone. General measures such as erosion control blanket, silt fence barriers, rock flow checks and quickly treating exposed earth surfaces with stabilizing cover material (seed and mulch, sod, etc.) are governed by special provisions (i.e. Ontario Provincial Standard Specification (OPSS) 805), which will be specified and refined in relation to the site conditions and construction requirements during the Detail Design phase. An Erosion and Sedimentation Control Plan will be developed during the subsequent Detail Design phase.

8.1.5.2 Mitigation Measures

Erosion and sediment control mitigation measures recommended to reduce potential impacts include:

- The Contractor should use dust control strategies to minimize wind-blown dust. Special care is recommended to minimize disturbance to private properties, including but not limited to tree protection, protecting any buildings or structures, driveways, lawns, gardens, buried utilities and using safety fencing to isolate the work area.
- All erosion and sediment control measures are to be inspected and maintained by the Contractor to ensure they are functioning as intended throughout the construction period and until such time that construction is complete and disturbed areas have been stabilized.
- All erosion and sediment control measures that are failing must be repaired / replaced by the Contractor as soon as possible as identified in OPSS 182 and OPSS 805.
- All erosion and sediment control measures that are non-biodegradable should be removed from the site when work is complete and the site is stabilized.
- Provided that the Contractor's Best Management Practices (BMPs) for erosion and sediment control are maintained and meet or exceed the requirements in the Ontario Provincial Standard Specifications (OPSS) listed and described above, this project can be completed with lower risk of environmental damage, with respect to erosion and sediment control (ESC).

8.1.5.3 Recommended Best Management Practices

Based on the assessment of the Study Area and the anticipated work to be completed, WSP recommends as a minimum following the Ontario Provincial Standards Specifications (OPSSs) for erosion and sediment control during construction. Refer to **Appendix S** for a list of recommended OPSSs and Ontario Provincial Standard Drawings (OPSDs).

8.1.5.4 Commitments to Future Work

It is recommended that a qualified terrestrial ecologist and aquatic biologist evaluate the erosion and sediment control plan in Detail Design and determine if additional measures are needed for wildlife protection. Further evaluations are required as follows:

- Identify areas where temporary wildlife exclusion fencing is needed, with respect to species of concern, along with recommended or required wildlife exclusion strategies.

- Specific measures and activities needed to search for and rescue any SARs or other species of concern from work areas, along with strategies to exclude them from the work area throughout the construction program and restore their habitat post-construction.
- With respect to any work in designated wetlands, a qualified geomorphologist, ecologist, and aquatic biologist, should be retained to develop watercourse restoration plans and / or creek realignments as necessary, and provide oversight during construction; and
- All erosion and sediment control measures are to be inspected and maintained by the Contractor to ensure they are functioning as intended throughout the construction period and until such time that disturbed areas have been stabilized. All erosion and sediment control measures that are failing must be repaired / replaced by the Contractor as soon as possible as identified in OPSS 182 and OPSS 805. All erosion and sediment control measures that are non-biodegradable should be removed from the site when work is complete, and the site is stabilized.

8.1.5.4.1 Erosion and Sediment Control Plan Approach

Given the high consequences of adverse effects of uncontrolled erosion and resultant sedimentation due to the close proximity to numerous waterbodies, watercourses, and wetlands, including Provincially Significant Wetlands, WSP recommends a Two-Part Main and Supplemental Erosion and Sediment Control Plan be completed prior to construction. This requires the consultant to prepare drawings, a Non-Standard Special Provision, and a technical memo. The contractor is required to prepare a supplemental ESCP to address construction methods. This approach is recommended as it incorporates the contractor's thought and preparation of a supplemental ESCP prior to the start of construction and during Detail Design.

8.1.6 Management of Excess Materials

Surplus materials will be generated during construction, such as old pavement, guardrail materials, and concrete. These materials will be sorted and either reused if feasible, recycled, or disposed of at an approved landfill facility in accordance with OPSS 180.

Standard mitigation will be used for dust control during construction.

8.1.7 Drainage and Stormwater Management

For the preliminary design, headwalls are proposed for 26 culverts ends that are located within the proposed grass median. Further ditching and median design and analysis will be carried out in the Detail Design phase, which includes the possibility of wingwalls being required for the culvert ends located in the side ditching. The catchments under proposed conditions are shown in **Appendix D**.

The hydraulic assessment under proposed conditions was completed in the same way as the existing conditions by using the CulvertMaster and HEC-RAS modelling tool with the MTO HDDS design standards. The culvert lengths were lengthened to accommodate the road widening and the invert elevations were updated to match the new proposed lengths.

From the results 11 non-structural culverts were proposed to get replaced. Two of them were recommended to be replaced from the Ainley Group Final Culvert Condition Reports (2015). Five of them are being replaced due to them not meeting the design criteria under existing conditions and the last four are getting replaced because the existing size does not meet the design criteria under proposed conditions.

All proposed structural culverts meet relevant design criteria and have a lower observed water level compared to existing conditions due to the flattening of the proposed culvert to better follow the watercourse slope and increased width of the culvert.

Exhibit 8-5 summarizes all of the culvert recommendations for the structural and non-structural culverts.

Exhibit 8-5: Culvert Recommendations

Culvert ID	Township	Station	Proposed Recommendations
Structural			
471	Cramahe	18+386	Replace with 4800 x 2400 mm box culvert embedded 300 mm
472	Cramahe	18+914	Replace with 4800 x 2400 mm box culvert embedded 300 mm
473	Cramahe	19+710	Replace with 4800 x 2400 mm box culvert embedded 300 mm
474	Brighton	10+215	Replace with 4800 x 2400 mm box culvert embedded 300 mm
Non-Structural			
0020	Cramahe	13+057	Extend culvert with a 900 mm pipe (like for like), a catch basin may be required in the median
0051	Cramahe	13+060	Extend culvert with a 900 mm pipe (like for like), a catch basin may be required in the median
0019	Cramahe	13+277	Replace with a 1000 mm CSP, headwall proposed in the median
0052	Cramahe	13+277	Replace with a 1000 mm CSP, headwall proposed in the median

Culvert ID	Township	Station	Proposed Recommendations
0018	Cramahe	13+520	Extend culvert with a 900 mm pipe (like for like), a catch basin may be required in the median
0053	Cramahe	13+527	Replace with a 1000 mm CSP, headwall proposed in the median
0017	Cramahe	14+112	Extend culvert with a 700 mm pipe (like for like), a catch basin may be required in the median
0054	Cramahe	14+112	Extend culvert with a 900 mm pipe (like for like), a catch basin may be required in the median
0016	Cramahe	14+328	Extend culvert with a 900 mm pipe (like for like), a catch basin may be required in the median
0055	Cramahe	14+328	Extend culvert with a 900 mm pipe (like for like), a catch basin may be required in the median
0015	Cramahe	14+542	Replace with a 1200 mm CSP, headwall proposed in the median
0056	Cramahe	14+548	Replace with a 1200 mm CSP, headwall proposed in the median
0014	Cramahe	14+959	Replace with a 2400 x 1500 mm NRFB, headwall proposed in the median
0057	Cramahe	14+968	Replace with a 2400 x 1500 mm NRFB, headwall proposed in the median
0013	Cramahe	15+547	Replace with a 1000 mm CSP, headwall proposed in the median
0058	Cramahe	15+547	Replace with a 1390 x 970 mm CSPA, headwall proposed in the median
0011A	Cramahe	16+492	Extend culvert on ditch side with 900 CSP (like for like), directly connected to 0011B
0011B	Cramahe	16+492	Extend culvert on ditch side with 900 CSP (like for like), directly connected to 0011A
0061	Cramahe	16+888	Extend culvert on ditch side with 1800 x 1200 RFB (like for like), directly connected to 0010
0010	Cramahe	16+888	Extend culvert on ditch side with 1800 x 1200 RFB (like for like), directly connected to 0061
0045	Brighton	12+090	Extend culvert with 1200 x 1200 NRFB (like for like), headwall proposed in median
0051	Brighton	12+110	Extend culvert with 1200 x 1200 NRFB (like for like), headwall proposed in median
0044	Brighton	12+460	Extend culvert with 1200 x 1200 NRFB (like for like), headwall proposed in median
0052	Brighton	12+460	Extend culvert with 1200 x 1200 NRFB (like for like), headwall proposed in median
0022B	Brighton	16+060	Extend culvert with 1200 x 1200 NRFB (like for like), directly connected to 0022A

Culvert ID	Township	Station	Proposed Recommendations
0022A	Brighton	16+060	Extend culvert with 1200 x 1200 NRFB (like for like), directly connected to 0022B
0021	Brighton	17+040	Replace with a 2800 x 1200 mm NRFB, headwall proposed in the median
0009	Brighton	17+040	Replace with a 2800 x 1200 mm NRFB, headwall proposed in the median
0020	Brighton	17+405	Extend culvert with 1200 x 900 NRFB (like for like), headwall proposed in median
0010	Brighton	17+405	Extend culvert with 1200 x 1200 NRFB (like for like), headwall proposed in median
0019	Brighton	17+630	Extend culvert with 1200 x 1200 NRFB (like for like), headwall proposed in median
0012	Brighton	17+630	Extend culvert with 1200 x 1200 NRFB (like for like), headwall proposed in median
0006	Brighton	18+695	Extend culvert with 1200 x 1200 NRFB (like for like), headwall proposed in median
0016	Brighton	18+710	Extend culvert with 1200 x 1200 NRFB (like for like), headwall proposed in median
0002	Brighton	20+375	Extend culvert with 1800 x 1200 NRFO (like for like) on the ditch side, storm sewer system will connect 0002 and 0003 in the proposed concrete median.
0003	Brighton	20+375	Extend culvert with 1800 x 1200 NRFO (like for like) on the ditch side, storm sewer system will connect 0003 and 0002 in the proposed concrete median
0001	Brighton	20+600	Extend culvert with 900 CSP (like for like) on the ditch side, storm sewer system will connect 0001 and 0004 in the proposed concrete median
0004	Brighton	20+600	Extend culvert with 900 CSP (like for like) on the ditch side, storm sewer system will connect 0001 and 0004 in the proposed concrete median

Under proposed drainage conditions, two additional lanes will be constructed either within the outer grassed ditch or one lane will be added on the inside shoulder while the other will be added on the outside shoulder. The proposed cross-section of the highway will include four lanes and shoulders on both eastbound and westbound lanes.

In most areas of the proposed design, runoff from the two inner lanes and median shoulders will be captured by catch basins. In some other areas of the proposed design, runoff from all 4 lanes and median shoulders or just the median shoulders will be collected by catch basins. Runoff that is not being captured by the catch basins will sheet flow to the highway outer ditches and ultimately to municipal drains.

Proposed storm sewer networks will be discharging to the highway outer ditches through storm sewer outlets. The existing drainage pattern will be maintained and the existing storm sewer outlets will be utilized whenever possible in the areas of the study limits that are not being realigned. In the one small section that is proposed to be realigned a new storm sewer network will need to be proposed. Another small section will also need to add a new storm sewer network, due to the grassed median being proposed to change into a concrete median.

The hydraulic assessment of the existing storm sewer under the proposed conditions and the proposed storm sewers in the section of the road that has a new alignment or for the small section that is proposed to be changed from a grassed median to a concrete median. The catchment drainage areas are shown in **Appendix D**.

Existing storm sewers and outlets are utilized as possible. In some sections the existing storm sewer size will need to be increased due to the increase in catchment size. The slope and spacing are proposed to stay the same as the existing. The storm sewer sections that will need to be upgraded are summarized in **Exhibit 8-6**.

Exhibit 8-6: Summary of Storm Pipe Upgrades

Reach		Spacing (m)	Existing Size (mm)	Proposed Size (mm)	Slope (%)
From Station	To Station				
Cramahe Township					
19+570	19+652	82	375	450	0.50
19+652	19+695	43	450	525	0.40
19+695	19+722	27	450	525	0.70
19+722	19+750	28	450	525	0.70
19+750	19+800	50	450	525	0.70
Brighton Township					
16+486	16+598	112	450	525	2.50

8.1.8 Groundwater

Based on the design information, background information review and inspection of the Study Area, the Groundwater Assessment conducted in support of this study (see **Appendix E**) identified potential impacts to existing groundwater conditions, associated with the proposed works. These impacts may be more significant where surface water features were identified or where geological formations have high permeability (i.e., sand and gravel deposits, described in **Section 4.1.8**). Potential impacts include the potential for the release of contaminants as well as aquifer and surface water susceptibility.

Aquifer susceptibility maps identify areas where contamination of aquifers is likely to occur as a result of surface contamination, construction depths, and multiple land use practices. Due to the presence of the watercourses within the Study Area, both groundwater and surface water features within the Study Area were examined for susceptibility to contamination.

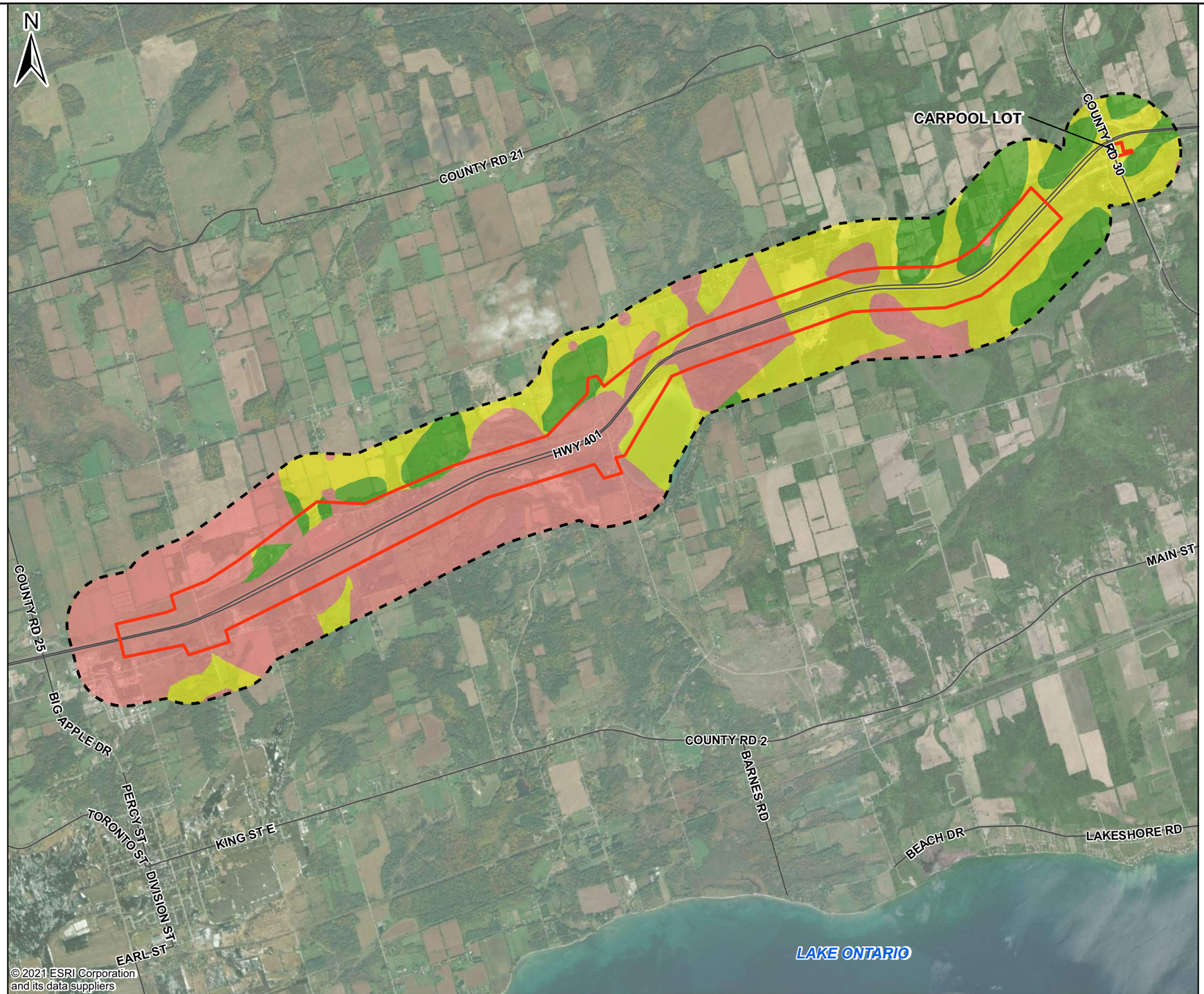
The degree of groundwater susceptibility to contamination largely depends on the presence or absence of permeable surficial materials, depth to the groundwater table, presence of surface water features, and/or location

relative to sensitive receptors, such as surface water features, catch basins, etc. Generally, aquifer susceptibility is higher in areas characterized as having a shallow aquifer system.

As shown in **Exhibit 8-7** and **Exhibit 8-8**, areas of low, moderate, and high groundwater susceptibility were identified within the Study Area, considering the following criteria:

- The areas identified as having a surficial geologic formation of high permeability such as sandy and/or gravelly (alluvium) deposits, organic deposits or exposed bedrock present within water stream valleys were marked as areas with high groundwater susceptibility;
- Areas in proximity to wetlands and source water protection elements (WHPA, IPZ, HVA and SGRA) were marked as areas with high groundwater susceptibility;
- Areas in proximity to properties that rely on private well water with a shallow static water level (within 3 m of the ground surface) were marked as areas with high groundwater susceptibility;
- Areas with an overburden composed of silty sand were marked as moderate groundwater susceptibility;
- Areas of low permeability deposits such as sandy silt till were considered as having low groundwater susceptibility to contamination.

Exhibit 8-9 and **Exhibit 8-10** shows areas of surface water susceptibility surrounding permanent and intermittent waterbodies. Watercourses are present throughout the Study Areas, indicating high surface water susceptibility to contamination.



N
W E
S

LEGEND:

- STUDY LIMITS
- STUDY AREA A - 500m BUFFER

GROUNDWATER SUSCEPTIBILITY

- HIGH
- MODERATE
- LOW

0 0.5 1 1.5 2 Kilometers

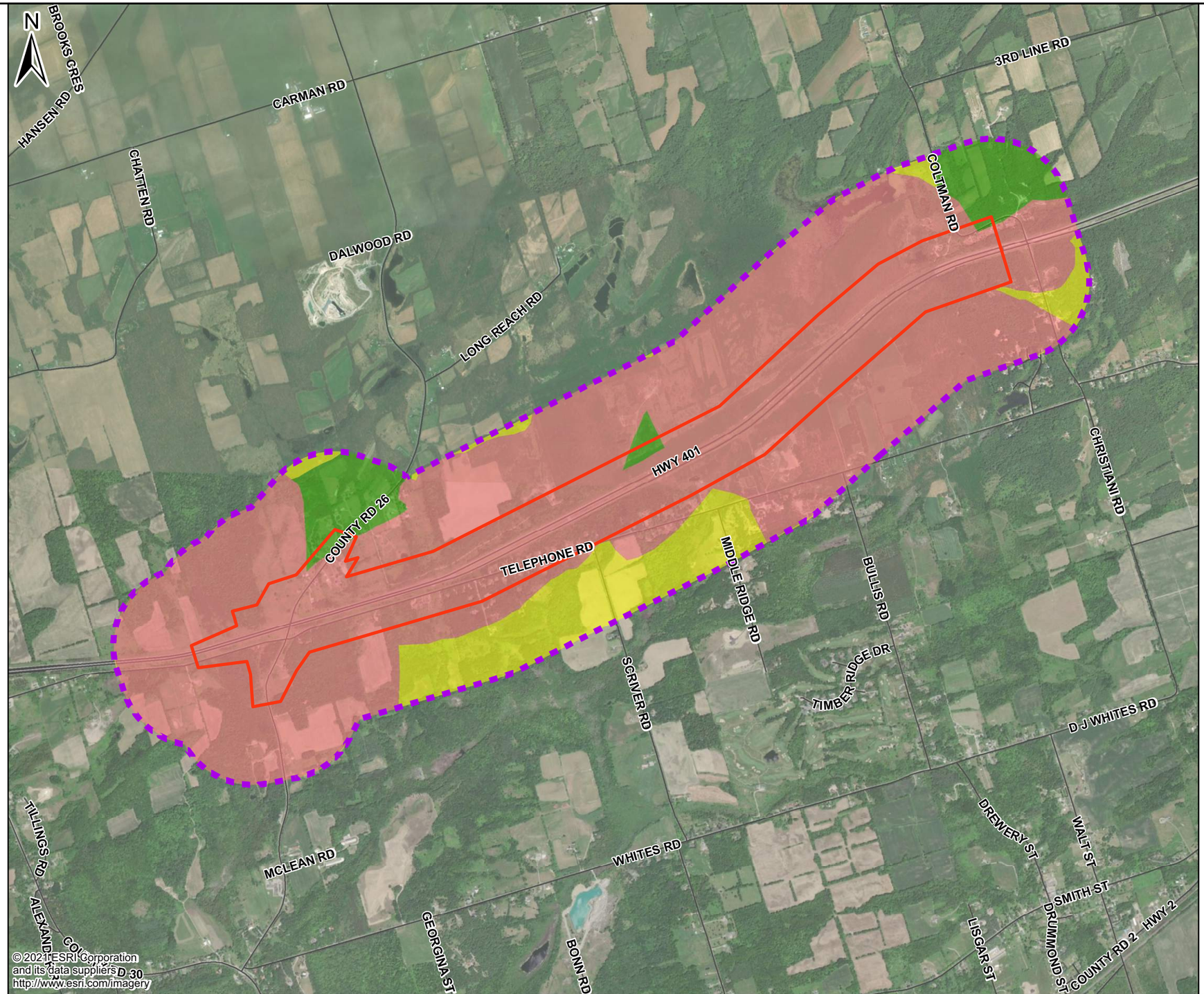
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Groundwater Susceptibility

Exhibit
8-7



LEGEND:

- STUDY LIMITS
- STUDY AREA B - 500m BUFFER

GROUNDWATER SUSCEPTIBILITY

- HIGH
- MODERATE
- LOW

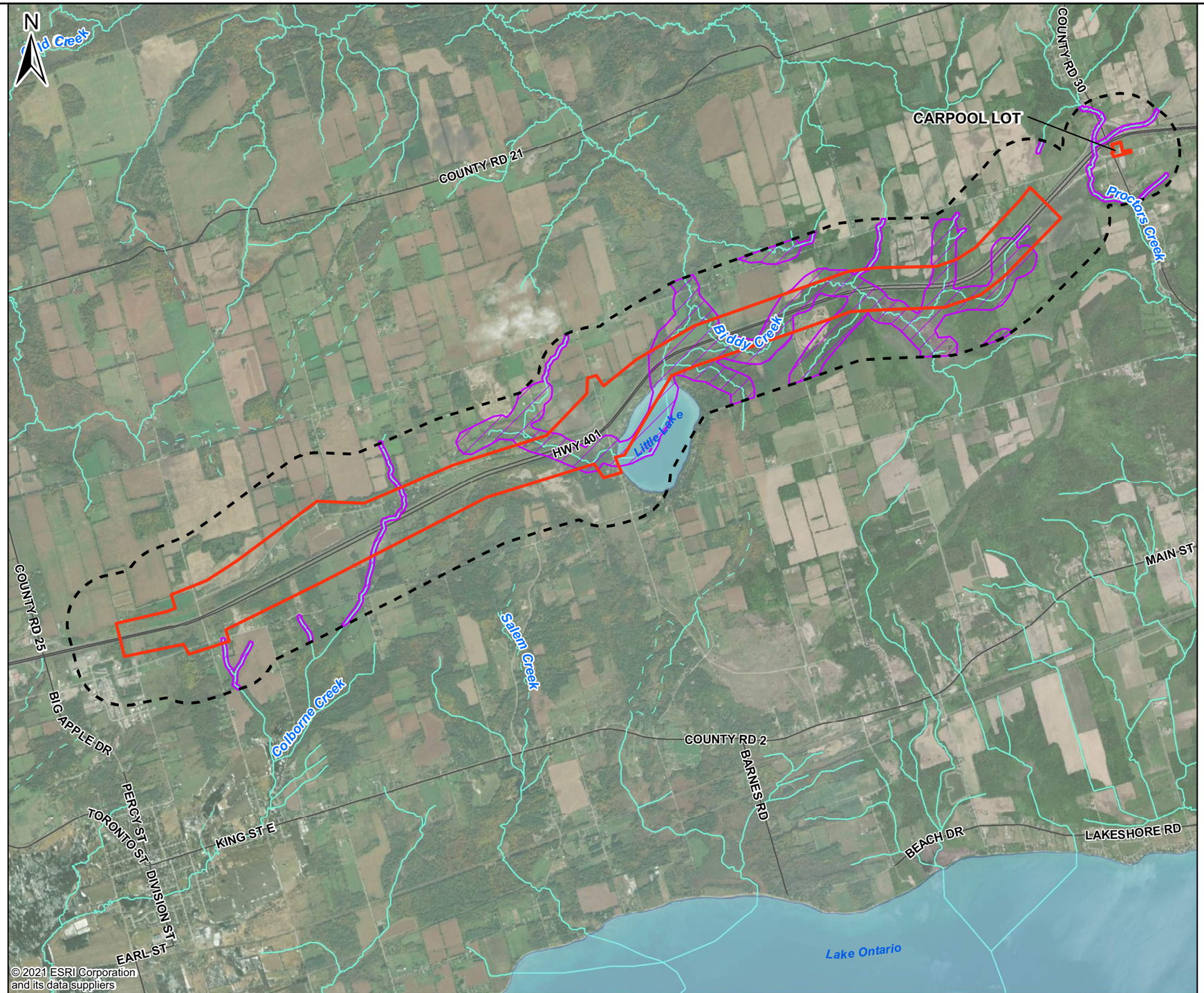
0 0.5 1 1.5 Kilometers

Ontario

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Groundwater Susceptibility

Exhibit
8-8



LEGEND:

- STUDY LIMITS
- STUDY AREA A - 500m BUFFER
- WATERBODIES

WATERCOURSES

- INTERMITTENT
- PERMANENT

SURFACE WATER SUSCEPTIBILITY

- HIGH
- LOW

0 0.5 1 1.5 2 Kilometers

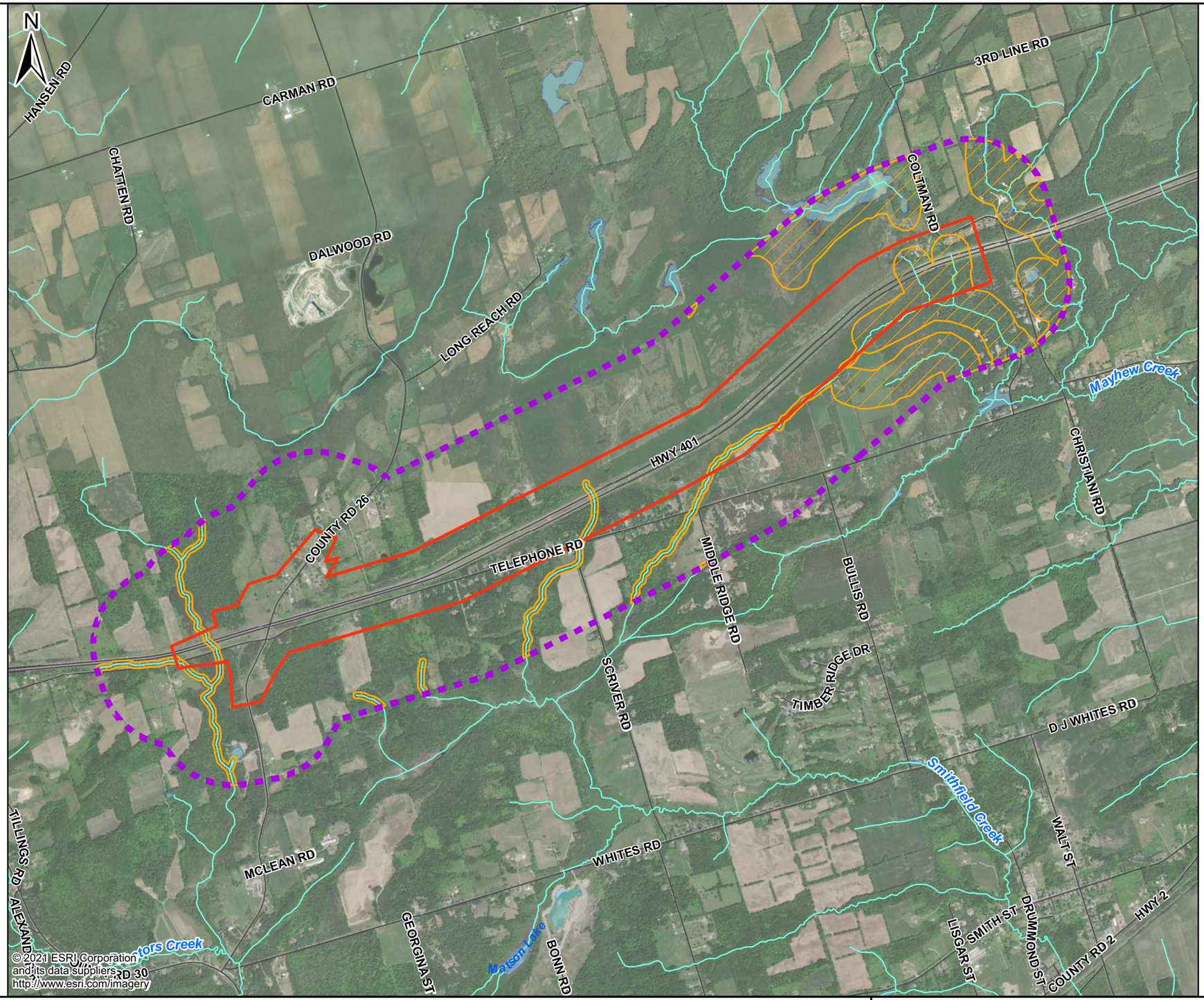
Ontario

wsp

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Surface Water Susceptibility

Exhibit
8-9



LEGEND:

- STUDY LIMITS
- STUDY AREA B - 500m BUFFER
- WATERBODIES

WATERCOURSES

- INTERMITTENT
- PERMANENT

SURFACE WATER SUSCEPTIBILITY

- HIGH
- LOW

0 0.5 1 1.5 Kilometers

Ontario

Highway 401 Planning Study from Colborne to Brighton
Preliminary Design and Class Environmental Assessment Study
GWP 4054-17-00

Surface Water Susceptibility

Exhibit
8-10

8.1.8.1 Drinking Water Source Protection

As discussed in **Section 4.1.9**, the Study Area is located in the Trent Source Protection Area. There are two WHPAs within the Study Areas A and B. There is a WHPA-A around the two wells, with WHPA-B, WHPA-C and WHPA-D delineated to the north of the wells (see **Exhibit 4-1**). In Study Area B, there is a WHPA-A around three wells at the Brighton Well Supply Field, approximately 600 m south of Highway 401 on the west of County Road 26. WHPA-B, WHPA-C and WHPA-D are delineated to the north of the well field. An IPZ-3 is present within the central portion of Study Area A and eastern portion of Study Area B. There are HVAs and SGRAs located within the Study Areas A and B.

There are 21 threats for which the Source Protection Committees must write policies in areas where a threat could be significant. For the scope of this Project, the following prescribed threats will be discussed as they relate to the construction and operation of a roadway/highway:

- Application of road salt;
- Application of commercial fertilizer; and
- Handling and storage of fuel.

The first two construction and operation activities are considered to pose a low-risk threat to the drinking water systems in the area. The risk associated with handling and storage of fuel represents a moderate risk.

8.1.9 Fluvial Geomorphology

8.1.9.1 Potential Impacts

Based on the Fish and Fish Habitat Existing Conditions Investigation (WSP, 2021), it was found that the four structural culverts are located in coldwater regimes of high reach sensitivity. Consequently, culvert replacements have potential to cause direct impacts to fish and fish habitat and require mitigation.

When applying the lateral and translational erosion rates produced from the erosion rate analyses, the Biddy Creek channel falls outside the proposed crossing structure openings. Consequently, the width of the crossing structure openings need to be increased to accommodate the anticipated future alignment to the watercourse. Based on the 89-year period of aerial photography indicating relatively static channel meanders and the fact that no excessive erosion was observed during field inspections, the existing and larger proposed culvert sizing is not an adverse constraint with respect to the natural channel meander migration and form. However, as the proposed culverts are sized smaller than the meander belt, there is potential for erosion impacts. Additionally, WSP completed a review of the preliminary culvert arrangements and noted that each of the proposed culvert locations have been shifted from the existing culvert locations and will require stream channel tie-ins.

8.1.9.2 Mitigation Measures and Recommendations

To address potential impacts of culvert replacement on fish and fish habitat it is recommended that the following design considerations at the replacement culverts be incorporated:

- The timing window where work can occur should be limited to between July 1st to September 30th ;
- Design should avoid disturbing spawning areas;
- Natural channel design should be completed by a fluvial geomorphologist for the C3 and C6 culverts; and

- Culverts should be built on the same alignment as the existing culverts to avoid unnecessary realignments to tie the culverts into the channel, as well as limit widening of the watercourse.

Based on the Drainage and Hydrology Study (WSP, 2023), the existing 4200 x 2400mm RFB culverts are proposed to be replaced by 4800 x 2400mm box culverts embedded 300mm. Based on WSP's review of the preliminary general arrangements, all four replacement culverts will also require additional topographic surveys at the Detail Design phase for existing and proposed channel inlet and outlet locations. This will be required to facilitate the incorporation of natural channel fluvial geomorphological features and erosion protection as appropriate in the connecting channel tie in design. Because the proposed culvert sizes are smaller than the calculated meander belt and slightly larger than the average bankfull width, erosion protection will be required at the culverts and must be added to the design drawings during Detail Design for review by a fluvial geomorphologist.

8.1.10 Air Quality

An Air Quality Impact Assessment (AQIA) Report was prepared in support of this Project and is available in **Appendix G**. A quantitative AQIA was completed for the ultimate widening conditions (8 lanes) as this is considered to be the worst-case scenario in terms of air quality impacts due to higher traffic volumes and emission sources being closer to sensitive receptors when compared to the interim widening (6 lanes). Refer to **Appendix G** for details on the modelling methodology used for this air quality impact assessment.

8.1.10.1 Air Quality and Greenhouse Gas Modelling Results

Significant air contaminants included in the modelling assessment were predicted to be below air quality thresholds for all averaging times for the future (2041) scenarios along each road section, except for B(a)P when assessed cumulatively. Existing concentrations of B(a)P are already above the respective air quality threshold; however, the available background B(a)P data is limited and is consistent with level founds across Ontario (Tevlin et al, 2020). Emission rates of B(a)P from vehicles are expected to decrease in the future as technology improves and the proportion of hybrid/electric vehicles increases. As a result, ambient concentrations of B(a)P are expected to decrease in the Study Area.

Modelling results showed an overall decrease in concentrations of nitrogen oxides (NO_X), carbon monoxide, acrolein, benzene, formaldehyde, and B(a)P for the future (2041) full build scenario when compared to existing (2022) scenario. Since the Project is not expected to result in an increase in traffic volume to the Study Area, a decrease in concentrations of a similar magnitude was also noted for these contaminants for the future (2041) no build scenario. For contaminants deemed negligible (i.e., acetaldehyde and 1,3-butadiene) and not included in the air dispersion modelling assessment, all future emission rates are expected to decrease for all road sections.

Modelling results showed a slight increase in $PM_{2.5}$ (fine particulate matter with a diameter of 2.5 microns or less) and PM_{10} (fine particulate matter with a diameter of 10 microns or less) concentrations for the future (2041) full build and no build scenarios; however, the cumulative concentrations of these contaminants remain below their respective air quality threshold. An increase in particulate matter is expected as SADT increases since particulate matter emissions are associated with tailpipe emissions, brake wear, and tire wear. The $PM_{2.5}$ and PM_{10} concentration increase between the full build and no build scenarios are overall the same for each road section, with some marginal differences; however, overall, the results show that the Project build would not have an adverse impact on air quality within the Study Area.

GHG emissions presented in Table 5-17 of **Appendix G** show that annual emissions of GHGs from vehicles are expected to decrease from 2022 to 2041 on all road sections except for 6-A and 7-A; however, the resulting increase along these sections is marginal and much lower than the expected increase in SADT presented in Table 5-16 of **Appendix G**. GHG emission estimates from all road sections are 0.01% or less of 2020 provincial GHG emission estimates as presented in Table 5-18 of **Appendix G**, and 0.01% or less of the 2030 provincial target as shown in Table 5-19 of **Appendix G**. Since no increase in traffic volume is expected from the Project, and GHG emissions from the Project no build and full build scenarios are the same, it can be concluded that the Project is not expected to have a significant impact on the regional and provincial GHG inventories or targets.

It is predicted that overall air emission concentration and annual greenhouse emission following the implementation of the Project will further decrease with advancements in vehicle technology, fuel efficiency and exhaust control efficiency. Emissions are also expected to decrease as public transit and alternative transportation uses in the area increase to continue to support the reduction of emissions to meet the provincial climate change targets.

8.1.10.1.1 Interim Widening Qualitative Air Quality Impact Assessment

A quantitative AQIA was completed for the ultimate widening conditions as this is considered to be the worst-case scenario in terms of air quality impacts due to higher traffic volumes and emission sources being closer to sensitive receptors when compared to the interim widening. Based on the results of the quantitative AQIA, a qualitative assessment of air quality impacts was completed for the interim widening conditions. It is assumed that the interim widening horizon year would be prior to 2041; therefore, based on traffic growth projections, traffic volumes in the Study Area would be lower than the ultimate conditions resulting in fewer vehicle emission sources. In addition, the interim conditions would result in widening from four to six lanes, resulting in the Highway 401 mainline being further from sensitive receptors when compared to the ultimate conditions. The results of the quantitative AQIA indicate that the Project ultimate widening is not expected to adversely impact air quality or GHG inventories within the Study Area. Due to the reduced traffic volume and increased distance to sensitive receptors for the interim widening conditions when compared to the ultimate widening, it is also expected that the interim conditions would not have an adverse impact on air quality or GHG inventories within the Study Area.

8.1.10.2 Impacts and Mitigation Measures

A qualitative assessment of the potential effects that may occur during construction operations and proposed mitigation measures and monitoring activities (as applicable) identified to minimize the predicted effects on air quality are documented below.

8.1.10.2.1 Operation Emissions Impacts and Mitigation Measures

The modelling results show an overall decrease in the maximum predicted concentrations during operations for all contaminants except for $PM_{2.5}$ and PM_{10}, which showed a slight increase for in the full build and no build scenarios. This overall decrease in concentrations is attributed to the expected increase in dispersion associated with road widening, increased efficiency of vehicles, more stringent emission standards, and emission control devices on future vehicles included within the MOVES3 model. The slight increase in particulate matter is expected due to an increase in future traffic volumes and associated tailpipe, brake wear, and tire wear emissions; however, the difference between the full build and no build scenarios is marginal. A comparison of the existing and future scenarios indicates that the Project is not expected to have a significant impact on provincial or regional GHG emission inventories and targets. As a result, there is no proposed mitigation required during Project operations except for regular road maintenance performed as part of normal operations for the MTO.

8.1.10.2.2 Construction Emissions Impacts and Mitigation Measures

Construction activities have the ability to impact localized air quality through increased particulate matter from fugitive dust and from combustion by-products through equipment mobilization. The construction activities associated with the Project consist of the construction of roadways and structures. Air emissions associated with construction typically include:

- Total Suspended Particulate (TSP), PM_{10}, and $PM_{2.5}$ resulting from:
  - Stockpiling of soils and other friable material;
  - Granular material loading and unloading activities;
  - Transportation of soils and other friable materials via dump trucks;
  - Soil excavation and filling activities;
  - Movement of heavy and light vehicles on paved and unpaved roads; and,
  - Cutting of existing concrete.
- Emissions resulting from the combustion engines of construction equipment.

Construction activities are exempt from air regulatory requirements in Ontario due to their temporary nature. Nuisance fugitive dust (coarse particulate such as TSP and PM_{10}) are the primary air quality impact during the construction phase of the Project. Nuisance fugitive dust can be managed through a Construction Air Quality Management Plan (CAQMP) for fugitive dust following the recommendations outlined in the ECCC guidance document “Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities”, dated March 2005. Air Quality Management Plans should ensure that dust from construction and demolition activities do not impact surrounding environmentally sensitive areas such as aquatic habitats and fisheries, terrestrial vegetation, and faunal communities, as well as residential properties in proximity to work areas.

To mitigate construction activities a CAQMP should be developed to address construction equipment vehicle exhaust, potential traffic disruptions and congestion, fugitive dust, and odour. Potential mitigation measures that may be incorporated in the CAQMP include:

- Dust suppression measures (e.g., application of water wherever appropriate, or the use of approved non-chloride chemical dust suppressants, where the application of water is not suitable);
- Use of dump trucks with retractable covers for the transport of soils and other friable materials;
- Minimize the number of loadings and unloading of soils and other friable materials;
- Minimize drop heights, use enclosed chutes, and cover bins for debris associated with deconstruction of affected structures;
- Washing of equipment and/use of mud mats where practical at construction site exits to limit the migration of soil and dust off-site;
- Stockpiling of soil and other friable materials in locations that are less exposed to wind (e.g., protected from the wind by suitable barriers or wind fences/screens, or covered when long-term storage is required) and away from sensitive receptors to the extent possible;

- Reduction of unnecessary traffic and implementation of speed limits;
- Permanent stabilization of exposed soil areas with non-erodible material (e.g., stone or vegetation) as soon as practicably possible after construction in the affected area is completed;
- Ensuring that all construction vehicles, machinery, and equipment are equipped with current emission controls, which are in a state of good repair; and,
- Dust-generating activities should be minimized during conditions of high wind.

In addition to the CAQMP, construction activities should be monitored by a qualified Environmental Inspector who will review the effectiveness of the mitigation measures and construction best management practices to confirm they are functioning as intended. If mitigation is found to not be effective, revised mitigation measures designed to improve effectiveness will be implemented. Dust levels should be monitored daily by the Contractor and frequently by the Environmental Inspector to assess the effectiveness of dust suppression measures and adjust as required. Monitoring should continue throughout the construction phase until activities are complete, the exposed soils have been stabilized, and the construction waste has been removed from site. A complaint response protocol will be established for nuisance effects, such as dust, for residents to provide feedback. Regular inspections of dust emissions should be carried out by the Contractor (frequency to be defined prior to project construction) to confirm dust control watering frequency and rates are adequate for control. Competent Site Supervisors should monitor the site for wind direction and weather conditions to ensure that high-risk dust generating activities are reduced when the wind is blowing consistently towards nearby sensitive receptors. The Site Supervisor should also monitor for visible fugitive dust and take action to determine and correct the cause. Specific details regarding monitoring should be included in the CAQMP.

8.2 Socio-Economic Environment

8.2.1 Landscape

The Preliminary Landscape Plan is presented in **Appendix H**. Most of the communities impacted by the proposed widening of Highway 401, carpool lot, and rehabilitation or replacement of bridges and culverts are comprised of cultural communities or small isolated groupings of trees with relatively minor ecological value. or disturbed communities for which the overall impact of the proposed works is expected to be low. Where the proposed works impact mature woodlands, however, there may be impacts to higher quality vegetation types, including species which are candidates of potential significance.

Tree and vegetation removals will be conducted in significant woodlands, wetlands, ANSIs, and Significant Natural Areas to accommodate the proposed widening of Highway 401, carpool lot, and rehabilitation or replacement of bridges and culverts. Direct and indirect impacts to vegetation, wildlife, and species-at-risk are anticipated as a result of the proposed works. Cultural vegetation may be removed from roadsides and cultural heritage landscapes and buildings to facilitate grading. These areas are of low ecological significance and impacts are expected to be minimal. Minor vegetation removal will occur at Little Lake, Biddy Creek, and along Highway 401 to facilitate culvert lengthening. Woodland edges, adjacent wetlands, and Butternut habitat will be directly impacted by the removal of approximately 2750 m of treed edge habitat along the ROW, and the removal of approximately 740 m of mature treed habitat in the Brighton Provincial Wildlife Area to facilitate the widening of Highway 401. However, encroachment of the proposed ROW on both sides of the highway will mainly directly impact areas of cultural vegetation of minor ecological value and small isolated groupings of trees.

In addition to direct impacts required for construction removals, there is potential for indirect impacts to retained vegetation and wildlife habitat features within and bordering the ROW. Vegetation beyond the anticipated footprint may be disturbed during or after construction and changes in drainage patterns may impact dependent vegetation. Further details regarding direct and indirect landscape impacts are provided in **Appendix H**.

Mitigation Measures

Mitigation measures recommended to protect existing vegetation and key natural heritage features include:

- Limit vegetation clearing and limit the size of the construction area and material staging to only what is needed.
- Keep the size of zones designated for brushing as small as possible, limiting them to the removal of only what is necessary for establishing clear sight lines.
- Locate construction access and staging areas in less sensitive areas and facilitate the regeneration of construction access and staging areas through active restoration plans.
- Clearly delineate ROW vegetation clearing zones and vegetation retention zones and protect vegetation that does not require removal for construction (e.g., using silt fencing or other temporary fencing) on both the Contract drawings and in the field with the Contractor prior to clearing and grading. Equipment, materials and other construction activities will not be permitted in vegetation retention zones.
- Carefully clear vegetation and trees designated for removal in accordance with OPSS 201 (Construction Specification for Clearing, Close Cut Clearing, Grubbing, and Removal of Surface and Piled Boulders). This includes felling trees into the ROW to minimize unnecessary disturbance beyond the ROW.
- Restrict vehicle maintenance and refueling to designated areas only. Refuelling shall be undertaken a minimum of 30 m from any watercourse and will be controlled to prevent any discharge of equipment fuels and fluids onto the ground.
- Protect against spills of contaminants, fuels and other potentially harmful materials that may reach natural areas. Machinery will arrive on site in a clean condition and will be maintained to prevent fluid leaks.
- Establish a Tree Protection Zone (TPZ) through the installation of tree protection fencing which follows standard arboricultural procedures (per OPSS 801).

A Landscape Plan will be developed at the Detail Design phase to include all elements of landscape restoration, as appropriate. The Landscape Plan will include a tree inventory, general landscape recommendations, recommendations for the use of native species, and provide enough coverage to offset vegetation losses, if feasible.

Further mitigation measures are outlined in **Appendix H** to specifically address the following concerns associated with landscape:

- Sediment Control;
- Grading;
- Watercourse and Wetland Crossings;
- Wildlife;
- Visual Buffering and Screening;
- Invasive Species; and,
- Forest Restoration Regular.

Environmental monitoring/ inspection will be implemented throughout construction to ensure that environmental protection measures are implemented, maintained and repaired, and that remedial measures are initiated where warranted. Monitoring will include an Environmental Inspector to observe, inspect and ensuring proper installation and maintenance of mitigation measures noted above during construction and for a specified period of time following the completion of construction.

8.2.2 Noise

The noise assessment conducted in support of this Study considered the noise impact resulting from operational improvements (i.e., road widening and interchange improvements) as well as from construction at locations adjacent to the NSAs within the Project Noise Limits. The potential noise impact due to the operational improvements are from future traffic on the improved corridor and was assessed in accordance with the MTO's *Environmental Guide for Noise*, October 2006 (the MTO's guide). The primary noise sources included in the noise modelling within the Study Area are vehicular traffic noise from Highway 401, and construction noise sources during Project construction.

8.2.2.1 Operation / Future Traffic Noise

Noise modeling was carried out for the following scenarios:

- Future without the Project undertaking – i.e., the future scenario due to traffic growth with the existing infrastructure (i.e., roadway alignments and profiles remain unchanged).
- Future with the Project undertaking – i.e., the future scenario due to traffic growth along with the proposed roadway alignments, profiles, interchanges etc., implemented.

The MTO's Guide requires the use of 24-hour traffic volumes. A review of the available information showed an existing noise berm at the intersection of Lake Road and Highway 401 (east of Lake Road and south of Highway 401). This noise berm provides sound mitigation for NSA 05 and is included in the modelling of the Project for scenarios of with undertaking and without undertaking.

Appendix I summarizes the predicted future sound levels at the receptor locations with and without the project undertaking, as well as the predicted changes in the future sound levels.

The predicted future sound level with the undertaking of the Project is below 65 dBA for all NSAs other than the following three (3) NSAs: NSA 03, NSA 11, and NSA 12 (as shown in **Exhibit 8-11** below).

Exhibit 8-11: Summary of Predicted Sound Levels

LAND USE	LOCATION OF THE RECEPTOR	PROJECTED SOUND LEVEL YEAR 2033 (SPL) (L_{EQ} 24-HR) (dBA)		PROJECTED CHANGE IN SOUND LEVEL (SPL CHANGE) (DB)	NOISE CONTROL CONSIDERATION		
		FUTURE WITHOUT PROJECT UNDERTAKING "FUTURE NO BUILD"	FUTURE WITH PROJECT UNDERTAKING "FUTURE BUILD"		SPL 6 dBA	SPL CHANGE dB	MITIGATION INVESTIGATION REQUIRED? Y/N OR N/A(1)
NSA 01	OLA	31 – 40.2	30.5 – 40	0.2 – 0.5	X	X	N
NSA 02	OLA	54.0 – 61.4	54.0 – 61.4	0	X	X	N
NSA 03	OLA	47.3 – 67.5	47.2 – 67.8	0.1 – 0.3	✓	X	Y
NSA 04	OLA	55.2 – 57.4	55.1 – 56.9	0.1 – 0.5	X	X	N
NSA 05	OLA	55.3 – 64.4	55.1 – 64.3	0.1 – 0.2	X	X	N
NSA 06	OLA	53.4 – 55.6	53.4 – 54.6	1.0	X	X	N
NSA 07	OLA	64.2	64.2	0	X	X	N
NSA 08	OLA	57.3 – 62.2	57.2 – 62.1	0.1	X	X	N
NSA 09	OLA	37.4 – 43.2	37.5 – 43.2	0.1	X	X	N
NSA 10	OLA	50.7 – 58.4	50.6 – 58.7	0.1 – 0.3	X	X	N
NSA 11	OLA	54 – 66.7	53.9 – 66.8	0.1	✓	X	Y
NSA 12	OLA	53.3 – 70.1	53.4 – 70.1	0.1	✓	X	Y
NSA 13	OLA	51.8	51.8	0	X	X	N
NSA 14	OLA	52.3 – 60.2	52.4 – 60.2	0.1	X	X	N

Notes: Yes, Mitigation investigation is required; N: No, Mitigation investigation is not required; and N/A: not applicable.

Investigation of noise control measure was conducted for NSA 03, NSA 11, and NSA 12. Noise control measure in the form of barriers were introduced within the ROW to investigate the technical, economic, and administrative feasibility of mitigating noise levels to less than 65 dBA at the impacted receptors. The following were assumed:

- A 5-metre-high noise wall, which is consistent with the maximum height considered for MTO projects.
- Typical cost for installing barrier per square metre is $600 (i.e., $600 / square metre installation cost).

- An acceptable or reasonable value for overall barrier is $120,000 / benefited receptors.

A 5-metre-high noise wall was reviewed along the ROW of the proposed Highway 401 for County Road 25 to County Road 40. The summary of the review is provided in **Exhibit 8-12**.

Exhibit 8-12: Summary of Feasibility Analysis

Reviewed Noise Wall #(1)	Length Of Noise Wall (m)	Average Noise Level Reduction over First Row Receptors (dB)	Technically Feasible? (Yes/No)	Total Noise Wall Cost ($) @ $600/ sq.m	Number Of Benefited Receptors (Over 5 dB Reduction)	Estimated Noise Wall Cost Per Benefitted House ($)	Economically Feasible? (Yes/No)
1	1370	9	Yes	4,110,000	19	228,333	No
2	320	8	Yes	960,000	1	930,000	No
3	1530	7	Yes	4,590,000	23	199,565	No

Further details of noise impact assessment are provided in **Appendix I**.

8.2.2.2 Mitigation Measures

Construction-related activities will occur throughout the project development area; however, a detailed construction schedule or equipment usage details are not available at this time for review. It is recommended to implement a complaint management process and noise mitigation measures on construction equipment/activities.

Consideration of detailed assessment of construction noise should be given during Detail Design. These measures will include, but are not limited to:

- Where possible, major construction activities to be scheduled during daytime hours (i.e. 07:00 to 19:00), avoiding the nighttime period in the vicinity of receptors. It should be noted that the township of Brighton has municipal by-laws exempting construction noise, between the hours of 07:00 and 21:00 Monday to Saturday, as per Noise By-Law 118-2017 Section 3.1(e); therefore, the following should be considered:
  - Although MTO is legally exempt from the requirements of municipal noise bylaws, where possible, avoid major noise generating construction between the nighttime hours of 21:00 to 7:00 in the vicinity of the receptors.
- The Contractor to keep the idling of construction equipment to a minimum as necessary and to maintain equipment in good working order to reduce noise from construction activities and meet MECP guideline NPC – 115 “Construction Equipment”.
- Equipment manufacturer recommended noise mitigation measures (e.g. muffler systems) to be installed on construction equipment and equipment to be properly maintained.
- Where possible, the Contractor is to implement administrative controls such as maintaining setbacks from NSAs, plan activities considering timing constraints, or scheduling of specific construction activities to minimally disturb the NSAs.

- Where required and where practical, the contract documents shall include these best management practice guidelines and identify NSAs in the contract package using SP 199F33 or similar documents.
- Special Provisions similar to the MTO's 199F33 should be included in the contract documents.
- Given that MTO is legally exempt from the requirements of municipal noise bylaws, MTO will no longer be applying for these exemptions. MTO recognizes the impacts that construction related noise can have on a community and will ensure clear and frequent communication with the municipality to work within the spirit of the municipal noise by-law. All reasonable attempts will be made including public notification and mitigation measures to reduce noise.
- Provide a contact number to the local municipality for residents to call if they have any concerns or questions (typically the Contract Administrator or Contract Services Administrator).
- Provide notification of the project prior to commencement of any work advising local residents and businesses of the project timeframe and that the project may create noise in the evening and/or night. Provide notification to property owners adjacent to the worksite prior to work commencing advising of the project timeframe and that the project may create noise in the evening and/or night (e.g., door-to-door flyers). Timing should be consistent with the timelines the local municipality would normally require in a noise bylaw exemption for a project of this scope/magnitude (typically 2-4 weeks prior to work commencing and 2-4 weeks prior to work recommencing each spring).
- A construction noise complaint management process should be implemented with the following steps:
  - Maintain a record of all noise complaints including date, time, location, and nature of complaint.
  - All complaints should be investigated by a Qualified Noise Specialist.
  - Appropriate mitigation measures are to be implemented where it is technically, economically, and administratively feasible.

8.2.3 Contaminated Areas

As noted in **Section 4.2.6**, five (5) areas of high potential for contamination and two (2) areas of moderate potential for contamination were identified in the Study Area.

8.2.3.1 Recommendations

Property Acquisitions Environmental Due Diligence: For the purpose of undertaking the future roadway construction, if property acquisitions are required within APECs with high potential for contamination, it is recommended that property specific Phase One ESAs (and if necessary, Phase Two ESAs) be completed in such areas in support of the property acquisition.

Road Construction and Management of Surplus/Excess Soil: Where possible, the reuse of excess soil within the Project Area should be incorporated into the detail design to minimize the need for off-site handling of material. In December 2019, the MECP filed O.Reg.406/19: On-Site and Excess Soil Management, which requires a notice to be filed on the Excess Soil Registry, if the following applies:

i) The Project Area contains a current or historical Enhanced Investigation Property (definition as per *O.Reg.406/19*), unless a Record of Site Condition has been filed for the Enhanced Investigation

Property, and no part of the project area has been used as an Enhanced Investigation Property since the filing of the Record of Site Condition.

ii) Any part of the Project Area is within a Settlement Area (as per definition in the *Planning Act*) and the volume of soil to be removed from the Project Area is 2,000 m^3 or greater, unless the whole Project Area is currently, or most recently used, for residential, institutional, parkland or agricultural or other use (definition of land uses per *O.Reg.153/04*).

iii) All or part of the Project Area is being remediated by excavating and removing excess soil from the project area for the purpose of reducing the concentration of contaminants on, in or under the project area, including remediating the project area for the purpose of filing a record of site condition.

If a notice is required to be filed on the Excess Soil Registry, then the following excess soil reuse planning documents are to be completed, including the Assessment of Past Uses, Sampling and Analyses Plan, Soil Characterization Report, and Excess Soil Destination Assessment Report. Soil sampling is to be completed in accordance with Part I, Section B, 2, of the Rules for Soil Management and Excess Soil Quality Standards (MECP, 2020) (Ontario Soil Rules). Tracking of the soil movement is required as per Part I, Section B, 5 of the Ontario Soil Rules.

Schedule 2 of O.Reg.406/19 details instances in which a project may be exempt from filing a notice. If a project is exempt from filing a notice, it is still recommended that soil sampling is completed on excess soil to be generated for due diligence purposes to document the condition of the soil prior to leaving the project area for proper management. If a project is exempt, hauling records are still required to be carried by haulers during transportation.

Regardless of if a project is exempt from filing a notice on the excess soil registry, the MTO forms PH-CC-182 and PH-CC-183 are required to document the reuse site selection notification for excess material managed as disposable fill and excess soil, and to document the reuse site property owner's release. The PHC-CC-182 and PHC-CC-183 forms are to be provided for all reuse sites, and shall be presented to the MTO's QP prior to hauling excess soil to the reuse sites for review and approval.

8.2.4 Designated Substances

A Designated Substance Survey (DSS) was conducted at the three (3) bridges and four (4) culverts outlined above within the Study Area. The scope of this work included identification of suspect or potential Designated Substances at the five bridge structures and at asphalt covered culverts within the Study Area.

The survey did not involve destructive sampling (i.e., inspection within abutment walls or ceilings, within light fixtures or electrical equipment), with the exception of those areas which may be accessed by moveable (non-fixed) barriers. These areas are considered not accessible to the surveyor and as such materials suspected to contain asbestos and other Designated Substances may be present within these inaccessible areas.

In accordance with the *Occupational Health and Safety Act*, R.S.O. 1990, c.01, the Contractor is advised of the presence, or the following Designated Substance(s) outlined in **Exhibit 8-13**.

Exhibit 8-13: Summary of Designated Substance Locations

Substance	Sample Location
Arsenic	▪ Sample obtained from the guardrail paint coating at Culvert 471 indicated concentrations of arsenic (4.9 mg/kg).

Substance	Sample Location
	▪ Sample obtained from the wood guardrail post from the south side approach guiderails at Herley Road Underpass (Site 21-294) indicated concentrations of arsenic were non-detect. ▪ Pressure treated wood posts were observed at majority of the guiderails for the bridges and culverts. Pressure treated lumber is assumed to be arsenic containing, therefore samples were not analyzed. ▪ If future construction activities affect the integrity of materials containing arsenic, standard demolition dust control measures should be implemented where practical to ensure airborne dusts are controlled as per O. Reg. 490/09, as amended.
Asbestos on Construction Projects and in Structures and Repair Operations (O. Reg. 278/05)	▪ Samples of concrete taken from the outer bridge and culvert structures at Herley Road (21-294), Lake Road (21-295), County Road 26 (21-297), Culvert 471, Culvert 473 and Culvert 474 were non-detect for asbestos. ▪ Samples of the grey foam joint material and black caulking collected from the Herley Road underpass were non-detect for asbestos. ▪ Samples of the black foam joint material and fibrous board material and grey foam padding collected from the County Road 26 Underpass were non-detect for asbestos. ▪ From the samples submitted as part of this DSS report, no asbestos-containing materials were identified. Materials suspected to contain ACM encountered during structure replacement or rehabilitation should be sampled at the time to confirm the presence or absence of Designated Substances and determine appropriate management options.
Lead	▪ A sample of green paint coating were submitted from the Lake Road Underpass (Site 21-295). The results indicated the green paint coating had a lead concentration of 10% weight. ▪ A sample of the grey graffiti coverup paint on the south abutment wall at Lake Road Underpass (Site 21-295) was also analyzed for lead. The results indicated the paint had a lead concentration of 0.0098% weight. ▪ A sample of the guiderail coating on the south guiderail at Culvert 471 was analyzed for lead. The results indicated the coating had a lead concentration of 0.56% weight. In general, the following procedures are recommended if/when removing lead-containing materials, coatings and paint applications: ▪ Follow Type 1 – if the coating is to be removed with a chemical gel or paste; ▪ Follow Type 2a – if the coating is to be removed by scraping or sanding using non-powered hand tools, or manual demolition of lead-painted building components by striking with sledgehammer or similar tool; ▪ Follow Type 3a – if the coating is to be removed using power tools; or, ▪ Follow Type 3b – if the coating is to be removed by abrasive blasting. If lead-containing paint applications and surface coatings are not removed prior to demolition, ensure that demolition waste complies with the requirements of General – Waste Management Regulation, R.R.O. 1990, Regulation 347.

8.2.5 Climate Change

Greenhouse gases (GHGs) are contributors to the radiative warming effect of the environment that results in global climate change. To assess the impact of the Project on GHG emissions, the GHG emissions from the No Build and Full Build Scenario (2041) were compared to existing conditions (2022). The GHGs included in the assessment are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) which are emitted from fuel combustion and from other anthropogenic and natural sources. Carbon dioxide is the main product of combustion while the other two gases are by-products of incomplete combustion. Methane and nitrous oxide have lower concentrations in the atmosphere than carbon dioxide, but their potential impact on global warming potential (GWP) per molecule is larger than for carbon dioxide. The 100-year global warming potential (GWP) factors were used to convert the GHGs emissions into CO_2 equivalent (CO_{2eq}).

The GHG emissions show that annual emissions of GHGs from vehicles are expected to decrease from 2022 to 2041 on all road sections except for Alternatives 6-A and 7-A; however, the resulting increase along these sections is marginal and much lower than the expected increase in SADT. GHG emission estimates from all road sections are 0.01% or less of 2020 provincial GHG emission estimates, and 0.01% or less of the 2030 provincial target. Since no increase in traffic volume is expected from the Project, and GHG emissions from the Project no build and full build scenarios are the same, it can be concluded that the Project is not expected to have a significant impact on the regional and provincial GHG inventories or targets. Further details on the GHG emissions assessment can be found in **Appendix G**.

It is predicted that overall air emission concentration and annual greenhouse emission following the implementation of the Project will further decrease with advancements in vehicle technology, fuel efficiency and exhaust control efficiency. Emissions are also expected to decrease as public transit and alternative transportation uses in the area increase to continue to support the reduction of emissions to meet the provincial climate change targets.

8.3 Cultural Environment

8.3.1 Archaeological Resources

As noted in **Section 4.3.1**, a Stage 1 Archaeological Assessment (AA) was carried out to identify and assess the known and potential archaeological resources within the Study Area. Archaeological recommendations have been made based on background historic research, property inspection, locations of known or registered archaeological sites, previous archaeological assessments, and indicators of archaeological potential. Based on the results of the Stage 1 AA, a Stage 2 AA is required for those parts of the Study Area determined to retain archaeological potential (see Figure 6 in **Appendix K**).

These recommendations for the Stage 2 archaeological assessment are to follow the requirements of Section 2 of the *Standards and Guidelines for Consultant Archaeologists* (MCM, 2011). The recommendations are as follows:

- Recently ploughed agricultural fields must be subject to pedestrian survey at 5 m intervals as per Section 2.1.1 of the *Standards and Guidelines for Consultant Archaeologists* (2011). Prior to pedestrian survey, the field must be ploughed and weathered to allow for ideal conditions for the identification of archaeological resources. After ploughing, soil visibility must be at least 80% in order for pedestrian survey to proceed.
- Where ploughing is not possible, the property must be subject to test pit survey at 5 m intervals as per Section 2.1.2 of the *Standards and Guidelines for Consultant Archaeologists* (2011). This recommendation

includes areas such as wood lots, bush lots, manicured lawns, and areas of scrub overgrowth. Test pit survey can be increased to 10 m intervals in areas of confirmed disturbance based on professional judgement.

- Orchards where the area between plants is less than 5 m can be subject to test pit survey at 5 m intervals. Orchards where are between plants is greater than 5 m can be subject to strip-ploughing.

It should be noted that areas determined to no longer retain archaeological potential should not be subject to ground disturbing activities until the recommendations stated herein have been accepted by the MCM, and the report has been entered into the Public Register of Archaeological Reports.

8.3.2 Built Heritage Resources and Cultural Heritage Landscapes

A Cultural Heritage Resource Assessment Report (CHRAR) was completed to document the cultural heritage landscapes and built heritage resources within and adjacent to the Study Area (see **Appendix L**). As part of this study, potential direct and indirect impacts to cultural heritage resources were identified and general mitigation measures were recommended for affected built heritage resources and cultural heritage landscapes.

Direct impacts refer to the demolition or removal of a structure, and/or occupying sites or locations that are required for temporary construction purposes, ancillary services and secondary functions. Indirect impacts which include temporary impacts during construction such as the introduction of physical, visual, audible or atmospheric elements that are not in keeping with their character and/or setting.

Exhibit 8-14 considers the potential direct and indirect impacts and mitigation strategies for the identified cultural heritage resources, based on the MCM's *Information Bulletin 3* (2017).

Exhibit 8-14: Potential Impacts and Mitigation Strategies for Built Heritage Resources (BHR) and Cultural Heritage Landscapes (CHL)

Resource	Address / Location	Impacting Alternative	Discussion of Impact	Mitigation Strategies
CHL 1	Highway 401	All alternatives	▪ Potential impact. ▪ Rationale: The portion of Highway 401 that comprises the Study Area will be impacted by the future widening and crossing road bridge replacements. The *Standards and Guidelines for Conservation of Provincial Heritage Properties* (2010) does not apply to roadways in the provincial highway network. As such, a detailed discussion of impacts and mitigation strategies is not necessary.	▪ N/A
CHL 2	Purdy Road	Section 1 Alternative 2 Herley Road Alternative 1 Herley Road Alternative 2 Herley Road Alternative 3	▪ Potential indirect impact. ▪ Rationale: Herley Road Alternatives 1 to 3 propose to replace the existing bridge and reconstruct and potentially realign the southern approach of Durham Road beginning at Purdy Road. This change will not directly impact the Purdy Road roadscape, however the proximity of construction work to the intersection of Purdy Road and Durham Road may result in indirect impacts.	▪ Storage and construction staging areas should be located away from the Purdy Road corridor where possible and other heritage resources identified in the Study Area.
CHL 3	478 Purdy Road	Section 1 Alternative 2	▪ Potential impact. ▪ Rationale: The Highway 401 widening proposed in Section 1 Alternative 1 may result in minor property acquisition along the north edge of 478 Purdy Road. It does not appear that the property taking will result in any impacts to built heritage resources or significant landscape features. Although this intervention will not significantly alter the landscape, it will result in direct impacts to the property parcel.	▪ Where feasible, the Recommended Plan should be designed in a manner requiring as little property acquisition as possible. Storage and construction staging areas should be located as close to the grading limits as possible.
CHL 4	856 Purdy Road	Section 1 Alternative 2	▪ Potential impact. ▪ Rationale: The Highway 401 widening proposed in Section 1 Alternative 2 may result in minor property acquisition along the north edge of 856 Purdy Road. It does not appear that the property taking will result in any impacts to built heritage resources or significant landscape features. Although this intervention will not significantly alter the landscape, it will result in direct impacts to the property parcel.	▪ Where feasible, the Recommended Plan should be designed in a manner requiring as little property acquisition as possible. Storage and construction staging areas should be located as close to the grading limits as possible.
CHL 5	Durham Road/Herley Road	Section 1 Alternative 2 Herley Road Alternative 1 Herley Road Alternative 2 Herley Road Alternative 3	▪ Potential impact. ▪ Rationale: Within the Study Area, Herley Road Alternatives 1 to 3 propose to replace the existing bridge and reconstruct and potentially realign the bridge approaches from Durham Road in the south and Herley Road in the north. This intervention may directly impact the Durham Road/Herley Road roadscape.	▪ Storage and construction staging areas should be limited to the extents of the Durham Road/Herley Road project location to minimize impacts to the adjacent road corridor and other heritage resources identified in the Study Area. ▪ The rural cross-section of Durham Road/Herley Road should be maintained to ensure the new construction is consistent with the rural character of the roadscape. ▪ Where construction is anticipated to result in grading impacts and tree removal along the Durham Road/ Herley Road corridor, post-construction landscaping with native tree species should be employed to mitigate visual impacts to the roadscape.
CHL 6	Honey Road	Herley Road Alternative 1 Herley Road Alternative 2 Herley Road Alternative 3	▪ Potential impact. ▪ Rationale: Herley Road Alternatives 1 to 3 propose to replace the existing bridge and reconstruct and potentially realign the northern approach of Herley Road, including the intersection of Honey Road. Although limited to the Honey Road intersection, this intervention may result in direct impacts to the roadscape.	▪ Storage and construction staging areas should be located away from the Honey Road corridor where possible and other heritage resources identified in the Study Area. ▪ The rural cross-section of Honey Road should be maintained to ensure the new construction is consistent with the rural character of the roadscape.
CHL 7	297 Honey Road	Section 1 Alternative 2	▪ Potential impact. ▪ Rationale: The Highway 401 widening proposed in Section 1 Alternative 2 may result in minor property acquisition along the south edge of 297 Honey Road. It does not appear that the property taking will result in any impacts to built heritage resources or significant landscape features. Although this intervention will not significantly alter the landscape, it will result in direct impacts to the property parcel.	▪ Where feasible, the Recommended Plan should be designed in a manner requiring as little property acquisition as possible. Storage and construction staging areas should be located as close to the grading limits as possible.
CHL 8	148 Samis Road	None	▪ No impact. ▪ Rationale: No work is proposed on or adjacent to the property at 148 Samis Road as part of this EA.	▪ N/A

Resource	Address / Location	Impacting Alternative	Discussion of Impact	Mitigation Strategies
CHL 9	Crandall Road	Section 3 Alternative 1 – Crandall Road Alternative 1 Section 3 Alternative 1 – Crandall Road Alternative 3 Section 3 Alternative 1 Lake Road Alternative 3	▪ Potential impact. ▪ Rationale: The realignment of the east end of Crandall Road proposed through Section 3 Alternative 1 – Crandall Road Alternatives 1 and 3 and the introduction of a replacement bridge at Lake Road through Lake Road Alternative 3 will result in a direct impact to the Crandall Road roadscape. ▪	▪ Where feasible, the Recommended Plan for Crandall Road should be designed in a manner resulting in as few property impacts as possible. Storage and construction staging areas should be located close to the grading limits to avoid impacts to the roadscape and other heritage resources identified in the Study Area. ▪ The rural cross-section of the realigned portion of Crandall Road should be maintained to ensure the new construction is consistent with the rural character of the roadscape. ▪ Where construction is anticipated to result in grading impacts and tree removal along the Crandall Road corridor, post-construction landscaping with native tree species should be employed to mitigate visual impacts to the roadscape.
CHL 10	426 Crandall Road	None	▪ No impact. ▪ Rationale: No work is proposed on or adjacent to the property at 426 Crandall Road as part of this EA.	▪ N/A
CHL 11	439 Crandall Road	Section 2 Alternative 1 Section 2 Alternative 2 Section 2 Alternative 3	▪ Potential impact. ▪ Rationale: The proposed Section 2 Alternatives 1 to 3 will pass through the south side of the property in proximity to built heritage resources, directly impacting the agricultural landscape.	▪ A CHER is recommended to be completed prior to selection of the Recommended Plan to determine whether the property possesses CHVI. If the property has CHVI, an HIA should also be completed to evaluate alternatives, assess potential impacts to the resource, and recommend appropriate mitigation measures.
CHL 12	Telephone Road	Section 6 Alternative 1 Section 7 Alternative 2 County Road 26 Alternative 2 County Road 26 Alternative 6 and 7	▪ Potential impact. ▪ Rationale: The realignment of Telephone Road at the County Road 26 intersection proposed through Section 6 Alternative 1, Section 7 Alternative 2, and the introduction of a replacement bridge at County Road 26 through County Road 26 Alternatives 2, 6 and 7 will result in a direct impact to the Telephone Road roadscape. ▪	▪ Where feasible, the Recommended Plan for Telephone Road should be designed in a manner resulting in as few property impacts as possible. Storage and construction staging areas should be located close to the grading limits to avoid impacts to the roadscape and other heritage resources identified in the Study Area. ▪ The rural cross-section of the realigned portion of Telephone Road should be maintained to ensure the new construction is consistent with the rural character of the roadscape. ▪ Where construction is anticipated to result in grading impacts and tree removal along the Telephone Road corridor, post-construction landscaping with native tree species should be employed to mitigate visual impacts to the roadscape.
CHL 13	13711 Telephone Road	None	▪ No impact. ▪ Rationale: No work is proposed on or adjacent to the property at 13711 Telephone Road as part of this EA.	▪ N/A
CHL 14	Lake Road	Section 3 Alternative 1 – Crandall Road Alternative 1 Section 3 Alternative 1 – Crandall Road Alternative 3 Section 3 Alternative 2 – Crandall Road Alternatives 2 and 3 Section 3 Alternative 3 – Crandall Road Alternatives 2 and 3 Section 3 Alternative 1 Section 3 Alternative 2	▪ Potential impact. ▪ Rationale: Within the Study Area, Lake Road Alternative 3 proposes to replace the existing bridge, reconstruct and potentially realign the bridge approaches and the intersection at Crandall Road as per Section 3 Alternative 1 – Crandall Road Alternatives 1 and 3, Section 3 Alternative 2 – Crandall Road Alternatives 2 and 3, and Section 3 Alternative 3 – Crandall Road Alternatives 2 and 3. This change will result in a direct impact the Lake Road roadscape.	▪ Where feasible, the Recommended Plan for Lake Road and the bridge replacement should be designed in a manner resulting in as few property impacts as possible. Storage and construction staging areas should be located close to the grading limits to avoid impacts to the roadscape and other heritage resources identified in the Study Area. ▪ The rural cross-section of Lake Road should be maintained to ensure the new construction is consistent with the rural character of the roadscape. ▪ Where construction is anticipated to result in grading impacts and tree removal along the Lake Road corridor, post-

Resource	Address / Location	Impacting Alternative	Discussion of Impact	Mitigation Strategies
		Section 3 Alternative 3 Lake Road Alternative 3		construction landscaping with native tree species should be employed to mitigate visual impacts to the roadscape.
CHL 15	McDonald Road	Section 3 Alternative 1 Section 3 Alternative 2 Section 3 Alternative 3 Lake Road Alternative 3	▪ Potential impact. ▪ Rationale: The Highway 401 widening proposed through Section 3 Alternatives 1 to 3 may result in indirect impacts to McDonald Road. The replacement of the bridge through Lake Road Alternative 3 may result in direct impacts to McDonald Road, primarily at the intersection of Lake Road and McDonald Road.	▪ Where feasible, the Recommended Plan for the Lake Road bridge replacement and associated McDonald Road intersection reconstruction should be designed in a manner resulting in as few property impacts as possible. Storage and construction staging areas should be located close to the grading limits to avoid impacts to the roadscape and other heritage resources identified in the Study Area. ▪ The rural cross-section of McDonald Road should be maintained to ensure the new construction is consistent with the rural character of the roadscape. ▪ Where construction is anticipated to result in grading impacts and tree removal around the intersection of Lake Road and McDonald Road and the north side of McDonald, post-construction landscaping with native tree species should be employed to mitigate visual impacts to the roadscape.
CHL 16	Little Lake	Section 3 Alternative 1 Section 3 Alternative 2 Section 3 Alternative 3 Lake Road Alternative 3	▪ Potential impact. ▪ Rationale: The Highway 401 widening proposed through Section 3 Alternatives 1 to 3 may cause direct impacts resulting from property acquisitions on the north side of the lots adjacent to Highway 401. The replacement of the bridge through Lake Road Alternative 3 may result in direct impacts, primarily at the intersection of Lake Road and McDonald Road.	▪ A Recommended Plan should be selected that maintains as great an offset as possible between the Highway 401 widening and the properties lining McDonald Road along the northwest shores of Little Lake. Given the immediate adjacency of these properties to the grading limits, mitigation measures should be undertaken during construction planning to ensure that indirect impacts, such as vibrations, or the proximity of construction equipment, do not damage the buildings. Staging and construction activities should be appropriately located and/or planned to avoid impacting the properties. If necessary, construction fencing should be erected around property boundaries to ensure they are not damaged by any construction machinery or vehicles. ▪ The Lake Road bridge replacement and associated McDonald Road intersection reconstruction should be designed in a manner resulting in as few property impacts as possible. Storage and construction staging areas should be located close to the grading limits to avoid impacts to the roadscape and the heritage resources identified in the Study Area. ▪ The rural cross-section of McDonald Road should be maintained to ensure the new construction is consistent with the rural character of the roadscape. ▪ Where construction is anticipated to result in grading impacts and tree removal around the intersection of Lake Road and McDonald Road and the north side of McDonald, post-construction landscaping with native tree species should be employed to mitigate visual impacts to the roadscape.
CHL 17	14764 Little Lake Road	None	▪ No impact. ▪ Rationale: No work is proposed on or adjacent to the property at 14764 Little Lake Road as part of this EA.	▪ N/A
CHL 18	14287 Telephone Road	Section 3 Alternative 1 Section 3 Alternative 2 Section 3 Alternative 3	▪ Potential impact. ▪ Rationale: The Highway 401 widening proposed in Section 3 Alternatives 1 to 3 may result in minor property acquisition along the south edge of 14287 Telephone Road. It does not appear that the	▪ Where feasible, the Recommended Plan should be designed in a manner requiring as little property acquisition as possible.

Resource	Address / Location	Impacting Alternative	Discussion of Impact	Mitigation Strategies
			property taking will result in any impacts to built heritage resources or significant landscape features. Although this intervention will not significantly alter the landscape, it will result in direct impacts to the property parcel.	Storage and construction staging areas should be located as close to the grading limits as possible.
CHL 19	14393 Telephone Road	Section 3 Alternative 1 Section 3 Alternative 2 Section 3 Alternative 3 Section 4 Alternative 1	▪ Potential impact. ▪ Rationale: The Highway 401 widening proposed in Section 3 Alternatives 1 to 3 and Section 4 Alternative 1 may result in minor property acquisition along the south edge of 14393 Telephone Road. It does not appear that the property taking will result in any impacts to built heritage resources or significant landscape features. Although this intervention will not significantly alter the landscape, it will result in direct impacts to the property parcel.	▪ Where feasible, the Recommended Plan should be designed in a manner requiring as little property acquisition as possible. Storage and construction staging areas should be located as close to the grading limits as possible.
CHL 20	14511 Telephone Road	None	▪ No impact. ▪ Rationale: No work is proposed on or adjacent to the property at 14511 Telephone Road as part of this EA.	▪ N/A
CHL 21	15064 Telephone Road	None	▪ No impact. ▪ Rationale: No work is proposed on or adjacent to the property at 15064 Telephone Road as part of this EA.	▪ N/A
CHL 22	15120 Telephone Road	None	▪ No impact. ▪ Rationale: No work is proposed on or adjacent to the property at 15120 Telephone Road as part of this EA.	▪ N/A
CHL 23	15154 Telephone Road	Section 5 Alternative 3 Section 5 Alternative 4	▪ Potential impact. ▪ Rationale: The Highway 401 widening proposed in Section 5 Alternatives 3 and 4 may result in minor property acquisition along the south edge of 15154 Telephone Road. It does not appear that the property taking will result in any impacts to built heritage resources or significant landscape features. Although this intervention will not significantly alter the landscape, it will result in direct impacts to the property parcel.	▪ Where feasible, the Recommended Plan should be designed in a manner requiring as little property acquisition as possible. Storage and construction staging areas should be located as close to the grading limits as possible.
CHL 24	County Road 26	Section 6 Alternative 1 County Road 26 Alternative 2 County Road 26 Alternative 6 and 7	▪ Potential impact. ▪ Rationale: The widening of Highway 401 and the introduction of a replacement bridge proposed through Section 6 Alternative 1, and County Road 26 Alternatives 2, 6 and 7 will result in a direct impact to the County Road 26 roadscape.	▪ Where feasible, the Recommended Plan for County Road 26 should be designed in a manner resulting in as few property impacts as possible. Storage and construction staging areas should be located close to the grading limits to avoid impacts to the roadscape and other heritage resources identified in the Study Area. ▪ The rural cross-section of the realigned portion of County Road 26 should be maintained to ensure the new construction is consistent with the rural character of the roadscape. ▪ Where construction is anticipated to result in grading impacts and tree removal along the County Road 26 corridor, post-construction landscaping with native tree species should be employed to mitigate visual impacts to the roadscape.
CHL 25	638 County Road 26	Section 6 Alternative 1 County Road 26 Alternative 2 County Road 26 Alternative 6 and 7	▪ Potential impact. ▪ Rationale: The proposed Section 6 Alternative 1 and County Road 26 Alternatives 2, 6 and 7 will pass through the south side of the property, directly impacting the collection of built heritage resources that comprise the agricultural landscape.	▪ A CHER is recommended to be completed prior to selection of the Recommended Plan to determine whether the property possesses CHVI. If the property has CHVI, an HIA should also be completed to evaluate alternatives, assess potential impacts to the resource, and recommend appropriate mitigation measures.
CHL 26	16536 Telephone Road	Section 7 Alternative 2 Section 7 Alternative 5	▪ Potential impact. ▪ Rationale: The Highway 401 widening proposed in Section 7 Alternatives 2 and 5 may result in minor property acquisition along the north edge of 16536 Telephone Road. It does not appear that the property taking will result in any impacts to built heritage resources or significant landscape features. Although this intervention will not significantly alter the landscape, it will result in direct impacts to the property parcel.	▪ Where feasible, the Recommended Plan should be designed in a manner requiring as little property acquisition as possible. Storage and construction staging areas should be located as close to the grading limits as possible.

Resource	Address / Location	Impacting Alternative	Discussion of Impact	Mitigation Strategies
BHR 1	296 Purdy Road	None	▪ No impact. ▪ Rationale: No work is proposed on or adjacent to the property at 296 Purdy Road as part of this EA.	▪ N/A
BHR 2	449 Purdy Road	Herley Road Alternative 1 Herley Road Alternative 2 Herley Road Alternative 3	▪ Potential indirect impact. ▪ Rationale: Herley Road Alternatives 1 to 3 propose to replace the existing bridge and reconstruct and potentially realign the southern approach of Durham Street beginning at Purdy Road. This intervention will not directly impact 449 Purdy Road, however the proximity of construction work may have indirect impacts.	▪ Given the immediate adjacency of 449 Purdy Road to the grading limits, mitigation measures should be undertaken during construction planning to ensure that indirect impacts, such as vibrations, or the proximity of construction equipment, do not damage the building. Staging and construction activities should be appropriately located and/or planned to avoid impacting the property. If necessary, construction fencing should be erected around the north and west property boundaries to ensure it is not damaged by any construction machinery or vehicles.
BHR 3	740 Purdy Road	None	▪ No impact. ▪ Rationale: No work is proposed on or adjacent to the property at 740 Purdy Road as part of this EA.	▪ N/A
BHR 4	756 Purdy Road	Section 1 Alternative 2	▪ Potential impact. ▪ Rationale: The Highway 401 widening proposed in Section 1 Alternative 2 may result in minor property acquisition along the north edge of 756 Purdy Road. It does not appear that the property taking will result in any impacts to built heritage resources or significant landscape features. Although this intervention will not significantly alter the landscape, it will result in direct impacts to the property parcel.	▪ Where feasible, the Recommended Plan should be designed in a manner requiring as little property acquisition as possible. Storage and construction staging areas should be located as close to the grading limits as possible.
BHR 5	356 Honey Road	None	▪ No impact. ▪ Rationale: No work is proposed on or adjacent to the property at 356 Honey Road as part of this EA.	▪ N/A
BHR 6	204 Crandall Road	None	▪ No impact. ▪ Rationale: No work is proposed on or adjacent to the property at 204 Crandall Road as part of this EA.	▪ N/A
BHR 7	377 Crandall Road	Section 1 Alternative 2 Section 2 Alternative 1 Section 2 Alternative 3	▪ Potential impact. ▪ Rationale: The Highway 401 widening proposed in Section 1 Alternative 2 and Section 2 Alternatives 1 and 3 may result in minor property acquisition along the south edge of 377 Crandall Road. It does not appear that the property taking will result in any impacts to built heritage resources or significant landscape features. Although this intervention will not significantly alter the landscape, it will result in direct impacts to the property parcel.	▪ Where feasible, the Recommended Plan should be designed in a manner requiring as little property acquisition as possible. Storage and construction staging areas should be located as close to the grading limits as possible.
BHR 8	389 Crandall Road	Section 1 Alternative 2 Section 2 Alternative 1 Section 2 Alternative 2 Section 2 Alternative 3	▪ Potential impact. ▪ Rationale: The proposed Section 1 Alternative 2 and Section 2 Alternatives 1 to 3 will pass through the south side of the property in proximity to built heritage resources, directly impacting the agricultural landscape.	▪ A CHER is recommended to be completed prior to selection of the Recommended Plan to determine whether the property possesses CHVI. If the property has CHVI, an HIA should also be completed to evaluate alternatives, assess potential impacts to the resource, and recommend appropriate mitigation measures.
BHR 9	318 Lake Road	Section 3 Alternative 1 – Crandall Road Alternative 1 Section 3 Alternative 1 – Crandall Road Alternative 3 Section 3 Alternative 2 – Crandall Road Alternatives 2 and 3 Section 3 Alternative 3 – Crandall Road Alternatives 2 and 3 Lake Road Alternative 3	▪ Potential impact. ▪ Rationale: The proposed Section 3 Alternative 1 –Crandall Road Alternatives 1 and 3, Section 3 Alternative 2 – Crandall Road Alternatives 2 and 3, Section 3 Alternative 3 – Crandall Road Alternatives 2 and 3, and Lake Road Alternative 3 will pass directly through the residential property at 318 Lake Road, resulting in a direct impact.	▪ A CHER is recommended to be completed prior to selection of the Recommended Plan to determine whether the property possesses CHVI. If the property has CHVI, an HIA should also be completed to evaluate alternatives, assess potential impacts to the resource, and recommend appropriate mitigation measures.
BHR 10	14835 Telephone Road	Section 5 Alternative 3 Section 5 Alternative 4	▪ Potential impact.	▪ Where feasible, the Recommended Plan should be designed in a manner requiring as little property acquisition as possible.

Resource	Address / Location	Impacting Alternative	Discussion of Impact	Mitigation Strategies
			▪ Rationale: The Highway 401 widening proposed in Section 5 Alternatives 3 and 4 may result in minor property acquisition along the south edge of 14835 Telephone Road. It does not appear that the property taking will result in any impacts to built heritage resources or significant landscape features. Although this intervention will not significantly alter the landscape, it will result in direct impacts to the property parcel.	Storage and construction staging areas should be located as close to the grading limits as possible.
BHR 11	15097 Telephone Road	None	▪ No impact. ▪ Rationale: No work is proposed on or adjacent to the property at 15097 Telephone Road as part of this EA.	▪ N/A

Based on the results of this assessment, 18 CHLs and 5 BHRs will be directly impacted by the proposed short-listed alternatives for the Project. In addition, there may be indirect impacts to one CHL and one BHR given the proximity of construction activities. As such, the recommendations are as follows:

- When determining the Recommended Plan, consideration should be given to design that directly and indirectly impacts as few BHRs and CHLs as is feasible. Alternatives should be selected that require as little property acquisition as possible.
- Storage and construction staging areas should be appropriately located and/or planned to avoid impacting any of the identified BHRs and CHLs.
- A CHER should be completed for CHL 11 (439 Crandall Road), CHL 16 (12 McDonald Road), CHL 25 (638 County Road 26), BHR 8 (389 Crandall Road), and BHR 9 (318 Lake Road) prior to the determination of the Recommended Plan as an appropriate mitigation measure to establish whether the properties possess Cultural Heritage Value or Interest (CHVI) (Cultural Heritage Evaluation Reports (CHERs) are further discussed in **Section 8.3.2.1** below). If a property is found to possess CHVI, a Heritage Impact Assessment (HIA) should also be completed during Preliminary Design to determine appropriate alternatives or mitigation measures early in the Project.
- Given the immediate adjacency of CHL 16 and BHR 2 to the grading limits, mitigation measures should be undertaken during construction planning to ensure that indirect impacts, such as vibrations, or the proximity of construction equipment, do not damage the properties. If necessary, construction fencing should be erected around property boundaries to ensure they are not damaged by any construction machinery or vehicles.
- The rural cross-sections of CHL 5, CHL 6, CHL 9, CHL 12, CHL 14, CHL 15, and CHL 24 should be maintained to ensure new construction is consistent with the rural character of the roadscapes.
- Where construction is anticipated to result in grading impacts and tree removal, post-construction landscaping with native tree species should be employed to mitigate visual impacts to CHL 3 to CHL 5, CHL 7, CHL 9, CHL 12, CHL 14, CHL 15, CHL 16, CHL 18, CHL 19, CHL 23, CHL 24, BHR 2 and CHR 10.
- Should future work require an expansion or alteration of the Study Area, the additional area or change should be studied by a qualified heritage professional to confirm the impacts of the proposed work on potential BHRs and CHLs.

8.3.2.1 Cultural Heritage Evaluation Reports

As noted in the previous section, CHERs were completed for 5 properties: 439 Crandall Road (CHL 11), 12 McDonald Road (CHL 16), 638 County Road 26 (CHL 25), 389 Crandall Road (BHR 8), and 318 Lake Road (BHR 9). 638 County Road 26 (CHL 25) was identified to have CHVI and an HIA should be completed for this property.

8.4 Technical Considerations

8.4.1 Structures

For technical considerations regarding structures refer to, **Section 7.4**.

Additional foundation investigation and field testing will be required for the Detail Design of the structures. Structural design of the proposed retaining walls, identified on the Recommended Plan in **Appendix A**, will be required in Detail Design.

8.4.2 Drainage and Stormwater Management

For technical considerations regarding drainage and stormwater management, refer to **Section 7.2**.

8.4.3 Geotechnical and Foundations

For technical considerations regarding foundations, refer to **Section 7.4.5** and **Section 7.6**.

During the Detail Design phase, additional site investigations and field testing will be required. Additional subsurface investigation is recommended to be carried out during Detail Design to confirm the subsurface soil and groundwater conditions the piers as well as for any retaining walls that may be incorporated adjacent to the abutments.

For the proposed retaining walls, identified on the Recommended Plan in **Appendix A**, soils and foundations investigations will be required.

Additional pavement design investigations will be required in Detail Design.

8.4.4 Illumination

The illumination warrant for the Study Area from the west project limits (0.8 km east of Percy Street) to just west of County Road 30 has not been met and as such no illumination is recommended for this section of Highway 401.

The warrants analysis for the full lighting of the east section resulted in an “optional“ lighting warrant. However, since the full illumination warrant is optional, the implementation of these warrants will be further reviewed by MTO against the availability of funds, and other priorities, when the widening of the highway occurs in the future.

8.4.5 Utilities

For technical considerations regarding utilities, refer to **Section 7.8**.

The following utilities are located within the Study Area: Enbridge Gas, Hydro One, and Bell and Cogeco has proposed infrastructure under the Highway 401 just west of Lake Road. Consultation with impacted local utility providers will be continued during Detail Design to confirm the location/type of utility, the potential project impact, and mitigation and/or utility relocation.

8.4.6 Property Impacts

Property is required to accommodate the proposed improvements. Property requirements are further detailed in **Section 7.11** and in the Preliminary Design Plates included in **Appendix A**. The study aimed to minimize property requirements were possible and as a result, grading modifications and toe/retaining walls are proposed at several locations.

Temporary access to properties and Temporary Limited Interests (TLIs) may be required to accommodate certain construction activities, for example to build retaining walls. Temporary requirements cannot be accurately determined at the preliminary design stage, and thus will be developed and confirmed during the Detail Design phase.

Negotiations with property owners will be carried out by the MTO Property Section to negotiate the acquisition or temporary use of property prior to tendering the project for construction.

8.4.7 Construction Staging

For technical considerations regarding construction staging, refer to **Section 7.9**. The construction staging plan has aimed to minimize traffic impacts during construction, traffic disruption and closures of the crossing roads are anticipated. A final construction staging plan will be developed during the Detail Design phase, during which MTO will further consult with key stakeholders (including Northumberland County, Townships of Cramahe and Brighton and the City of Quinte West) to further quantify the impacts of the construction staging and confirm mitigation measures.

The demolition of the existing underpasses will require both directions of Highway 401 traffic to be detoured via the existing Emergency Detour Routes (EDRs) as shown in **Section 7.9.2**. Further consultation with Northumberland County, Townships of Cramahe and Brighton and the City of Quinte West will be required during Detail Design to coordinate the closures with any local construction projects and events.

Herley Road, Lake Road and County Road 26 will be closed during the construction of the new Underpasses at Highway 401. Herley Road and Lake Road are not to be closed at the same time. Consultation with Northumberland County and the Townships of Cramahe and Brighton as well as the local emergency services will be required in Detail Design to confirm the closure timings and detour routes. Additionally, it is recommended that in Detail Design innovative solutions (such as rapid bridge replacement) be reviewed to reduce the closure times of the crossing roads as much as possible.

Overall, all transportation (motorists, cyclists and pedestrians) may experience delays and disruption during construction. Advisory signage of detours and advance signing of construction zones is recommended.

8.4.8 Emergency Vehicle Response

Temporary impacts to the Highway 401 and local roadways during construction may affect emergency service routes. Emergency services will be further consulted in the Detail Design phase to discuss potential impacts and communication protocols. While the construction staging of the Highway 401 improvements may impact routes/travel times, connectivity to the provincial network will not be altered by the proposed improvements.

8.5 Summary of Identified Concerns and Proposed Mitigation / Commitments to Future Work

Exhibit 8-15: Summary of Identified Concerns and Mitigation, and Commitment to Future Work

LEGEND	
MTO: Ministry of Transportation	MCM: Ministry of Citizenship and Multiculturalism
MNRF: Ministry of Natural Resources and Forestry	MUN: Municipality of Brighton, Township of Cramahe, Northumberland County
MECP: Ministry of the Environment, Conservation and Parks	ES: Emergency Service Providers
DFO: Department of Fisheries and Oceans, Canada	UTIL: Utilities

ENVIRONMENTAL ISSUE/CONCERN	AGENCIES	PROPOSED MITIGATION / COMMITMENTS TO FUTURE WORK
Vegetation (See Section 8.1.1 for further details)		
▪ Encroachment of the new ROW limits on both sides of Highway 401 ▪ Removals will directly impact the edge of woodlands and habitat of Butternut, adjacent wetlands and vegetation within the Brighton Provincial Wildlife Area ANSI ▪ Removal or disturbance of cultural roadside vegetation ▪ Vegetation removal is planned to occur within various vegetation communities / treed habitat. These removals will create new woodland edge, which may result in negative impacts on retained woodlands. ▪ No other further direct impacts to rare or sensitive flora species are expected. ▪ No rare vegetation community types are present within or adjacent to the ROW. ▪ The majority of the vegetation removal will occur directly at the edge and thus creates a minimal impact. ▪ Invasive Common Reed was found within marsh drainage ditches (MAMM1-12). Disturbance to this community type is expected with grading activities adjacent to culverts. There is a high risk of spreading this invasive species to other wetland communities if machinery or workers are allowed to enter these areas.	MTO MECP MNRF	▪ Minimize the extent of vegetation removal and damage within construction access, work and staging areas, particularly adjacent to woodland or wetland habitat. These areas will be clearly identified in the Contract documents, and then delineated in the field using erosion and sediment control fencing. Erosion and sediment control fencing will be maintained throughout the construction period. ▪ Re-stabilize and re-vegetate exposed soil surfaces as soon as possible, using native seed mixes where possible. Native seed mixes to be appropriate to site conditions. ▪ Plant shrubs and trees at new forest edge where tree removal has occurred. ▪ Ensure that machinery arrives on site in a clean condition and is maintained free of invasive species and noxious weeds. ▪ Conduct vehicle maintenance and fueling at the designated and properly contained maintenance areas in the works yards or at commercial garages located well away from retained vegetation areas. Commitments to Future Work: ▪ At Detail Design complete vegetation surveys of properties that were not accessible for this preliminary design study. Surveys to include ELC and species composition and to identify any SAR plant species. ▪ Re-stabilize and re-vegetate exposed soil surfaces as soon as possible, using native seed mixes where possible. Native seed mixes to be appropriate to site conditions. ▪ Investigate opportunity to plant shrubs and trees where new forest edge has been created. The purpose of the plantings would be to minimize effects such as wind exposure, drying forest soils that could extend into the forest. Planting species will be native to the region, and planting species and location of plantings will be determined during Detail Design.
Wildlife and Wildlife Habitat (See Section 8.1.2 for further details)		
Direct Impacts: ▪ The largest areas of vegetation removal include cultural meadow (CUM1-1), cultural thicket (CUT) cultural woodland (CUW) and cultural plantation (CUP) communities which are primarily composed of introduced species or non-native weed species. ▪ Moderate impact to wildlife mortality during construction, particularly during vegetation removal and grubbing. ▪ Minimal impacts to wildlife movement opportunities. ▪ Low impacts to habitat SAR wildlife. ▪ Low impacts to habitat for area-sensitive birds	MTO MECP MNRF	*Migratory Bird Convention Act* (MBCA): ▪ Ensure that timing constraints are applied to avoid vegetation clearing (including grubbing and removal of trees, shrubs, plants, grasses and brush piles) and construction during the breeding bird season (April 1 to August 31). It should be noted that occasionally bird species will precede (e.g., mid-March) or exceed (e.g., September) the approximate breeding bird season window. ▪ The Contractor shall not destroy active nests (nests with eggs or young birds) of protected migratory birds. If active bird nests are encountered, the Contract Administrator must be contacted. ▪ If a nesting migratory bird is identified within or adjacent to the construction site and the construction activities are such that continuing construction in that area would result in a contravention of the MBCA all activities will stop and the Contract Administrator will contact the MTO Environmental Planner to discuss mitigation options.

ENVIRONMENTAL ISSUE/CONCERN	AGENCIES	PROPOSED MITIGATION / COMMITMENTS TO FUTURE WORK
▪ Low impact to Pileated Woodpecker nest cavity trees. Indirect Impacts: ▪ Construction-related impacts – generally limited to temporary disturbances to edge habitats during construction such as noise-related effects to wildlife inhabiting adjacent lands. Potential for sedimentation and contamination are addressed by ESC measures. ▪ Hydrology impacts – potential impacts to retained wetland habitats as the result of culvert replacement should have no significant hydrological changes that may impact wildlife habitat (e.g. amphibian breeding in wetlands).		Other Wildlife: ▪ No removal of a Schedule 1 (MBCA) bird nest and associated vegetation/structure that it is found in ▪ Wildlife incidentally encountered during construction shall not knowingly be harmed and shall be allowed to move away from the construction area on its own. ▪ In the event that an animal encountered during construction does not move from the construction zone and construction activities are such that continuing construction in the area would result in harm to the animal, all activities that could potentially harm the animal will cease immediately and the Contract Administrator will be notified. ▪ In the event that an injured animal is encountered in the construction zone, all activities that could potentially harm the animal will cease immediately and the Contract Administrator will be notified. The Contract Administrator will immediately contact a Wildlife Custodian (authorized under the Fish and Wildlife Conservation Act) to provide care for the animal. A list of authorized Wildlife Custodians, their locations and their specialties is available at https://www.ontario.ca/page/find-wildlife-rehabilitator. Wildlife Passage and Wildlife Enhancement Opportunities: ▪ Installing rock piles, logs and stumps to provide cover, nesting and basking habitat for snakes and small mammals. ▪ Supplemental planting / seeding of native vegetation, specifically vegetation that attracts wildlife (e.g., milkweed for Monarch and berry-producing shrubs for forage [e.g., serviceberries, elderberry, nannyberry, sumac, dogwood, etc.]). ▪ Construction of turtle nesting habitat away from the highway at suitable locations to reduce the use of the highway shoulder as a nesting habitat. Commitments to Future Work: ▪ Conduct survey of woodland habitat in areas that are identified for tree removal to identify the presence of Pileated Woodpecker nest cavity trees and other locations where the project may impact the nesting habitat of other Schedule 1 species. ▪ Conduct breeding bird surveys in locations where access to property was not granted at the time of this preliminary design study. ▪ Review opportunities for improving wildlife passage through replaced structural culverts. This would relate to turtles and medium size mammals. Also examine opportunities for installing directional fencing in the local area of new structural culverts.
Species at Risk (See Section 8.1.3 for further details)		
▪ Three (3) potential Butternuts (Endangered) may be impacted. ▪ No other SAR flora were observed within the project limits. ▪ Four (4) Barn Swallows (Special Concern) may be impacted – there is potential for the proposed works to impact nesting habitat for Barn Swallow if nests are built within the structural culverts proposed for rehabilitation during the year of construction. ▪ Evidence of 'possible' breeding as two (2) Eastern Meadowlark (Threatened) males were observed singing in suitable habitat on adjacent properties, outside of the Study Area. There are five (5) properties with potentially suitable grassland habitat where the construction footprint and/or the ultimate MTO ROW encroaches into the habitat. ▪ Evidence of 'possible' breeding as two (2) Eastern Wood-pewee (Special Concern) males were observed singing in suitable habitat. The majority of suitable woodlands such as Brighton Provincial Wildlife Area will be retained with only minor edge removals. No impacts are anticipated to this species with the implementation of timing windows for tree removals (i.e., no removals during the breeding bird season April 1 to August 31). ▪ Four (4) Monarchs (Special Concern) were recorded foraging throughout the Study Area. Suitable Monarch habitat will be removed within the ROW,	MTO MECP MNRF	SAR Generally: ▪ Awareness and Encounter protocols will be implemented within the Contract documents and specifications to identify the potential for SAR to be encountered during construction and the procedures to be followed in the event of an encounter. All on-site personnel must be made aware of the potential presence of SAR and the protection afforded under the ESA 2007 and SARA 2002, prior to conducting any work on the site. ▪ In the event that a SAR or possible SAR encountered during construction does not move from the construction zone and construction activities are such that continuing construction in the area would result in harm to the animal, all activities that could potentially harm the animal will cease immediately and the Contract Administrator will be notified. The Contract Administrator or Environmental Inspector will then contact the MTO Environmental Planner for direction, as these animals are protected under the ESA (2007) and SARA (2002). ▪ All disturbed areas will be restored to pre-construction conditions. SAR Vegetation: ▪ In accordance with the regulations of Ontario's ESA (2007), O. Reg. 230/08A, any potential Butternuts observed must be assessed to determine whether the trees are hybrids or pure Butternuts. ▪ A Butternut Health Assessment (BHA) is to be conducted for the one tree in the Brighton Provincial Wildlife Area may be impacted by the proposed works. The Butternut Health Expert (BHE) report must be submitted to the MECP for approval. SAR Insects:

ENVIRONMENTAL ISSUE/CONCERN	AGENCIES	PROPOSED MITIGATION / COMMITMENTS TO FUTURE WORK
however other suitable habitat will remain as well as other surrounding habitats where milkweed occurs. ▪ One (1) adult Snapping Turtle (Special Concern) was observed dead on the westbound highway shoulder north of Little Lake. There is potential habitat present along the adjacent tributaries and wetlands. These aquatic habitats will be retained. There is potential for Snapping Turtle encounters during construction in terrestrial areas adjacent to wetlands and watercourses, especially during the nesting season. In-water works have the potential to impact hibernating turtles, depending on the timing of works. ▪ There is moderate to high potential for an additional 10 SAR fauna to occur within the project limits and be impacted by the proposed works. There will be tree removals and encroachment within four (4) forested habitats. These areas have potential bat habitat, which may result in the loss of bat maternity habitat and result in harm or mortality of adult bats and their young. Removal of trees may also impact SAR bird nests and young. Impacts to bats and birds can be mitigated through timing windows for tree removals.		▪ Restore disturbed meadow areas using Native Grass and Forb Mix – Well Drained. This seed mix contains Common Milkweed which supports Monarch breeding. SAR Birds: ▪ Adhere to mitigation measures for MBCA compliance to avoid impacts to SAR bird species potentially nesting in the work area or vicinity (i.e., Barn Swallow, Eastern Meadowlark, Eastern Wood-pewee, Red-headed Woodpecker, Wood Thrush) ▪ If a Barn Swallow nest is encountered in a structure which occurs within proximity to the work zone, a 10 m buffer will be implemented around the structure to avoid harassment to Barn Swallows until the young have fully fledged or the nest is no longer active (to be determined by a qualified avian biologist) SAR Bats: ▪ No tree removals shall be completed during the bat breeding season (i.e., April 1 to September 30) SAR Turtles: ▪ In order to prevent SAR turtles from entering the construction zone, temporary exclusion fencing should be installed to isolate the work areas adjacent to wetlands and watercourses prior to the start of construction. Locations include: C3 Little Lake Tributary and the large Cattail Mineral Shallow Marsh east of Cochrane Road. Fencing should be paige-wire backed and follow the OMNR Best Practices Technical Guide for Reptile and Amphibian Exclusion Fencing (https://www.ontario.ca/page/reptile-and-amphibian-exclusion-fencing). Temporary exclusion fencing can be combined with erosion and sediment control fencing, following the OMNR Best Practices Technical Guide ▪ In the event that a SAR turtle is encountered while nesting, all activities within 30 m shall cease until the turtle has finished nesting and left the area on its own accord (this may take several hours). Any SAR turtle nests laid within the construction zone shall be protected with a 10 m buffer and an MNRF authorized local wildlife rehabilitator shall be contacted immediately (https://www.ontario.ca/page/find-wildlife-rehabilitator) to relocate the nest to a suitable location outside the construction zone or collect the nest for ex situ incubation under an approved permit. Commitments to Future Work: ▪ A review of updated SAR lists (under SARA and SARO), SAR guidelines and policies, and additional agency consultation will be required at Detail Design to confirm SAR approvals and mitigation requirements. ▪ Conduct species specific surveys for Eastern Meadowlark/Bobolink in areas identified as potential habitat and where highway widening will result in the removal of habitat. ▪ Conduct survey of woodland habitat in areas that are identified for tree removal to identify the presence of snag trees that could be used as maternity roost habitat for SAR bats and any potential areas that could be used by Eastern Small-footed Bat. MTO to identify the requirement for acoustic surveys of any locations where a density of snag trees are found that would warrant further survey. ▪ Conduct survey of suitable woodland habitat for the presence of Butternut in areas that were not accessible during the preliminary design study. The extent of the survey should be based on identification of the 25 m critical root zone of a tree. ▪ Conduct a Butternut Health Assessment for the tree found in the area of the Brighton Provincial Wildlife Area and for any additional trees found in the Detail Design study.
Fish and Fish Habitat (see Section 8.1.4 for further details)		
▪ There are a number of watercourse crossings within the Study Area that support fish either directly or indirectly through conveyance of nutrient and allochthonous inputs to a receiving watercourse that supports fish downstream. As such, the proposed works for the highway widening through the study limits have the potential to impact fish and fish habitat through alteration of habitat structure and cover. ▪ Longer culverts (either through extensions or replacements) will result in additional enclosure of channel and fish habitat, reducing solar and	MTO MECP DFO	▪ Refer to **Section 8.1.4.2**, specifically **Exhibit 8-1** to **Exhibit 8-3**, for Design Consideration Tables that identify the project-specific design considerations. Mitigation Measures: ▪ Shorter culvert lengths minimize the impact of solar inputs to the channel. Shorter culverts should be designed, where feasible, using head and/or wingwalls.

ENVIRONMENTAL ISSUE/CONCERN	AGENCIES	PROPOSED MITIGATION / COMMITMENTS TO FUTURE WORK
allochthonous inputs to the channel, potentially impacting fish habitat and use of the habitat for the life cycle functions it supports. ▪ Culvert extensions and longer culverts have the potential to result in increases in velocity through the corridor that may impact fish use and passage through the crossing unless properly designed. ▪ Installation of rock scour protection will result in a change in the substrates and habitat supporting fish, transitioning the channel sections into and out of the culvert, and altering potential food sources. ▪ Temporary diversion channels and by-pass pumping have the potential to temporarily impact fish passage and access to habitat upstream of the highway, as well as increase potential for sediment release to the receiving watercourse/body. ▪ Due to proximity to the widened lanes, and to avoid tight angles into and out of the highway corridor, some channel section may require realignment. These realigned sections will provide limited fish habitat until they are established, and the benthic organisms recolonize, and also increase the potential for sediment release to the receiving watercourse/body downstream.		▪ Maintaining a median opening through the corridor either through use of headwalls/wingwalls, culvert beveling or steeper embankment grades. These options will maintain some day-lighting through the longer culverts that will encourage fish passage through the corridor. The median openings should provide some rest area (pools) for fish that are using the culvert for migratory purposes. ▪ Transitioning the new culvert ends with embedded rock scour protection when possible. The embedded scour protection will provide substrate diversity that will attract benthic macroinvertebrates as a food source but will also protect against future erosion and scouring of the channel that could impact fish passage though creation of perched culverts or barriers. ▪ Existing perched culverts will be replaced with new culverts that are properly embedded and transitioned smoothly with the adjacent channel features to address existing fish passage issues and ensure new issues do not form. ▪ Existing eroded banks within the highway corridor will be addressed through redesign of the flow direction, enclosed within the longer culverts, or protected with rock scour protection/bank armouring. ▪ Diversion channels will be considered for use during culvert replacement works to ensure that fish passage and access to habitat upstream of the crossing is maintained throughout construction. Diversion channels will be designed using natural channel design principles to mimic habitat conditions in the existing channel to minimize impacts on fish habitat and use during construction. ▪ The angle at which the channel is entering and leaving the highway corridor will be designed to ensure that there are no concerns for erosion or scouring of culvert ends and banks. If required, minor channel modifications will be designed to smoothly transition flows into and out of the highway corridor that avoids impacts to the adjacent bed and banks. If the alignment cannot be addressed, then bank protection measures (embedded rock) will be considered to avoid exacerbating erosion concerns that would impact downstream habitat (i.e., bury spawning areas). ▪ The new and replacement culverts will all be designed generally using MTO's WC-12 water crossing standard to avoid impacts to flows and fish passage through the corridor. The culverts will be sized to support the needed hydraulic capacity while also maintaining a velocity suitable for the target fish swim speeds. The culvert capacity will consider the need for low flow channels that will help confine flows to a smaller area to promote fish passage during lower flow events, and the substrates used in the low flow channel design will be sized to stay in place for designed flows. Each replacement culvert will be embedded to address future scour potential, and transition smoothly with adjacent channel sections. Commitments to Future Work: ▪ If substantial channel realignments and channel tie-ins beyond MTO's ROW are necessary at the watercourse crossings that support fish, it would be anticipated that a Request for Review (RfR) be required to identify next steps for Fisheries Act Authorization. It is unknown at this time whether or not an Authorization will be required as it is dependent on the finalization of the proposed works and impacts to fish and fish habitat. Impact assessments will be completed during Detail Design.
Erosion and Sediment Control (See Section 8.1.5 for further details)		
▪ Construction activities may result in sediment-laden runoff entering watercourses, private property or other sensitive areas.	MTO MECP MNRF	▪ General measures such as erosion control blankets, silt fence barriers, rock flow checks and quickly treating exposed earth surfaces and stabilizing cover material (seed and mulch, sod, etc.) are governed by special provisions (i.e. Ontario Provincial Standard Specification (OPSS) 805), which will be specified and refined in relation to the site conditions and construction requirements during the Detail Design phase. ▪ The Contractor should use dust control strategies to minimize wind-blown dust. Special care is recommended to minimize disturbance to private properties, including but not limited to tree protection, protecting any buildings or structures, driveways, lawns, gardens, buried utilities and using safety fencing to isolate the work area. ▪ All erosion and sediment control measures are to be inspected and maintained by the Contractor to ensure they are functioning as intended throughout the construction period and until such time that construction is complete and disturbed areas have been stabilized. ▪ All erosion and sediment control measures that are failing must be repaired / replaced by the Contractor as soon as possible as identified in OPSS 182 and OPSS 805. ▪ All erosion and sediment control measures that are non-biodegradable should be removed from the site when work is complete and the site is stabilized.

ENVIRONMENTAL ISSUE/CONCERN	AGENCIES	PROPOSED MITIGATION / COMMITMENTS TO FUTURE WORK
		▪ Provided that the Contractor's Best Management Practices (BMPs) for erosion and sediment control are maintained and meet or exceed the requirements in the Ontario Provincial Standard Specifications (OPSS) listed and described above, this project can be completed with lower risk of environmental damage, with respect to erosion and sediment control (ESC). Recommended Best Management Practices: ▪ Based on the assessment of the Study Area and the anticipated work to be completed, WSP recommends as a minimum following the Ontario Provincial Standards Specifications (OPSSs) for erosion and sediment control during construction. Refer to **Appendix S** for a list of recommended OPSSs and Ontario Provincial Standard Drawings (OPSDs). Commitments to Future Work: It is recommended that a qualified terrestrial ecologist and aquatic biologist evaluate the erosion and sediment control plan in Detail Design and determine if additional measures are needed for wildlife protection. Further evaluations are required as follows: ▪ Identify areas where temporary wildlife exclusion fencing is needed, with respect to species of concern, along with recommended or required wildlife exclusion strategies. ▪ Specific measures and activities needed to search for and rescue any SARs or other species of concern from work areas, along with strategies to exclude them from the work area throughout the construction program and restore their habitat post-construction. ▪ With respect to any work in designated wetlands, a qualified geomorphologist, ecologist, and aquatic biologist, should be retained to develop watercourse restoration plans and / or creek realignments as necessary, and provide oversight during construction; and ▪ All erosion and sediment control measures are to be inspected and maintained by the Contractor to ensure they are functioning as intended throughout the construction period and until such time that disturbed areas have been stabilized. All erosion and sediment control measures that are failing must be repaired / replaced by the Contractor as soon as possible as identified in OPSS 182 and OPSS 805. All erosion and sediment control measures that are non-biodegradable should be removed from the site when work is complete, and the site is stabilized. ▪ Erosion and Sediment Control Plan Approach: Given the high consequences of adverse effects of uncontrolled erosion and resultant sedimentation due to the close proximity to numerous waterbodies, watercourses, and wetlands, including Provincially Significant Wetlands, WSP recommends a Two-Part Main and Supplemental Erosion and Sediment Control Plan be completed prior to construction. This requires the consultant to prepare drawings, a Non-Standard Special Provision, and a technical memo. The contractor is required to prepare a supplemental ESCP to address construction methods. This approach is recommended as it incorporates the contractor's thought and preparation of a supplemental ESCP prior to the start of construction and during Detail Design.
Management of Excess Material (See Section 8.1.6 for further details)		
▪ Excess materials may be encountered during construction and require proper management/disposal. ▪ Property contamination may be encountered during construction and require proper management/disposal.	MTO MECP	▪ Surplus materials will be generated during construction, such as old pavement, guardrail materials, and concrete. These materials will be sorted and either reused if feasible, recycled, or disposed of at an approved landfill facility in accordance with OPSS 180. ▪ Standard mitigation will be used for dust control during construction.
Drainage and Stormwater (See Section 8.1.7 for further details)		
▪ Potential impacts on drainage and surface water	MTO MECP MNRF	▪ A Drainage and Stormwater Management Plan was prepared for the Recommended Plan is summarized in **Section 7.2**. ▪ A stormwater management (SWM) strategy was developed for the Study Area based on the result of soil hydraulic conductivity testing and hydrologic modelling. The proposed SWM strategy consists of enhanced grassed swales, shields at the catch basins, and two infiltration ponds. ▪ It is understood that there is high potential for variability of soil conditions near the proposed infiltration pond locations. Therefore, additional geotechnical testing and surveys at the pond locations should be completed in subsequent design phases. SWM recommendations will need to be reviewed in the context of the information obtained at that time.
Groundwater (See Section 8.1.8 for further details)		

ENVIRONMENTAL ISSUE/CONCERN	AGENCIES	PROPOSED MITIGATION / COMMITMENTS TO FUTURE WORK
▪ Potential impacts on the groundwater quantity and quality.	MTO MECP	▪ The project will be required to be assessed during Detail Design when detailed construction information becomes available, to address the potential impacts of any construction period dewatering on groundwater and surface water resources. An EASR/PTTW may be required for some sections of the project due to presence of permeable soils and groundwater sensitivity, shallow water table, groundwater discharge areas, presence of wetlands and unserviced areas. If it is determined during Detail Design that an EASR/PTTW is required for water control, wetlands and areas with the groundwater discharge or shallow water levels should be evaluated in detail in a report supporting an EASR/PTTW application. ▪ All groundwater studies for an EASR/PTTW will be conducted in accordance with the MECP guidelines. ▪ It is recommended to solicit private properties to participate in water well surveys during Detail Design, to evaluate the sensitivity of these locations to construction activities once Detail Design information is available.
Fluvial Geomorphology (See Section 8.1.9 for further details)		
▪ Culvert replacements have potential to cause direct impacts to fish and fish habitat and require mitigation. ▪ The Biddy Creek channel falls outside the proposed crossing structure openings. Consequently, the width of the crossing structure openings need to be increased to accommodate the anticipated future alignment to the watercourse. As the proposed culverts are sized smaller than the meander belt, there is potential for erosion impacts. ▪ WSP completed a review of the preliminary culvert arrangements and noted that each of the proposed culvert locations have been shifted from the existing culvert locations and will require stream channel tie-ins.	MTO MECP MNRF DFO	▪ The timing window where work can occur should be limited to between July 1st to September 30th ; ▪ Design should avoid disturbing spawning areas; ▪ Natural channel design should be completed by a fluvial geomorphologist for the C3 and C6 culverts; and ▪ Culverts should be built on the same alignment as the existing culverts to avoid unnecessary realignments to tie the culverts into the channel, as well as limit widening of the watercourse. ▪ All four replacement culverts will also require additional topographic surveys at the Detail Design phase for existing and proposed channel inlet and outlet locations. This will be required to facilitate the incorporation of natural channel fluvial geomorphological features and erosion protection as appropriate in the connecting channel tie in design. Because the proposed culvert sizes are smaller than the calculated meander belt and slightly larger than the average bankfull width, erosion protection will be required at the culverts and must be added to the design drawings during Detail Design for review by a fluvial geomorphologist.
Air Quality (See Section 8.1.10 for further details)		
▪ An air quality assessment study was undertaken which determined that significant impacts are not anticipated during operations.	MTO MECP	▪ There is no proposed mitigation required during Project operations except for regular road maintenance performed as part of normal operations for the MTO. ▪ To mitigate construction activities a Construction Air Quality Management Plan (CAQMP) should be developed to address construction equipment vehicle exhaust, potential traffic disruptions and congestion, fugitive dust, and odour. Potential mitigation measures that may be incorporated in the CAQMP include: ▪ Dust suppression measures (e.g., application of water wherever appropriate, or the use of approved non-chloride chemical dust suppressants, where the application of water is not suitable); ▪ Use of dump trucks with retractable covers for the transport of soils and other friable materials; ▪ Minimize the number of loadings and unloading of soils and other friable materials; ▪ Minimize drop heights, use enclosed chutes, and cover bins for debris associated with deconstruction of affected structures; ▪ Washing of equipment and/use of mud mats where practical at construction site exits to limit the migration of soil and dust off-site; ▪ Stockpiling of soil and other friable materials in locations that are less exposed to wind (e.g., protected from the wind by suitable barriers or wind fences/screens, or covered when long-term storage is required) and away from sensitive receptors to the extent possible; ▪ Reduction of unnecessary traffic and implementation of speed limits; ▪ Permanent stabilization of exposed soil areas with non-erodible material (e.g., stone or vegetation) as soon as practicably possible after construction in the affected area is completed; ▪ Ensuring that all construction vehicles, machinery, and equipment are equipped with current emission controls, which are in a state of good repair; and, ▪ Dust-generating activities should be minimized during conditions of high wind.
Landscape (See Section 8.2.1 for further details).		

ENVIRONMENTAL ISSUE/CONCERN	AGENCIES	PROPOSED MITIGATION / COMMITMENTS TO FUTURE WORK
▪ Alterations to landscape character and scenic integrity.	MTO	▪ Limit vegetation clearing and limit the size of the construction area and material staging to only what is needed. ▪ Keep the size of zones designated for brushing as small as possible, limiting them to the removal of only what is necessary for establishing clear sight lines. ▪ Locate construction access and staging areas in less sensitive areas and facilitate the regeneration of construction access and staging areas through active restoration plans. ▪ Clearly delineate ROW vegetation clearing zones and vegetation retention zones and protect vegetation that does not require removal for construction (e.g., using silt fencing or other temporary fencing) on both the Contract drawings and in the field with the Contractor prior to clearing and grading. Equipment, materials and other construction activities will not be permitted in vegetation retention zones. ▪ Carefully clear vegetation and trees designated for removal in accordance with OPSS 201 (Construction Specification for Clearing, Close Cut Clearing, Grubbing, and Removal of Surface and Piled Boulders). This includes felling trees into the ROW to minimize unnecessary disturbance beyond the ROW. ▪ Restrict vehicle maintenance and refueling to designated areas only. Refuelling shall be undertaken a minimum of 30 m from any watercourse and will be controlled to prevent any discharge of equipment fuels and fluids onto the ground. ▪ Protect against spills of contaminants, fuels and other potentially harmful materials that may reach natural areas. Machinery will arrive on site in a clean condition and will be maintained to prevent fluid leaks. ▪ Establish a Tree Protection Zone (TPZ) through the installation of tree protection fencing which follows standard arboricultural procedures (per OPSS 801). ▪ A Landscape Plan will be developed at the Detail Design phase to include all elements of landscape restoration, as appropriate. The Landscape Plan will include a tree inventory, general landscape recommendations, recommendation for the use of native species, and provide enough coverage to offset vegetation losses, if feasible. ▪ Further mitigation measures are outlined in **Appendix H**. ▪ Environmental monitoring/ inspection will be implemented throughout construction to ensure that environmental protection measures are implemented, maintained and repaired, and that remedial measures are initiated where warranted. Monitoring will include an Environmental Inspector to observe, inspect and ensuring proper installation and maintenance of mitigation measures noted above during construction and for a specified period of time following the completion of construction.
Noise (See Section 8.2.2 for further details)		
▪ No noise mitigation is warranted as per MTO Noise Guide Policy.	MTO MUN	▪ Where possible, major construction activities to be scheduled during daytime hours (i.e. 07:00 to 19:00), avoiding the nighttime period in the vicinity of receptors. It should be noted that the township of Brighton has municipal by-laws exempting construction noise, between the hours of 07:00 and 21:00 Monday to Saturday, as per Noise By-Law 118-2017 Section 3.1(e); therefore, the following should be considered: ▪ Although MTO is legally exempt from the requirements of municipal noise bylaws, where possible, avoid major noise generating construction between the nighttime hours of 21:00 to 07:00 in the vicinity of the receptors. ▪ Given that MTO is legally exempt from the requirements of municipal noise bylaws, MTO will no longer be applying for these exemptions. MTO recognizes the impacts that construction related noise can have on a community and will ensure clear communication with the municipality to work within the spirit of the municipal noise by-law. All reasonable attempts will be made including public notification and mitigation measures to reduce noise.
Contaminated Areas (See Section 8.2.3 for further details)		

ENVIRONMENTAL ISSUE/CONCERN	AGENCIES	PROPOSED MITIGATION / COMMITMENTS TO FUTURE WORK
▪ Five (5) areas of high potential for contamination and two (2) areas of moderate potential for contamination were identified in the Study Area.	MTO MECP	▪ **Property Acquisitions Environmental Due Diligence:** For the purpose of undertaking the future roadway construction, if property acquisitions are required within APECs with high potential for contamination, it is recommended that property Specific Phase One ESAs (and if necessary, Phase Two ESAs) be completed in such areas in support of the property acquisition. ▪ **Road Construction and Management of Surplus/Excess Soil:** Where possible, the reuse of excess soil within the Project Area should be incorporated into the detail design to minimize the need for off-site handling of material. In December 2019, the MECP filed O.Reg.406/19: On-Site and Excess Soil Management, which requires a notice to be filed on the Excess Soil Registry, if the following applies: i) The Project Area contains a current or historical Enhanced Investigation Property (definition as per *O.Reg.406/19*), unless a Record of Site Condition has been filed for the Enhanced Investigation Property, and no part of the project area has been used as an Enhanced Investigation Property since the filing of the Record of Site Condition. ii) Any part of the Project Area is within a Settlement Area (as per definition in the *Planning Act*) and the volume of soil to be removed from the Project Area is 2,000 m^3 or greater, unless the whole Project Area is currently, or most recently used, for residential, institutional, parkland or agricultural or other use (definition of land uses per *O.Reg.153/04*). iii) All or part of the Project Area is being remediated by excavating and removing excess soil from the project area for the purpose of reducing the concentration of contaminants on, in or under the project area, including remediating the project area for the purpose of filing a record of site condition. If a notice is required to be filed on the Excess Soil Registry, then the following excess soil reuse planning documents are to be completed, including the Assessment of Past Uses, Sampling and Analyses Plan, Soil Characterization Report, and Excess Soil Destination Assessment Report. Soil sampling is to be completed in accordance with Part I, Section B, 2, of the Rules for Soil Management and Excess Soil Quality Standards (MECP, 2020) (Ontario Soil Rules). Tracking of the soil movement is required as per Part I, Section B, 5 of the Ontario Soil Rules. Schedule 2 of O.Reg.406/19 details instances in which a project may be exempt from filing a notice. If a project is exempt from filing a notice, it is still recommended that soil sampling is completed on excess soil to be generated for due diligence purposes to document the condition of the soil prior to leaving the project area for proper management. If a project is exempt, hauling records are still required to be carried by haulers during transportation.
Designated Substances (See Section 8.2.4 for further details)		
▪ Results of sampling are provided in Exhibit 8-13.	MTO MECP	If future construction activities affect the integrity of materials containing arsenic, standard demolition dust control measures should be implemented where practical to ensure airborne dusts are controlled as per O. Reg. 490/09, as amended. In general, the following procedures are recommended if/when removing lead-containing materials, coatings and paint applications: ▪ Follow Type 1 – if the coating is to be removed with a chemical gel or paste; ▪ Follow Type 2a – if the coating is to be removed by scraping or sanding using non-powered hand tools, or manual demolition of lead-painted building components by striking with sledgehammer or similar tool; ▪ Follow Type 3a – if the coating is to be removed using power tools; or, ▪ Follow Type 3b – if the coating is to be removed by abrasive blasting. ▪ If lead-containing paint applications and surface coatings are not removed prior to demolition, ensure that demolition waste complies with the requirements of General – Waste Management Regulation, R.R.O. 1990, Regulation 347.
Climate Change (See Section 8.2.5 for further details)		
▪ Potential impacts related to climate change	MTO MECP	▪ All new drainage infrastructure (culverts, storm sewers, ditches, etc.) should be designed considering climate change impacts in the Detail Design phase. ▪ LED lighting will be used to reduce energy requirements.

ENVIRONMENTAL ISSUE/CONCERN	AGENCIES	PROPOSED MITIGATION / COMMITMENTS TO FUTURE WORK
Archaeology (See Section 8.3.1 for further details)		
▪ The Stage 1 Archaeological Assessment revealed evidence of intensive and extensive disturbance as well as identified areas requiring Stage 2 Archaeological assessments within the study corridor.	MTO MCM	▪ Recently ploughed agricultural fields must be subject to pedestrian survey at 5 m intervals as per Section 2.1.1 of the *Standards and Guidelines for Consultant Archaeologists* (2011). Prior to pedestrian survey, the field must be ploughed and weathered to allow for ideal conditions for the identification of archaeological resources. After ploughing, soil visibility must be at least 80% in order for pedestrian survey to proceed. ▪ Where ploughing is not possible, the property must be subject to test pit survey at 5 m intervals as per Section 2.1.2 of the *Standards and Guidelines for Consultant Archaeologists* (2011). This recommendation includes areas such as wood lots, bush lots, manicured lawns, and areas of scrub overgrowth. Test pit survey can be increased to 10 m intervals in areas of confirmed disturbance based on professional judgement. ▪ Orchards where the area between plants is less than 5 m can be subject to test pit survey at 5 m intervals. Orchards where are between plants is greater than 5 m can be subject to strip-ploughing. ▪ All lands that have been identified as disturbed or previously assessed require no further assessment. ▪ Should plans change to include areas outside of the current Study Area, additional archaeological assessment will be required. ▪ If archaeological materials are encountered during construction, they may constitute a new site and are therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the material must cease work immediately and a provincially licensed consultant archaeologist must assess the material's cultural heritage value or interest in accordance with Section 48 (1) of the *Ontario Heritage Act*.
Heritage Resources (See Section 8.3.2 for further details)		
▪ Potential for direct impacts, i.e., removal/demolition, with respect to cultural heritage resources as a result of the Recommended Plan. ▪ Potential for indirect impacts, i.e., disturbance, with respect to cultural heritage resources as a result of the Recommended Plan.	MTO MCM	▪ Storage and construction staging areas should be appropriately located and/or planned to avoid impacting any of the identified BHRs and CHLs. ▪ If a property is found to possess CHVI, an HIA should also be completed during Preliminary Design to determine appropriate alternatives or mitigation measures early in the Project. ▪ 638 County Road 26 (CHL 25) was identified to have CHVI and a Heritage Impact Assessment (HIA) should be completed for this property. ▪ Given the immediate adjacency of CHL 16 and BHR 2 to the grading limits, mitigation measures should be undertaken during construction planning to ensure that indirect impacts, such as vibrations, or the proximity of construction equipment, do not damage the properties. If necessary, construction fencing should be erected around property boundaries to ensure they are not damaged by any construction machinery or vehicles. ▪ Should future work require an expansion or alteration of the Study Area, the additional area or change should be studied by a qualified heritage professional to confirm the impacts of the proposed work on potential BHRs and CHLs.
Construction Staging (See Section 8.4.7 for further details)		
▪ Motorists may experience delays and disruption during construction.	MTO	▪ Adequate traffic planning measures, including signage to advise motorists of traffic delays and alternate routing will be considered to reduce any inconvenience and impacts during construction. ▪ Short term, off-peak closures may be required during some operations. ▪ A detailed construction staging plan will be developed during the Detail Design phase.
Emergency Vehicle Response (See Section 8.4.8 for further details)		
▪ Potential impacts to emergency services response times.	MTO MUN ES	▪ Mitigation measures to be developed in consultation with emergency service providers in the subsequent Detail Design phase to maintain appropriate emergency response times.
Illumination (See Section 8.4.4 for further details)		
▪ Potential for light spillage onto private properties and adjacent sensitive areas.	MTO	▪ The design of future lighting will consider a balance of road safety and environmental concerns. MTO is committed to minimizing glare and spill from highway luminaries.

ENVIRONMENTAL ISSUE/CONCERN	AGENCIES	PROPOSED MITIGATION / COMMITMENTS TO FUTURE WORK
Property and Access (See Section 8.4.6 for further details)		
▪ Property acquisition is required as a result of the proposed improvements. ▪ Potential for access interruptions.	MTO MECP Property Owner	▪ MTO will negotiate with individual property owners to provide fair market value for the required property. ▪ Access disruptions will be minimized during construction.
Utilities (See Section 8.4.5 for further details)		
▪ Disruptions to utilities. ▪ Impacts to/relocation of the existing utilities.	MTO UTL	▪ Impacts to/relocation of the existing utilities will occur through consultation with the affected utility providers in the subsequent Detail Design phase.

9.0 OTHER APPROVAL REQUIREMENTS

In addition to MTO Class EA approval, there are a number of other provincial, federal, municipal and utility approvals/permits required to implement the Recommended Plan.

A number of provincial approvals / endorsements from the following ministries and government agencies may be necessary for the Recommended Plan:

- Ministry of Natural Resources and Forestry
- Ministry of Citizenship and Multiculturalism
- Ministry of the Environment, Conservation and Parks
- Department of Fisheries Canada (DFO)
- Utility Providers

The approval requirements are documented below, which are categorized by the level of government.

9.1 Provincial

9.1.1 Ministry of Natural Resources and Forestry

If SAR or their regulated habitat are identified as impacted during the subsequent phases of the Environmental Assessment, there is the potential that permits/approvals or registration under the *Endangered Species Act* (ESA) will be required. Discussions with MNRF were initiated during the Preliminary Design. Responsibility for administration of the ESA has since been switched over to the MECP as of April 1, 2019. Therefore, consultation with MECP regarding ESA compliance will be required at the Detail Design phase.

9.1.2 Ministry of Citizenship and Multiculturalism

The Ministry of Citizenship and Multiculturalism (MCM) is the provincial regulatory agency responsible for built heritage, cultural landscapes, and archaeological resources in Ontario. Routinely, MCM participates in the review of all heritage and archaeological EA documentation and thereby provides comment on whether or not provincial concerns for heritage resources have been addressed in accordance with the *Ontario Heritage Act*.

All archaeological fieldwork undertaken to satisfy the conservation requirements tied to the EA process must be conducted by a consultant archaeologist holding a valid archaeological license issued by MCM under the *Ontario Heritage Act*. When no resources are identified, the assessment report is filed in the public registry. Once archaeological resources that may be disturbed by highway design investigations, construction, operation or maintenance have been identified and conserved, MCM may provide written notification of concurrence with recommendations and acknowledgement if resources are identified during the archaeological assessment.

9.1.3 Ministry of the Environment, Conservation and Parks

In accordance with the *Ontario Water Resources Act* (OWRA), an EASR/PTTW is required from the Ministry of the Environment, Conservation and Parks (MECP) if the diversion of surface water or the extraction of groundwater is excess of 50,000 litres per day (24 hours).

Localised groundwater areas of concern may exist within the Study Area. The location and depths of proposed structures should be reviewed against groundwater sensitivity in Detail Design to determine if the proposed works will result water takings; thus, triggering the need for an EASR/PTTW.

9.1.4 Compliance with Provincial Plans and Policies

In addition to requiring the preceding approvals, the following list of provincial plans were reviewed to determine the applicable policies and ensuring that the Recommended Plan conformed to the legislation. A total of four (4) plans were determined to be applicable:

- The *Planning Act* (2004)
- Provincial Policy Statement (2014)
- Growth Plan for the Greater Golden Horseshoe (2020)
- The *Clean Water Act* (2006)

Policies provide the policy framework that will shape and manage the forecasted growth in Northumberland County, and these policies were considered throughout the Class EA Study. No permits or approvals are anticipated to be required with respect to these plans and policies.

9.2 Municipal

As a provincial agency, typically MTO does not require municipal permits or approvals; however, MTO's policy is to adhere to the intent of specific municipal permit and approval requirements and submit applications for review and information.

It should be noted that MTO is legally exempt from the requirements of municipal noise bylaws and therefore no longer applies for these exemptions. MTO recognizes the impacts that construction related noise can have on a community and will ensure clear and frequent communication with the municipality to work within the spirit of the municipal noise by-law.

9.3 Utility Providers

Contact with potentially affected utility providers within the study corridor was initiated to acquire utility location information and identify potential conflicts between the location of utilities and the interchange improvements. During subsequent design phases, formal notification and consent will be obtained from relevant authorities

10.0 NEXT STEPS

Following the filing of the TESR and Environmental Clearance for utility relocation, right-of-way designation and property acquisition, MTO may proceed to the Detail Design phase as outlined in the MTO's *Class Environmental Assessment for Provincial Transportation Facilities* (2000).

10.1 Potential Changes during Detail Design

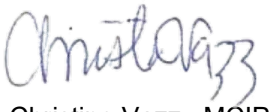
Detail Design refines the work completed during Preliminary Design and further develops that work to a more detailed level. While the intent of the work approved during Preliminary Design will not change, a Design and Construction Report (DCR) and/or other document, will be prepared during Detail Design to address all issues which were outstanding at the end of Preliminary Design and identified during Detail Design.

Any minor design modifications or refinements made by the Project Team, or that stem from discussions with agencies (such as regulatory agencies and local municipalities) made during Detail Design will be documented in

the DCR and/or other document. These refinements could result in environmental benefits or impacts that may not have been anticipated during Preliminary Design and documented in this TESR.

Signature Page

Nadia Dabagh
Environmental Planner, WSP Canada



Christine Vazz , MCIP, RPP
Senior Environmental Planner, WSP Canada

Rhonda George-Hiebert, P.Eng
Senior Project Manager, WSP Canada

Amanda Dickson
(A) Senior *Environmental Planner, MTO*

Darren Cizmar,P.Eng
Project Engineer, MTO

ND/CV/sp

wsp.com