NOVA SCOTIA DEPARTMENT OF PUBLIC WORKS
PROJECT NUMBER: 211-04152-00

HIGHWAY 101 CAMBRIDGE INTERCHANGE AND CONNECTOR ROADS EA

REGISTRATION DOCUMENT

APRIL 04, 2023

FINAL

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FINAL
PROJECT NO.: 211-04152-00
DATE: APRIL 04, 2023

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REVISION HISTORY

FIRST ISSUE

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REVISION 1

December 11, 2022	Second draft for client review			
Prepared by	Reviewed by	Approved By		
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REVISION 2

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Prepared by	Reviewed by	Approved By		
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REVISION 3

April 4, 2023	Final for EA Registration			
Prepared by	Reviewed by	Approved By		
Cody Pytlak, Ecologist	Daniel Edwards, EIA Specialist	Sean Cassidy, Director		

SIGNATURES

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4 April 2023
Date

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4 April 2023
Date

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4 April 2023
Date

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EXECUTIVE SUMMARY

Nova Scotia Department of Public Works (NSDPW) is proposing a new interchange and connector roads from Highway 101 to Trunk 1, located in Cambridge, Nova Scotia (the Project). The interchange will consist of a 2-kilometre (km) connector road south to Trunk 1, and a 1.6 km connector road north to Brooklyn Street. The proposed interchange and connector roads will improve access to the communities within the Cambridge, Nova Scotia (NS) area, including the Annapolis Valley First Nation (AVFN). Furthermore, the new interchange will provide a more direct connection to industrial and commercial businesses as well as residential areas and alleviate traffic by an estimated 20-25% at the neighbouring interchanges and along Trunk 1.

Highway 101 is part of the National Highway Core System. It is over 300 km in length and provides a direct link from the Halifax area to the Annapolis Valley, Municipality of the County of Kings (Kings County), and surrounding areas. It also acts as one of two main highway links between the Halifax Regional Municipality (HRM) and Yarmouth. It connects many communities within the region including Kentville, Coldbrook, and Berwick. Highway 101 is a two-lane highway with a posted speed limit of 100 kilometre per hour (km/h) featuring a rural cross-section and 2 metre (m) shoulders.

Clearing of the corridor may commence as early as 2023, in advance of construction which is pending funding availability and project approvals. Once construction begins, it is expected to take 3 years to complete.

The Cambridge Interchange will be a diamond interchange with four single-lane ramps, and a roundabout at each ramp intersection. The interchange will be located to the west of AVFN, and the south roundabout will provide a connection to the AVFN community. The north roundabout will have a connection north to Brooklyn Street. The interchange structure across Highway 101 will be built to accommodate future twinning on the north side of the highway.

The South Connector Road will be an access controlled, two-lane minor arterial roadway that runs for 2 km south, from the south roundabout to Trunk 1. The connector road will have 3.7 m lanes and 2.2 m shoulders, designed for a speed of 80 km/h, and posted with a speed limit of 70 km/h. A separated multi-purpose path will run parallel to the South Connector Road. The North Connector Road will be a two-lane collector roadway, coming off the north roundabout of the Cambridge Interchange and running northwards towards Brooklyn Street for 1.6 km. It will have 3.5 m lanes and 2.0 m shoulders, and will be designed for a speed of 80 km/h, and posted for a speed limit of 70 km/h.

Investing in the new construction of the Highway 101 Cambridge Interchange and Connector Roads Project will have broad public benefits and contribute to long-term prosperity of the area. The proposed interchange will provide the AVFN with a secondary access into their community, which was severed with the construction of Highway 101 in the 1970s. It will also allow additional land development near the municipal lands surrounding the existing wastewater treatment plant with easy access to the 100-Series Highway network.

The Project requires a Class 1 Environment Assessment (EA) under the NS Environmental Assessment Regulations (EA Regulations) as it is anticipated to disrupt a total of 2 hectares (ha) or more of any wetland.

NSDPW will obtain any required permits, approvals, or authorizations prior to construction. Relevant policies, such as the Nova Scotia Wetland Conservation Policy will be adhered to, and NSDPW will work with the Municipality of the County of Kings to meet any applicable municipal requirements. In addition, NSDPW has been, and will continue to consult with the Mi'kmaq under the Terms of Reference (TOR) for a Mi'kmaq-Nova Scotia-Canada Consultation Process.

Public consultation was completed through the development of a project website and soliciting community feedback. NSDPW has also engaged local stakeholders such as Kings County, Michelin Canada, and Kings Regional Rehabilitation Centre, at various points in the Project development, from conceptual design to present design. Since 2015, NSDPW has been collaborating with Indigenous Services Canada, Annapolis Valley First Nations and The County of Kings including the Mayor and Councillors (The Annapolis Valley Highway Planning Committee). Through the Annapolis Valley Highway Planning Committee these stakeholders have been actively involved in the planning and design stages of the project and had the opportunity to share comments and concerns from their respective communities.

First Nations consultation with AVFN and the Mi'kmaq of Nova Scotia was initiated in 2015 with a similar iteration of the Project. More recently, engagement with AVFN has been on-going with informal project meetings. The AVFN Chief and Council have been engaged on all aspects of the proposed Project and are represented on the Annapolis Valley Highway Planning Committee. Consultation with the Mi'kmaq of Nova Scotia will continue throughout Project implementation.

The EA evaluates the anticipated direct and indirect effects on Valued Environmental Components (VECs). VECs are components of the environment that have potential to be altered or affected by the Project and are of concern to municipal, provincial, and federal regulators, Mi'kmaq, the public, and project stakeholders.

The potential effects resulting from Project interactions with each VEC have been identified and assessed to determine the degree of impact. The assessment was based on quantitative and qualitative professional knowledge and data analysis and modeling. The eleven VECs evaluated within this EA comprise:

- Air Quality
- Acoustic Environment
- Groundwater
- Terrestrial Habitat and Vegetation
- Terrestrial Wildlife
- Avifauna
- Wetlands
- Fish and Fish Habitat
- Economy and Land Use
- Traditional Use of Land and Resources
- Archaeology and Heritage Resources

The effects assessment considered all activities associated with the preparation, construction, and operation and maintenance phases of the Project. The assessment also factored in potential effects that environmental conditions may have on the Project, as well as cumulative effects from the entirety of the Project. Mitigation measures and monitoring recommendations were prepared to address anticipated impacts and avoid or minimize adverse effects.

The assessment results anticipate that traffic generated greenhouse gas (GHG) emissions will decrease within the area due to the decrease in traffic idling once the Project is operational. Adverse effects to other VECs, such as noise, potential harm to wildlife, or sedimentation of surface water, can be avoided or limited through the implementation of standard mitigation measures or compensation. Construction and post-construction monitoring recommendations for several VECs are also recommended to ensure mitigation measures are properly implemented and maintained throughout the duration of the Project. Overall, no significant adverse effects are anticipated to occur as a result of the Project. Ultimately, it is expected that the Project will provide improved connectivity for the local community and contribute to long-term economic benefits.

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1 INTRODUCTION

Nova Scotia Department of Public Works (NSDPW) is proposing a new interchange and connector road from Highway 101 to Trunk 1 (Figure 1). The proposed interchange is located between Coldbrook and Berwick (Exits 14 and 15, respectively) in Cambridge, Nova Scotia, just west of the Annapolis Valley First Nation (AVFN). It will feature a 2 km section of connector road which extends in a southerly direction to Trunk 1, and a 1.6 km section of connector road which extends northerly to connect with Brooklyn Street. The connector road to Trunk 1 will be a controlled access minor arterial roadway owned by NSDPW, with a limited number of access points to adjacent lands. At Trunk 1, the new intersection will be constructed as a roundabout just east of County Home Road, with a new 600 m southerly connection to Waterville Mountain Road.

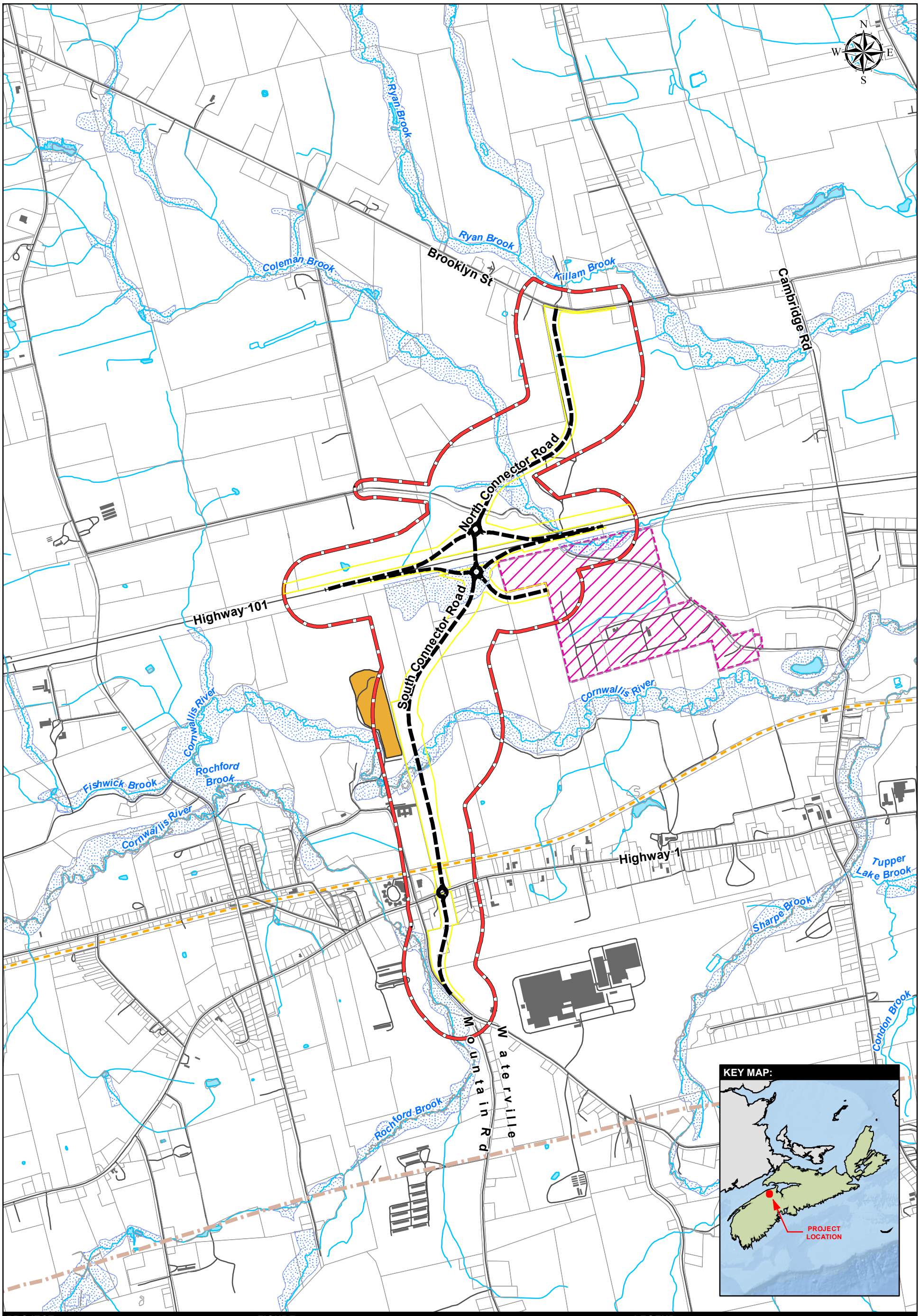
This Project meets the threshold of an 'undertaking' as defined by the Nova Scotia *Environment Act* and the *Environmental Assessment Regulations*. This document has been prepared following the requirements for the registration of a Class I Undertaking under the Environmental Assessment Regulations and applicable guidance documents such as Nova Scotia Environment and Climate Change's (NSECC) A Proponent's Guide to Environmental Assessment (NSE 2018).

1.1 IDENTIFICATION OF THE PROPONENT

The name, address, identification of the Proponent, and additional contact persons for the Environmental Assessment of the proposed undertaking are as follows:

Table 1-1 Project Proponent description and contact information

NAME OF PROJECT	PROJECT CONTACT
Name of Proponent	Nova Scotia Department of Public Works (NSDPW)
Address of Proponent	P.O. Box 186 Johnston Building, 1672 Granville Street Halifax, NS, B3J 2N2
Proponent Environmental Assessment Contact	Peter Fleming Hydrogeologist, Environmental Services, NSDPW P.O. Box 186 Johnston Building, 1672 Granville Street Halifax, NS, B3J 2N2 (902) 424-7262 Peter.Fleming@novascotia.ca
Proponent Executive Contact	Jason Rae Manager, Environmental Services, NSDPW P.O. Box 186 Johnston Building, 1672 Granville Street Halifax, NS, B3J 2N2 (902) 424-4725 Jason.Rae@novascotia.ca
Consultant Contact for the Environmental Assessment	Sean Cassidy WSP Canada Inc. 1 Spectacle Lake Drive Dartmouth, NS, B3B 1X7 (902) 835-9955 sean.cassidy@wsp.com



PROJECT:

PROJECT: **NOVA SCOTIA - HIGHWAY 101 CAMBRIDGE INTERCHANGE AND CONNECTOR ROADS EA KINGS COUNTY, NS**

PROJECT NO.: **211-04152**

CLIENT: NOVA SCOTIA

FIGURE:

TITLE: **PROJECT OVERVIEW**

FIGURE NO.: **1**

REVISION NO.: **0**

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DATUM: NAD 83 CSRS

PROJECTION: UTM ZONE 20 NORTH

DRAWN BY: C. PYTLAK

CHECKED BY: D. EDWARDS

CREATED DATE: (YYYY-MM-DD) 2022/01/25

REVISION DATE: (YYYY-MM-DD) 2023/03/07

LEGEND:

- LOCAL ASSESSMENT AREA
- PROJECT DEVELOPMENT AREA
- PROPOSED ALIGNMENT
- PROPERTY BOUNDARY
- ANNNAPOLIS VALLEY FIRST NATION
- WASTEWATER TREATMENT FACILITY
- BUILDINGS
- UTILITY LINES
- ROAD
- HARVEST MOON TRAIL
- WATERCOURSE
- WATERBODY
- WETLAND

SCALE: 1:20,000

0 300 600 1,200 Meters

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1.2 PURPOSE OF AND NEED FOR THE UNDERTAKING

Highway 101 is part of the National Highway Core System. It is over 300 km in length and provides a direct link from the Halifax area to the Annapolis Valley, Kings County, and surrounding areas. It also acts as one of two main highway links between the Halifax Regional Municipality (HRM) and Yarmouth. It connects many communities within the region including Kentville, Coldbrook and Berwick. Highway 101 is a two-lane highway with a posted speed limit of 100 km/h featuring a rural cross-section and 2 m shoulders.

Exit 14 (Trunk 1) and Exit 15 (Route 360) serve the communities in the area, as well as the industrial and commercial businesses located south of Highway 101, off Trunk 1 at Waterville Mountain Road. A 15 km stretch currently separates Exits 14 and 15, causing transport truck traffic heading to the Cambridge/Waterville area to use Trunk 1. Exit 14 in Coldbrook experiences significant congestion as a large portion of traffic exiting from Highway 101 East is destined for Trunk 1 West.

A new interchange and connector road to Trunk 1 will provide better network connectivity by alleviating the traffic along Trunk 1 by an estimated 20-25% (Crandall Engineering 2019). A large proportion of truck traffic will be diverted from Trunk 1 to the new interchange, including the existing 130 truck trips per day at Michelin and other future truck traffic growth related the Waterville Business Park. The reduction in truck traffic and general traffic on Trunk 1 will improve safety along the corridor, reduce delays at driveways and side streets, and reduce stress and deterioration to the Trunk 1 road structure. Traffic volumes at the Exit 14 interchange will reduce, resulting in improved operations at the signalized ramp terminals.

Investing in the new construction of the Highway 101 Cambridge Interchange and Connector Project will have broad public benefits and contribute to long-term prosperity of the area. The proposed interchange will provide the AVFN with a secondary access into their community, which was severed with the construction of Highway 101 in the 1970s. It will also allow additional land development near the municipal lands surrounding the existing wastewater treatment plant with easy access to the 100-Series Highway network.

1.3 REGULATORY OVERVIEW

Pursuant to the Nova Scotia *Environment Act* and *Environmental Assessment Regulations*, the Project requires a Class 1 provincial environmental assessment (EA), meeting the following criteria:

- An undertaking that disrupts a total of 2 ha or more of any wetland.

Provincial and federal legislation relevant to the Project have been identified in Table 1-2 and Table 1-3. Any permits, approvals or authorizations that are required will be obtained by NSDPW before construction. Relevant policies and guidance that frame legislation (see Section 2.4) will also be followed, and NSDPW will work with the Municipality of the County of Kings to meet any applicable municipal requirements. In addition, NSDPW has been, and will continue to, align with the Mi'kmaq-Nova Scotia-Canada Framework Agreement respecting Mi'kmaq rights and title.

Table 1-2 Provincial regulatory and permitting requirements for the Project

LEGISLATION & REGULATORY AUTHORITY	CONTEXT / REQUIREMENTS	AUTHORIZATION REQUIRED
PROVINCIAL		
Nova Scotia *Environment Act* – NSECC	Supports and promotes the protection of the environment by maintaining environmental protection, implementing sustainable development, remediating adversely affected areas, and developing policies, standards, objectives, and guidelines to facilitate environmental protection.	Compliance required
Nova Scotia *Environmental Assessment Regulations* – NSECC	Approval is required for all undertakings as designated in Schedule A. The Project is anticipated to result in the disruption of a total of 2 ha or more of any single wetland and therefore an Environmental Assessment Approval is required.	Environmental Assessment Approval
Nova Scotia *Environment Act – Activities Designation Regulations* – NSECC	Any Project activities resulting in the alteration to a watercourse, water resource, wetland or the flow of water will require an Approval by the Minister of Environment. Any Project activities occurring in wetlands greater than 0.01 ha (100 m^2) will require an approval under the Nova Scotia *Environment Act* and *Activities Designation Regulations*	Watercourse Alteration Notification / Approval Wetland Alteration Approval
Nova Scotia *Environment Act – Air Quality Regulations* – NSECC	Standards for maximum permissible ground level concentrations of air contaminants.	Compliance required
Nova Scotia *Environment Act – Sulphide Bearing Material Disposal Regulations* - NSECC	Regulation of acid draining rock, including approval for disposal of sulphide bearing material as defined by legislation over 500 m^3 in situ or 1,300 tonnes.	Compliance required
Nova Scotia *Environment Act - Contaminated Sites Regulations* – NSECC	Specific requirements if contaminated sites are identified or managed as part of Project.	Compliance required
Nova Scotia *Environment Act – Petroleum Management Regulations* – NSECC	Specifies petroleum storage requirements.	Compliance required

LEGISLATION & REGULATORY AUTHORITY	CONTEXT / REQUIREMENTS	AUTHORIZATION REQUIRED
PROVINCIAL		
Nova Scotia *Sustainable Development Goals Act* – NSECC	Aims to achieve environmental goals and sustainable prosperity, focusing on climate mitigation and adaptation and the requirements of a circular economy.	None required
Nova Scotia Endangered Species Act (*NSESA*) – Nova Scotia Department of Natural Resources and Renewables (NSDNRR)	Protection of species listed as Extirpated, Endangered, Threatened or of Special Concern, and habitat which supports them. The following acts are prohibited: • Killing, injuring, or disturbing species at risk; • Destroying, disturbing or interfering with its residence (e.g., nest, den, hibernaculum); and • Destroying, disturbing or interfering with its core habitat.	Species-At-Risk Permit
Wildlife Act – NSDNRR	Provides protection measures for wildlife including birds, turtles, and fur-bearing mammals.	*Wildlife Act* Permit may be required for some species (e.g., Snapping Turtle)
Crown Lands Act and *Regulations* – NSDNRR	Prohibits the following activities, unless authorized by the Minister: • Cutting, damaging or removing timber or other resources on crown lands; and • Damaging or removing property on crown lands. Activities on crown lands requiring a permit include, but are not limited to, the construction of access roads and right of ways (ROWs) and cutting or removal of timber.	Compliance required for any activities on Crown Land.
Forests Act and *Regulations* – NSDNRR	Requirements for fire suppression equipment for operations in forests.	Compliance required
Public Highways Act – NSDPW	Governs activities including the use, construction, and maintenance of highways in Nova Scotia. Project activities on or within a highway ROW, will require a Work Within Highway ROW Permit.	Work Within Highway ROW Permit

LEGISLATION & REGULATORY AUTHORITY	CONTEXT / REQUIREMENTS	AUTHORIZATION REQUIRED
PROVINCIAL		
Special Places Protection Act – Nova Scotia Department of Communities, Culture, Tourism and Heritage (NSCCTH)	Protection of all palaeontological and archaeological sites. This Act applies to anyone exploring or excavating land, including land covered by water, to seek archaeological, historical or paleontological sites and remains. No person shall: • Knowingly destroy, desecrate, deface, or alter archaeological resources, or • Excavate or alter an archaeological site or remove any objects from an archaeological site without approval.	Heritage Research Permit (Reconnaissance, Research and Resource Impact Assessment)
Dangerous Goods Transportation Act and *Regulations*	Requirements for safe transport of dangerous goods.	Compliance required
Labour Standards Codes – NSDLSI	Labour Standards legislation establishes the minimum employment rules in Nova Scotia that employers and employees must follow.	Compliance required
Occupational Health and Safety Act and *Regulations* – NSDLAE	Workplace health and safety requirements to be met. Regulations pursuant to Section 82 outline guidelines and regulations for blasting safety. Proponent personnel performing blasting during construction must do so in accordance with these regulations and be in compliance with the Act.	Activity-specific compliance required
Municipal Government Act – (NSDMA)	Provides authority to municipal governments to develop municipal planning strategies and land-use by-laws.	https://www.countyofkings.ca/government/bylaws.aspx

Table 1-3 Federal regulatory and permitting requirements for the Project

LEGISLATION & REGULATORY AUTHORITY	CONTEXT / REQUIREMENTS	AUTHORIZATION REQUIRED
FEDERAL		
Impact Assessment Act (*IAA*) – *Physical Activities Regulations* Canadian Impact Assessment Agency (the Agency)	The *IAA* and its regulations establish the legislative basis for the federal environmental assessment process. Projects that require an environmental impact assessment are set out in the Physical Activities Regulations.	Not required
Canadian Environmental Protection Act (*CEPA*) and *Regulations* – ECCC	Primary federal legislation for protecting the Canadian environment and human health, including prevention and management of risks posed by toxic and other harmful substances.	Compliance required
Fisheries Act and *Regulations* – DFO / ECCC	Aims to conserve and protect fish and fish habitat, including by preventing pollution. Prohibits activities that cause death of fish, and harmful alteration, disruption and destruction (HADD) of fish habitat, unless authorized by the Minister of Fisheries and Oceans Canada. Activities occurring in fish habitat are anticipated to require an Authorization under the *Fisheries Act*. The deposit of a deleterious substance into fish-bearing waters is prohibited.	Request for Review *Fisheries Act* Authorization (incl. offsetting).
Species at Risk Act (*SARA*) – DFO / ECCC	Protection of species at the national level to prevent extinction and promote recovery of Endangered, Threatened or Extirpated species, and facilitates the management of species listed as Special Concern. Species listed under Schedule 1 of the SARA are federally protected within Canada through general prohibitions. If Project activities interfere with a species-at-risk and its habitat, SARA approvals may be required.	*SARA* permit
Migratory Birds Convention Act (*MBCA*) and *Regulations* - ECCC	Protection of migratory birds, including the prohibition of disturbance or destruction of migratory bird nests and eggs in Canada, regardless of land ownership. The *MBCA* also prohibits the dumping of substances harmful to birds in areas and water frequented by them.	Compliance required

LEGISLATION & REGULATORY AUTHORITY	CONTEXT / REQUIREMENTS	AUTHORIZATION REQUIRED
FEDERAL		
Canadian Navigable Waters Act (*CNVA*) – Transport Canada	Regulates works that potentially interfere with navigation on navigable waters, as defined within the Act.	NPA Opt-out form NPA Notice of Works NPA Approval
Transportation of Dangerous Goods Act (*TDGA*) and *Regulations* – Transport Canada	The Transportation of Dangerous Goods Program, pursuant to *TDGA*, promotes public safety during the transportation of dangerous goods.	Compliance required

1.4 ENVIRONMENTAL ASSESSMENT CONCORDANCE

This document is prepared in accordance with the *Environment Act*, *Environmental Assessment Regulations* and associated guidance documents. A summary of concordance of this document with the required components under the *Environmental Assessment Regulations* in order to register a Class 1 undertaking in Nova Scotia is included in Table 1-4.

Table 1-4 Concordance with the registration requirements of the Nova Scotia Environment Act and Environmental Assessment regulations description

REQUIREMENT	DOCUMENT REFERENCE
(i) Name of the undertaking	Section 1 – Introduction Section 1.2 – Identification of the Proponent
(ii) Location of the undertaking	Section 1 – Introduction Section 2 – Project Description
(iii) Name, address, signature, and identification of the proponent including the name of the Chief Executive Office and contact persons	Section 1.2 – Identification of the Proponent
(iv) Nature of the undertaking	Section 2 – Project Description
(v) Purpose of the undertaking	Section 1.2 – Purpose of and Need for the Undertaking
(vi) Proposed construction and operation schedules	Section 2 – Project Description
(vii) Description of the undertaking	Section 2 – Project Description
(viii) Environmental baseline information	Section 5 – Description of the Environment
(ix) All steps taken or proposed by Proponent to identify and address the concerns of the public and aboriginal people	Section 3 – Public and Indigenous Engagement
(x) List of approvals which will be required and other forms of authorization; and	Section 1.3 – Regulatory Overview
(xi) Sources of any public funding	Section 1.2 – Purpose of and Need for the Undertaking

2 PROJECT DESCRIPTION

2.1 PROJECT OVERVIEW AND LOCATION

NSDPW is proposing a new interchange and connector road from Highway 101 to Trunk 1 (Figure 1). The proposed interchange is located in Kings County, between Coldbrook and Berwick (Exits 14 and 15, respectively) in Cambridge, Nova Scotia, just west of AVFN.

It will feature a 2 km section of connector road which extends in a southerly direction to Trunk 1, as well as a 1.6 km section which extends northerly to connect with Brooklyn Street. The connector road to Trunk 1 will be a controlled access minor arterial roadway with two main travel lanes owned by NSDPW. The road will have a limited number of access points to adjacent lands, crossing agricultural and wooded fields, as well as the Cornwallis River and the surrounding flood plain. A new bridge crossing will be required as part of the Project. At Trunk 1, the new intersection will be constructed as a roundabout just east of County Home Road, with a new 600 m southerly connection to Waterville Mountain Road.

The north connection to Brooklyn Street will cross agricultural and wooded fields, including Coleman Brook. Additionally, the connector will cross through AVFN development lands. The Project will not impact AVFN reserve lands.

2.2 PROJECT COMPONENTS

The proposed Highway 101 Cambridge Interchange and Connectors will consist of the following components:

- Cambridge Interchange, roundabouts (2) and connection to the AVFN boundary;
- South Connector Road;
- North Connector Road;
- Roundabout at Trunk 1 with tie-in to Waterville Mountain Road;
- Waterville Mountain Road cul-de-sac;
- Temporary access roads and laydown areas;
- Watercourse crossings and wetland alteration;
- Harvest Moon Trail crossing (former Dominion Atlantic Railway tunnel); and
- Multi-purpose path parallel to South Connector Road

2.2.1 CAMBRIDGE INTERCHANGE AND ROUNDABOUTS

The Cambridge Interchange will be a diamond interchange with four single-lane ramps, and a roundabout at each ramp intersection. The interchange will be located to the west of AVFN reserve lands (see Figure 1), and the south roundabout will have a connection from it to the AVFN boundary. The north roundabout will have a connection north to Brooklyn Street. The interchange structure across Highway 101 (bridge/underpass) will be built to accommodate future twinning on the north side of the highway.

2.2.2 SOUTH CONNECTOR ROAD

The South Connector Road will be an access controlled, two-lane minor arterial roadway that runs for 2 km south from the south roundabout to Trunk 1. The route is adjacent to the Kings County wastewater treatment facility (see Figure 1), crossing primarily agricultural and undeveloped land. The connector road will have two 3.7 m lanes and two 2.2 m shoulders; it will be designed for a speed of 80 km/h, with a posted speed limit of 70 km/h. A separated multi-purpose path will run parallel to the South Connector Road.

The connector road will cross the Cornwallis River via a new bridge, with a multi-use path. It will also cross over the existing Harvest Moon Trail and a tunnel will be constructed for the existing trail. It ties into a new roundabout at Trunk 1.

2.2.3 NORTH CONNECTOR ROAD

The North Connector Road will be a two-lane collector roadway, coming off the north roundabout of the Cambridge Interchange and running northwards towards Brooklyn Street for 1.6 km. It will have two 3.5 m lanes and two 2.0 m shoulders, and will be designed for a speed of 80 km/h, and a posted speed limit of 70 km/h. The road will primarily cross agricultural land, running along the boundary of/through fee-simple farm land, owned by AVFN.

2.2.4 ROUNDABOUT AT TRUNK 1 TO WATERVILLE MOUNTAIN ROAD

A new roundabout will be constructed on Trunk 1, about 120 m east of County Home Road, to tie into the South Connector Road. A new connection from this roundabout to Waterville Mountain Road will be constructed, crossing a wooded lot and tying into the existing road. The connection to Waterville Mountain Road will be a minor arterial road with two 3.5 m lanes and two 2 m shoulders, blending to match the existing road conditions where the connection is made. The remainder of the existing Waterville Mountain Road (west of the roundabout) will have a cul-de-sac.

2.2.5 TEMPORARY ACCESS ROADS AND LAYDOWN AREAS

The development of temporary ancillary features that may be required for the construction of the Project would typically occur within ROW and may include:

- Access roads;
- Laydown areas for materials and equipment storage;
- Mobile offices;
- Crushing operations;
- Borrow sites; and
- Waste disposal sites.

Temporary ancillary features will be located and operated in accordance with NSDPW standards and applicable legislation.

2.2.6 WATERCOURSE CROSSINGS AND WETLAND ALTERATIONS

The proposed project crosses five watercourses, of which four will require culverts. The crossing at the Cornwallis River will require a bridge, resulting in minimum disturbance to the watercourse. Requisite hydraulic designs considering both current and future conditions will be carried out for all water crossings.

Culverts will be constructed with either concrete box or pipe culverts, designed to meet the DFO *Guidelines for the design of fish passage for culverts in Nova Scotia* (DFO 2015). Dimensions will be determined during detailed design and based on hydrological investigations and a determination of volumes associated with a 1:100-year storm event. Prior to any in-stream work, approval pursuant to the NS *Designated Activities Regulations* will be obtained, and where applicable, authorization from DFO under the *Fisheries Act*.

Watercourse crossings will be constructed according to NSECC and DFO approval requirements and NSDPW's *Generic Environment Protection Plan for the Construction of 100 Series Highways (EPP)* (NSDPW 2007). In-water works will be scheduled to occur between June 1st and September 30th, to minimize disturbance to key life stages of resident and migratory fish.

The interchange footprint is partially located on a large wetland referred to as the Waterville Wetland, of which 22 ha was delineated during field surveys. The proposed interchange footprint may impact up to 3.73 ha of this wetland, in addition to up to 4.83 ha of other wetlands within the Project area, depending on design requirements for land clearing and grading. Prior to any intrusive work to wetlands, NSDPW will obtain wetland alteration approvals from NSECC in accordance with the NS *Environment Act*, including the appropriate habitat compensation.

Specific wetland infill designs will be developed following geotechnical investigations. Where required, unsuitable soils will be used as fill or dressing slopes or will be disposed of at sites within the ROW approved by the Project Engineer. If peat is excavated, it will be salvaged, where feasible, for ESC use and ultimately ROW landscaping or offsite restoration projects.

Surface water from the highway will be collected in drainage ditches running alongside the highway shoulders. There will be no direct connection of surface water runoff into existing watercourses.

Additional information regarding watercourses and wetlands is provided in Section 5.1.4 and Section 5.2.4, respectively.

2.2.7 TRAIL CROSSING

The Harvest Moon Trail is a multi-use trail which follows the old rail corridor north of Trunk 1. This trail will intersect the South Connector Road approximately 130 m north of Trunk 1. Motorized and non-motorized uses are permitted on the trail. The Nova Scotia *Off-Highway Vehicles General Regulations* prohibits the operation of an off-highway vehicle upon or across a controlled access highway. The South Connector will be designed as a controlled access highway, therefore requiring a grade-separated structure to allow for continuity of the trail. The South Connector will be raised over the trail with a tunnel system on the existing Harvest Moon Trail.

2.3 PROJECT PHASES AND ACTIVITIES

2.3.1 SITE PREPARATION PHASE

The site preparation activities include:

- Vegetation clearing and grubbing; and,
- Installation of erosion and sediment control (ESC) measures.

Site preparation activities and their associated environmental management standards are described in Table 2-1 and are identified from either the NSDPW's Generic Environmental Protection Plan (NSDPW 2007) or best management practices (BMPs).

Table 2-1 Site Preparation Activities and their Environmental Management

ACTIVITY	DESCRIPTION	ENVIRONMENTAL MANAGEMENT
SITE PREPARATION		
Vegetation Clearing	Clearing involves the removal of trees and shrubs found within the proposed Project footprint and ROW, using conventional arboriculture or harvesting equipment: ▪ Trees will be cut to within 0.3 m of the ground. ▪ Merchantable timber will be de-limbed and removed from site. ▪ Non-salvageable material will be chipped within the ROW and left in place (except in buffer zones for wetlands and watercourses).	In accordance with: ▪ NSDPW's Standard Specifications ▪ Generic EPP (Sections 3.3 & 3.6 of EPP) *Migratory Birds Convention Act* ▪ Limits of clearing will be surveyed and marked prior to construction. ▪ Vegetation removal will be completed outside of biologically sensitive time windows, ideally during winter months on frozen ground. ▪ Hand clearing will be implemented within buffer zones of wetlands and watercourses. ▪ Grubbing within 30 m of a watercourse will be completed after culverts and ESC measures are in place. ▪ Grubbing materials may be used for ESC. ▪ Best management practices for the control of invasive species
Grubbing	Grubbing involves the removal of all organic material and unsuitable soil above the under-lying soil and either stockpiling adjacent to road toe-of slope for future on-site use, or transport offsite to areas approved by NSDPW's Project Engineer and/or its contractor.	In accordance with: ▪ NSDPW's Standard Specifications ▪ Grubbing within 30 m of a watercourse will be completed after culverts and ESC measures are in place. ▪ Grubbing materials may be used for ESC.

ACTIVITY	DESCRIPTION	ENVIRONMENTAL MANAGEMENT
Erosion and Sediment Control	Implementation of ESC where there is exposed soil and potential for erosion.	In accordance with: ▪ NSDPW's Standard Specifications ▪ Generic EPP (Section 3.2 of EPP) ▪ NS Watercourse Alterations Standards (NSE 2015a) ▪ ESC measures will be included in the design tendered for construction.

2.3.2 CONSTRUCTION PHASE

The construction activities associated with roadbed preparation include:

- Roadbed development (excavation and blasting);
- Grading (sub-grade and sub-base and base construction);
- Installation of drainage and watercourse crossing structures (culverts and bridges); and
- Surfacing and finishing (paving; shouldering and topsoil; hydroseeding; finishing).

These construction activities and environmental management BMPs and standards are described in Table 2-2.

Table 2-2 Construction Activities and Their Environmental Management

ACTIVITY	DESCRIPTION	ENVIRONMENTAL MANAGEMENT
ROADBED DEVELOPMENT		
Excavation	Removal of material for the construction of subgrade layer, including: ▪ Rock excavation – removal of sandstones, shales, weathered bedrock, and single pieces >1 m^3, with ripper blades on heavy equipment. ▪ Swamp excavation – removal of peat or water-saturated soils where soil is unsuitable for use as the subgrade. Soil is either excavated and replaced with a competent fill or floated over, using geogrids or berm construction. ▪ Common excavation – all excavation other than rock or swamp, including removal of overburden (e.g., till, small boulders, topsoil).	In accordance with: ▪ NSDPW's Standard Specifications (Division 2, Section 3) ▪ Generic EPP (Sections 3.2 of EPP) ▪ Proper ESC methods are to be implemented throughout this process. ▪ All suitable materials removed from the excavation will be used as far as practical in the construction of the Project ▪ Excavated soils that are unsuitable for use as fill or dressing slopes are disposed of at a site approved by the Project Engineer.

ACTIVITY	DESCRIPTION	ENVIRONMENTAL MANAGEMENT
GRADING		
Sub-grade Construction	Grading and placement of suitable fill is required to construct a structurally sound subgrade. Activities include:	In accordance with: ▪ Generic EPP (Sections 3.7 of EPP) ▪ Design will be based on slope stability, ESC, location, availability and suitability of fill material and borrow sources, and impacts of surface water and groundwater.
Sub-base & Base Construction	After completion of the subgrade, coarse granular subbase material of crushed and screened rock or gravel is applied. An additional gravel base layer is applied above this, consisting of several graded gravel layers to contribute to the structural integrity and drainage beneath the asphalt concrete pavement surfacing.	In accordance with: ▪ Generic EPP (Sections 3.7 of EPP)
WATERCOURSE CROSSINGS & WETLAND ALTERATIONS		
Bridges	Bridge and grade separation structures are required to allow the safe passage of traffic over watercourses and over the proposed highway infrastructure (e.g., the trail).	In accordance with: ▪ Generic EPP (Section 3.5 of EPP) ▪ NS Watercourse Alterations Standard (NSE 2015a) ▪ Guide to Altering Watercourses (NSE 2015b) ▪ Applicable government approvals, permits and authorizations
Culverts	Installation of concrete pipe or box culverts and development of a drainage system conducted during the earthworks.	In accordance with: ▪ Generic EPP (Section 3.5) ▪ NS Watercourse Alterations Standard (NSE, 2015a) ▪ Guide to Altering Watercourses (NSE, 2015b) ▪ Applicable government approvals, permits and authorizations

ACTIVITY	DESCRIPTION	ENVIRONMENTAL MANAGEMENT
SURFACING AND FINISHING		
Paving	Paving of the roadway will be the final surface on the highway, using black asphalt concrete, composed of petroleum-based liquid asphalt with sand and crushed stone. It will be mixed at an offsite asphalt plant or onsite in an approved mobile plant. It will be transported, spread, and rolled to pave the surface on site, using heavy trucks, graders and asphalt concrete pavers.	In accordance with: ▪ NSDPW's Standard Specifications (Division 4) ▪ Generic EPP (Section 3.17 of EPP)
Shouldering and Topsoil	Addition of gravels by a shouldering machine to the pavement edge and subsequently compacted to grade. Topsoil will be applied to cover medians and side slopes.	In accordance with: ▪ NSDPW's Standard Specifications (Division 2, Section 7) ▪ Generic EPP (Section 3.6 of EPP) ▪ Topsoil retained from clearing and grubbing may be re-used for this purpose.
Revegetation/Hydroseeding	Revegetation will be used to stabilize exposed soil areas and slopes within the ROW. Revegetation mainly entails hydroseeding, but may also include the application of mulch, erosion mats, dressing with reclaimed soil and vegetation, or other organics excavated from within the Project footprint, and planting of native vegetation. Hydroseeding is a slurry of seed, fertilizer, hydraulic mulch, binder, water, and other components as required, which are prepared on-site in a tank (truck or trailer mounted) and sprayed onto exposed soils and slopes.	In accordance with: ▪ NSDPW's Standard Specifications (Division 7, Section 5) ▪ Generic EPP (Section 3.10 of EPP) as soon as practicable after surfacing preparation activities.
Finishing	Line painting, and installation of signage, lighting, guide rails, fencing and barriers.	In accordance with: ▪ NSDPW's Standard Specifications (Division 6)

Various equipment will be required for construction activities. The following equipment has been identified as potential being required:

- Asphalt or concrete paving equipment;
- Asphalt and concrete plants;
- Cranes and boom lifts;
- Excavators;
- Fueling equipment (fueling trucks and temporary storage);
- Graders;
- Dump trucks;

- Hydroseeding equipment;
- Rollers;
- Rock breakers;
- Road marking equipment (such as paint trucks); and
- Steel drum compactors.

The volume of construction traffic will depend on the placement of temporary ancillary features such as laydown areas for materials and equipment storage as well as borrow sites and asphalt plants. Construction vehicles are expected to operate during the day in 12-hour shifts. There is a less likely possibility for operation 24-hrs per day in 12-hour shifts, but only outside of the residential areas. Detailed information regarding construction traffic is presently unknown since specific borrow and disposal sites have not yet been identified.

2.3.3 OPERATION AND MAINTENANCE PHASE

Activities anticipated during operation and maintenance include the following:

- Highway operation (i.e., traffic);
- Highway maintenance (i.e., snow removal, sanding, and salting; infrastructure maintenance), and
- Vegetation management (i.e., vegetation removal, mowing, and planting).

HIGHWAY OPERATION

The proposed interchange and connectors will alleviate traffic congestion at Exit 14 and improve the connectivity between Highway 101 and Trunk 1. Based on impacts to existing traffic levels, it is estimated that approximately 2,500 vehicles per day will divert to the new interchange from Exit 14 and 1,000 vehicles per day will divert to the new interchange from Exit 15. A large proportion of truck traffic will be diverted from Trunk 1 to the new interchange, including the existing 130 truck trips per day to Michelin and other future truck traffic growth related to the Michelin expansion and Waterville Business Park.

For traffic travelling between Highway 101 east and Waterville Mountain Road, the new interchange will save approximately 2 minutes per trip compared to the existing route via Exit 14. For traffic travelling between Highway 101 west and Waterville Mountain Road, the new interchange will save approximately 1 minute per trip compared to the existing route via Exit 15.

Both the connector roads will have a posted speed limit of 70 km/h, and a design speed of 80 km/h.

MAINTENANCE ACTIVITIES

Highway maintenance generally includes the activities to maintain the safe use of the highways. These are described in Table 2-3 and their associated environmental management standards identified, from either the NSDPW Generic EPP (NSDPW 2007) or BMPs.

Table 2-3 Operation and Maintenance Activities and Their Environmental Management

ACTIVITY	DESCRIPTION	ENVIRONMENTAL MANAGEMENT
WINTER MAINTENANCE		
Snow Removal	Snow is ploughed using graders, light trucks and four-wheel drive vehicles.	In accordance with: ▪ NSDPW's Winter Maintenance Standards ▪ 100-series and trunk highways cleared within eight hours after snow stops.
Ice Control	Sanding and salting by snow removal equipment. Rate of application depends on the severity of winter conditions.	In accordance with: ▪ Generic EPP (Section 3.18, Salt Management Plan) ▪ Salting/sanding expected to occur shortly after storm event ▪ Sanding conducted in places where salt could adversely affect a nearby surface water body or other sensitive feature.
INFRASTRUCTURE MAINTENANCE		
Pavement repair	Maintenance can include minor crack filling and pothole repair, resurfacing every 10-15 years, and repaving every 20-25 years.	In accordance with: ▪ NSDPW's Standard Specifications (Division 4) ▪ Generic EPP (Sections 3.17 of EPP).
Repainting	Painting of highway lines and markers may be regularly conducted.	In accordance with: ▪ NSDPW's Standard Specifications (Division 6)
Shoulder and finishing maintenance	The roadway shoulder is maintained using a grader. Finishing infrastructure may be replaced using standard methods.	In accordance with: ▪ NSDPW's Standard Specifications (Division 2)
Ditch maintenance	Maintenance of ditches and drainage (e.g. reditching)	In accordance with: ▪ NSDPW's Standard Specifications (Division 2)
Culvert and bridge maintenance	Bridge maintenance to meet safety standards. Removal of debris blockages and small repairs to complete culvert replacements as needed.	In accordance with: ▪ NSDPW's Standard Specifications (Division 5) ▪ NS Watercourse Alterations Standard (NSE, 2015a)

ACTIVITY	DESCRIPTION	ENVIRONMENTAL MANAGEMENT
VEGETATION MANAGEMENT		
Manual and mechanical removal	Vegetation is removed to maintain the lines of sight required for highway safety. Clearing may be by manual and mechanical removal.	In accordance with: ▪ NSDPW's Integrated Roadside Vegetation Maintenance (IRVM) program.
Herbicide use	Herbicides may be used for the control of noxious weeds and maintaining lines of sight. only if other options are not effective.	In accordance with: ▪ NSDPW's Integrated Roadside Vegetation Maintenance (IRVM) program. ▪ NS Environment Act (NSE pesticides application approval) Herbicide use is not allowed under the following conditions: ▪ Within 30 m of a watercourse or wetland; ▪ Within any distance of a watercourse as prescribed on the product label ▪ Within 60 m of a protected water supply.
Integrated vegetation management	The use and encouragement of plant species that require minimal management on site.	In accordance with: ▪ NSDPW's Integrated Roadside Vegetation Maintenance (IRVM) program.

2.3.4 ACCIDENTS AND UNPLANNED EVENTS

Potential accidents and unplanned events that may arise during the Project include:

- Spills of chemicals and petroleum, oils or lubricants;
- Failure of ESC measures;
- Fires; and
- Vehicular collisions.

Contingency plans are provided in NSDPW's Generic EPP (NSDPW 2007) and plans will be tailored by NSDPW to accommodate any sensitive features within the ROW. Potential adverse effects and specific avoidance and contingency measures are discussed in Section 6.

2.4 ENVIRONMENT MANAGEMENT

NSDPW is committed to designing, constructing, and maintaining projects that reflect best-practice environmental protection and management.

2.4.1 ENVIRONMENTAL DESIGN CONSIDERATIONS

The following environmental design considerations will be incorporated into the final design in addition to NSDPW's Generic EPP (NSDPW 2007), applicable design criteria following TAC or CSA standards, and Project-specific mitigation measures:

- NSDPW (NSTIR) Standard Specification (NSDPW 1997, revised in 2021);
- Nova Scotia Temporary Workplace Traffic Control Manual (NSDPW 2018);
- Guide to Considering Climate Change in Project Development in Nova Scotia (NSE 2011b);
- NSE's Watercourse Alterations Standard (NSE 2015a);
- NSE's Guide to Altering Watercourses (NSE 2015b);
- DFO's Guidelines for the Design of Fish Passage for Culverts in Nova Scotia (DFO 2015);
- NSE's Water Well Decommissioning Guidelines (NSE 2007); and
- Pit and Quarry Guidelines (NSE 1999).

2.4.2 ENVIRONMENTAL PROTECTION PLAN AND GUIDANCE DOCUMENTS

The Project will be conducted under the guidance of NSDPW's Generic Environmental Protection Plan (EPP) for the Construction of 100 Series Highways (Generic EPP; NSDPW 2007). The Generic EPP was developed to provide an overview of NSDPW's commitment for the construction of 100 Series Highways. It contains the following components to address environmental interactions that may occur during highway construction:

- Best Management Practices (BMPs);
- ESC measures;
- Spill contingency plans;
- Winter clearing protocols;
- Access Road Specifications, and
- NSDPW's Salt Management Plan.

All parties involved with the construction of the Project are expected to understand and comply with the Generic EPP. NSDPW's construction contractor will also have their own EPP and implement BMPs to ensure environmental protection and compliance with provincial and federal regulatory approvals and authorizations.

In addition to the Generic EPP, numerous guidance documents are directly applicable to the various works associated with the construction and operation of the Cambridge Interchange and connectors. These documents will be followed where applicable:

- Nova Scotia Wetland Conservation Policy (NSE 2011c);
- Nova Scotia Sulphide Bearing Material Disposal Regulations (NSE 1995);
- Canadian Council of Ministers of the Environment (CCME 2007) Canadian Environmental Quality Guidelines (CEQGs);

- Guidelines for Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hokpy 1998);
- Integrated Roadside Vegetation Management Manual (NSE no date);
- Beaverdam Removal Code of Practice (NSDNRR no date);
- National Guide to Erosion and Sediment Control on Roadway Projects (TAC 2005), and
- Synthesis of Environmental Management Practices for Road Construction, Operation and Maintenance (TAC 2014).

2.4.3 EMISSIONS AND WASTE MANAGEMENT

Emissions from the Project could include air emissions from construction and other vehicles; dust from cleared areas; noise emissions, and runoff from the site. During construction, all emissions will be controlled by mitigation measures as outlined in Section 3.0 of the Generic EPP. The contractor will be responsible for monitoring the equipment used during construction to maintain good operating condition. The contractor will be encouraged to establish vehicle non-idling policies during construction to help minimize adverse effects on local air quality and greenhouse gas (GHG) emissions. Dust management will be practiced during construction and monitoring may be conducted in response to dust complaints in accordance with NSECC and ECCC guidelines. ESC measures will be in place prior to commencing, and throughout the duration of, the Project to ensure that runoff from the site does not impact nearby watercourses and wetlands.

Section 3.15 of the Generic EPP also provides guidelines for waste management and the handling and storage of fuels, oils and lubricants.

2.4.4 INSPECTION AND MONITORING

Depending upon specific circumstances, the Proponent will implement compensation, follow-up monitoring and inspections as required for the Project. Compensation programs may include compensation for the acquisition of land or for the loss of habitat (fish habitat/wetlands) as a result of the Project. NSDPW's construction contractors will be responsible for designing and implementing an environmental compliance inspection and monitoring program to meet regulatory requirements.

Inspection and monitoring will be conducted in accordance with the Generic EPP (Section 4.0), commitments in this EA Registration Document, and conditions of regulatory approvals and authorizations. A summary of the Project- specific commitments to mitigation and monitoring are presented in Section 7.

2.5 PROJECT SCHEDULE

Preliminary design work to finalize the road and intersections is ongoing, and a reserve corridor has been created to facilitate the purchase of the necessary lands.

Field studies to prepare for the EA occurred largely in 2021, with some supplemental surveys continuing into 2022 and 2023. The EA is expected to be completed in mid-2023. It is anticipated that applications for, and approvals of, subsequent permits and authorizations will begin during a detailed design phase immediately following EA approval, if received, with completion anticipated in early 2024. Provided all necessary approvals have been obtained and funding has been secured, clearing of the corridor may commence as early as 2023, with construction taking place over a 3-year period.

Project activities will be scheduled to avoid potentially adverse interactions with valued components during sensitive periods (e.g., migratory bird nesting periods; fish spawning times) as described in mitigation measures and in compliance with permits and conditions of approvals.

Operation and maintenance of the proposed Connector Road will continue indefinitely, with no plans for decommissioning.

2.6 PROJECT ALTERNATIVE

Several alternatives to the proposed Project were considered over the years. The original configuration in 1999 had the interchange placement nearly identical to the proposed placement today, although the Connector Road route varied. The Connector Road to Trunk 1 bisected several agricultural fields, including Kings Regional Rehabilitation Centre's front gardens. At the time, the concept was not favored by the farming community and the impacted farm owners.

In 2006 another option was presented which placed a new interchange at the Black Rock Road underpass on Highway 101, west of the proposed Project. The Black Rock Road option was not desirable as the Connector Road to Trunk 1 would include a section of Black Rock Road and new road cutting through farmland to the east and tying into County Home Road. This option presented several concerns, specifically that a controlled access connector could not be achieved.

In recent years, AVFN purchased Webster Farms, just south of their community, and are very supportive of the Project. The Project will allow AVFN to have a secondary access into their community. In comparison to previous concepts, the South Connector Road will minimize impacts to agricultural fields and allow for a controlled access roadway to Trunk 1.

3 INDIGENOUS AND PUBLIC ENGAGEMENT AND CONSULTATION

Public, stakeholder, and rightsholder (i.e., Indigenous Peoples) consultation is required for all EAs in Nova Scotia under the provincial EA process. The Province discharges its Duty to Consult with the Mi'kmaq of Nova Scotia in a manner that is consistent with current Canadian common law in accordance with the *Nova Scotia Policy and Guidelines: Consultation with the Mi'kmaq of Nova Scotia* (Government of Nova Scotia, 2015). Engagement of the Mi'kmaq of Nova Scotia is a critical component of the regulatory review process.

Meaningful engagement and consultation are internationally recognized as the best practice to build trust, enhance transparency, and ultimately strengthen public acceptance for proposed projects, such as the new Highway 101 Interchange and Connector Roads.

The following sections outline the various agencies who have expressed active interest in the Project, the consultation and engagement activities that have been conducted to date, and proposed activities to be taken in the future.

3.1 INDIGENOUS ENGAGEMENT AND CONSULTATION

Aboriginal consultation was initiated in 2015. However, due to departmental priorities, further planning work did not advance at that time. NSDPW sent a continuing consultation letter on July 26, 2022 to update the Mi'kmaq of Nova Scotia on the project status and to inform them that the EA would be registered in March 2023.

Aboriginal consultation letters include:

- April 17, 2015 – Letter to initiate consultation sent to Assembly of Nova Scotia Mi'kmaq Chiefs, and Sipekne'katik First Nation.
- October 20, 2016 – General highway update letter (including Cambridge Interchange) sent to Assembly of Nova Scotia Mi'kmaq Chiefs, and Sipekne'katik First Nation.
- July 26, 2022 – Continuing consultation letter to the Assembly of Nova Scotia Mi'kmaq Chiefs (Kwilmu'kw Maw-klusuaqn Negotiation Office [KMKNO]), Sipekne'katik First Nation, and Millbrook First Nation.

Rightsholder engagement is ongoing with AVFN, as their reserve lands are adjacent to the Project footprint. Informal monthly Project meetings and ongoing communications with the AVFN have been occurring since 2018, to promote transparency and ensure there are dedicated opportunities to exchange information and share Project concerns. NSDPW will continue the consultation with the Mi'kmaq of Nova Scotia throughout the EA approval process and Project implementation.

NSPW has engaged AVFN Chief and Council on all aspects of the proposal including information on project details and departmental decision-making. NSDPW has encouraged AVFN leadership to share this information with the wider community and to seek input from community members.

Proposed opportunities for future engagement with AVFN have been identified and include but are not limited to information session(s), presentation(s), and/or an open house, pending further discussion with the responsible parties. The proposed session(s) will serve as an opportunity to share Project updates and present initial findings from the various environmental and archaeological field surveys.

As part of the due diligence process, an Archaeological Resource Impact Assessment (ARIA) was conducted and staff from the Archaeology Research Division of Kwilmu'ku Maw-klusuaqn (KMKNO-ARD) were contacted in an effort to gather information on past and present traditional land use within the Project area.

A Mi'kmaq Environmental Knowledge Study (MEKS) is being completed by the Membertou Geomatics Solutions. A site walkthrough was completed in July 2022 and community interviews are expected to be completed in 2023. Results from the MEKS will be shared separately from this Registration Document.

NSDPW will continue the consultation with the Mi'kmaq of Nova Scotia throughout the EA approval process and Project implementation.

3.2 PUBLIC ENGAGEMENT AND CONSULTATION

Opportunities to host an open house have been limited due to COVID-19 public health measures. As a result, NSDPW developed a Project website providing detailed project information and circulated a dedicated email address to solicit public comment. The webpage launched in summer 2022 (www.novascotia.ca/101cambridge) and was promoted with mailout flyers, radio advertisements, and targeted social media posts. Radio advertisements ran on three stations in the Annapolis Valley for a total of two weeks (week of September 12th and October 10th, 2022). Community feedback was collected/received and compiled during the virtual comment period, with comments received from 40 emails.

Public comments identified several concerns relating to project location, traffic management, conditions of nearby local roads, safety for vulnerable road users, environmental and agricultural impacts. Table 3-1 summarizes the key community concerns and measures developed or incorporated to address the concerns.

Public comments have also voiced support for the Project, with positive responses received on the following:

- Traffic reduction and improvement of commute times [3 comments];
- Overall decrease in heavy truck traffic [3 comments];
- Improvement of road conditions along Trunk 1 due to decrease in truck traffic [1 comment];
- Improved safety along Highway 101 [1 comment];
- Economic development opportunities for local communities [4 comments]; and,
- Improved access into local communities [3 comments].

Additionally, public consultation includes activities that predate the current iteration of the Project. Public information sessions were held in 1999 and 2006 in the local community, where these prior iterations were presented and discussed. At this time, a similar Project configuration was presented to the public, with a connector road from the new interchange south to Trunk 1. However, due to departmental priorities, further planning work did not advance at the time.

NSDPW has sought feedback and concerns from local stakeholders at various points in Project development, from conceptual design of the Project through to present. Stakeholders include, but are not limited to, the Municipality of the County of Kings, Michelin Canada, and Kings Regional Rehabilitation Centre. Adjustments to the Project approach have been made to address concerns raised through these discussions.

More recently, there has been initial consultation with NSDNRR to gain input on wildlife management and crossings, and discussions with NSECC concerning wetland compensation.

Table 3-1 Summary of Key Community Concerns and Mitigation Measures

KEY CONCERNS IDENTIFIED	PROPOSED MEASURES TO ADDRESS CONCERN
Road design – Project location and creation of new roads / use of existing roads (i.e. Cambridge Road or Black Rock Road) **[12 comments]**	Project alternatives have been investigated over the past 20 years and are described in Section 2.6. Concerns from the farming community and affected landowners, as well as design logistics were the primary reasons these alternatives were not selected.
Road design – Cul-de-sac of Waterville Mountain Road **[4 comments]**	Waterville Mountain Road will continue to have access from Trunk 1 for existing residents. It will have a cul-de-sac approximately 150 m south of Trunk 1. The portion of Waterville Mountain Road being realigned to the new roundabout can be accessed from the new roundabout at Trunk 1. Maintaining a through-connection here will increase future maintenance costs and introduces an additional intersection that will encourage shortcutting as some drivers attempt to avoid the new roundabout. The proposed roundabout has sufficient capacity to manage the forecasted traffic volumes and provides a safer location for pedestrians to cross Trunk 1.
Road design – safety risks to pedestrians and cyclists **[6 comments]**	The interchange and connector road design is expected to alleviate traffic along Trunk 1. The reduction in traffic will improve safety along the Trunk 1 corridor. Additionally, the South Connector Road will incorporate a separate multi-use path for pedestrians and cyclists.
Road design – Traffic levels will not substantially decrease **[5 comments]**	A traffic study completed in 2019 has indicated that traffic along Trunk 1 will be alleviated by an estimated 20-25%. For traffic travelling between Highway 101 east and Waterville Mountain Road, the new interchange will save approximately 2 minutes per trip compared to the existing route via Exit 14. For traffic travelling between Highway 101 west and Waterville Mountain Road, the new interchange will save approximately 1 minute per trip compared to the existing route via Exit 15.
Road design – roundabout safety and usage **[6 comments]**	Roundabouts have been implemented to maintain better traffic flow at major intersections and have been shown to reduce vehicle collisions and the severity of collisions due to the reduced speed.
Road design - Access to Harvest Moon Trail and safety **[3 comments]**	The Harvest Moon Trail will intersect the South Connector Road, which will be raised over the trail. The trail will utilize a tunnel for connectivity across the South Connector Road. Access to the trail will be maintained as best and safely as possible throughout construction.
Project Planning – Project cost **[6 comments]**	The Province has a number of important priorities as part of it's mandate for Nova Scotians. Infrastructure growth, such as expanding the Provincial road network is important for supporting the economy and road user safety. Project costs are dynamic as the design is still being developed. Combined with the current market volatility in construction costs, it was decided to exclude them from the current documents.
Project planning – Increase in construction traffic **[1 comment]**	Construction traffic will depend on placement of temporary ancillary features, vehicles are expected to operate during the day in 12-hour shifts (and a less likely possibility for 24-hour per day operation outside of residential areas only, with an adequate disturbance buffer zone in place and noise/light reduction measures in place, as necessary. Detailed information regarding construction traffic is presently unknown since specific borrow and disposal sites have not yet been identified.

KEY CONCERNS IDENTIFIED	PROPOSED MEASURES TO ADDRESS CONCERN
Project planning – prioritizing repair or upgrade of existing roads **[10 comments]**	Maintenance of Provincial Roads is an ongoing effort as NSDPW resources and operational funding is spread throughout the Province. Constructing new roads such as this project is expected to improve road safety and will also reduce the volume of heavy trucks through the Coldbrook area which impact the life span of other paved surfaces.
Environment - Loss of agricultural lands **[5 comments]**	The Project has received support from agricultural landowners being affected by the Project. Generally, farmland impacts are minimal as the alignment is along farmland boundaries and therefore will not result in the removal of large swaths of farmland.
Environment – Impact to natural habitat and wildlife habitat **[3 comments]**	The Project layout has been designed to minimize removals of natural habitat where feasible. This includes locating roads along natural habitat edges and avoiding fragmentation of larger woodlands with interior forest. Mitigation measures (Section 6) have been prepared to mitigation potential adverse interactions with natural environment Valued Environmental Components (VECs) during construction. This includes avoiding sensitive periods for wildlife, and installing bridges and culverts to maintain fish and wildlife passage. NSDPW has developed a variety of habitat compensation banks in advance of construction to offset unavoidable habitat loss and actively seeks agreements with local communities and conservation organizations for new projects.
Environment – Sustainability and alternative transportation options **[2 comments]**	Greenhouse Gas Study (Appendix A) indicates that GHG emissions within the LAA will decrease as idling times are expected to decrease from improved travel times and due to the gradual increase in the use of electric vehicles. Additionally, the Coldbrook and surrounding areas do not carry the population density that would be required to support commuter rail. Rapid rail is not within the direction of provincial government and the limited commercial and industrial density of the Annapolis Valley would not support the capital investment required to support the technological requirements. Existing transit fleets are under municipal mandate and not governed by NSDPW.
Community – Public consultation and access to information **[3 comments]**	NSDPW has developed several initiatives to engage local residents, stakeholders, and First Nations communities throughout this process. Consultation initiatives have been described in Section 3 and include a project website and comment form, meetings with stakeholders, consultation letters for First Nations communities, and the inclusion of AVFN representative on Project Advisory Committee. Public information sessions for previous iterations of the Project were held in 1999 and 2006. As required by the *Environmental Assessment Regulations*, this EA Registration Document will be made available online for public viewing and comment.
Community – First Nations engagement **[1 comment]**	NSDPW has a legal Duty to Consult with the Mi'kmaq of Nova Scotia and have been regularly engaging with AVFN to advise on aspects of the Project (Section 3.1), including a role on the Project Advisory Committee for the AVFN Senior Finance Officer. Consultation letters have been circulated to KMKNO, Sipekne'katik First Nation, and Millbrook First Nation, an ARIA has been completed, and a MEKS is in-progress.
Community – Loss of rural lifestyle **[2 comments]**	Improvements to transportation access are expected to provide business growth opportunities for local communities and businesses. However, these opportunities are not anticipated to significantly affect the community fabric or result in urbanization of the local area.

4 ENVIRONMENTAL ASSESSMENT SCOPE AND METHODOLOGY

4.1 SCOPE OF ASSESSMENT

The environmental assessment scope and methodology for the Project have been developed to satisfy regulatory requirements of the Province of Nova Scotia. Given a proposed alteration of more than 2 ha of wetland, the proposed Project must be registered for an EA as a Class 1 Undertaking pursuant to the *Environmental Assessment Regulations* of the Nova Scotia *Environment Act*. This document fulfills the requirements for Project registration under this legislation and as outlined in *A Proponent's Guide to Environmental Assessment* (NSE 2018).

The approach used in this report has evolved from methods proposed by Beanlands and Duinker (1983), who stressed the importance of focusing the assessment on environmental components of greatest concern to society or as indicators of environmental health. In general, the methodology is designed to produce an EIS document that:

- Focuses on issues of greatest concern;
- Addresses regulatory requirements;
- Addresses issues raised by the public, the Mi'kmaq of Nova Scotia, and stakeholders;
- Integrates engineering design and mitigation and monitoring programs into a comprehensive environmental management planning process, and
- Integrates cumulative effects assessment (CEA) into the overall assessment of residual environmental effects.

The environmental assessment methodology for this Project includes an evaluation of the potential effects, including cumulative effects, of each Project phase, as well as malfunctions and accidents, with regards to each valued environmental component and valued socio-economic component (collectively referred to as VECs). Project-related effects are assessed within the context of boundaries established for the assessment.

4.1.1 SCOPE

The scope of the Project addressed by the EA includes those components and activities described in Section 2. The assessment encompasses the construction and operation phases of the Project as presented in Table 4-1, as well as accidental and unplanned events. It does not include an assessment of decommissioning for which plans, and related environmental management and mitigation measures, will be generated by NSDPW in accordance with all applicable regulatory requirements at the time of decommissioning.

Table 4-1 Summary of Project Phases and Activities

PROJECT PHASE	WORKS AND ACTIVITIES	DESCRIPTION
Site preparation	Vegetation Clearing and Grubbing	Vegetation removal Brush and stump removal
	Erosion and Sediment Control (ESC)	Installation of ESC measures
Construction	Roadbed Development	Excavation Blasting
	Grading	Sub-grade construction Sub-base & base construction
	Watercourse Crossings and Wetland Alteration	Bridges (one) Culverts (four) Wetland infilling ESC
	Surfacing and Finishing	Paving Shouldering and topsoil Hydroseeding Finishing
Operation	Highway Operation	Highway traffic
	Winter Maintenance	Snow removal Ice control
	Infrastructure Maintenance	Pavement repair Repainting Shoulder and finishing Maintenance Ditch maintenance Culvert and bridge maintenance ESC
	Vegetation Management	Manual and mechanical removal Herbicide use Integrated vegetation management
Accidental and Unplanned Events		Spills of chemicals and petroleum, oils or lubricants Failure of ESC measures Fires Vehicular collisions

4.1.2 VALUED ENVIRONMENTAL COMPONENTS (VEC) IDENTIFICATION

Valued environmental and socio-economic components (referred to as VECs) are environmental, biophysical, or human features that are of value or interest and which may be affected by the Project. The potential VECs for this assessment (Table 4-2) have been identified because they may be of value or interest to regulatory agencies, the Mi'kmaq of Nova Scotia (specifically AVFN), key stakeholders, and the general public. Other criteria for their selection included site-specific existing environmental conditions, features and functions in the Project area, and the study team's experience and professional judgement with other highway projects.

Table 4-2 Valued Ecosystem Components

PROJECT PHASE	WORKS AND ACTIVITIES
Atmospheric Environment	Air Quality
	Climate Change and Greenhouse Gas (GHG) Emissions
	Noise
Aquatic Environment	Groundwater Resources (Quantity and Quality)
	Surface Water Resources (Quantity and Quality)
	Fish and Fish Habitat
	Aquatic Species at Risk
Terrestrial Environment	Vegetation and Habitat
	Plant Species at Risk
Wetlands	Wetland Functions
	Wetland Types and Protection Status
Wildlife	Wildlife Habitat
	Wildlife Connectivity and Crossings
	Wildlife Species at Risk
Avifauna	Migratory Birds
	Breeding Birds
	Raptors
	Avian Species at Risk
Land Use	Existing Land Use
	Planned Land Use
Traditional Use of Lands and Resources	Traditional Use of Resources (e.g., Hunting, Country Foods, Medicine) Traditional Use of Land (e.g., Burial Grounds, Hunting Camps)
Archaeology and Cultural Heritage	Features and Artefacts of Scientific, Historical and / or Heritage Significance

4.1.3 PROJECT – ENVIRONMENT INTERACTIONS

Potential interactions between the Project components and VECs were identified, based on the effects pathways for activities associated with construction, operation and accidents and malfunctions (Table 4-3). Potential interactions were identified based knowledge of the Project and the environmental characteristics of the area.

Table 4-3 Potential Project – VEC Interactions

WORKS AND ACTIVITIES	ATMOSPHERIC ENVIRONMENT - AIR QUALITY & GHGS	ATMOSPHERIC ENVIRONMENT -NOISE	AQUATIC ENVIRONMENT	TERRESTRIAL ENVIRONMENT	WETLANDS	WILDLIFE	AVIFAUNA	LAND USE	TRADITIONAL USE OF LANDS AND RESOURCES	ARCHAEOLOGY AND CULTURAL HERITAGE
SITE PREPARATION										
Vegetation Clearing	x	x	x	x	x	x	x	x	x	x
ESC			x	x	x	x		x		
CONSTRUCTION										
Roadbed development	x	x	x	x	x	x	x	x	x	x
Grading	x	x	x	x	x	x	x	x	x	
Watercourse Crossings and Wetland Alteration	x	x	x		x	x	x	x	x	x
Surfacing and Finishing	x	x						x		
OPERATIONS AND MAINTENANCE										
Highway Operation	x	x		x		x	x	x	x	
Winter Maintenance	x		x	x	x	x	x		x	
Infrastructure Maintenance	x	x	x	x	x	x	x			
Vegetation Management	x	x	x	x	x	x	x		x	
ACCIDENTAL OR UNPLANNED EVENTS										
Spills			x	x	x	x	x	x	x	
Failure of ESC Measures	x		x	x	x	x	x	x	x	
Fires	x			x		x	x	x	x	x
Vehicular Collisions						x	x	x		

4.1.4 SPATIAL AND TEMPORAL BOUNDARIES

VEC-specific spatial and temporal boundaries were determined for the geographical areas and time periods within which the VECs may interact or are likely to be influenced by the Project. Each identified environmental effect, either direct or indirect, was evaluated within these boundaries. VEC-specific spatial and temporal boundaries are presented in Section 6.

SPATIAL BOUNDARIES

The following spatial boundaries have been established for the effects assessment:

Project Development Area (PDA): The PDA includes the footprint of the ROW for the intersection and connector roads and represents the maximum limits of physical disturbance associated with the proposed Project. This includes all the activities as defined in Table 4-1, such as any areas of vegetation clearing, grubbing, cut and fill. The extent of the PDA will remain the same for all VECs.

Local Assessment Area (LAA): The LAA typically extends beyond the PDA and includes areas where a likelihood of probable effects to VECs exists. The LAA includes all areas surveyed for VECs; field assessments were undertaken within 200 m of the two initially proposed route options (Figure 1). The LAA is specific to each VEC and is outlined in Section 6.

Regional Assessment Area (RAA): The RAA extends outside of the LAA and PDA and is used to assess the broader effects of the Project and VEC interactions, including those associated with atmospheric, socio-economic, and cultural environments. The RAA is specific to each VEC and is outlined in Section 6.

TEMPORAL BOUNDARIES

The temporal boundaries identify the duration or timing of environmental effects to the identified VECs during the construction and the operation phases of the Project. Site clearance is planned to commence in late 2023, with construction taking place over 2 years from the Spring of 2024. Operation and maintenance of the proposed infrastructure will continue indefinitely, with no plans for decommissioning.

Similar to spatial boundaries, temporal boundaries may be different for each VEC. For natural features, the assessment considers the ecological variability, sensitivities, and interactions over the course of a full year (e.g., sensitivities associated with migratory time periods, bird nesting or fish spawning time periods). Project activities will be scheduled to avoid potentially adverse interactions with valued components during sensitive periods (e.g., migratory bird nesting periods; fish spawning times) as described in mitigation measures and in compliance with permits and conditions of approvals.

4.2 EFFECTS ASSESSMENT

The analysis methodology employed for the environmental effects assessment represents the accepted practice to meet the requirements of the NS *Environmental Assessment Regulations* as outlined in *A Proponent's Guide to* Environmental *Assessment* (NSE 2018). The environmental effects assessment considers any positive and negative environmental effects that the Project may cause. It addresses potential effects associated with routine, planned Project activities, as well as accidents and unplanned events. The process to assess environmental effects includes the following steps:

- Prediction and assessment of Project-related environmental effects, including both positive and negative effects;
- Identification of mitigation measures that would be incorporated into the Project, including avoidance (through design), mitigation using best practice, and compensation, and
- Determination of residual effects and their significance.

4.2.1 VEC DESCRIPTION AND BOUNDARIES

A description of each VEC, its ecological and/or socio-economic context and rationale for selection is provided. VEC-specific spatial and temporal boundaries have been determined for geographical areas and time periods within which the VECs may interact or are likely to be influenced by the Project.

4.2.2 SIGNIFICANCE DEFINITION

To determine whether an environmental effect is significant, significance criteria or thresholds are defined for each VEC. These thresholds constitute a measure or standard beyond which residual environmental effects (those remaining after implementation of mitigation and controls) would be significant. Thresholds are quantitative, where possible, and based on: concerns identified during scoping of the Project; existing information regarding the characteristics and state of the VEC (such as its persistence within the Project area); applicable legislation, standards, policies and guidelines; stakeholder input, or professional judgement.

4.2.3 ENVIRONMENTAL EFFECTS ANALYSIS

The potential effects resulting from interactions with the Project, either directly or indirectly, are identified and described for each VEC. The effects analysis includes effects from interactions associated with the construction and operation phases of the Project, as well as for potential accidents and unplanned events.

Further analysis will not be conducted for noted interactions that are determined unlikely to result in an effect, based on existing knowledge. The effects assessment involves both qualitative and quantitative analyses using existing knowledge, professional judgment, and analytical tools (e.g., computer modelling) where appropriate and feasible.

4.2.4 MITIGATION MEASURES

Mitigation measures to reduce or eliminate potential environmental effects are identified. These include environmental protection measures, best management practices, industry standards, and habitat compensation or off-setting projects.

Where possible, mitigation measures have been incorporated into the Project design and implementation in order to eliminate or reduce potential adverse effects. A hierarchy approach has been taken to mitigation options, where mitigation at the source of the effect is deemed the most preferable (design or engineering controls); mitigation at the receptor end was considered only if avoidance was deemed not feasible or not sufficiently effective. In instances where an adverse effect is unavoidable and cannot be mitigated to non-significant levels, options for compensation were investigated. For interactions where positive effects are anticipated, opportunities were considered for maximizing the positive effects.

4.2.5 SIGNIFICANCE OF RESIDUAL EFFECTS

Residual effects are environmental effects that will remain after the successful application of proposed mitigation measures. They have been evaluated for the Project construction and operation phases as well as for potential accidents and unplanned events.

Significant environmental effects are those adverse effects that will cause a change in the VEC that will alter its status or integrity beyond an acceptable level. The residual effects classification is based on the magnitude, geographic extent, duration/frequency, reversibility and ecological context, and is used to describe residual effects predicted for the Project. These criteria are used to describe the nature and type of an effect on VECs. The residual effects classification is then used to determine the environmental significance of Project effects to VECs. The definitions of the criteria are presented below:

Magnitude is a measure of the intensity of a residual effect or the degree of change cause by a Project on a VEC relative to the existing conditions. Geographic extent and duration of an effect is important in classifying magnitude for a VEC. For magnitude, the criteria are defined as follows:

> **High:** A residual environmental effect affecting a whole stock, population, habitat or ecosystem, outside the range of natural variation that may be near or exceed the resilience limits of a population or community, such that communities do not return to pre-Project levels for multiple generations. For social environment VECs, the residual effect is expected to substantially enhance or interfere with existing conditions in communities in the local area and beyond.
>
> **Moderate:** A small, measurable residual environmental effect affecting a portion of a population or habitat, or ecosystem, returns to pre- Project levels in one generation or less, rapid and unpredictable change, temporarily outside range of natural variability. For social environment VECs, the residual effect is noticeable and may be potentially beneficial or detrimental to individuals and communities in the local area but not beyond.
>
> **Low:** A negligible residual environmental effect affecting a specific local group, habitat, or ecosystem, returns to pre-Project levels in one generation or less, within natural variation. For social environment VECs, the residual effect is limited to a slight positive effect or nuisance to individuals or communities in the local area.
>
> **Nil:** No discernable change to a VEC.
>
> **Unknown:** A residual environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.

Geographic extent refers to the spatial extent of the area affected and is related to the spatial distribution and movement of a VEC. When considering geographic extent in the determination of magnitude, it is important to understand that local scale effects are less severe than those that extend to the regional scale or beyond. Geographic extent is broken into local, regional, and beyond regional as defined as follows:

> **Local scale** effects are those largely associated with direct effects from the Project footprint (i.e., removal of vegetation for construction of project components) and project specific small-scale indirect changes (i.e., within the Local Assessment Area).
>
> **Regional scale** effects are those that are associated with incremental and cumulative changes from the Project and other developments but are restricted to within the Regional Assessment Area.
>
> **Beyond regional** includes cumulative residual effects from the Project and other developments that extend beyond the Regional Assessment Area.

Frequency refers to how often a residual effect will occur but is not to be confused with the frequency of the activity that causes a residual effect. Frequency is explained by identifying when the source of change and residual effect occurs. Frequency is broken into the following categories:

> **Infrequent:** isolated or confined to a discrete period.
>
> **Frequent:** occur repeatedly over the assessment period.
>
> **Continuous:** occurs continuously over the assessment period.

Duration is defined as the amount of time from the beginning of a residual effect to when that effect on a VEC is reversed. Duration is the results of two factors, the amount of time between the start and end of a Project activity that causes stress on a VEC, and the time required for the effect to be reversible. The duration of individual Project activities and the period in which the residual effect may occur are considered. Some effects are reversible shortly after the stress has been removed (e.g., changes in the distribution of some wildlife species following the removal of noise after decommissioning and abandonment), while others may take longer to be reversed (e.g., the change in abundance of some species until revegetation has occurred). In some cases, a prediction of duration may be well beyond the temporal boundary of the Project, it is not known when those effects may be reversed, and a VEC may never return to a state that was unaffected by the Project. In these cases, the likelihood of reversibility is so low that the effect is classified as irreversible. Therefore, duration is broken into the following categories:

Short-term: the residual effect is reversible at the end of construction

Medium-term: the residual effect is reversible at the end of operation of the project

Long-term: the residual effect is reversible within a defined length of time where prediction certainty can predict the effect is reversible after decommissioning and abandonment.

Permanent: the residual effect is predicted to influence a VEC indefinitely. This is applied when an effect is determined to be irreversible.

Reversibility is considered the likelihood that the Project will no longer affect a VEC, as well as the ability of a VEC to return to an equal or improved condition once the interaction with the Project has ended. Reversibility has two alternatives, reversible or irreversible. Reversible is applied to short- medium- and long-term duration residual effects where the Project no longer cases changes to a VEC. Irreversible is applied when the residual effect is predicted to influence a VEC indefinitely or the duration of an effect is unknown.

For adverse residual effects, the evaluation for the individual criteria was combined into an overall rating of significance as follows:

Major: Potential impact could jeopardize the long-term sustainability of the resource, such that the impact is considered sufficient in magnitude, areal extent, duration, and frequency, as well as being considered irreversible. Additional research, monitoring, and/or recovery initiatives should be considered.

Medium: Potential impact could result in a decline of a resource in terms of quality/quantity, such that the impact is considered moderate in its combination of magnitude, aerial extent, duration, and frequency, but does not affect the long-term sustainability (that is, it is considered reversible). Additional research, monitoring, and/or recovery initiatives may be considered.

Minor: Potential impact may result in a localized or short-term decline in a resource during the life of the Project. Typically, no additional research, monitoring, and/or recovery initiatives are considered.

Minimal: Potential impact may result in a small, localized decline in a resource during the construction phase of the Project and should be negligible to the overall baseline status of the resource.

Ecological and socio-cultural context includes the sensitivity, disturbance, and change to the current status of the VEC. This evaluates residual effects on a larger scale within the surrounding landscape and communities. The ecological and socio-cultural context is evaluated on the level of disturbance to the existing conditions present within and around the Project lands.

The adverse residual effects have been evaluated in the following categories:

Low disturbance: Potential impacts are unlikely to result in landscape-level alterations or community-wide disturbances. Impacts are anticipated to be localized and not affect the local community at large.

Medium disturbance: Potential impact could result in moderate landscape-level changes of ecological conditions, such as habitat fragmentation and resulting edge effects. Socio-cultural impacts at this level may cause temporary disruptions to businesses and residents (i.e., road closures).

High disturbance: Potential impacts resulting in a high level of disturbance may significantly alter the landscape, such as removal of large swaths of natural habitat and wildlife corridors. The socio-cultural impacts resulting in high disturbance may include long term disruptions, such as a permanent increase in noise for residents or permanent road closures affecting access to local businesses.

4.3 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The effects assessment also considers how the proposed Project could be affected by environmental conditions, such as severe weather or climate change. This includes a discussion of extreme weather events, the potential consequences for the Project and environmental components, and the identification of mitigation requirements. The determination of significance follows the same general approach as applied in the assessment of effects associated with planned activities.

4.4 CUMULATIVE EFFECTS WITH OTHER UNDERTAKINGS

The effects assessment identifies other planned and reasonably foreseeable activities that could overlap in time and space with the proposed Project construction and operation phases. Where such overlap is identified, the potential for cumulative effects and requirements for mitigation measures is discussed. The significance levels of the residual adverse effects, if any, is determined applying the criteria presented above.

5 DESCRIPTION OF THE ENVIRONMENT

5.1 PHYSICAL ENVIRONMENT

5.1.1 TOPOGRAPHY

The Project is in the Annapolis Valley Ecodistrict (610), which is bounded by the south-facing slopes of the North Mountain and the north-facing slopes of the South Mountain. Ecodistrict 610 has an area of 92,800 ha and is about 130 km long, varying in width from 3 to 11 km. The Gaspereau Valley is also included within this Ecodistrict. (Neily *et al.* 2017).

5.1.2 GEOLOGY AND SOILS

The LAA is underlain entirely by the Wolfville Formation (Figure 2) which is composed of pink to red, coarse-grained sandstone and conglomerate with minor red-brown siltstone and shale (White 2019).

This ecoregion is located on the Atlantic Uplands of Nova Scotia, which represents the lower southern slope of the southeastwardly tilted Cretaceous peneplain. Rolling till plain, drumlin fields, extensive rockland, and wetlands are underlain by folded Paleozoic slates and quartzites intruded with granites. The plain rises from 30 m asl near the Atlantic Ocean to 220 m asl at its northern limit and is mantled with stony, discontinuous veneers and blankets of glacial till. Loamy Humo-Ferric Podzols are the dominant soils in the ecoregion (Webb and Marshall 1999).

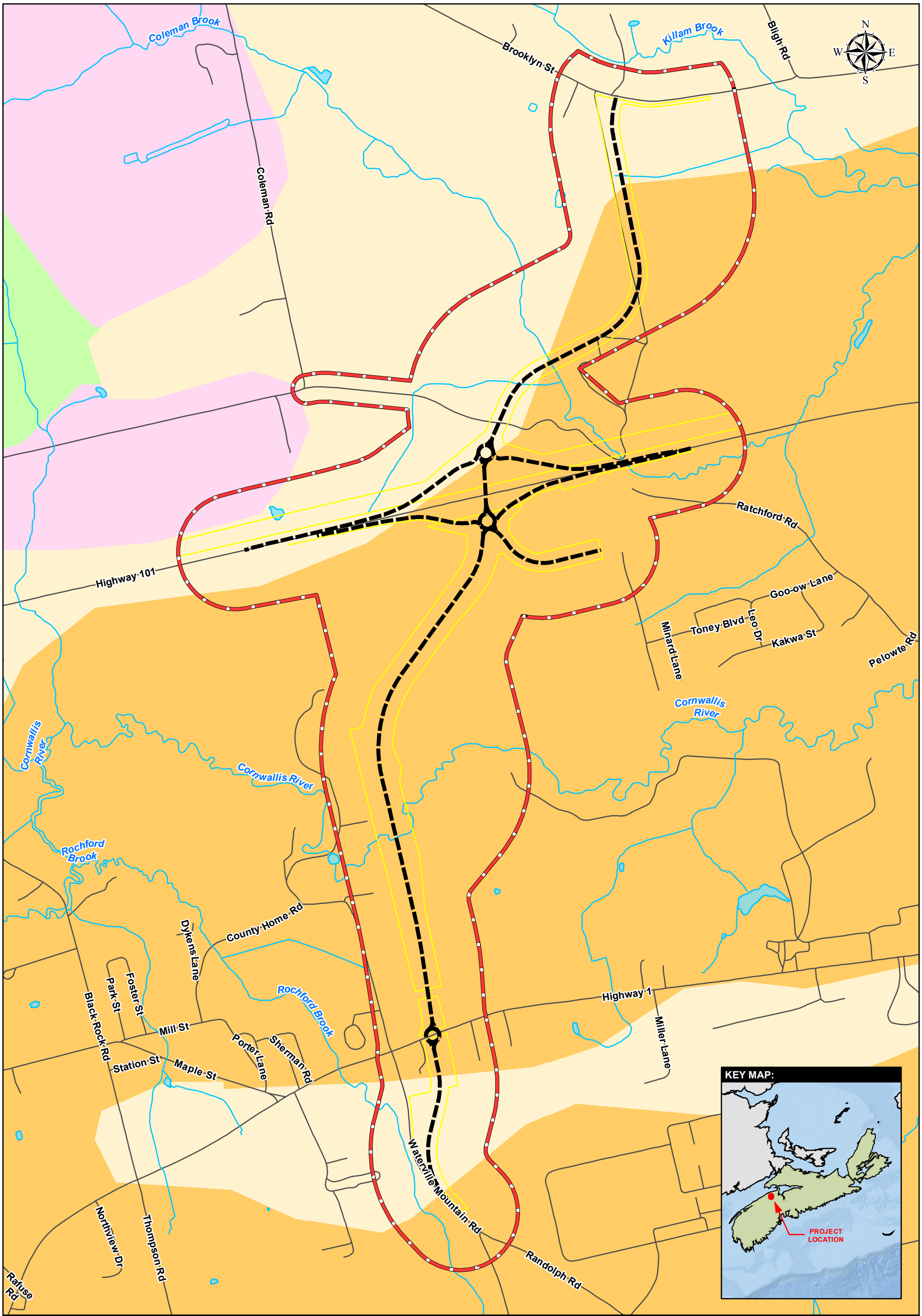
Peaty Gleysols, Fibrisols on raised bogs, and Mesisols on horizontal fens are also components of the landscape (Webb and Marshall 1999).

5.1.3 GROUNDWATER

The LAA is located within the sedimentary groundwater region of Nova Scotia (Kennedy and Drage 2009). Wells located within the sedimentary groundwater region have high yields, (median yield of 181.8 litres per minute), high specific capacity (median 20.4 m^3 per day per metre) and high transmissivity (median 16.0 m^2 per day) because these rocks tend to be more fractured and groundwater can flow both along the fractures and through the rock itself (Kennedy and Drage, 2009).

The NSE Well Log Database was accessed to identify the locations of water wells within a 500 m radius of the LAA (Figure 3). A total of 110 wells were identified; however, most wells were georeferenced using the Nova Scotia Mapbook (accuracy ±707 m), Nova Scotia Atlas (accuracy ± 641 m), NTS Claim (accuracy ±1130 m) or NSPRD (accuracy ~10 to 2,000 m) methods; therefore, the exact location of all wells are not known and could potentially be inside the LAA or outside of the 500 m radius. Of the 110 wells identified, 76 wells are domestic, five are commercial, four are industrial, 9 are agricultural (non-irrigation), two are municipal, one is public (non-municipal), and 13 have an unknown/non-listed use. The average well depth (for 108 of 110 wells) is 30.5 m and the average static ground level (for 86 of 110 wells) is measured at 1.8 m below top of casing. The average depth to bedrock is 12.2 m below ground surface water for 91 of 110 wells. One hundred nine (109) wells are drilled, and one well is dug.

A total of 13 wells were identified within the LAA; however, if the older georeferenced wells are removed from the search, 8 wells remain within the LAA. The average well depth (for 8 wells) is 34.0 m and the average static ground water level (for 3 wells) is 5.2 m below top of casing. The average depth to bedrock (for 7 wells) is 10.2 m below ground surface.



PROJECT:

PROJECT: **NOVA SCOTIA - HIGHWAY 101 CAMBRIDGE INTERCHANGE AND CONNECTOR ROADS EA KINGS COUNTY, NS**

PROJECT NO.: **211-04152**

CLIENT: NOVA SCOTIA

FIGURE:

TITLE: **SURFICIAL GEOLOGY**

FIGURE NO.: **2**

REVISION NO.: **0**

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DATUM: NAD 83 CSRS

PROJECTION: UTM ZONE 20 NORTH

DRAWN BY: C. PYTLAK

CHECKED BY: D. EDWARDS

CREATED DATE: (YYYY-MM-DD) 2022/01/28

REVISION DATE: (YYYY-MM-DD) 2023/03/07

LEGEND:

- LOCAL ASSESSMENT AREA
- PROJECT DEVELOPMENT AREA
- PROPOSED ALIGNMENT
- ROAD
- WATERCOURSE
- WATERBODY

SURFICIAL GEOLOGICAL UNIT

- GLACIOFLUVIAL DEPOSITS (KAMES AND ESKERS)
- GLACIOFLUVIAL DEPOSITS (OUTWASH FANS)
- RESIDUUM
- SILTY TILL PLAIN (GROUND MORAINE)

SCALE: 1:12,500

0 200 400 800 Meters

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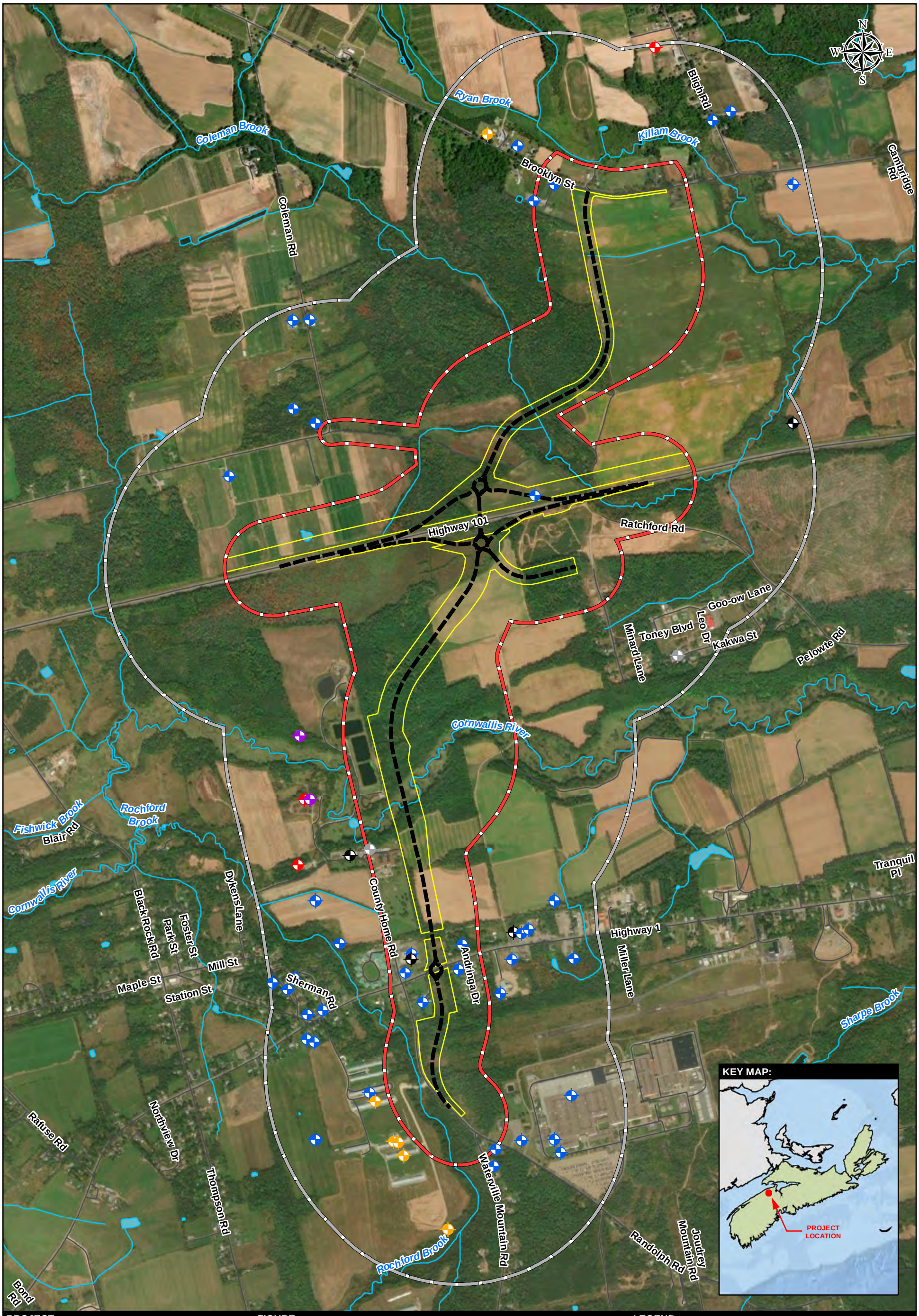

PROJECT:

PROJECT: NOVA SCOTIA - HIGHWAY 101 CAMBRIDGE INTERCHANGE AND CONNECTOR ROADS EA KINGS COUNTY, NS

PROJECT NO.: 211-04152

CLIENT: NOVA SCOTIA

FIGURE:

TITLE: GROUNDWATER WELLS WITHIN 500M

FIGURE NO.: 3

REVISION NO.: 0

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DATUM: NAD 83 CSRS

PROJECTION: UTM ZONE 20 NORTH

DRAWN BY: C. PYTLAK

CHECKED BY: D. EDWARDS

CREATED DATE: (YYYY-MM-DD) 2022/01/28

REVISION DATE: (YYYY-MM-DD) 2023/03/07

LEGEND:

- LOCAL ASSESSMENT AREA
- GROUNDWATER ASSESSMENT AREA (500M)
- PROJECT DEVELOPMENT AREA
- PROPOSED ALIGNMENT
- ROAD
- WATERCOURSE
- WATERBODY

WATER WELL USE (# OF WELLS WITHIN STUDY AREA)

- UNKNOWN (13)
- AGRICULTURAL [NOT IRRIGATION] (9)
- COMMERCIAL (5)
- DOMESTIC (76)
- INDUSTRIAL (4)
- MUNICIPAL (2)
- PUBLIC [NOT MUNICIPAL] (1)

SCALE: 1:15,000

0 250 500 1,000 Meters

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5.1.4 SURFACE WATER

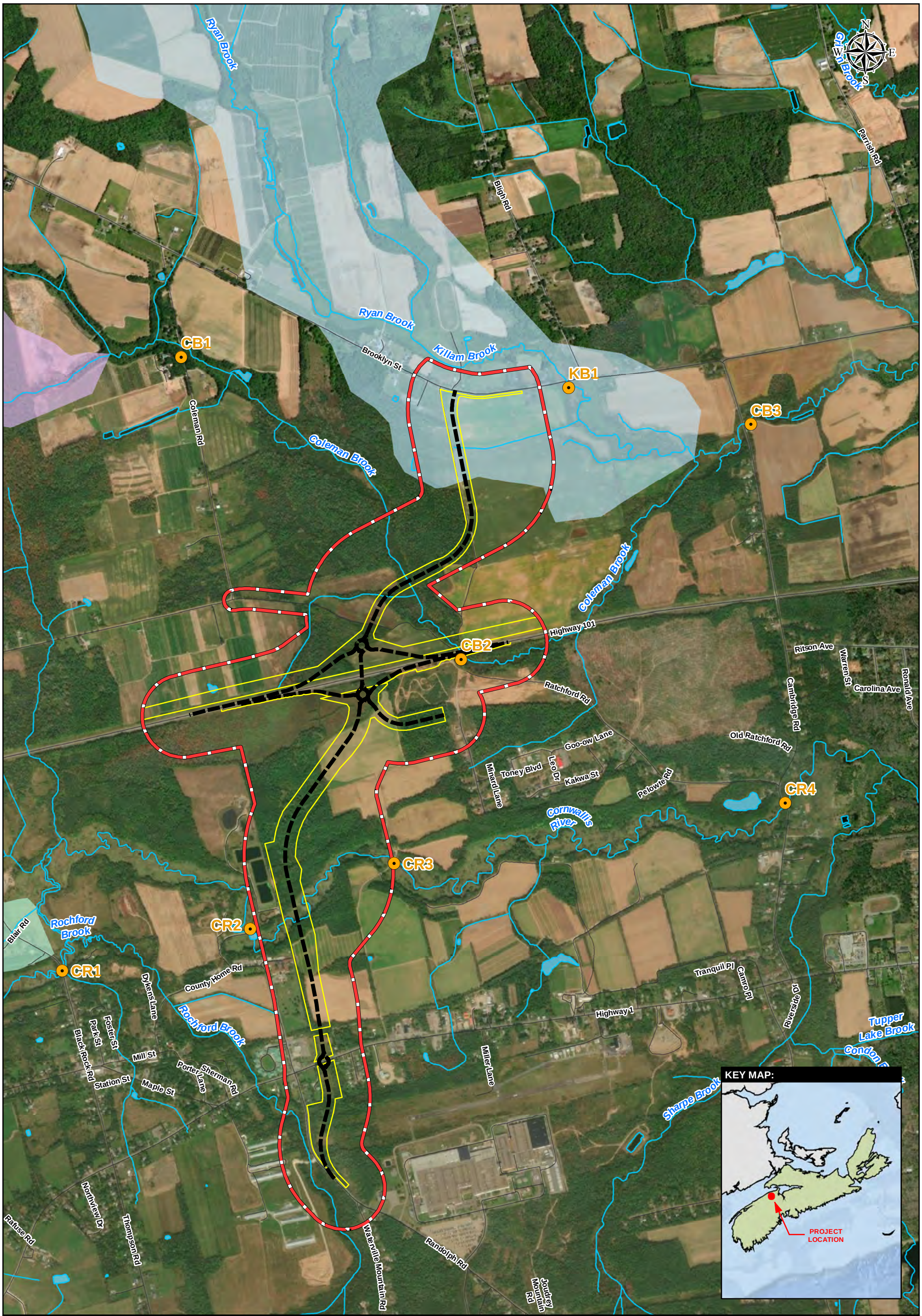
The LAA is located within the Annapolis primary watershed and the Cornwallis River secondary watershed. A portion of the Ryan and Killian quaternary watershed is located in the northern limit of the LAA. The Cornwallis River, Rochford Brook, and Coleman Brook are located within the LAA, and a total of 5 watercourses were identified based on available mapping and field observations. Field surveys to evaluate water quality conditions at eight separate locations on the Cornwallis River (CR1-4), Coleman Brook (CB1-3) and Killam Brook (KB1) were undertaken by Mi'kmaw Conservation Group (MCG) between May and December 2021. Temperature, dissolved oxygen, specific conductance, total dissolved solids, salinity, pH, and turbidity was measured at each location using calibrated water quality meters. Temperature loggers were deployed at all monitoring sites and recorded temperature on 10-minute intervals. Water chemistry samples were collected at all eight sites in October 2021, with samples collected specifically to test for E. coli and total coliform collected in June and October 2021. Other surveys and field observations pertaining to fish and fish habitat are discussed in Section 5.2.5. The locations of watercourses and field sampling locations are illustrated on Figure 4. Appendix B – Fish Biodiversity and Habitat Assessments further describes the methods and results of surface water surveys.

Measured pH values were generally within the CCME guidelines for the protection of aquatic life, with the exception of outliers on July 9th, 2021. Dissolved oxygen levels across all sites were considered suitable for cold water ecosystems, under the CCME guidelines. Sampling locations with the lowest values (CB2, KB1) are likely due to channel morphology as these reaches are flat and slow-moving without riffles or runs to help buffer the dissolved oxygen levels. Total dissolved solids were consistent across all sites, with the highest values recorded at CR1 and KB1. Specific conductance, total dissolved solids and salinity measured values all gradually increased across all sites between May to October.

Turbidity measurements at all sites were low, although extremely high values were recorded on September 8th and October 7th, 2021. The increased values for the September 8th sample were likely caused by heavy rains several days earlier, leading to additional runoff and turbulent flows. No specific cause was identified for the increased values on the October 7th sample.

Temperature was recorded from May to December 2021. The average water temperature was generally consistent across all sites in each sample period (May to August, August to December). During the May to August recordings, the average temperature across all sites was approximately 17°C. The Coleman Brook sites (CB1, CB2, CB3) were slightly cooler than the Cornwallis River (CR1, CR2, CR3, CR4) sites. During the August to December recordings, the average temperature was approximately 12°C, with the Coleman Brook sites being slightly warmer by approximately 1°C. The highest maximum temperature recorded was 26°C at CR2 and the lowest minimum temperature recorded was 2°C at CR3.

E. coli measurements taken during the June 30th, 2021, sampling event exceeded the CCME's guidelines for protection of agriculture standards. The Coleman Brook and Killam Brook values were much greater (>600 CFU/100mL) than the Cornwallis River values (<200 CFU/100mL). Additionally, the Coleman Brook and Killam Brook sites also exceeded the Guideline for Canadian Recreational Water Quality Single Sample Maximum levels during the June sample. The October 25th, 2021 E. coli measurements were lower across all sites except for CR1, which had an increase in E. coli presence and exceeded the CCME guidelines. The Coleman Brook and Killam Brook sites remained in exceedance of the CCME guidelines, although values were much lower than June. All sites were below the Canadian Recreational Water Quality Single Sample Maximum levels during the October sampling. The generally high levels of E. coli are likely associated with runoff from agricultural fields and pasture lands within the watershed.



PROJECT:

PROJECT: NOVA SCOTIA - HIGHWAY 101 CAMBRIDGE INTERCHANGE AND CONNECTOR ROADS EA KINGS COUNTY, NS

PROJECT NO.: 211-04152

CLIENT: NOVA SCOTIA

FIGURE:

TITLE: SURFACE WATER

FIGURE NO.: 4

REVISION NO.: 0

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CREATED DATE: (YYYY-MM-DD) 2022/01/28

REVISION DATE: (YYYY-MM-DD) 2023/03/07

LEGEND:

- LOCAL ASSESSMENT AREA
- PROJECT DEVELOPMENT AREA
- PROPOSED ALIGNMENT
- ROAD
- WATERCOURSE
- WATERBODY
- AQUATIC HABITAT AND WATER SAMPLING STATION

QUARTERNERY WATERSHEDS

- FISHWICK BROOK
- RYAN AND KILLIAN
- UNNAMED

SCALE: 1:17,500

0 300 600 1,200 Meters

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The highest surface velocities were measured at CR1, CB1, and CR4, and lowest values at CB2 and KB1. The remaining three monitoring locations had consistent velocities across all monitoring dates. Surface velocity across all sites was generally below 0.5 m/s. The average stream velocity was highest at CR3 and CR4, which are the two most downstream sites of the Cornwallis River, and measured at 0.26 m/s

Table 5-1 Water Chemistry In-Situ Sampling Minimum and Maximum Values

SITE	TEMP (°C)		DO (MG/L)		SPC (MS/CM)		TDS (MG/L)		SALINITY (PPT)		PH		TURBIDITY (NTU)	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
CR1	8.00	22.70	8.39	9.90	150.30	416.30	97.50	271.05	0.06	0.20	6.86*	8.34	2.81	12.80
CR2	8.40	22.60	7.93*	10.64	132.81	379.80	86.45	247.00	0.06	0.18	7.02*	7.97	3.27	16.40
CR3	8.40	21.90	6.93	12.33	127.8	398.20	82.55	258.70	0.06	0.19	6.60*	7.51	2.76	10.69
CR4	8.80	21.20	7.44*	11.45	118.23	376.20	76.70	244.40	0.06	0.18	6.74*	7.56	1.73	11.40
CB2	8.90	24.00	6.10*	11.28	167.08	310.20	108.55	201.50	0.08	0.19	6.87*	7.80	2.80	19.20
CB1	8.70	20.10	6.99*	11.01	173.67	320.97	113.10	205.40	0.08	0.15	6.56*	7.84	1.80	9.42
CB3	8.10	19.10	6.50*	10.99	139.25	352.10	90.35	229.45	0.07	0.17	6.68*	7.62	1.61	25.30
KB1	8.90	20.30	5.60*	11.17	265.63	412.50	122.20	267.80	0.13	0.20	6.95*	7.93	5.39	11.40

** Indicates that a lower value was recorded during sampling, however, this value does not accurately represent the low range of the parameter in the watercourse; all values, including outliers, are listed in Appendix B – Fish Biodiversity and Habitat Assessments*

Table 5-2 Water Quality Laboratory Analyses Results and Reporting Detection Limits (RDL)

PARAMETER	UNIT	RDL	CR1	CR2	CR3	CR4	CB1	CB2	CB3	KB1
Chloride	mg/L	1	78	33	38	34	21	21	20	15
Sulphate	mg/L	2	65	45	43	39	9	9	47	92
Ammonia as N	mg/L	0.03	0.12	1.17	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Total Phosphorous	mg/L	0.02	0.38	0.18	0.2	0.18	0.06	0.07	0.06	0.08
Total Aluminum	µg/L	5	650	79	88	158	75	90	160	564
Total Iron	µg/L	50	1990	564	510	512	189	351	452	912

5.1.5 CLIMATE AND WEATHER

Nova Scotia has a modified continental climate, with local climate variations being affected by proximity to the coast and elevation. Daily temperature and weather conditions fluctuations are common, particularly in the spring and fall seasons. The province's weather and climate are affected by westerly winds and the movement of air masses that produce frequent storms and result in regular fluctuations between moderate and stormy weather.

Long term meteorological data (1981 to 2010) collected by Environment and Climate Change Canada (ECCC) at the Kentville CDA station (45°04' N, 64°29' W) has been used to characterize and describe the climate and weather within the LAA and surrounding areas in the RAA landscape (ECCC 2021).

TEMPERATURES

The seasonal range of temperatures is relatively wide compared to elsewhere in the province with warm and humid summers contrasted with cold winters. The coldest average daily temperature is -5.6°C (January) and the warmest average daily temperature is 19.5°C (July). The annual average daily temperature is 7.1°C. The region also has an average of 145 frost free days, and an average growing season of 195 days.

PRECIPITATION

Precipitation remains relatively stable throughout the year. The winter months (November to March) see the highest monthly precipitation with average monthly totals ranging between 101.3 mm to 122 mm. The summer months (June to September) are drier, with average monthly totals ranging between 76.7 mm to 84.4 mm. Annual average precipitation is 1,117.1 mm, with an average annual rainfall amount of 903.5 mm and average annual snowfall of 270.7 cm. The area generally receives less rainfall during the summer months compared to elsewhere in the province.

WINDS

Wind conditions can be localized and greatly affected by local topography, man-made obstructions, and land cover. Generally, the inland areas of the Annapolis Valley are relatively protected by the North Mountain and are less likely to be influenced by marine effects, including winds. The average annual wind speed is 14.2 km/h, with winds most frequently from the west. The windiest months occur in the winter, with January having the highest average wind speed of 16.5 km/h. During the summer months the winds speeds are lighter, with a monthly average speed of 10.9 km/h in August. The maximum gust recorded at the Kentville CDA station was 188 km/h on February 2, 1976.

SEVERE WEATHER

As previously described, the region is protected from marine influences by the North Mountain and, therefore experiences less severe or disruptive weather such as seasonal fog or mist. Overall, the area frequently experiences more clear and sunny days than coastal areas.

CLIMATE CHANGE

ECCC and Climate Change Nova Scotia have used the Canadian Global Climate Model to estimate possible future climate conditions across the province. The models are based on a 30-year baseline period (1961 – 1990), with future projections based on 30-year time periods: 2020s, 2050s, and 2080s. Within the Kentville and Annapolis Valley region, the average annual temperature is anticipated to increase approximately 1.2°C over each 30 -year period. By the 2080s period, the average annual precipitation may increase approximately 83.5 mm from the baseline data period. The climate forecast for the region predicts more days with rain (increase of 19) but fewer days with snow (decrease of six). Additionally, the growing season (mean daily temperature > 5°C) is anticipated to increase by 46 days by the 2080s (180 days to 226 days). However, the water deficit is forecasted to increase from 36 mm to 58 mm in the same time period (Climate Change Nova Scotia 2021).

5.1.6 AIR QUALITY

The Air Quality Management System (AQMS) is a federal air quality management system which was implemented by the CCME to guide work on air emissions across Canada. The AQMS is a collaborative approach by federal, provincial, and territorial governments to reduce emissions and pollutants and improve air quality (Canadian Council of Ministers of the Environment 2022). The primary components of the AQMS include:

- Establishment of Canadian Ambient Air Quality Standards (CAAQS) to define the standards and air quality objectives across Canada;
- Air zone management within provinces and territories which permit management actions tailored to specific or unique air quality characteristics (i.e., pollutant sources, meteorological patterns, population density) that influence ambient air concentrations;
- Establishment of base-level industrial emission requirements for new and existing major industrial sectors;
- Six regional airsheds covering the entirety of Canada which allow for joint coordination and action involving the movement of air pollutants across provincial/territorial and international borders; and,
- Improvement to existing federal and provincial initiatives to address emissions from the transportation sector.

The background air quality represents the existing conditions of air quality before the implementation of a Project. Sources contributing to the existing air quality conditions include industrial activities, roadways, long-range transboundary air pollution, and small regional sources.

This section discusses the selection of contaminants considered, applicable guidelines for this assessment, selection of the monitoring stations, and comparison of the selected data to the applicable CAAQS

The CAAQS are specifically health-based air quality objectives for pollutant concentrations in outdoor air. Under the Air Quality Management System, ECCC and Health Canada established air quality standards for fine particulate matter. The CAAQS were established by the Federal government in 2013 and are referred to as “air quality indicators”. A value above an air quality indicator does not indicate a concern but is used to describe the air quality qualitatively. The CAAQS include a long-term (annual) target for fine particulate matter (Environment Canada, 2013). Applicable standards include the 2020 CAAQS standards for fine particulate matter ($PM_{2.5}$). Additional CAAQS for nitrogen dioxide (NO_2), ozone (O_3), and sulphur dioxide (SO_2) are to be implemented by 2025. The standards are described in Table 5-3.

Table 5-3 Canadian Ambient Air Quality Standards

POLLUTANT	AVERAGING TIME	STANDARDS			METRIC
		2015	2020	2025	
Fine Particulate Matter ($PM_{2.5}$)	24-hour	28 µg/m^3	27 µg/m^3		The 3-year average of the annual 98th percentile of the daily 24-hour average concentrations
	Annual	10.0 µg/ m^3	8.8 µg/m^3		The 3-year average of the annual average of the daily 24-hour average concentrations
Ozone (O_3)	8-hour	63 ppb	62 ppb	60 ppb	The 3-year average of the annual 4th highest of the daily maximum 8-hour average ozone concentrations
Sulphur Dioxide (SO_2)	1-hour	-	70 ppb	65 ppb	The 3-year average of the annual 99th percentile of the SO_2 daily maximum 1-hour average concentrations
	Annual	-	5.0 ppb	4.0 ppb	The average over a single calendar year of all 1-hour average SO_2 concentrations

POLLUTANT	AVERAGING TIME	STANDARDS			METRIC
		2015	2020	2025	
Nitrogen Dioxide (NO_2)	1-hour	-	60 ppb	42 ppb	The 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations
	Annual	-	17.0 ppb	12.0 ppb	The average over a single calendar year of all 1-hour average concentrations

$PM_{2.5}$: Particulate matter less than 2.5 micrometres (µm) in diameter; µg/m3: micrograms per cubic metre; ppb: parts per billion

In addition to the defined CAAQS listed in Table 5-3, Nova Scotia has also developed its own Air Quality Regulations under Sections 25 and 112 of the *Environment Act*. The *Air Quality Regulations* define the maximum permissible ground level concentrations for six compounds. Table 5-4 lists the provincial *Air Quality Regulations*.

Table 5-4 Nova Scotia Provincial Air Quality Standards

POLLUTANT	AVERAGING TIME	MAXIMUM PERMISSIBLE GROUND LEVEL CONCENTRATION	
		µG/M^3	PPHM
Carbon Monoxide (CO)	1-hour	34 600	3000
	8-hours	12 700	1100
Hydrogen Sulphide (H_2S)	1-hour	42	3
	24-hours	8	0.6
Nitrogen Dioxide (NO_2)	1-hour	400	21
	Annual	100	5
Ozone (O_3)	1-hour	160	8.2
Sulphur Dioxide ($S0_2$)	1-hour	900	34
	24-hours	300	11
	Annual	60	2
Total Suspended Particulate (TSP)	24-hours	120	-
	Annual	70*	-

** Geometric mean; µg/m3: micrograms per cubic metre; pphm: parts per hundred million*

As a method for managing air quality across jurisdictional boundaries, the CCME created an Air Zone Management Framework (AZMF) to categorize provincial regions by existing air quality and management goals and actions. The LAA is located within Nova Scotia's Western Air Zone, which is categorized as 'yellow', indicating the associated management actions are to prevent air quality deterioration from the increase of Ground-level Ozone (GLO) and PM2.5 levels. Yellow level regions are the second lowest level of air quality management (NSECC 2021).

MONITORING AND EMISSIONS

The concentrations of the selected contaminants resulting from background sources were estimated by analyzing historical monitoring data from ECCC National Air Pollution Surveillance (NAPS) stations. Consideration was given to assess the representativeness of the data for the stations selected. Publicly available data was obtained from these stations for the latest available years. For most of the ambient stations, 2019 is the most recent year of data that has been through rigorous quality assurance and quality control (QA/QC). More than one station was required due to some contaminants not being measured at closer ambient air monitoring stations.

The station information and period of analysis are listed in Table 5-5. Data from the Kentville Agri-Food Canada station was used for $PM_{2.5}$, O_3, and NO_2. Data from the Johnston Building station was used for SO_2 and CO. These stations were selected as a result of the station proximity to the Project site, data availability, as well as the stations being located in a similar geographic region with similar local land use.

Table 5-5 Air monitoring stations and data availability for selected contaminants

STATION NAME	NAPS STATION ID	AVAILABLE DATA					YEARS OF DATA[1]	DIRECTION FROM PROJECT
		$PM_{2.5}$	O_3	SO_2	NO_2	CO		
Kentville – Agri-Food Canada	31101	Y	Y	N	Y	N	2017-2019	E
Johnston Building	30113	N	N	Y	Y	Y	2017-2019	SE

Table 5-6 summarizes background concentrations in the area of the Project and provides an explanation of each threshold.

Table 5-6 Background Concentrations In Project Area

CONTAMINANT	AVERAGING TIME	BACKGROUND CONCENTRATION	AIR QUALITY THRESHOLD (MG/M^3)	METRIC
Fine Particulate Matter ($PM_{2.5}$)	24-hour	11	27	The 3-year average of the annual 98th percentile of the daily 24-hour average concentrations
	Annual	6.3	8.8	The 3-year average of the annual average of the daily 24-hour average concentrations
Ozone (O_3)	8-hour	103	117.8	The 3-year average of the annual 4^{th} highest of the daily maximum 8-hour average ozone concentrations
Sulphur Dioxide (SO_2)	1-hour	5.2	170.3	The 3-year average of the annual 99^{th} percentile of the SO_2 daily maximum 1-hour average concentrations
	Annual	0.7	10.5	The average over a single calendar year of all 1-hour average SO_2 concentrations

CONTAMINANT	AVERAGING TIME	BACKGROUND CONCENTRATION	AIR QUALITY THRESHOLD (MG/M^3)	METRIC
Nitrogen Dioxide (NO_2)	1-hour	7.5	79	The 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations
	Annual	1.6	22.6	The average over a single calendar year of all 1-hour average concentrations

A possible explanation for the increasing trends or high level of annual $PM_{2.5}$ and O_3 is increased transboundary pollution due to long-range air pollutants originating further west from sources such as forest fires and fossil fuel-fired power plants (NSECC 2021).

WIND ROSE

The prevailing wind direction for this area is shown in Figure 5 for the data period of January 1, 2017 to December 31st, 2021. The wind directions are based on meteorological data from ECCC station #27141 located in Kentville, Nova Scotia. Note that the direction of the flow vectors shows the direction the wind is blowing towards.

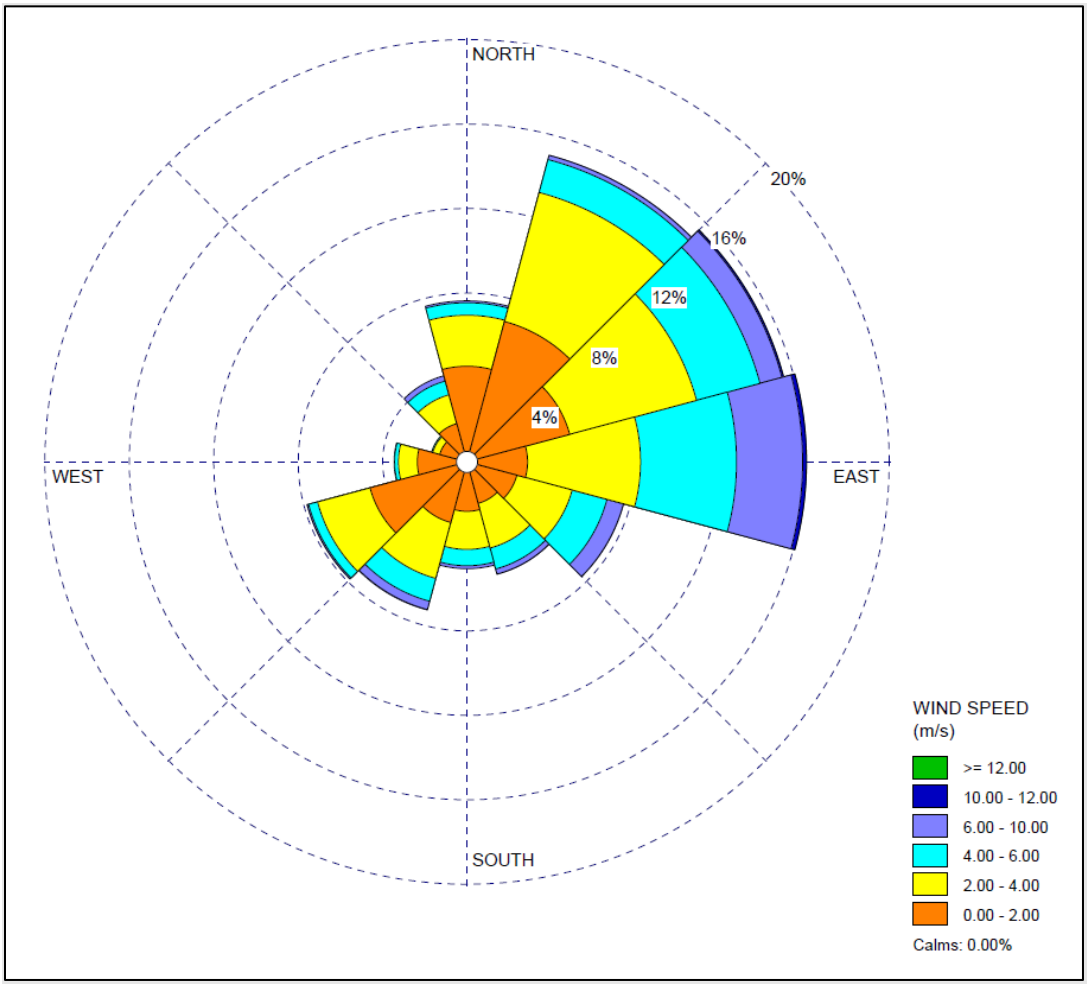


Figure 5 Kentville CDA CS Wind Rose

GREENHOUSE GAS (GHG)

A GHG Mitigation Assessment was undertaken by WSP in May 2022 (Appendix A) The assessment identified the estimated baseline GHG emissions from mobile sources using fossil fuels, emissions from zero emission vehicles (ZEVs), annual road GHG emissions from the operating and maintenance phases, and baseline annual and cumulative emissions. The baseline emissions were modeled using available provincial traffic and vehicle composition data with the assumption that the proposed Project does not exist.

The estimated baseline mobile emissions (tonnes CO_2e) for fossil fuels in 2023 is expected to be 21,759 tonnes CO_2e. This value includes light duty, medium duty, and heavy-duty vehicles driving and idling. The annual value is anticipated to increase until approximately 2033 before declining. Conversely, baseline ZEV electricity emissions in 2023 is anticipated to be 89.2 tonnes CO_2e and will steadily increase annually. The total baseline mobile emissions (fuel and electricity) is 21,848.1 tonnes CO_2e in 2023.

The estimated annual baseline emissions for the operation and maintenance of roads is approximately 76.5 tonnes CO_2e. This includes emissions associated with general maintenance as well as operation stage for lighting and traffic systems.

The cumulative baseline emissions in 2023 is 21,925 tonnes CO_2e.

A detailed description of the methodology and sources for baseline emission data and modeling is included in Appendix A.

5.1.7 ACOUSTIC ENVIRONMENT

The former Nova Scotia Department of Environment and Labour (NSDEL)'s Guidelines for Environmental Noise Measurement and Assessment defines noise as "unwanted sound" (Nova Scotia Department of Environment and Labour 1990). Excess noise can disrupt daily activities and affect the quality of life in the surrounding areas. The intensity (or volume) of sound is measured using a logarithmic system called decibels (dB). To measure and evaluate ambient noise, A-Weighted decibel (dBA) is used, as this compensates for the human ear's varying ability to detect very high or low-pitched sounds. Examples of the varying levels of sound intensity and their effects on human health are listed in Table 5-7.

Table 5-7 Background Concentrations In Project Area

SOUND SOURCE	SOUND INTENSITY (DBA)	EFFECTS TO HUMAN HEALTH
Airplane takeoff heard from about 50 m	140	Unbearable pain
Jackhammer, pneumatic tool	130	Threshold of pain
Emergency vehicle siren, airplane takeoff heard from 300 m	120	Beginning of pain
Loud concert, club	110	Bearable for short period of time; maximum vocal effort to be heard
Drill, chainsaw, motorcycle	100	Risk of hearing loss if greater than one hour per day
Lawnmower, alarm, subway	90	Very annoying
Alarm clock, noisy restaurant, factory	80	Difficult to have conversation
Busy street, vacuum cleaner	70	Interferes with telephone conversation
Normal conversation	60	Mild disturbance
Moderate rain, washing machine	50	Quiet, beginning of disturbance

SOUND SOURCE	SOUND INTENSITY (DBA)	EFFECTS TO HUMAN HEALTH
Library, refrigerator, or a quiet street at night	40	Peaceful area
Low voice conversation	30	Sense of calmness
Light wind in trees	20	Deep sense of calmness
Normal breathing	10	Barely audible
No perceptible sound	0	Lowest threshold of human hearing

Source: Gouvernement du Québec (2021)

SENSITIVE RECEPTORS

Noise Sensitive Areas (NSA) and representative locations within the LAA were considered as receptors. The Nova Scotia Guidelines for Environmental Noise Measurement and Assessment requires quantifying areas where people normally live, work, or partake in recreation. Generally, outdoor living areas such as the backyard of a house, are considered as the most impacted from environmental noise. Therefore, for the assessment of acoustic environment and sensitive receptors, NSA include specific land-uses provided they have an associated outdoor living area (OLA). The following OLAs were considered to be NSAs: private dwellings and private individual family units with an OLA; educational facilities and daycare centres with OLAs for students; hospitals and nursing homes with OLAs for patients; campgrounds providing overnight accommodations; and motels with communal OLAs for visitors.

Twenty-two Points of Reception (PORs) were selected based on a desktop review of available information. The PORs are representative of OLAs within the LAA. However, one receptor (POR_16) is located within the Project ROW and will be demolished. Therefore POR_16 is not considered further as a receptor and will not be included in the effects assessment (Section 6.3).

In addition to the PORs, five points of interest were selected within the AVFN lands. These points were selected to represent potential land uses for the AVFN. The locations of PORs are shown in Figure 6.

AMBIENT NOISE MEASUREMENTS AND NOISE GUIDELINES

Continuous ambient noise was monitored at three locations between July 28th to August 13th, 2021. Noise was monitored using Type 1 precision measurement system suitable for outdoor measurements. The locations of monitoring stations are shown in Figure 6. Station M1 is located on the north side of the Evangeline Trail, east of the Waterville Fire Hall Bay Station. Station M2 is located south of Highway 101, approximately 100 m west of the AVFN reserve boundary. Station M3 is located out of Brooklyn Street and approximately 0.5 km west of Bligh Road.

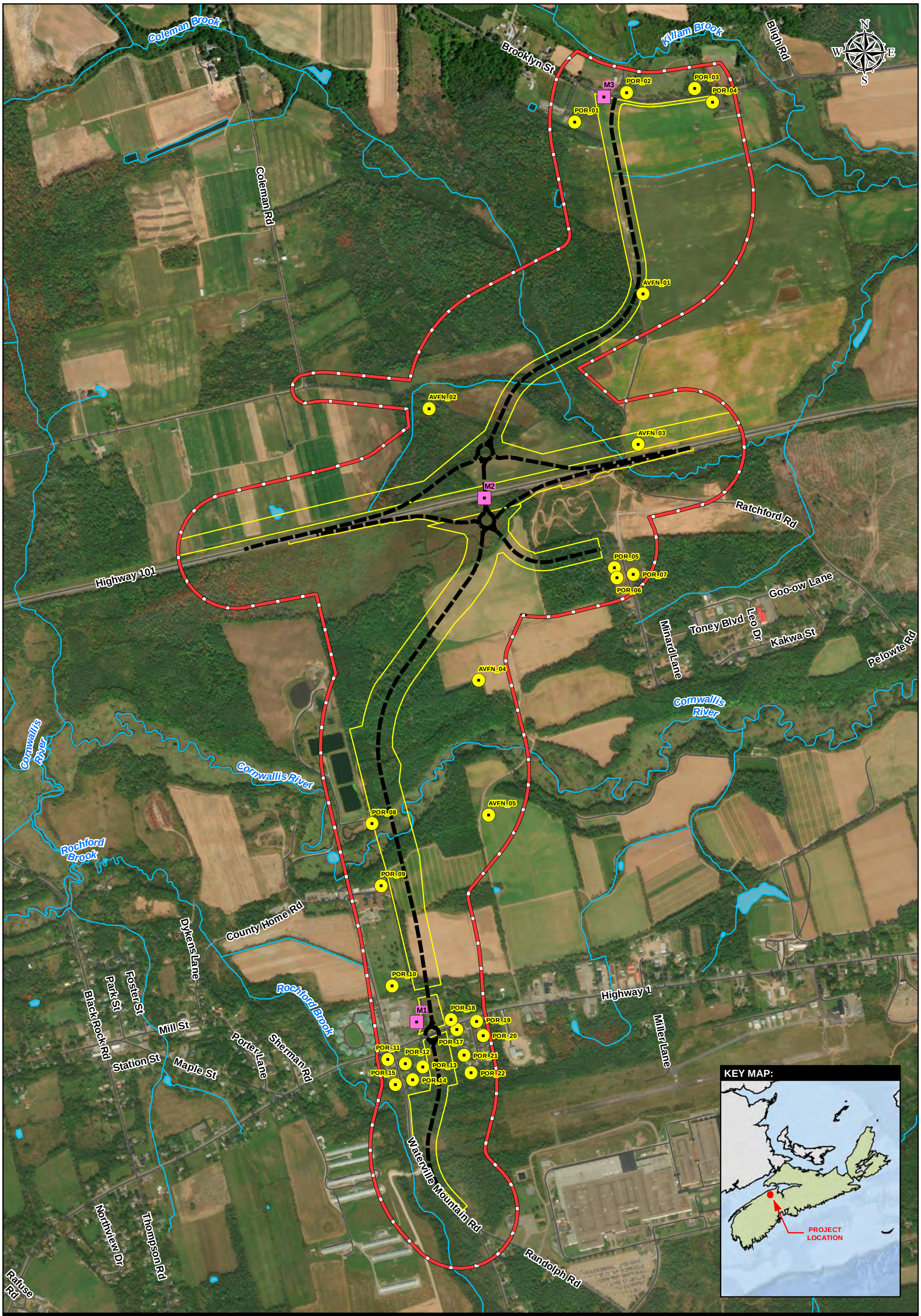
Noise measurements were recorded using a calibrated Larson David LxT Type 1 precision integrating sound level meter (SLM). Measurements were used to calculate Equivalent Sound Level (L_{eq}) for the daytime hours (L_{eq} Day), evening hours (L_{eq} Evening), and nighttime hours (L_{eq} Night). L_{eq} is the average sound pressure, measured in dB, encountered by a receptor from all events, including highly intrusive short duration noise (i.e., vehicle or aircraft fly by) over a specified duration. As per the NSDEL guidelines, the daytime period is defined as 07:00 hours to 19:00 hours, evening period is defined as 19:00 hours to 23:00 hours, and nighttime period is defined as 23:00 hours to 07:00 hours.

The acceptable noise levels, as defined by NSDEL, are as follows:

- L_{eq} ≤ 65 dBA between 07:00 and 19:00 hours (L_{eq} Day)
- L_{eq} ≤ 60 dBA between 19:00 and 23:00 hours (L_{eq} Evening)
- L_{eq} ≤ 55 dBA between 23:00 and 07:00 hours (L_{eq} Night)

However, it should be noted that the guideline noise levels are measured in areas where people normally live, work, or take part in recreation. Transportation (i.e., highways) are excluded from these guidelines (NSE 1990).

The measured sound levels at the three monitoring stations are summarized in Table 5-8. As indicated in Table 5-8, the ambient noise levels exceeded the recommended NSE guidelines (1990) at Station M2 during all monitoring periods, although the noise at this station is associated with highway traffic. The measured sound levels at Stations M1 and M3 met the guideline criteria. A detailed description of sound measurements and modeling is included in Appendix C – Noise Operation and Construction Noise Study.



PROJECT:

PROJECT: NOVA SCOTIA - HIGHWAY 101 CAMBRIDGE INTERCHANGE AND CONNECTOR ROADS EA KINGS COUNTY, NS

PROJECT NO.: 211-04152

CLIENT: NOVA SCOTIA

FIGURE:

TITLE: NOISE RECEPTORS AND MEASUREMENT LOCATIONS

FIGURE NO.: 6

REVISION NO.: 0

WSP Canada Inc.
1 Spectacle Lake Drive,
Dartmouth, Nova Scotia
www.wsp.com

DATUM: NAD 83 CSRS

PROJECTION: UTM ZONE 20 NORTH

DRAWN BY: C. PYTLAK

CHECKED BY: D. EDWARDS

CREATED DATE: (YYYY-MM-DD) 2021/10/18

REVISION DATE: (YYYY-MM-DD) 2023/03/13

LEGEND:

- LOCAL ASSESSMENT AREA
- PROJECT DEVELOPMENT AREA
- PROPOSED ALIGNMENT
- ROAD
- WATERCOURSE
- WATERBODY
- NOISE MONITORING LOCATION
- SENSITIVE RECEPTOR

SCALE: 1:12,500

0 200 400 800 Meters

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Table 5-8 Measured sound levels at Stations M1, M2 and M3

LOCATION	DATE	TIME OF DAY	MEASURED SOUND LEVELS – L_{EQ} (DBA)	
M1	August 4 – August 13, 2021	Day	07:00 to 19:00	55
		Evening	19:00 to 23:00	54
		Night	23:00 to 7:00	48
M2	July 28 – August 4, 2021	Day	07:00 to 19:00	71
		Evening	19:00 to 23:00	68
		Night	23:00 to 7:00	64
M3	July 28 – August 4, 2021	Day	07:00 to 19:00	63
		Evening	19:00 to 23:00	60
		Night	23:00 to 7:00	54

5.2 BIOLOGICAL ENVIRONMENT

5.2.1 TERRESTRIAL HABITAT

GENERAL HABITAT AND VEGETATION

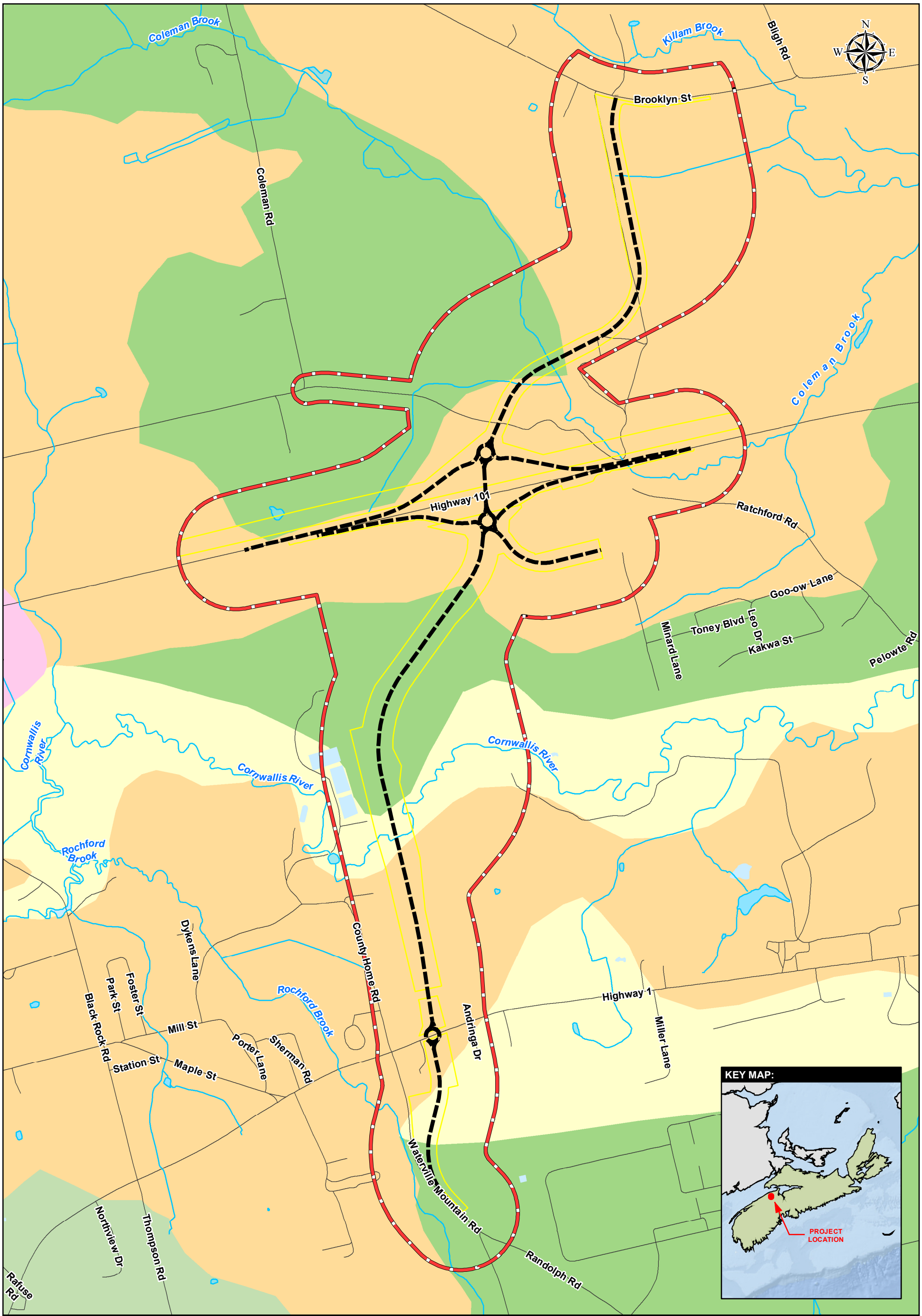
The provincial Ecological Land Classification system identifies the LAA as within the Valley and Central Lowlands Ecoregion (Ecoregion 6) and the Annapolis Valley Ecodistrict (Ecodistrict 610). Ecodistrict 610 is described as a warm, broad plain seldomly exceeding 11 km in width and extending over 140 km from the Minas Basin to Digby. It is generally flat, with the landscape sloping northeast to the Minas Basin along the Cornwallis River, and southwest along the Annapolis River to the Annapolis Basin. The flattest areas, with are largely located within Kings County, are sandy glaciofluvial outwash plains. Ecodistrict 610 is also the most heavily and intensely farmed ecodistrict within the province. The warm climactic conditions, deep and relatively stone-free soil, and ample groundwater supply are the primary factors for the prevalence of agricultural operations in the Annapolis Valley.

Based on the provincial habitat type mapping, four general habitat types were identified within the LAA: Floodplain, Pine Oak Flats, Pine Oak Hills and Hummocks, and Water (retention ponds). The habitat types are illustrated in Figure 7.

Vegetation and rare plant and lichen surveys were conducted in 2021. The surveys were completed to:

- Characterize vegetation communities and habitats within the LAA;
- Compile a list of vascular vegetation species occurring within the LAA;
- Identify the presence or potential presence of rare or endangered vascular plants; and
- Evaluate the LAA for the presence or potential presence of rare or endangered lichen species.

The terrestrial habitat within the LAA was found to mainly be comprised of agricultural fields (row crops), softwood forests, coniferous forests, mixed wood forests, shrub wetlands, and rural residential properties. Nine types of forest stands were identified and are described in Table 5-9. The age of the stands varied from overmature to early successional. Fragmentation of forest stands due to agricultural operations and development is common throughout the LAA and RAA.



PROJECT:

PROJECT: **NOVA SCOTIA - HIGHWAY 101 CAMBRIDGE INTERCHANGE AND CONNECTOR ROADS EA KINGS COUNTY, NS**

PROJECT NO.: **211-04152**

CLIENT: NOVA SCOTIA

FIGURE:

TITLE: **TERRESTRIAL HABITAT**

FIGURE NO.: **7**

REVISION NO.: **0**

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1 Spectacle Lake Drive,
Dartmouth, Nova Scotia
www.wsp.com

DATUM: NAD 83 CSRS

PROJECTION: UTM ZONE 20 NORTH

DRAWN BY: C. PYTLAK

CHECKED BY: D. EDWARDS

CREATED DATE: (YYYY-MM-DD) 2022/01/28

REVISION DATE: (YYYY-MM-DD) 2023/03/07

LEGEND:

- LOCAL ASSESSMENT AREA
- PROJECT DEVELOPMENT AREA
- PROPOSED ALIGNMENT
- ROAD
- WATERCOURSE
- WATERBODY

ECOLOGICAL LAND CLASSIFICATION (NSDNR)

- Floodplain
- Pine Oak Flats
- Pine Oak Hills and Hummocks
- Red and Black Spruce Hummocks
- Spruce Hemlock Pine Hummocks and Hills
- Water

SCALE: 1:12,500

0 200 400 800 Meters

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Vascular plant species within the LAA were inventoried during field surveys. A total of 99 vascular species and 16 lichen species were identified. The overall diversity of species is moderate when considering the extent of residential and commercial development, as well as agricultural operations within the LAA and RAA. The vegetation species observed are largely native species, with exotic species confined mainly to anthropogenically altered or disturbed areas. The composition of species encountered is typical for the region, also reflecting the nutrient and moisture regimes found within the LAA and RAA.

The vegetation species list and description of survey methods and results is included in Appendix D – Vegetation and Lichen Assessments.

Table 5-9 Descriptions of Forest Stands Occurring With The LAA

STAND TYPE	DESCRIPTION
Softwood dominant	These are dominated by coniferous species such as Balsam Fir (*Abies balsamea*), White Spruce (*Picea glauca*), Red Spruce (*Picea rubens*), Eastern Hemlock (*Tsuga canadensis*), as well as Eastern White Pine (*Pinus strobus*) and Red Pine (*Pinus resinosa*).
Eastern Hemlock dominant	These stands are comprised mostly of Eastern Hemlock, often with little understory. These stands often host small populations of shade-tolerant hardwood species such as Yellow Birch (*Betula alleghaniensis*) and Striped Maple (*Acer pensylvanicum*) and are found mainly near the Cornwallis River.
Mixed White and Red Pine dominant	These areas may have had forestry operations carried out in years past.
Tolerant Hardwood dominant	These stands are comprised mostly of hardwood species such as American Beech (*Fagus grandifolia*), White Ash (*Fraxinus americana*), Red Maple (*Acer rubrum*), Striped Maple and Yellow Birch.
Intolerant Hardwood dominant	These stands are comprised mostly of hardwood species such as Large-toothed Aspen (*Populus grandidentata*), Trembling Aspen (*Populus tremuloides*), White Birch (*Betula papyrifera*), and Grey Birch (*Betula populifolia*).
Mixed forest	These stands are comprised of a mixture of coniferous and deciduous species. Red Maple, White Birch, Trembling Aspen, Balsam Fir, White Ash, Yellow Birch, Eastern Hemlock, and Red Spruce were common in mixed forest locations.
Regeneration forest	These areas have had vegetation removed through either natural or unnatural processes leaving these areas mostly bare of significant canopy cover. Stands are commonly comprised of species including Red Maple, Balsam Fir, Grey Birch, Speckled Alder (*Alnus incana*), Eastern White Pine, and Red Oak (*Quercus rubra*) in areas previously burned.
Coniferous wetland	These stands are comprised mainly of stunted Black Spruce (*Picea mariana*) and Larch (*Larix laricina*), along with mainly ericaceous shrubs such as Labrador Tea (*Rhododendron groenlandicum*), Northern Bayberry (*Morella pensylvanica*), Sheep Laurel (*Kalmia angustifolia*), and Leatherleaf (*Chamaedaphne calyculata*).
Deciduous shrub dominant wetland	These stands were mainly found surrounding watercourses within the Project area. These stands were commonly comprised of Speckled Alder, Black Cherry (*Prunus serotina*), Hawthorn (*Crataegus* spp.), Common Winterberry (*Ilex verticillata*), and Willow (*Salix* spp.).

PRIORITY PLANT SPECIES

To evaluate the potential presence of priority vascular and lichen species, a background review of species occurrence records and field surveys were completed. Priority species are defined as species:

- Designated as Endangered, Threatened or of Special Concern under the federal *Species At Risk Act* (*SARA*) and any species listed as Endangered, Threatened or Vulnerable under the provincial NS *Endangered Species Act* (NS ESA);
- Listed as S1-S3S4 (provincial rarity rankings) by the Atlantic Canada Conservation Data Centre (ACCDC). A description of provincial rarity rankings is included in Appendix D – Vegetation and Lichen Assessments.

The background data report from ACCDC (Appendix E – ACCDC Data Report 6923) indicates occurrence records for 23 vascular and 6 non-vascular priority species within 5 km of the LAA (Table 5-10). The majority of the priority vascular plants were observed in or near riparian habitats associated with the Cornwallis River, mainly east of the LAA.

Additionally, consultation with DNRR identified critical habitat for Black Ash approximately 4.2 km east of the PDA.

Two SoCC (Species of Conservation Concern) were encountered during the surveys: American Beech (*Fagus grandifolia*) and White Elm (*Ulmus americana*). Neither species are federally or provincially protected and both have S-Ranks of S3S4. Both of the species were found throughout the LAA.

No priority lichen species were observed and none of the priority vegetation species identified in the ACCDC report were encountered during field surveys. No Black Ash were encountered during the dedicated plant surveys or wetland surveys.

Table 5-10 Priority vegetation observations with 5 km of the Project site (ACCDC Report 6923)

COMMON NAME (*SCIENTIFIC NAME*)	# OF RECORDS WITHIN 5 KM[1]	FIELD SURVEY OBSERVATIONS	CONSERVATION STATUS[2, 3]			
			COSEWIC	SARA	NS ESA	S-RANK
VASCULAR PLANTS						
False Mermaidweed (*Floerkea proserpinacoides*)	20	0	NAR	-	-	S2S3
Eastern White Cedar (*Thuja occidentalis*)	1	0	-	-	VUL	S2S3
Clustered Sanicle (*Sanicula odorata*)	4	0	-	-	-	S1S2
Secund Rush (*Juncus secundus*)	1	0	-	-	-	S1
Wild Leek (*Allium tricoccum*)	18	0	-	-	-	S2
Smooth Sweet Cicely (*Osmorhiza longistylis*)	1	0	-	-	-	S2S3
Blue Cohosh (*Caulophyllum thalictroides*)	7	0	-	-	-	S2S3
Pinebarren Golden Heather (*Hudsonia ericoides*)	1	0	-	-	-	S2
Bog Willow (*Salix pedicellaris*)	4	0	-	-	-	S3
Porcupine Sedge (*Carex hystericina*)	3	0	-	-	-	S2S3
Canada Lily (*Lilium canadense*)	2	0	-	-	-	S2

COMMON NAME (*SCIENTIFIC NAME*)	# OF RECORDS WITHIN 5 KM[1]	FIELD SURVEY OBSERVATIONS	CONSERVATION STATUS[2, 3]			
			COSEWIC	SARA	NS ESA	S-RANK
Richardson's Pondweed (*Potamogeton richardsonii*)	3	0	-	-	-	S3
Common Bedstraw (*Galium aparine*)	1	0	-	-	-	S3S4
Pennsylvania Smartweed (*Persicaria pensylvanica*)	1	0	-	-	-	S3S4
Yellow-seeded False Pimperel (*Lindernia dubia*)	1	0	-	-	-	S3
Canada Wood Nettle (*Laportea canadensis*)	1	0	-	-	-	S3
Blue Vervain (*Verbena hastata*)	5	0	-	-	-	S3S4
Hop Sedge (*Carex lupulina*)	2	0	-	-	-	S3
Canada Waterweed (*Elodea canadensis*)	2	0	-	-	-	S4
Large Purple Fringed Orchid (*Platanthera grandiflora*)	1	0	-	-	-	S3
Hooker's Orchid (*Platanthera hookeri*)	1	0	-	-	-	S3
Arrow-Leaved Violet (*Viola sagittata* var. *ovata*)	2	0	-	-	-	S3S4
Silvery-flowered Sedge (*Carex argyrantha*)	2	0	-	-	-	S3S4
MOSS						
Meadow Plait Moss (*Hypnum pratense*)	1	0	-	-	-	S1S2
Cuspidate Earth Moss (*Tortula acaulon*)	1	0	-	-	-	S1S2
a Moss (*Weissia muhlenbergiana*)	1	0	-	-	-	S2?
Long-stalked Fine Wet Moss (*Campylium radicale*)	1	0	-	-	-	S2?
Condensed Broom Moss (*Dicranum condensatum*)	1	0	-	-	-	S2?
Giant Spear Moss (*Calliergon giganteum*)	1	0	-	-	-	S3?

[1] ACCDC Report 6923 Records; [2] END: Endangered, THR: Threatened, SC: Special Concern, VUL: Vulnerable; [3] S-Rank is an indicator of commonness in the Province of Nova Scotia. A scale between 1 and 5, with 5 being very common and 1 being least common.; --- denotes no status or available information

5.2.2 TERRESTRIAL WILDLIFE

The evaluation of terrestrial (non-avian) wildlife within the LAA was comprised mainly of a desktop review and incidental observations during vegetation, wetland, and avian surveys. The ACCDC background report (Appendix E) lists occurrence records for six priority wildlife species and occurrence records for bat hibernaculum or SAR bat species (Table 5-11).

Table 5-11 Priority wildlife (non-avian) observations with 5 km of the Project site (ACCDC Report 6923)

COMMON NAME (*SCIENTIFIC NAME*)	# OF RECORDS WITHIN 5 KM[1]	FIELD SURVEY OBSERVATIONS	CONSERVATION STATUS[2, 3]			
			COSEWIC	SARA	NS ESA	S-RANK
HERPETILES						
Wood Turtle (*Glyptemys insculpta*)	n/a[4]	0	THR	THR	THR	S2
MAMMALS						
Bat hibernaculum or bat species occurrence	n/a[4]	0	END	END	END	-
INVERTEBRATES						
Aphrodite Fritillary (*Speyeria aphrodite*)	2	0	-	-	-	S3S4
Milbert's Tortoiseshell (*Aglais milberti*)	1	0	-	-	-	S2S3
Monarch (*Danaus plexippus*)	23	1	END	SC	END	S2?B, S3M
Question Mark (*Polygonia interrogationis*)	1	0	-	-	-	S3B

[1] ACCDC Report 6923 Records; [2] END: Endangered, THR: Threatened, SC: Special Concern, VUL: Vulnerable; [3] S-Rank is an indicator of commonness in the Province of Nova Scotia. A scale between 1 and 5, with 5 being very common and 1 being least common.; [4] Location sensitive species / habitat features and therefore number of records is not shared; --- denotes no status or available information

Of the listed species, only the Monarch Butterfly (*Danaus plexippus*) was observed incidentally during field surveys. A single individual was observed flying along an all-terrain vehicle (ATV) trail south of Highway 101. The habitat within this area was generally disturbed and contained abundant Milkweed (*Asclepias* spp.) plants. Milkweed plants were found growing elsewhere within the LAA, primarily in disturbed areas bordering agricultural fields. The Department of Natural Resources and Renewables considers Milkweed important breeding habitat for Monarch Butterflies although Milkweed itself is not a priority species.

NSDNRR identified that critical habitat for Wood Turtle (*Glyptemys insculpta*) is present approximately 1.8 km from the PDA. An environmental DNA (eDNA) evaluation of Coleman Brook was undertaken in 2019 indicated a lack of positive results for Wood Turtle DNA present within the collected samples (East Coast Aquatics 2020).

A field assessment of Wood Turtle habitat was undertaken for the LAA in October 2022 with a specific focus on the Cornwallis River, Coleman Brook, and Rochford Brook and their associated riparian habitats (Appendix F – Wood Turtle Habitat Suitability Survey). The survey evaluated the presence and quality of potential nesting habitat, foraging habitat quality, and areas with thermoregulatory potential. Of the three watercourses, the Cornwallis River provided the greatest suitability with an overall assessment of

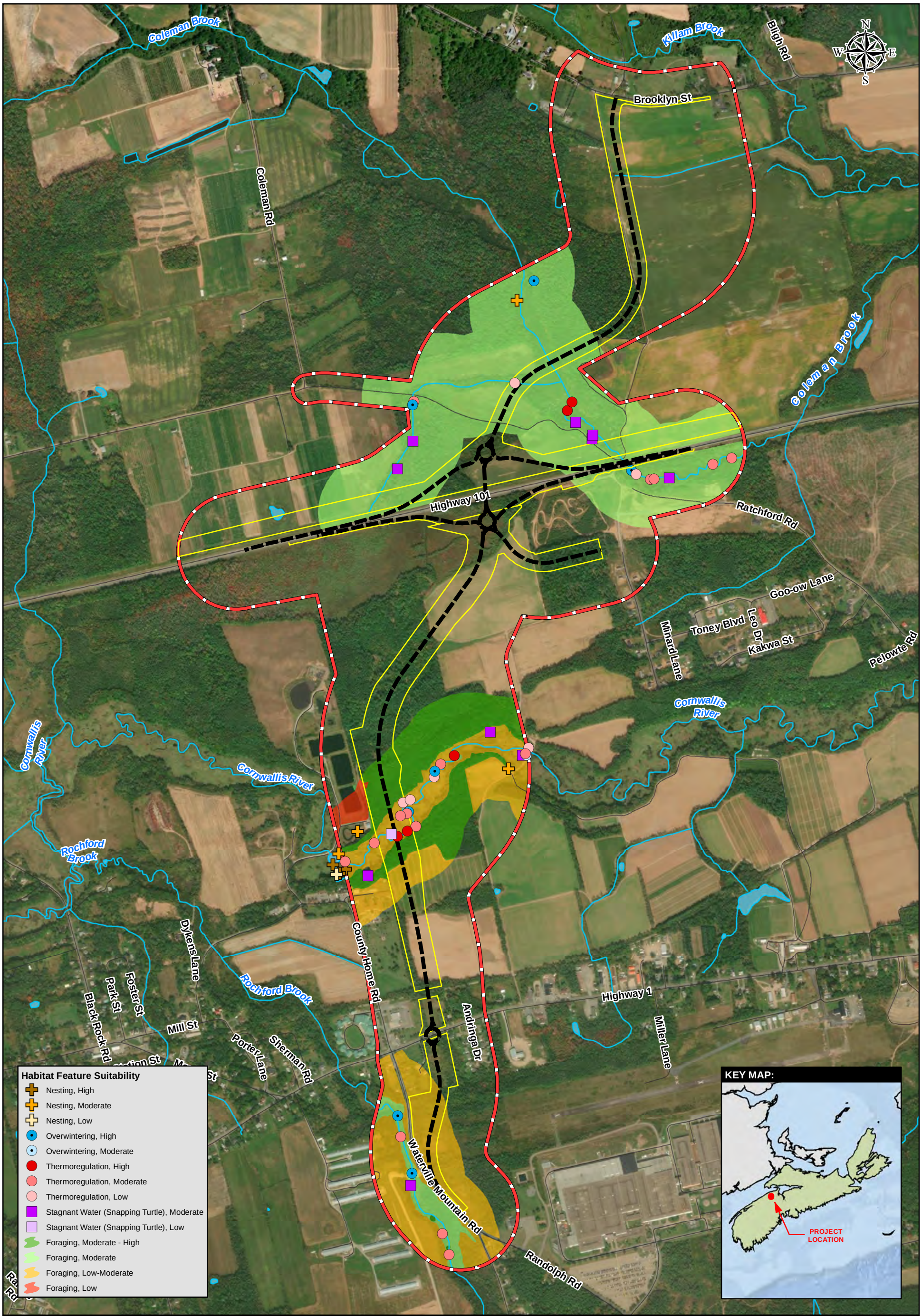
‘moderate’ based on the presence of high suitability for foraging habitat, the presence of high-quality potential nesting locations, and thermoregulatory habitat and features. Coleman Brook and Rochford Brook were both classified as ‘moderate-low suitability’ for Wood Turtles. Coleman Brook contained areas with moderate suitability for foraging and basking but contained minimal locations for nesting potential. Rochford Brook had greater foraging diversity but low suitability for nesting and thermoregulation. No Wood Turtles were observed during the survey. Habitat observations are illustrated in Figure 8. The survey methods, results, and photographs are included in Appendix F.

Targeted visual encounter surveys for Wood Turtle will be undertaken in spring 2023 after the hibernation period. Survey effort will be focused on areas with medium and high potential, and areas directly within the PDA. The remaining surveys will inform evaluation of habitat usage within the LAA and assist in developing specific avoidance and mitigation measures for Wood Turtle and its habitat. Results from the visual encounter surveys, and re-evaluated effects and mitigation for Wood Turtle will be presented in a separate report in June 2023.

Potential habitat for Snapping Turtle (*Chelydra serpentina*) was observed incidentally during the Wood Turtle habitat survey. Pools of stagnant water were recorded at each of the three watercourses, including where the PDA intersects with the Cornwallis River. Snapping Turtle is listed as ‘Vulnerable’ under the NS *ESA* and ‘Special Concern’ under both COSWEIC and *SARA*. No individuals were observed during the fall survey. Any individuals observed incidentally during the Wood Turtle visual encounter surveys in 2023 will be recorded.

Consultation with NSDNRR identified the PDA as low risk for bat hibernacula or maternity roosts as there are no critical habitat, abandoned mines, or karst present within 10 km of the project. Based on the low risk of habitat, targeted surveys for bat and bat habitat were not conducted.

Other wildlife observed incidentally include White-tailed Deer (*Odocoileus virginianus*) and American Red Squirrel (*Tamiasciurus hudsonicus*). Both species are common to the Annapolis Valley region and are adapted to anthropogenically altered landscapes.



PROJECT:

PROJECT: **NOVA SCOTIA - HIGHWAY 101 CAMBRIDGE INTERCHANGE AND CONNECTOR ROADS EA KINGS COUNTY, NS**

PROJECT NO.: **211-04152**

CLIENT: NOVA SCOTIA

FIGURE:

TITLE: **WOOD TURTLE HABITAT ASSESSMENT**

FIGURE NO.: **8**

REVISION NO.: **0**

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www.wsp.com

DATUM: NAD 83 CSRS

PROJECTION: UTM ZONE 20 NORTH

DRAWN BY: C. PYTLAK

CHECKED BY: D. EDWARDS

CREATED DATE: (YYYY-MM-DD) 2022/01/28

REVISION DATE: (YYYY-MM-DD) 2023/03/07

LEGEND:

- LOCAL ASSESSMENT AREA
- PROJECT DEVELOPMENT AREA
- PROPOSED ALIGNMENT
- ROAD
- WATERCOURSE
- WATERBODY

SCALE: 1:12,500

0 200 400 800 Meters

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5.2.3 AVIFAUNA

The assessment of avian presence within the LAA was focused primarily on priority species and consisted of a desktop review and field surveys. The desktop review included identifying the presence of important or significant bird habitats using the available desktop mapping resources, such as the ACCDC database, Maritimes Breeding Bird Atlas (MBBA), and Important Bird Areas (IBA) of Canada database.

The ACCDC report (Appendix E) identified occurrence records within 5 km of the Project LAA for 15 priority species. Of the 15 priority species, five are listed as SAR under Schedule 1 of *SARA* and the NS *ESA*. The five SAR are: Bank Swallow (*Riparia riparia*), Barn Swallow (*Hirundo rustica*), Bobolink (*Dolichonyx oryzivorus*), Eastern Wood-pewee (*Contopus virens*), and Olive-sided Flycatcher (*Contopus cooperi*).

The Project LAA is located primarily within one 10 x 10 km MBBA atlas square (Square no. 20LQ79) with small portions extending into adjacent atlas squares (Square no. 20LQ69 & 20LQ68) (Bird Studies Canada 2015). MBBA survey data from the first and second atlases indicate observations of 40 priority species, including the following SAR: Bank Swallow, Barn Swallow, Bobolink, Canada Warbler (*Cardellina canadensis*), Chimney Swift (*Chaetura pelagica*), Eastern Wood-pewee, Evening Grosbeak (*Coccothraustes vespertinus*), and Olive-sided Flycatcher. Additionally, according to the MBBA data, 97 species may be breeding within the primary MBBA atlas square (Square no. 20LQ79) and up to 96 and 93 species may be breeding in the secondary MBBA atlas squares (Square no. 20LQ69 & 20LQ68, respectively).

The nearest IBA is the Southern Bight, Minas Basin IBA and is located approximately 18 km east of the Project LAA. The IBA is described as a large tidal embayment comprised mainly of intertidal mudflats. The mudflats support large stopover populations of migratory shorebirds, specifically the Semipalmated Sandpiper (*Calidris pusilla*). An estimated 1 to 2 million shorebirds use the mudflats within the head of the Bay of Fundy as a staging area between late July and early August. Other shorebird species abundantly found within the IBA include Red Knot (*Calidris canutus*), Sanderling (*Calidris alba*), Least Sandpiper (*Calidris minutilla*), Short-billed Dowitcher (*Limnodromus griseus*), and Semipalmated Plover (*Charadrius semipalmatus*) (IBA Canada No date).

Bird surveys were carried out using three separate survey protocols and all habitats used by the targeted birds were surveyed to fully evaluate bird presence and habitat usage. Field survey locations and priority species observations are illustrated in Figure 9.

Two rounds of breeding bird surveys were conducted over the course of four mornings in June 2021 (June 10, 12, 29, and 30). The breeding bird surveys implemented a 10-minute point count survey at 26 pre-determined locations, which were selected based on adjacency to suitable bird habitat. The surveys were completed in the dawn hours to maximize the likelihood of detecting target species. All birds observed either visually or audibly within 100 m of the point count station were recorded, along with behavioural observations to evaluate breeding status. The locations of SAR were recorded using distance and bearing from the survey station.

A single round of targeted Common Nighthawk (*Chordeiles minor*) surveys was completed on July 12, 2021. A six-minute passive point count was completed at ten survey stations adjacent to suitable Common Nighthawk habitat (i.e., transitional habitats near forest edges and adjacent to open areas for foraging, in forests with clearings). Any Common Nighthawks detected within 400 m of the point count station were recorded as direct observations and any detections beyond 400 m were recorded as incidental observations. Any other bird species were recorded as incidental observations.

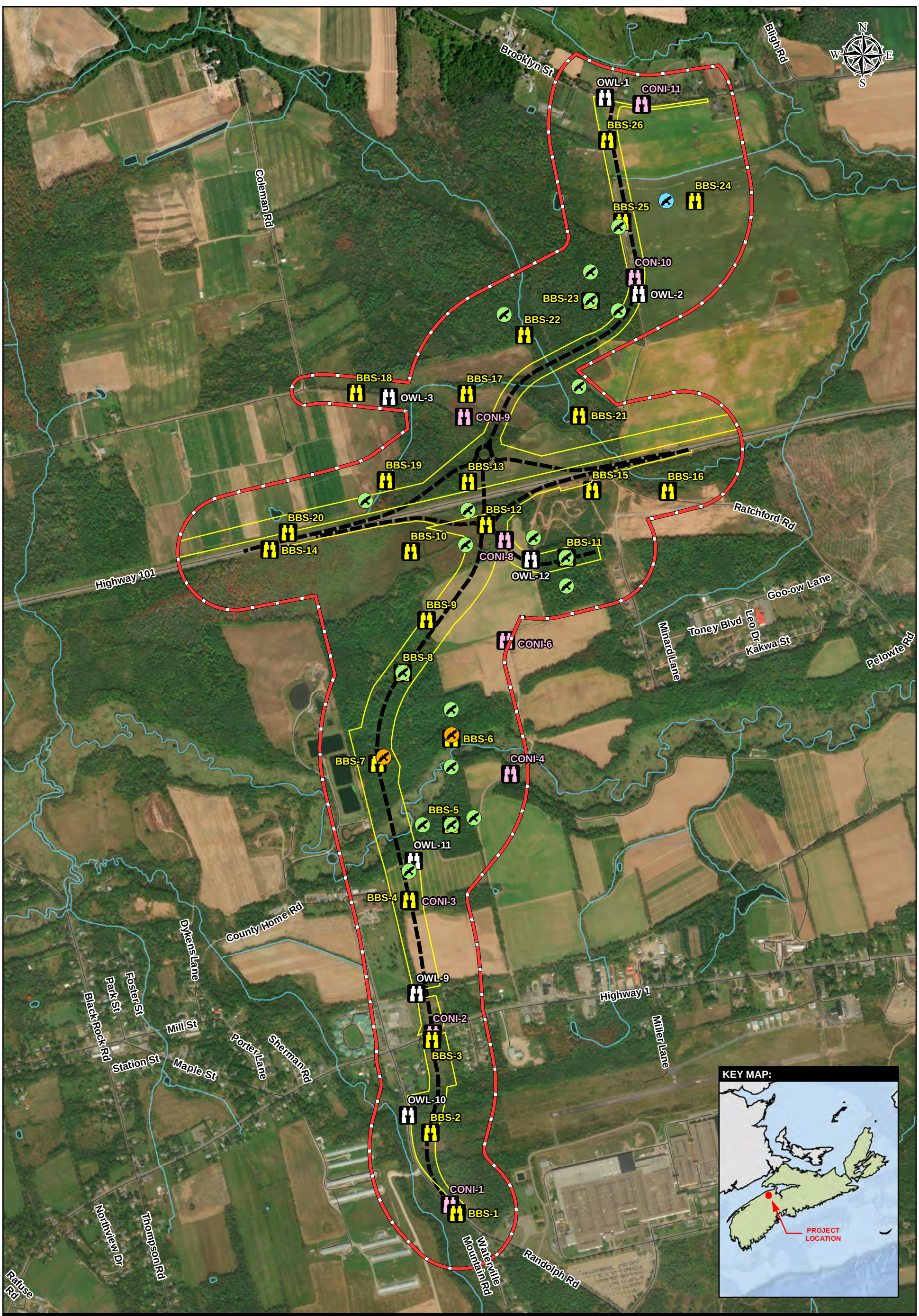
Two rounds of Nocturnal Owl surveys were completed on April 15 and May 4, 2021. The survey implemented a call playback methodology with broadcast stations placed at least 1 km apart in areas of suitable habitat. The playback survey consisted of broadcasting various owl calls followed by silent listening periods at seven survey stations.

A total of 689 individual birds, comprised of 62 species, were detected during the breeding bird surveys. Seven priority species were observed, three of which are listed as provincial or federal SAR: Barn Swallow, Eastern Wood-pewee, and Wood Thrush (*Hylocichla mustelina*). Bird species detected during the surveys are commonly associated with deciduous and mixed-wood forests and shrub habitats which are common throughout the LAA. Steps will be taken within the Project to mitigate or reduce impact upon these priority species, and ensure all development is in compliance with *MBCA, SARA* or NS *ESA* legislation. Specific mitigation measures for avifauna species of concern are listed in Section 6.6.4.

No Common Nighthawks were recorded during the targeted Common Nighthawk surveys. However, Eastern Wood-Pewee was detected incidentally at two locations during the surveys.

Two Barred Owls were detected during the second round of Nocturnal Owl survey. They were recorded at two locations on the edge of mature deciduous forests and agricultural fields.

A full description of avian survey methodologies, field survey species observations, and a species list are described in Appendix G – Highway 101 Cambridge Interchange and Connector Roads Avian Survey Report. Table 5-12 provides a list of priority species with potential to occur within the LAA.



PROJECT:

PROJECT: NOVA SCOTIA - HIGHWAY 101 CAMBRIDGE INTERCHANGE AND CONNECTOR ROADS EA KINGS COUNTY, NS

PROJECT NO.: 211-04152

CLIENT: NOVA SCOTIA

FIGURE:

TITLE: AVIAN SURVEYS

FIGURE NO.: 9

REVISION NO.: 0

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DATUM: NAD 83 CSRS

PROJECTION: UTM ZONE 20 NORTH

DRAWN BY: C. PYTLAK

CHECKED BY: D. EDWARDS

CREATED DATE: (YYYY-MM-DD) 2022/01/28

REVISION DATE: (YYYY-MM-DD) 2023/03/07

LEGEND:

- LOCAL ASSESSMENT AREA
- PROJECT DEVELOPMENT AREA
- PROPOSED ALIGNMENT
- ROAD
- WATERCOURSE
- BREEDING BIRD SURVEY STATION
- NOCTURNAL OWL SURVEY STATION
- COMMON NIGHTHAWK SURVEY STATION

SAR OBSERVATIONS

- BARN SWALLOW
- EASTERN WOOD-PEWEE
- WOOD THRUSH

SCALE: 1:12,500

0 200 400 800 Meters

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Table 5-12 Priority avian observations with potential to occur within the LAA

COMMON NAME (*SCIENTIFIC NAME*)	# OF RECORDS WITHIN 5 KM[1]	FIELD SURVEY OBSERVATIONS	HABITAT DESCRIPTION	CONSERVATION STATUS[2, 3]				POTENTIAL TO OCCUR WITHIN LAA
				COSEWIC	SARA	NS ESA	S-RANK	
Bank Swallow (*Riparia riparia*)	16	0	The Bank Swallow breeds wherever suitable nesting sites in banks and cliffs are available. Nesting colonies are usually found near open areas, and often close to water.	THR	THR	END	S2B	Potentially present
Barn Swallow (*Hirundo rustica*)	1	1	Largely nests in and on artificial structures, including barns and other outbuildings, garages, houses, bridges, and road culverts. Barn Swallows prefer various types of open habitats for foraging, including grassy fields, pastures, various kinds of agricultural crops, lake and river shorelines, cleared rights-of-way, cottage areas and farmyards, islands, wetlands, and subarctic tundra.	SC	THR	END	S2S3B S3B	Present
Bobolink (*Dolichonyx oryzivorus*)	2	0	Bobolink has nested in forage crops (e.g., hayfields and pastures dominated by a variety of species, such as clover, Timothy, Kentucky Bluegrass, and broadleaved plants). The Bobolink also occurs in various grassland habitats including wet prairie, graminoid peatlands and abandoned fields dominated by tall grasses, remnants of uncultivated virgin prairie (tall-grass prairie), no-till cropland, small-grain fields, restored surface mining sites and irrigated fields in arid regions.	THR	THR	VUL	S3B	Unlikely to be present – Minimal areas of suitable habitat present; not observed during field surveys

COMMON NAME (*SCIENTIFIC NAME*)	# OF RECORDS WITHIN 5 KM[1]	FIELD SURVEY OBSERVATIONS	HABITAT DESCRIPTION	CONSERVATION STATUS[2, 3]				POTENTIAL TO OCCUR WITHIN LAA
				COSEWIC	SARA	NS ESA	S-RANK	
Cliff Swallow (*Petrochelidon pyrrhonota*)	1	0	Historically they inhabited open canyons, foothills, escarpments, and river valleys that offered a vertical cliff face with a horizontal overhang for nest attachment. With the present use of artificial nesting structures such as bridges and buildings, the species is now found in a wide variety of habitats: grasslands, towns, broken forest, riparian edge. Avoids heavy forest, desert, and alpine areas. Proximity to mud source (for nest-building) is often cited as a breeding-habitat requirement, although some colonies are located several kilometers from the nearest mud supply.	-	-	-	S2S3B	Unlikely to be present – No suitable habitats observed within LAA; not observed during field surveys
Eastern Kingbird (*Tyrannus tyrannus*)	1	0	Eastern Kingbirds breed in open habitats such as yards, fields, pastures, grasslands, or wetlands, and are especially abundant in open places along forest edges or water.	-	-	-	S3B	Potentially present
Eastern Wood-Pewee (*Contopus virens*)	6	21	Mostly associated with the mid-canopy layer of forest clearings and edges of deciduous and mixed forests. It is most abundant in forest stands of intermediate age and in mature stands with little understory vegetation.	SC	SC	VUL	S3S4B	Present – Observed regularly throughout deciduous and mixed forests within LAA
Northern Mockingbird (*Mimus polyglottos*)	2	0	Year-round the Northern Mockingbird is found in areas with open ground and with shrubby vegetation like hedges, fruiting bushes, and thickets. When foraging on the ground, it prefers grassy areas, rather than bare spots. Common places to find Northern Mockingbirds include parkland, cultivated land, suburban areas and in second growth habitat at low elevations	-	-	-	S1B	Potentially present

COMMON NAME (*SCIENTIFIC NAME*)	# OF RECORDS WITHIN 5 KM[1]	FIELD SURVEY OBSERVATIONS	HABITAT DESCRIPTION	CONSERVATION STATUS[2, 3]				POTENTIAL TO OCCUR WITHIN LAA
				COSEWIC	SARA	NS ESA	S-RANK	
Olive-sided Flycatcher (*Contopus cooperi*)	1	0	Prefers semi-open, conifer forest with preference to spruce; near ponds, lakes or rivers. Nests in treed wetlands and found in burns with dead trees	SC	THR	THR	S3BS2B	Potentially present
Rose-breasted Grosbeak (*Pheucticus ludovicianus*)	6	3	Lives in immature and mature broad-leaved deciduous forests,	-	-	-	S3B	Present
Tennessee Warbler (*Oreothlypis peregrina*)	-	1	Tennessee Warbler is found in areas with brushy, semi-open land, grassy openings in coniferous, deciduous or mixed woods with dense shrubs and scattered clumps of young deciduous trees, treed fens or boggy areas and dry pine plantations	-	-	-	S3S4B, S5M	Present
Vesper Sparrow (*Pooecetes gramineus*)	2	3	Found in open areas with short, herbaceous vegetation and song perches, such as fields with hedgerows or regrowth; well-drained dry grassland areas with scattered trees or shrubs; open, dry conifer plantations; gravel pits; short grass meadows and pastures	-	-	-	S1S2B, SUM	Present
Willow Flycatcher (*Empidonax traillii*)	2	0	Prefers open areas with secondary shrubby growth or low trees of willow, red osier dogwood, hawthorn. Also found in damp to dry	-	-	-	S2B	Potentially present
Wilson's Snipe (*Gallinago delicata*)	1	0	Found in and around large, open marshes, fens, peatlands, bogs or wet meadows with short vegetation; alder, willow swamps, thickets on pond, lake, river edges; brook and river lowlands with moist, soft organic soil and low sparse vegetation	-	-	-	S3B, S5MS3B	Potentially present

COMMON NAME (*SCIENTIFIC NAME*)	# OF RECORDS WITHIN 5 KM[1]	FIELD SURVEY OBSERVATIONS	HABITAT DESCRIPTION	CONSERVATION STATUS[2, 3]				POTENTIAL TO OCCUR WITHIN LAA
				COSEWIC	SARA	NS ESA	S-RANK	
Wilson's Warbler (*Cardellina pusilla*)	1	0	Habitat includes boggy areas with tamarack or spruce, swampy, brushy land, streamside thickets, wet, wooded high shrubs or low deciduous trees	-	-	-	S3B, S5M	Potentially present
Wood Thrush (*Hylocichla mustelina*)	-	3	Breed throughout mature deciduous and mixed forests in eastern North America, most commonly those with American beech, red maple, black, eastern hemlock, oaks, or pines. Prefers forests with mature trees ad established canopy, with a moderately dense understory and open forest floor with moist soils	THR	THR	-	SUB	Present

[1] ACCDC Report 6923 Records; [2] END: Endangered, THR: Threatened, SC: Special Concern, VUL: Vulnerable; [3] S-Rank is an indicator of commonness in the Province of Nova Scotia. A scale between 1 and 5, with 5 being very common and 1 being least common.; --- denotes no status or available information

5.2.4 WETLANDS

Wetlands within the LAA were identified, delineated, and evaluated during field surveys in August and September 2021. A total of twelve (12) wetlands were identified and delineated, encompassing a total delineated area of approximately 50.9 ha (16.5% of the LAA).

Prior to the commencement of field surveys, a desktop review of DNRR Significant Habitat Database, Service Nova Scotia and Municipal Relations Property Online, 1:10K Topographic Maps and available satellite imagery was completed to identify the locations of known mapped wetlands and areas with high potential for wetlands.

Wetland field delineations were completed in accordance with the U.S. Army Corps of Engineers *Wetlands Delineation Manual and the Northcentral and Northeastern Interim Regional Supplement* (U.S. Army Corps of Engineers 2012). Delineations were based on the presence of hydrophytic vegetation, hydric soils, and wetland hydrology. Wetland boundaries were recorded using a Differential Global Positioning System (GPS) unit with +/- 5 m accuracy. The wetland was classified using the U.S. Army Corps of Engineers *Wetland Delineation Manual* (Environmental Laboratory 1987). Functional assessments for each wetland were completed using the *Wetland Ecosystem Services Protocol for Atlantic Canada (WESP-AC)*, Nova Scotia Version 2.0 (NB ELG 2018), which is a combined field and desktop evaluation method designed to assess the condition and function of wetlands. A full description of wetland delineation and assessment methodologies are described in Appendix H – Wetland Delineation and Functional Assessments Report.

The wetland field surveys identified the presence of 12 wetlands within the LAA. Table 5-13 summarizes the conditions of each delineated wetland. The delineated wetlands were comprised of five wetland types: Forested swamp, fen, riparian shrub swamp, riparian graminoid marsh, and vernal pool. The locations of wetlands are shown in Figure 10.

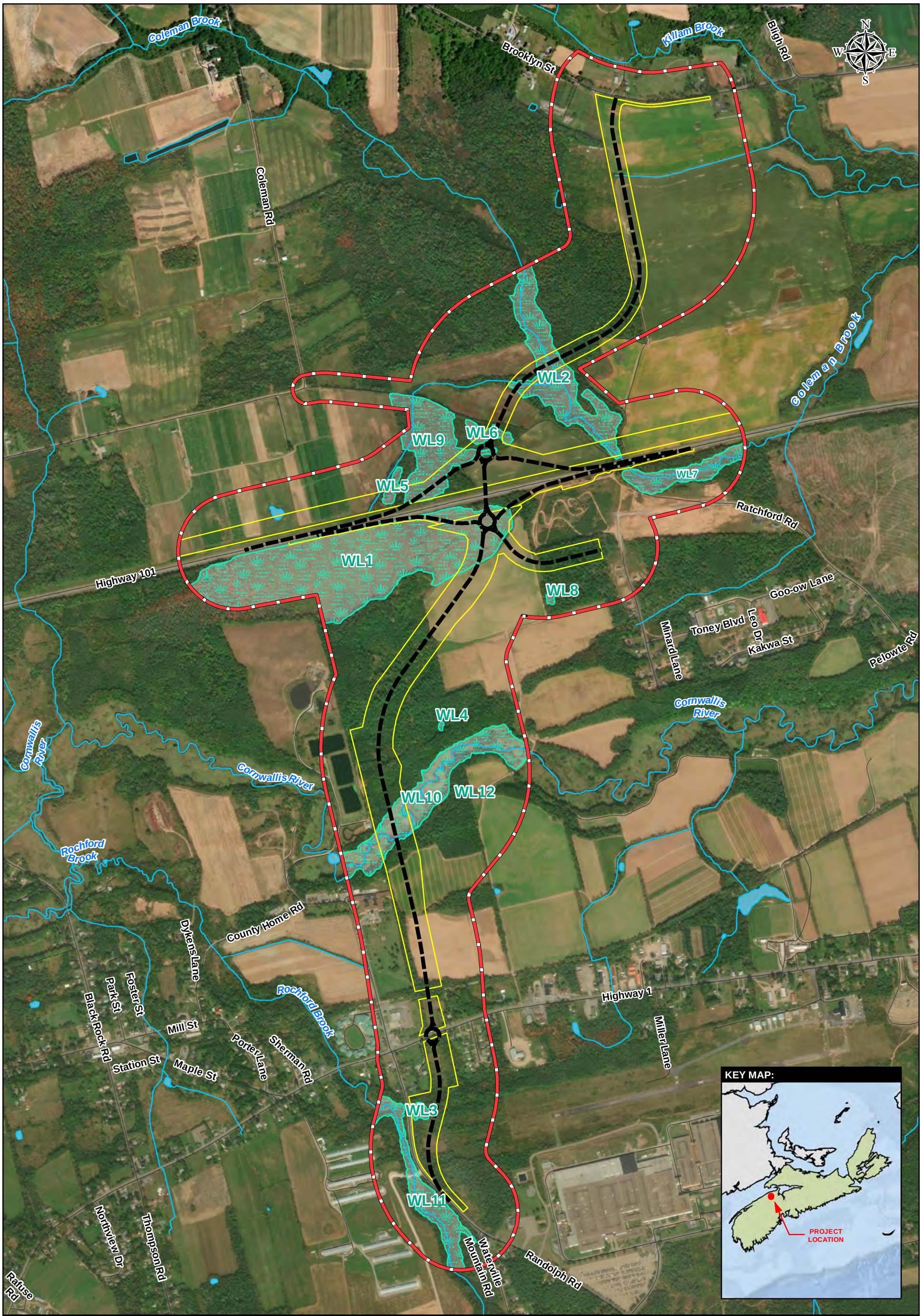
Table 5-13 Summary of wetlands within the LAA

WETLAND ID	TYPE	DELINEATED AREA (HA)	DESCRIPTION
Wetland 1	Forested swamp / fen complex	22	Wetland complex with Black Spruce (*Picea mariana*), Yellow Birch (*Betula alleghaniensis*), Red Maple (*Acer rubrum*), Eastern Larch (*Larix laricina*), and Leatherleaf (*Chamaedaphne calyculata*). Hydric soil indicator was identified as histosol; surface water, saturation, and high-water table present.
Wetland 2	Riparian shrub swamp	7.26	Located along Coleman Brook, north of Highway 101, a small permanent watercourse, which extends beyond project boundary. Vegetation species include Red Maple, Speckled Alder (*Alnus incana*), Bluejoint Reed-grass (*Calamagrostis canadensis*) and Spotted Jewelweed (*Impatiens capensis*). Hydric soil indicator was identified as histosol; surface water, high water table, and saturation present.
Wetland 3	Forested swamp	0.29	Wetland with small intermittent watercourse flowing through wetland. Vegetation includes Red Maple, Speckled Alder, and Spotted Jewelweed. Hydric soil indicator was identified as a thin dark surface. Surface water, high water table, and saturation present.

WETLAND ID	TYPE	DELINEATED AREA (HA)	DESCRIPTION
Wetland 4	Vernal pool	0.04	Vernal pool located within forested area. Vegetation includes Quaking Aspen (*Populus tremuloides*), Pussy-Willow (*Salix discolor*) and Sallow Sedge (*Carex lurida*). Hydric soil indicator identified as a thin dark surface. Surface water, high water table, and saturation present.
Wetland 5, Wetland 6, Wetland 9	Forested swamp	6.96	Wetland complex formed with three separate forested swamps; small areas of marginal upland inclusions separating each individual wetland. Vegetation includes Black Spruce, Balsam Fir (*Abies balsamea*), Speckled Alder, Common Winterberry (*Ilex vertifillata*), Wool-Rush (*Scirpus cyperinus*), and Cinnamon Fern (*Osmunda cinnamomea*). Surface water, high water table, and saturation present.
Wetland 7	Riparian shrub swamp	2.55	Wetland bordering Coleman Brook, south of Highway 101, a large permanent watercourse. Vegetation species include Red Maple, Speckled Alder, Rice Cutgrass (*Leersia oryzoides*), and Reed Canary Grass (*Phalaris arundinacea*). Hydric soil indicator was identified as histosol. Surface water, high water table, and saturation present.
Wetland 8	Forested swamp	0.08	Vegetation includes Red Maple, Largetooth Aspen (*Populus grandidentata*), Gray Birch (*Betula populifolia*), Bristly Dewberry (*Rubus hispidus*), and Cinnamon Fern. Hydric soil indicator was identified as thin dark surface. Saturation present.
Wetland 10	Riparian graminoid marsh	7.35	Wetland is located along the Cornwallis River and extends beyond the project boundary. Vegetation includes Willow (*Salix spp*.), Hawthorn (*Crataegus spp*.), and Reed Canary Grass. The hydric soil indicator identified was a depleted matrix. Surface water, high water table, and saturation present.
Wetland 11	Riparian shrub swamp	3.6	Wetland is located along Rochford Brook, a small permanent stream, which extends beyond of the project area. Vegetation includes Black Cherry, Speckled Alder, and Sensitive Fern (*Onoclea sensibilis*). Hydric soil indicator was identified as thin dark surface. Surface water, high water table, and saturation present.
Wetland 12	Vernal pool	0.007	Vegetation includes Red Maple and Serviceberry (*Amelanchier* spp.). Hydric soil indicator was identified as thin dark surface. Saturation present.

The functional wetland assessments identified wetlands within the LAA appear to mostly have higher functions or benefits relating to water quality. Additionally, Wetlands 2, 7, 10, and 11 border permanent watercourses and have better overall functions and benefits relating to aquatic habitat. It was identified that the majority of wetlands have higher risk potential for degradation compared to wetlands typically found in undeveloped areas. This may be due to the prevalence of agricultural operations within the LAA and the associated potential for sedimentation and input of nutrients and contaminants.

The functional assessment is described further in Appendix H – Wetland Delineation and Functional Assessments Report.



PROJECT:

PROJECT: NOVA SCOTIA - HIGHWAY 101 CAMBRIDGE INTERCHANGE AND CONNECTOR ROADS EA KINGS COUNTY, NS

PROJECT NO.: 211-04152

CLIENT: NOVA SCOTIA

FIGURE:

TITLE: WETLANDS

FIGURE NO.: 10

REVISION NO.: 0

WSP Canada Inc.
1 Spectacle Lake Drive,
Dartmouth, Nova Scotia
www.wsp.com

DATUM: NAD 83 CSRS

PROJECTION: UTM ZONE 20 NORTH

DRAWN BY: C. PYTLAK

CHECKED BY: D. EDWARDS

CREATED DATE: (YYYY-MM-DD) 2022/01/28

REVISION DATE: (YYYY-MM-DD) 2023/03/07

LEGEND:

- LOCAL ASSESSMENT AREA
- PROJECT DEVELOPMENT AREA
- PROPOSED ALIGNMENT
- ROAD
- WATERCOURSE
- WATERBODY
- WETLAND (WSP, 2021)

SCALE: 1:12,500

0 200 400 800 Meters

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5.2.5 FISH AND FISH HABITAT

The evaluation of fish and fish habitat consisted of fish community sampling and aquatic habitat assessments, specifically for Brook Trout (*Salvelinus fontinalis*) and Atlantic Salmon (*Salmo salar*).

FISH BIODIVERSITY

Fish community sampling within and around the eight locations in three watercourses described in Section 5.1.4 and illustrated in Figure 4 was completed by MCG, primarily using beach seine netting due to high water levels. Beach seine netting was carried out in June, September, and October. Electrofishing was conducted at CB1 in June and October. Furthermore, eel pots were deployed in October at each of the eight sampling locations.

A total of 1165 individual fish, comprised of 11 species, were caught during the sampling. The most abundant fish species found within the Cornwallis River and Coleman Brook study sites include 3-Spine Stickleback (*Gasterosteus aculeatus*) (n = 639; 55% of study total), Northern Redbelly Dace (*Chrosomus eos*) (n = 323; 28% of study total), and Banded Killifish (*Fundulus diaphanus*) (n = 111; 10% of study total). Table 5-14 summarizes the fish community sampling results for each location.

None of the species caught are listed as provincial or federal SAR. However, American Eel (*Anguilla rostrata*) is listed as 'Threatened' by COSEWIC. Additionally, Brook Stickleback (*Culaea inconstans*), and Brook Trout (*Salvelinus fontinalis*) are considered priority species. American Eel has an S-rank of S3N, while Brook Stickleback and Brook Trout are both ranked at S3, indicating these species populations are considered vulnerable. American Eel was found in limited numbers at sites CR3, CR4, and CB1. Only a single Brook Stickleback was caught at CB1. Twenty-three Brook Trout were recorded during sampling, with most being caught using eel pots during the fall at CB2, adjacent to Highway 101. No fish were caught in Killam Brook (sampling site outside of PDA and LAA), possibly due to stream morphology resulting in low water quality values.

A full description of fish sampling methods and results are included in Appendix B - Fish Biodiversity and Habitat Assessments.

Table 5-14 Fish community sampling results

SPECIES	CR1	CR2	CR3	CR4	CB1	CB2	CB3	KB1	TOTAL
American Eel (*Anguilla rostrata*)	-	-	1	2	7	-	-	No fish	10
Banded Killifish (*Fundulus diaphanus*)	19	-	92	-	-	-	-		111
Black-nosed Dace (*Rhinichthys atratulus*)	-	1	1	-	-	-	-		2
Brook Stickleback (*Culaea inconstans*)	-	-	-	1	-	-	-		1
Brook Trout (*Salvelinus fontinalis*)	-	1	-	3	1	16	2		23
Brown Trout (*Salmo trutta*)	3	-	3	1	-	-	-		7
Northern Redbelly Dace (*Chrosomus eos*)	130	102	77	10	4	-	-		323
Mummichog	1	-	5	-	-	-	-		6

SPECIES	CR1	CR2	CR3	CR4	CB1	CB2	CB3	KB1	TOTAL
(*Fundulus heteroclitus*)									
Three-spined Stickleback (*Gasterosteus aculeatus*)	40	14	523	53	9	-	-		639
Unknown species	-	-	1	1	-	-	-		2
Unknown Stickleback	-	1	-	-	-	-	-		1
White Sucker (*Catostomus commersonii*)	11	1	20	8	-	-	-		40
TOTAL	204	120	723	79	21	16	2	0	1,165

AQUATIC HABITAT ASSESSMENT

In addition to the fish community sampling, Habitat Suitability Index (HSI) assessments were undertaken in three sections: Coleman Brook, Cornwallis River, and Cornwallis River tributaries. The assessment sites were based on changes of in-stream and stream bank habitat, a change in surrounding vegetation, or a change in the stream morphology or structure (i.e., road crossings, or confluences with other tributaries). HSI data was collected between June 11th – 15th, 2021. The HSI assessments measure habitat suitability for Brook Trout and Atlantic Salmon based on various parameters such as stream morphology and channel depths, substrate composition, riparian and in-stream vegetation composition and cover, water temperature and chemistry, and stream shade. The suitability index ranges between 0 and 1 for each of the parameters, with values less than 0.4 considered poor quality, values between 0.4 and 0.8 are moderate quality, and values over 0.8 represent good quality.

The freshwater habitat of Coleman Brook was assessed near CB1, located approximately 2 km upstream of the Highway 101 crossing. The habitat for Brook Trout and Atlantic Salmon was overall considered good quality, although ranked poorly for lack of pool habitats, an undefined stream thalweg, and unsuitable substrate in riffle-run areas.

The HSI data collected for sites on the Cornwallis River indicate that freshwater habitat for Brook Trout and Atlantic Salmon is degraded, with minimal pool habitat and fish cover and spawning areas, as well as limited stream shade and poor substrate quality in riffle-run sections. However, temperature suitability was assessed as good, as well as the abundance of streambank vegetation in the floodplain. There is potential for habitat enhancement in these area - options and recommendations are outlined in Section 6.8.1.

The Cornwallis River tributaries, Killam Brook, Rochford Brook and Sharpe Brook, were surveyed in five locations total. The three tributaries have similar morphology and provide good stream shade, in-stream cover, and streambank vegetation. However, the limited pool habitat is poor quality and there are few spawning areas. Substrate in riffle-run areas is more suitable for Brook Trout and Atlantic Salmon compared to the sites surveyed on the Cornwallis River.

Data tables and additional descriptions of results are included in Appendix B - Fish Biodiversity and Habitat Assessments.

5.3 SOCIO-ECONOMIC ENVIRONMENT

The proposed interchange is located in Kings County Municipality. The community of Cambridge encompasses most of the southern portion of the LAA. The communities of Waterville and Woodville, and the AVFN are also located within the Project LAA. Woodville, Waterville, and Cambridge, along with Grafton (located northwest of the LAA) form the Village of Cornwallis Square. The Village of Cambridge was incorporated in 1947 and expanded in the 1960s to include Woodville and surrounding areas.

The following subsections describe the local communities, First Nations communities, existing and planned land uses, traditional First Nations land and resource uses, and cultural and archaeological resources.

5.3.1 COMMUNITIES

The primary residential communities within and adjacent to the LAA are Waterville and Cambridge. Waterville has a population of approximately 900 residents and Cambridge's population is approximately 750 (Municipality of the County of Kings 2021). Both communities are distinct Growth Centres within the Village of Cornwallis Square and comprise a significant portion of the Berwick to Coldbrook cluster within Kings County. The major employers in this area are Michelin Tire, Kings Regional Rehabilitation Centre, the Nova Scotia Youth Centre, and three schools. The number of employees in these businesses exceed the population of residents in Waterville and Cambridge (Municipality of the County of Kings 2019).

5.3.2 FIRST NATIONS COMMUNITIES

The Mi'kmaq are the First Nations people of Nova Scotia and are the predominant Indigenous group within the province. The most recent available census data states the registered population of First Nations in Nova Scotia is 15,320 (Statistics Canada 2017). Nova Scotia has 13 Mi'kmaw First Nations, eight of which are part of The Confederacy of Mainland Mi'kmaq.

AVFN is situated north of the Cornwallis River and south of Highway 101, along the eastern boundary of the LAA. AVFN was established in 1880 and is the smallest Mi'kmaq band in the province with a registered population of 315 members, with approximately 135 members living in the community (GC 2021). AVFN also includes the reserve St. Croix 34, located in Hants County on the shore of Panuke Lake. The AVFN community has an area of 59 ha. The band is governed by Chief Gerald B. Toney and three councillors.

5.3.3 EXISTING AND PLANNED LAND USES

The land within the LAA primarily consists of remnant forest stands and agricultural fields. Other land uses present include commercial, residential, and industrial which are focused along the Trunk 1 corridor and connecting roads. A new business park and commercial businesses are located along or near Highway 1. The traditional downtown area of Waterville, on Maple Street, has seen former commercial buildings converted to other uses as commercial business has gradually migrated towards Highway 1 (Municipality of the County of Kings 2019). As the overall area is generally rural, development density is low with most development occurring in small pockets interspersed with large areas of agricultural and forested lands.

The zoning for the LAA and surrounding lands is shown in Figure 11. The majority of the LAA is currently zoned Rural Mixed Use (A2) and Agricultural (A1). The zoning designations near the southern limits of the LAA located within the Growth Centre of Cambridge include Mixed Commercial Residential (C3), Residential Mixed Density (R3) and Heavy Industrial (M2). The Cornwallis River and riparian habitat is zoned O1: Environmental Constraint.

5.3.4 TRADITIONAL USE OF LAND AND WATER RESOURCES

An ARIA of the LAA was completed by Davis MacIntyre & Associates Limited in 2021 and includes a background review of traditional land and resource uses by the Mi'kmaq. The LAA is located within the Mi'kmaw territory Sipekne'katik ("place of groundnuts"). Three, and potentially four, summer villages were located within Sipekne'katik and located at Truro, Shubenacadie, Tatamagouche and near Halifax. Archaeological evidence supports preoccupation of the Cornwallis River and surrounding landscape, however, there is a lack of archaeological research within the landscape.

The Cornwallis River provides access from the Minas Basin to the interior and as a passage to the Annapolis River. Coastal areas would have provided opportunities for the Mi'kmaq to harvest marine birds and other animals, and interior rivers and lakes would have had seasonal migrations of fish and eel, as well as opportunities for hunting larger game animals. The movement between the coast and interior likely followed a seasonal pattern and the use of rivers and long inlets would allow for fluid movement between these areas.

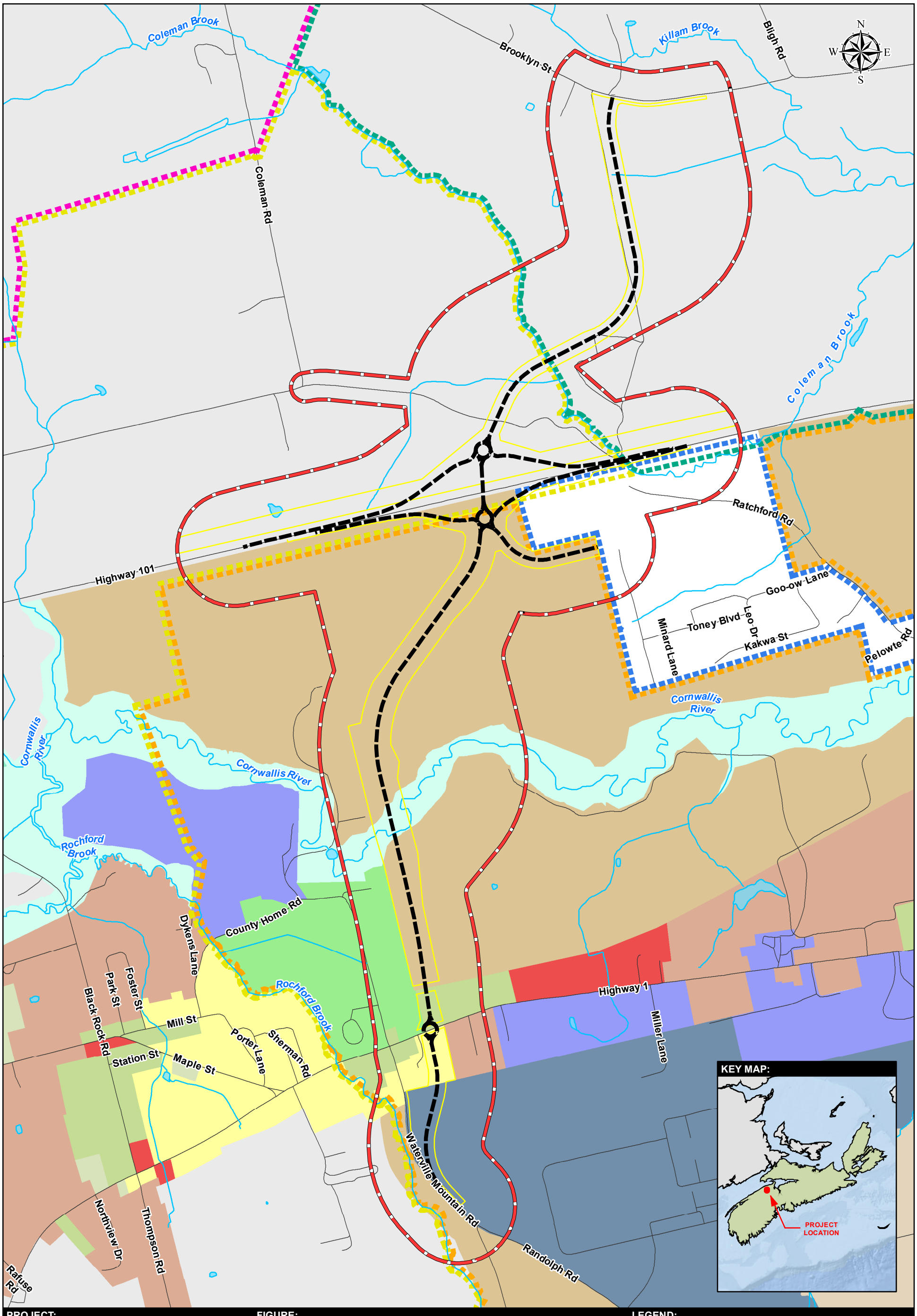
5.3.5 CULTURAL AND ARCHAEOLOGICAL RESOURCES

The ARIA includes a historic background study and reconnaissance to determine the potential for archaeological resources in the impact area and to provide recommendations for further mitigation, if necessary. The assessment was conducted under Heritage Research Permit A2021NS056 (Category C), issued to Davis MacIntyre & Associates Limited by the NSCCTH. The ARIA report has been submitted to NSCCTH but cannot be shared publicly due to confidentiality and risk of archaeological site looting.

The background review identified two known precontact sites recorded within six kilometres of the LAA, located along a terrace overlooking the Cornwallis River. Historic research and mapping indicate that Euro-Canadian occupation of the LAA and surrounding communities began in the late 18th to early 19th centuries. The establishment of farms and homesteads in the Cambridge area slowly occurred over the mid to late 19th century, along main roads in the area.

A field reconnaissance of the LAA identified seven areas of high archaeological potential for encountering Mi'kmaq resources, as well as four areas of medium archaeological potential for encountering Mi'kmaq resources. These areas are located primarily along the Cornwallis River, as well as along Rochford Brook and Coleman Brook. In addition, there are two historic homesteads with elevated potential for historic resources.

Additional shovel testing occurred at four locations in 2022 with the results and recommendations pending review and approval from NSDPW and NSCCTH.



PROJECT:

PROJECT: NOVA SCOTIA - HIGHWAY 101 CAMBRIDGE INTERCHANGE AND CONNECTOR ROADS EA KINGS COUNTY, NS

PROJECT NO.: 211-04152

CLIENT: NOVA SCOTIA

FIGURE:

TITLE: ADMINISTRATIVE BOUNDARIES AND LAND ZONING

FIGURE NO.: 11

REVISION NO.: 0

WSP Canada Inc.
1 Spectacle Lake Drive,
Dartmouth, Nova Scotia
www.wsp.com

DATUM: NAD 83 CSRS

PROJECTION: UTM ZONE 20 NORTH

DRAWN BY: C. PYTLAK

CHECKED BY: D. EDWARDS

CREATED DATE: (YYYY-MM-DD) 2022/01/28

REVISION DATE: (YYYY-MM-DD) 2023/03/07

LEGEND:

- LOCAL ASSESSMENT AREA
- PROJECT DEVELOPMENT AREA
- PROPOSED ALIGNMENT
- ROAD
- WATERCOURSE
- WATERBODY

ADMINISTRATIVE BOUNDARIES

- ANNAPOLIS VALLEY FIRST NATION
- CAMBRIDGE
- GRAFTON
- WATERVILLE
- WOODVILLE

ZONING DESIGNATION (KINGS COUNTY)

- A1: AGRICULTURAL
- A2: RURAL MIXED USE
- A4: COUNTRY RESIDENTIAL
- C1: GENERAL COMMERCIAL
- C3: MIXED COMMERCIAL RESIDENTIAL
- I1: INSTITUTIONAL
- M1: LIGHT INDUSTRIAL COMMERCIAL
- M2: HEAVY INDUSTRIAL
- M3: RURAL INDUSTRIAL
- O1: ENVIRONMENTAL CONSTRAINTS
- R2: RESIDENTIAL ONE AND TWO UNITS
- R3: RESIDENTIAL MIXED DENSITY
- R4: RESIDENTIAL MULTI-UNIT

SCALE: 1:12,500

0 200 400 800 Meters

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6 ENVIRONMENTAL EFFECTS ASSESSMENT

6.1 AIR QUALITY

6.1.1 VEC DESCRIPTION AND BOUNDARIES

Air quality is a valued component in the ecosystem for both flora and fauna. Degraded air quality conditions for extended periods of time have potential to alter the plant community as several species of vascular and non-vascular plants require good to pristine air quality. Air pollution may also deter avian or terrestrial fauna from accessing the area or add health risks to species that choose to continue inhabiting the area. Air quality, including acceptable GHG levels, is also vital for the health and wellbeing of the community residing in the LAA and RAA.

The boundaries selected for this VEC include the PDA, specifically areas where significant ground works are anticipated, and the Project LAA where vehicles and equipment may cause increased emissions of contaminants of concern.

6.1.2 SIGNIFICANCE DEFINITION

A significant adverse effect on air quality is defined as a condition where regulatory objectives are routinely exceeded. Nova Scotia Maximum Permissible Ground Level Concentrations as specified by the Nova Scotia Air Quality Regulations under the NSEA will apply for total suspended particulates (TSP), NO_2, SO_2 and CO. Canadian Ambient Air Quality Standards (CCME 2012) will apply to fine particulate matter (PM2.5).

Current provincial and federal guidance documents on assessing project-related impacts on climate change do not provide thresholds for determining significance. A significant effect would be a measurable increase in provincial GHG emissions from baseline, outside the annual variability of emissions.

A positive effect is an effect that measurably reduces the atmospheric contaminant loading as a result of the Project.

6.1.3 ENVIRONMENTAL EFFECTS ANALYSIS

Air quality effects were evaluated based on knowledge of standard construction methods and equipment. GHG emissions and associated effects were modeled and identified based on two assessment scenarios: baseline scenario and Project scenario. The scenarios factored in anticipated direct emissions from vehicles during construction and operation phases, as well as energy indirect emissions (i.e., electricity consumption) and other indirect emissions. Vehicle types, including ZEVs, and planned policies to accelerate ZEV sales, were included into the assessment scenarios. The specific model results of anticipated GHG emissions are detailed in Appendix A – Climate Lens Assessment – GHG Mitigation Assessment. Anticipated direct and indirect emissions for each project phase are summarised as follows:

<u>SITE PREPARATION</u>

- Dust from land clearing entering the air and depositing on nearby vegetation;
- Increased localised humidity from spraying trucks to combat dust;

- Increased carbon emissions from heavy machinery in the site preparation stage; and
- Removal of trees and other vegetation may decrease soil stability and increase the potential for particulates to enter the ambient air.

CONSTRUCTION

- Construction materials such as asphalt and road paint may contain VOCs which could enter ambient air;
- Increased dust from material deliveries and other ground works including grading and grubbing;
- Increased localised humidity from water spraying to combat dust; and
- Increased carbon emissions from construction vehicles.

OPERATION

Operation of the Interchange and Connector Roads will result in localized emissions from vehicles. However, it is anticipated that the new roads will increase the efficiency of traffic movement rather than increase overall traffic. Therefore, additional impacts to air quality from traffic operation are not anticipated.

Maintenance operations, such as snow removal, road salt application, re-paving and re-painting may result in emissions from vehicles and materials, but impacts are likely to be negligible due to the infrequent nature and short-term duration of these operations.

The anticipated effects of the project's operation on air quality are summarised as follows:

- Potential for reduced GHG emissions from vehicle idling operation due to trip savings of 1-2 minutes;
- Annual GHG emissions expected to decline each year due to the implementation of zero emission vehicle policies; and
- Potential short-term emission of VOCs or other harmful substances during maintenance (i.e re-paving, re-painting, pothole remediation, etc).

6.1.4 MITIGATION MEASURES

The following mitigation measures have been prepared to minimize potential adverse effects to air quality during the site preparation, construction, and operation phases of the Project:

- Implementation of EPP addressing mitigation to reduce air particulates (i.e. dust control measures, equipment maintenance)
- Minimize vehicle and machinery idling;
- Vehicles and equipment should be maintained and inspected as per manufacturer and / or provincial specifications and regulations;
- Where appropriate, trucks carrying loose material should be properly loaded and unloaded and tarped when travelling on and off-site; and,
- Stabilization of erodible materials, including stockpiles and excavated lands

6.1.5 SIGNIFICANCE OF RESIDUAL EFFECTS

With the successful implementation of proposed mitigation during the site preparation, construction, and operation phases, residual effects to air quality and GHG emissions are anticipated to be negligible (Table 6-1).

Table 6-1 Residual effects – air quality and GHG emissions

PROJECT VEC INTERACTIONS	MITIGATION AND COMPENSATION MEASURES	NATURE OF EFFECT	SIGNIFICANCE CRITERIA FOR RESIDUAL ENVIRONMENTAL EFFECTS						RESIDUAL EFFECT	SIGNIFICANCE
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Social Context		
Adverse effects on air quality from site preparation and construction	-Implementation of EPP to minimize air particulates (i.e., speed limits, dust suppressants) -Inspect and maintain machinery and equipment -Stabilize or cover erodible materials -Transported loose material should be loaded and unloaded properly and covered while in transit	A	L	LAA	MT	S	R	LD	Minimal and localized disturbance to air quality	Not Significant
Contribution or increase to GHG emissions from site preparation and construction	-Limit vehicle and machinery idling -Inspect and maintain machinery and equipment	A	L	LAA	MT	S	IR	LD	Negligible increase to GHG emissions	Not Significant
Adverse effects on air quality from maintenance	-Limit vehicle and machinery idling -Inspect and maintain machinery and equipment	A	L	LAA	ST	S	R	LD	Minimal and localized disturbance to air quality	Not Significant
Decrease of GHG emissions from operation and maintenance	-None required	P	L	LAA	ST	S	IR	LD	Overall decrease of GHG emissions due to decrease in vehicle idling	Not Significant

LEGEND
Nature of Effect: (A – Adverse) (P – Positive)
Magnitude: (N – Negligeable) (L – Low) (M – Medium) (H – High)
Geographic Extent: (PDA – Project Development Area) (LAA – Local Assessment Area) (RAA – Regional Assessment Area)
Duration: (ST – Short-Term) (MT -Medium-Term) (LT – Long Term) (P – Permanent)
Frequency: (O – Once) (S-Sporadic) (R – Regular) (C-Continuous)
Reversibility: (R – Reversible) (IR – Irreversible)
Ecological and Social Context: (LD – Low Disturbance) (MD – Medium Disturbance) (HD – High Disturbance)

6.2 ACOUSTIC ENVIRONMENT

6.2.1 VEC DESCRIPTION AND BOUNDARIES

The acoustic environment was selected as a VEC due to the potential for noise-related impacts from the Project within the PDA and LAA. An assessment of noise receptors within the LAA was undertaken to identify anticipated impacts from construction noise and operational noise (i.e., road traffic). The spatial boundaries for this VEC have been defined as the Project LAA, while also considering the surrounding lands within the RAA.

6.2.2 SIGNIFICANCE DEFINITION

A significant adverse effect on the acoustic environment is defined as a predicted noise level that exceeds the Nova Scotia *Guidelines for Environmental Noise Measurement and Assessment* (NSE, 1990). The guideline defines the maximum acceptable noise levels at specific times as follows:

- L_{eq} of 65 dBA between 0700 to 1900 hours (daytime);
- L_{eq} of 60 dBA between 1900 to 2300 hours (evening time), and
- L_{eq} of 55 dBA between 2300 to 0700 hours (nighttime, all day Sunday and statutory holidays).

A positive effect is an effect that measurably reduces the ambient noise as a result of the Project.

6.2.3 ENVIRONMENTAL EFFECTS ANALYSIS

The assessment of the effects of noise generated by construction activities on the identified receptors was completed by determining the typical construction sound levels at the receptors and comparing against the assessment criteria, evaluating the relative change due to construction activities, and establishing a construction noise mitigation plan as a reliable engineering practice to reduce the potential for annoyance

Considering construction activities are temporary in nature and a necessary operation, a perceptibility-based criteria is considered in conjunction with the criteria discussed for traffic noise (Section 5.1.7). A 1-3 dB change in sound level is considered to be imperceptible and therefore insignificant, while an increase of 5 dB or greater is a “clearly noticeable” perception and therefore a “significant” impact.

Noise from construction activities were modelled using Cadna/A, a computer implementation of the ISO Standard 9613-2. As details of equipment usage are not yet available, the equipment selected for input to the model was conservatively assumed to be operating concurrently and continually to assess a worst-case operating scenario. The equipment selected includes a milling machine, dump truck, sweeper, paver, and roller.

The predicted sound levels at the representative receptors, based on the assumed construction activities, are outlined in Table 6-2. The results indicate that construction noise is predicted at or below the criteria at all locations during the daytime (07:00 – 19:00). During the evening, construction noise is predicted below the criteria or exceed by 1 dB to 3 dB at most locations which is “insignificant”, except a 4 dB excess at POR_13 and AVFN_01, and a 5 dB excess at POR_17. Construction noise at nighttime is predicted to exceed the criteria at most locations. Since the excess at more than three receptors are predicted during evening and at several receptors during nighttime hours and a detailed construction schedule is not available at this time, it is recommended to consider administrative controls and a Noise Management Plan to mitigate the effects.

Table 6-2 Predicted sound level at representative receptors – construction noise

	ASSESSMENT CRITERIA			PREDICTED SOUND LEVEL			BELOW THE CRITERIA (YES / NO)		
RECEPTOR ID	L_{EQ} DAY	L_{EQ} EVENING	L_{EQ} NIGHT	L_{EQ} DAY	L_{EQ} EVENING	L_{EQ} NIGHT	L_{EQ} DAY	L_{EQ} EVENING	L_{EQ} NIGHT
POR_01	65	60	55	57	57	57	Yes	Yes	**No**
POR_02	65	60	55	61	61	61	Yes	**No**	**No**
POR_03	65	60	55	52	52	52	Yes	Yes	Yes
POR_04	65	60	55	51	51	51	Yes	Yes	Yes
POR_05	65	60	55	59	59	59	Yes	Yes	**No**
POR_06	65	60	55	58	58	58	Yes	Yes	**No**
POR_07	65	60	55	57	57	57	Yes	Yes	**No**
POR_08	65	60	55	61	61	61	Yes	**No**	**No**
POR_09	65	60	55	61	61	61	Yes	**No**	**No**
POR_10	65	60	55	60	60	60	Yes	Yes	**No**
POR_11	65	60	55	58	58	58	Yes	Yes	**No**
POR_12	65	60	55	60	60	60	Yes	Yes	**No**
POR_13	65	60	55	64	64	64	Yes	**No**	**No**
POR_14	65	60	55	61	61	61	Yes	**No**	**No**
POR_15	65	60	55	58	58	58	Yes	Yes	**No**
POR_16*	--	--	--	--	--	--	--	--	--
POR_17	65	60	56	65	65	65	Yes	**No**	**No**
POR_18	65	60	57	63	63	63	Yes	**No**	**No**
POR_19	65	60	56	58	58	58	Yes	Yes	**No**
POR_20	65	60	55	58	58	58	Yes	Yes	**No**
POR_21	65	60	55	61	61	61	Yes	**No**	**No**
POR_22	65	60	55	59	59	59	Yes	Yes	**No**
AVFN_01	65	60	55	64	64	64	Yes	**No**	**No**
AVFN_02	65	60	55	59	59	59	Yes	Yes	**No**
AVFN_03	65	60	55	63	63	63	Yes	**No**	**No**
AVFN_04	65	60	55	57	57	57	Yes	Yes	**No**
AVFN_05	65	60	55	54	54	54	Yes	Yes	Yes

**To be demolished and therefore no longer considered a receptor*

Future road traffic/operational sound levels were predicted using the commercially available software package Cadna/A, a computer implementation of the algorithms ISO Standard 9613-2 Acoustics – *Attenuation of Sound During Propagation Outdoors*, and Traffic Noise Model (TNM) by the Federal Highway Administration. Road alignment and gradients, traffic volumes, commercial vehicle percentages, traffic speed, shielding from barriers/buildings, and special details were taken into consideration in developing the model. Future road traffic (2023) volumes and vehicle speeds were obtained from the Highway 101 Cambridge Interchange Interchange Traffic Study final report, dated March 29, 2019, for NSTIR (now NSDPW).

The predicted sound levels without any noise control measures at the representative receptors (Figure 6) are outlined in Table 6-3 and are compared with the assessment criteria. The results show that the future road traffic (operational) noise meet the criteria at a majority of the receptors except for POR_17, located at the southeast corner of the Trunk 1 roundabout, during the evening period by 1 dB. This excess is considered an imperceptible risk and therefore, noise control is not considered further.

Table 6-3 Predicted sound level at representative receptors – road traffic noise, unmitigated

	ASSESSMENT CRITERIA			PREDICTED SOUND LEVEL			BELOW THE CRITERIA (YES / NO)		
RECEPTOR ID	L_{EQ} DAY	L_{EQ} EVENING	L_{EQ} NIGHT	L_{EQ} DAY	L_{EQ} EVENING	L_{EQ} NIGHT	L_{EQ} DAY	L_{EQ} EVENING	L_{EQ} NIGHT
POR_01	65	60	55	47	45	40	Yes	Yes	Yes
POR_02	65	60	55	61	59	54	Yes	Yes	Yes
POR_03	65	60	55	59	57	52	Yes	Yes	Yes
POR_04	65	60	55	58	56	51	Yes	Yes	Yes
POR_05	65	60	55	46	43	39	Yes	Yes	Yes
POR_06	65	60	55	45	43	39	Yes	Yes	Yes
POR_07	65	60	55	45	43	38	Yes	Yes	Yes
POR_08	65	60	55	50	47	43	Yes	Yes	Yes
POR_09	65	60	55	51	48	44	Yes	Yes	Yes
POR_10	65	60	55	51	49	44	Yes	Yes	Yes
POR_11	65	60	55	61	59	53	Yes	Yes	Yes
POR_12	65	60	55	58	56	51	Yes	Yes	Yes
POR_13	65	60	55	58	56	50	Yes	Yes	Yes
POR_14	65	60	55	55	53	47	Yes	Yes	Yes
POR_15	65	60	55	54	52	47	Yes	Yes	Yes
POR_16*	--	--	--	--	--	--	--	--	--
POR_17	65	60	56	63	61	55	Yes	**No**	Yes
POR_18	65	60	57	62	60	55	Yes	Yes	Yes
POR_19	65	60	56	61	60	54	Yes	Yes	Yes
POR_20	65	60	55	58	56	51	Yes	Yes	Yes
POR_21	65	60	55	55	53	48	Yes	Yes	Yes
POR_22	65	60	55	53	51	45	Yes	Yes	Yes
AVFN_01	65	60	55	50	47	43	Yes	Yes	Yes
AVFN_02	65	60	55	47	44	40	Yes	Yes	Yes

RECEPTOR ID	ASSESSMENT CRITERIA			PREDICTED SOUND LEVEL			BELOW THE CRITERIA (YES / NO)		
	L_{EQ} DAY	L_{EQ} EVENING	L_{EQ} NIGHT	L_{EQ} DAY	L_{EQ} EVENING	L_{EQ} NIGHT	L_{EQ} DAY	L_{EQ} EVENING	L_{EQ} NIGHT
AVFN_03	65	60	55	54	51	47	Yes	Yes	Yes
VFN_04	65	60	55	45	42	38	Yes	Yes	Yes
AVFN_05	65	60	55	43	41	36	Yes	Yes	Yes

**To be demolished and therefore no longer considered a receptor*

6.2.4 MITIGATION MEASURES

The following mitigation measures are recommended to be implemented to minimize the risk of potential noise-related adverse effects on receptors during Project site preparation and construction:

- Avoid noisy evening and nighttime construction activities near receptors that are likely to experience noise exceedances during those periods (Refer to Table 6-2);
- Routine inspection of machinery and construction vehicles to ensure noise levels are acceptable. Any faulty mufflers or other sound dampening equipment should be replaced if necessary;
- Keep idling of construction equipment to a minimum as necessary and maintain equipment in good working order to reduce noise from construction activities;
- Locate noisy equipment, such as generators, away from receptors where possible;
- Awareness training for machine and vehicle operators on techniques to reduce noise emissions;
- Where required and practical, the contract documents shall include these recommendations and general best management practice guidelines, as well as identify the receptors in the contract package;
- All reasonable attempts will be made to reduce noise; and,
- Implement a complaint management process. If persistent noise complaints occur, develop specific noise mitigation measures to reduce these impacts.

Noise mitigation is not anticipated to be required for the operational phase, as the predicted excess noise levels are considered to be minor or imperceptible over the defined criteria.

6.2.5 SIGNIFICANCE OF RESIDUAL EFFECTS

With the successful implementation of the recommended mitigation measures and a noise control plan, residual effects from the construction and operational phases are anticipated to be insignificant. Furthermore, a complaint management process to address community complaints will assist in addressing and managing any unexpected excess noise generation.

6.3 GROUNDWATER

6.3.1 VEC DESCRIPTION AND BOUNDARIES

Groundwater resources were identified as a VEC based on potential Project-related effects to water supply well quantity and quality, and effects that changes to the groundwater regime may have on surface water bodies, streams and wetlands adjacent to the Project. The groundwater assessment desktop review examined a radius of 500 m from the centre line of the proposed interchange and connector road.

6.3.2 SIGNIFICANCE DEFINITION

A significant adverse effect on groundwater is defined as:

- A change in water well yields that result in a long-term reduction in water supply at a receiver location, or
- A decrease in groundwater quality resulting in values outside of the Guidelines for Canadian Drinking Water Quality from Health Canada (Health Canada 2021).

A positive effect would be an increase in groundwater quantity or quality within the LAA.

6.3.3 ENVIRONMENTAL EFFECTS ANALYSIS

The desktop review indicated that there were potentially 110 wells located within 500 m of the LAA. Project-environment interactions of concern include:

- Siltation of wells and possible permanent change in water quality or well yield from blasting and vibrations;
- Water level reductions as a result of trenching, drainage, and large cuts or changes in surface topography; and
- Contamination of wells from road salting and vegetation management.

Direct effects to groundwater quality could also result in indirect effects on surface waterbodies such as stream dewatering, which may be caused by deep and/or large-scale site drainage.

Contamination of wells from acid rock drainage is not a concern due to the regional bedrock of the Project being comprised of sandstone and conglomerate which typically consist of low-no sulphide-bearing minerals.

6.3.4 MITIGATION MEASURES

The documentation applicable for both construction and operation/maintenance phases of the Project include:

- Standard Specification; Highway Construction and Maintenance (NSDPW 1997-2014)
- Generic EPP for the Construction of 100 Series Highways (NSDPW 2007)

These documents offer specific mitigation guidance as follows:

- Mitigation of siltation of groundwater include a pre-blast well survey, avoid blasting (when possible) within 500 m of residential wells, remedial action as necessary to restore damaged wells and/or provide temporary potable water as needed;
- Mitigation of water level reductions include monitoring and remedial action as necessary to restore damaged wells and/or provide temporary potable water as needed; and,

- Mitigation of contamination of wells include following NSDPW's Salt Management Plan during winter road maintenance and use of mechanical vegetation control where possible.

6.3.5 SIGNIFICANCE OF RESIDUAL EFFECTS

The effects on groundwater quality and quantity in the LAA caused by the construction, operation and maintenance are not expected to be significant.

6.4 TERRESTRIAL HABITAT AND VEGETATION

6.4.1 VEC DESCRIPTION AND BOUNDARIES

Priority plant species are valued as intrinsic components of the natural environment in Nova Scotia. The protection or avoidance of priority or rare plant species, and often by proxy, their habitats, preserves the biodiversity of our natural environment.

The Project LAA defined the spatial boundaries used for the assessment of effects to flora and lichen. All habitat types on site were investigated, with an emphasis on mature forested stands, which are anticipated to be impacted by Project activities.

Data from the ACCDC was used to help target habitats which may be important for SAR and SoCC within the Project site.

6.4.2 SIGNIFICANCE DEFINITION

A significant adverse effect on terrestrial habitat and vegetation is defined as:

- For species at risk, one that results in contravention of SARA or NSESA provisions;
- For rare species or species of conservation concern not listed under SARA or NSESA, a decline in abundance and/or change in distribution beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return the population to its pre-project level within several (three to five) generations; or
- For sensitive or critical habitat, a permanent net loss of habitat function.

A positive effect is one that may enhance the quality of habitat, increase species diversity, or increase the area of valued habitat.

6.4.3 ENVIRONMENTAL EFFECTS ANALYSIS

Site preparation, construction, and subsequent ongoing usage and maintenance (operation) of the Cambridge interchange and connector roads may impact terrestrial habitat and vegetation in a variety of ways:

<u>SITE PREPARATION</u>

- Loss or reduction of wildlife and/or vegetation habitat functions;
- Non-limiting loss of vegetation supporting SAR and SoCC wildlife species (Milkweed);
- Introduction of invasive or alien species;
- Alteration of surface hydrology; and
- Fragmentation of wildlife habitat.

CONSTRUCTION

- Direct habitat loss;
- Increased events of sedimentation or erosion;
- Introduction of invasive or alien species;
- Nutrient- and/or salt -loading;
- Increased flooding frequency of wetland habitat; and
- Hazardous or deleterious substance release.

OPERATION

- Introduction of invasive or alien species; and
- Recurring road salt or and deleterious substance release from winter maintenance and leaks from commercial and passenger vehicles.

6.4.4 MITIGATION MEASURES

Proposed mitigation measures to offset potential adverse effects to terrestrial habitat and vegetation during all phases of the project are outlined below:

- Intact forest stands will be avoided, wherever possible, during detailed Project planning and design in favor of previously disturbed areas (e.g., stands disturbed by timber harvesting, agricultural fields, existing roads, or other development), especially those that are predominantly mature softwood, as several SoCC lichens utilize this type of habitat;
- Topsoil is to be salvaged and stored for use in site restoration, where possible. Upland and wetland soils should be stockpiled separately;
- Implementation of Invasive Species Management Plan;
- Where natural, intact habitat cannot be avoided, minimization of total Project footprint will be considered during detailed planning;
- ESC planning will be completed to ensure site runoff is not directed towards unaltered habitat, where possible, to ensure existing drainage patterns are maintained;
- The effect of dust accumulation on adjacent undisturbed vegetation can be mitigated by monitoring dust conditions and when normal precipitation levels are not enough to suppress fugitive dust, water trucks can be used to suppress dust. This reduces potential impacts on flora and fauna and improves safety and visibility for other vehicular traffic as well. Oil will not be used as an alternate dust suppressant;
- Winter road maintenance will follow NSDPW standards for snow and ice clearing; and
- Trucks will be equipped with spill kits and crew will be instructed on their use, as well as on BMPs for spill prevention. Site personnel trained in spill isolation, containment, and recovery will also be on-site.

6.4.5 SIGNIFICANCE OF RESIDUAL EFFECTS

The predicted residual environmental effects of the Project on vascular and non-vascular plant species, including SAR and SoCC, are assessed to be adverse, but not significant; whereas the overall residual effect of the Project is assessed as not significant after mitigation measures have been implemented. See Table 6-4 for a summary of the residual environmental effects for habitat and flora.

Table 6-4 Residual effects – terrestrial habitat and vegetation (including priority species)

PROJECT VEC INTERACTIONS	MITIGATION AND COMPENSATION MEASURES	NATURE OF EFFECT	SIGNIFICANCE CRITERIA FOR RESIDUAL ENVIRONMENTAL EFFECTS						RESIDUAL EFFECT	SIGNIFICANCE
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Social Context		
Clearing and grubbing	-Avoidance of intact mature forest stands to the greatest extent feasible -Salvage topsoil for site restoration where possible -Follow best management practices for control of invasive species	A	L	LAA	MT	S	R	LD	Reduction in habitat and biodiversity	Not Significant
Heavy machinery operation	-Monitor dust conditions on roads in periods with low rain, and practice spill preparedness -Ensure machinery and vehicles are clean and free of leaks	A	L	PDA	MT	R	R	LD	None expected	Not Significant
Roadway operation (vehicle use) – sedimentation and runoff	-Roadway grading and drainage should direct runoff away from sensitive habitats (i.e. mature forest stands, wetlands).	A	L	PDA	LT	C	R	LD	None expected	Not Significant
Roadway maintenance	-Vegetation maintenance should follow NSDPW best practices -Winter road maintenance should follow NSDPW standards	A	L	LAA	LT	R	R	LD	Disturbance	Not Significant

LEGEND
Nature of Effect: (A – Adverse) (P – Positive)
Magnitude: (N – Negligeable) (L – Low) (M – Medium) (H – High)
Geographic Extent: (PDA – Project Development Area) (LAA – Local Assessment Area) (RAA – Regional Assessment Area)
Duration: (ST – Short-Term) (MT -Medium-Term) (LT – Long Term) (P – Permanent)
Frequency: (O – Once) (S-Sporadic) (R – Regular) (C-Continuous)
Reversibility: (R – Reversible) (IR – Irreversible)
Ecological and Social Context: (LD – Low Disturbance) (MD – Medium Disturbance) (HD – High Disturbance)

6.5 TERRESTRIAL WILDLIFE

6.5.1 VEC DESCRIPTION AND BOUNDARIES

Terrestrial wildlife, and the habitat upon which they rely, may be altered either directly or indirectly by proposed Project activities. While this valued component includes understanding the potential effects of the Project on all fauna, the specific survey methods are mainly driven by identification of SAR and SoCC. Many terrestrial wildlife species have significant intrinsic value, and also assist in maintaining biodiversity in an area through several functions. Please note that avifauna are addressed in Section 6.6

The spatial boundaries used for the assessment of effects to terrestrial fauna include the LAA, with extra emphasis on areas to experience direct impacts within the PDA and areas thought to have a higher potential for SAR species, such as the Wood Turtle (*Glyptemys insculpta*).

6.5.2 SIGNIFICANCE DEFINITION

A significant adverse effect on terrestrial wildlife is defined as:

- For species at risk, one that results in contravention of S*ARA* or NS *ESA* provisions; or
- For rare species or species of conservation concern not listed under *SARA* or NS *ESA*, one that results in contravention of the Nova Scotia *Wildlife Act* or a decline in abundance and/or change in distribution beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return the population to its pre-project level within several (three to five) generations.

A positive effect is one that may enhance increase species abundance and diversity.

6.5.3 ENVIRONMENTAL EFFECTS ANALYSIS

Site preparation, construction, and subsequent ongoing usage and maintenance (operation) of the Cambridge interchange and connector roads may impact terrestrial wildlife in a variety of ways:

SITE PREPARATION

- Clearing and grubbing of vegetated areas may directly reduce available wildlife habitat;
- Fragmentation of habitat corridors along Cornwallis River and Coleman Brook;
- Potential reduction of foraging habitat for Wood Turtle;
- Removal or disturbance to suitable thermoregulatory features for Wood Turtle along the Cornwallis River;
- Removal or disturbance to suitable thermoregulatory features for Wood Turtles along Coleman Brook;
- Removal or disturbance to suitable Snapping Turtle aquatic habitat within Cornwallis River;
- Potential removal of Milkweed and other plants supporting Monarch; and
- Sensory disturbance from increased noise and activity in the area may decrease wildlife utilization.

CONSTRUCTION

- Construction lights, if required, may cause sensory disturbance to wildlife in the area;
- Increased vehicular activity may cause direct animal mortality in road crossing situations;

- Opportunistic species such as raccoons, skunks, coyotes, and black bear may be attracted to wastes generated on-site during construction;
- Increased ground vibration during construction activities may cause sensory disruption;
- Potential habitat loss or degradation for aquatic and semi-aquatic fauna if wetlands or watercourses are altered;
- Dust from construction may reduce quality or quantity of available forage options;
- Increased workers in the area may result in animal – human interaction; and
- Construction of the interchange and connector roads may result in habitat fragmentation.

OPERATION

- Streetlights in the new interchange area may add additional sensory disruption;
- Sustained vehicular use in the area may deter wildlife; and,
- Risk of wildlife – vehicle collisions, particularly near habitat corridors (i.e. Cornwallis River).

The Wood Turtle habitat assessment identified suitable thermoregulatory and overwintering features where the PDA intersects the Cornwallis River. Impacts to these features are likely to be avoided as a bridge will be utilized as the watercourse crossing at this location. Indirect impacts, such as sedimentation and construction-related disturbance may occur but can be mitigated through protection measures or compensation. A watercourse crossing on Coleman Brook may impact a potential basking feature although this can be mitigated through habitat enhancements nearby, outside of the PDA. An overall loss of suitable foraging habitat is expected at all three watercourses.

While the project has potential to reduce available terrestrial wildlife habitat, the current land use and condition within nearly half of the LAA (~140 ha) comprises agricultural operations, residential homes, or other disturbed areas. Much of the available habitat has been disturbed previously and utilized for anthropogenic activities over several decades. Existing baseline wildlife and habitat disturbances within the site are substantial, with several sources noted including:

- Roadway traffic from Highway 101, Highway 1, Coleman Road and Brooklyn Street;
- Regular ATV usage throughout the site, with a dedicated ATV track area found in the central area of the site near the end of Ratchford Road;
- Noise related to agricultural operations - tractors, trucks, pumps, other machinery and implements;
- Sirens and traffic from the Waterville Firehall found in the southern area of the Project site along Country Home Road;
- Aircraft noise from the small airport at Taxiway Drive;
- Regular heavy truck traffic on Waterville Mountain Road relating to industrial businesses in the southern portion of the Project site;
- Disturbed areas related to private residences and commercial operations;
- Disturbed areas transformed to croplands; and,
- Streetlights and other sources of anthropogenic light pollution.

6.5.4 MITIGATION MEASURES

Proposed mitigation measures to offset potential adverse effects to terrestrial wildlife during all phases of the Project are outlined below:

- Minimizing Project footprint to avoid altering natural habitat where possible;
- Incorporate Wood Turtle protection measures into Project design where warranted by 2023 field studies;
- Ensure ESC measures are in-place and effective during site preparation and construction;
- Conduct vegetation clearing and grubbing during winter months, outside of sensitive periods for wildlife;
- In-water work to be avoided in areas with high suitability for Wood Turtle overwintering during winter months;
- Implement dust control measures during site preparation and construction;
- Utilization of trash receptacles and good housekeeping practices to avoid attracting wildlife;
- Ensure vehicles and equipment have sufficient noise muffling equipment in good working order;
- Limit amount of construction conducted during nighttime hours, especially near wildlife habitat areas. If nighttime work is required, construction lighting should be directed away from adjacent wildlife habitats;
- If areas are identified as requiring blasting, areas should be cleared for wildlife prior. Other wildlife mitigation techniques within blasting areas such as air horns may be utilized as a final measure before blasting commences; and
- Any handling of wildlife may be subject to regulatory approval via the Nova Scotia Department of Natural Resources and Renewables, and/or Environment and Climate Change Canada.

Additional mitigation measures to avoid or minimize adverse effects to Wood Turtle and its habitat will be developed following the completion of Wood Turtle surveys in 2023 and the evaluation of habitat usage in the PDA.

6.5.5 SIGNIFICANCE OF RESIDUAL EFFECTS

The residual effects classification is based on the magnitude, geographic extent, duration/frequency, reversibility and ecological context and is to describe residual effects predicted for the Project. The criteria are used to describe the nature and type of an effect on VECs. The residual effects classification is then used to determine the environmental significance of Project effects to VECs. The definitions of the criteria are presented below in Table 6-5.

Table 6-5 Residual effects – terrestrial wildlife (including priority species)

PROJECT VEC INTERACTIONS	MITIGATION AND COMPENSATION MEASURES	NATURE OF EFFECT	SIGNIFICANCE CRITERIA FOR RESIDUAL ENVIRONMENTAL EFFECTS						RESIDUAL EFFECT	SIGNIFICANCE
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological And Social Context		
Clearing and grubbing	-Minimize project footprint to the smallest required extent possible -Evaluation and identification of Wood Turtle habitat usage and avoidance of impacts to areas with documented Wood Turtle presence -Incorporate Wood Turtle protection measures where necessary (pending 2023 survey results) -Ensure ESC measures are in place and monitored for effectiveness and repaired as necessary -Conduct clearing and grubbing outside of sensitive time periods for wildlife, particularly in areas with high potential for priority species	A	L	PDA	MT	O	R	LD/MD	Habitat loss	Not Significant
Heavy machinery operation and truck traffic	-Ensure noise muffling equipment is in good working order -Dust control measures in-place -In-water work should occur during June 1st – September 30th to avoid potential disturbance to hibernating turtles	A	L	PDA	ST	S	R	LD	Sensory disruption	Not Significant
Ambient lighting (construction)	-Reduce the need for construction lighting by working in daylight hours when possible -Construction lighting should be directed away from wildlife habitats	A	L	PDA	ST	R	R	LD	Sensory disruption	Not Significant

PROJECT VEC INTERACTIONS	MITIGATION AND COMPENSATION MEASURES	NATURE OF EFFECT	SIGNIFICANCE CRITERIA FOR RESIDUAL ENVIRONMENTAL EFFECTS						RESIDUAL EFFECT	SIGNIFICANCE
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological And Social Context		
Blasting	-Clear blasting areas of wildlife -Use airhorns prior to blasting to alert animals and allow them to safely flee the area	A	L	PDA	ST	O	R	LD	Sensory disruption	Not Significant
Transport of materials	-Implement best practices when transporting impacted materials -Ensure spill control plan is known to staff	A	N	LAA	ST	R	R	LD	None expected	Not Significant
Wildlife interactions	-Utilize trash receptacles and keep construction areas free of food waste	A	N	PDA	ST	S	R	LD	None expected	Not Significant
Increased vehicle traffic upon completion	-Road lighting should be directed downwards towards the road to limit light trespass into the sky or adjacent wildlife habitats -Implementation of Wood Turtle protection measures into road design where appropriate	A	L	LAA	LT	R	R /IR	MD	Disturbance, incidental harm/mortality	Not Significant

LEGEND
Nature of Effect: (A – Adverse) (P – Positive)
Magnitude: (N – Negligeable) (L – Low) (M – Medium) (H – High)
Geographic Extent: (PDA – Project Development Area) (LAA – Local Assessment Area) (RAA – Regional Assessment Area)
Duration: (ST – Short-Term) (MT -Medium-Term) (LT – Long Term) (P – Permanent)
Frequency: (O – Once) (S-Sporadic) (R – Regular) (C-Continuous)
Reversibility: (R – Reversible) (IR – Irreversible)
Ecological and Social Context: (LD – Low Disturbance) (MD – Medium Disturbance) (HD – High Disturbance)

6.6 AVIFAUNA

6.6.1 VEC DESCRIPTION AND BOUNDARIES

Birds and their habitat may be altered either directly or indirectly by proposed Project activities. This VEC includes migratory birds and their nests, raptors and their nests, and priority species. Many avian species have significant intrinsic value and also assist in maintaining biodiversity.

The spatial boundaries used for the assessment of effects to avifauna include the LAA, with emphasis on the PDA for direct impacts to avifauna and their habitat.

6.6.2 SIGNIFICANCE DEFINITION

A significant adverse effect on avifauna (birds) is defined as:

- For migratory birds, one that results in contravention of the *MBCA*;
- For species at risk, one that results in contravention of *SARA* or NS *ESA* provisions; or
- For rare species or SoCCs not listed under *SARA* or NS *ESA*, one that results in a decline in abundance and/or change in distribution beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return the population to its pre-project level within several (three to five) generations.

A positive effect is one that may enhance increase species abundance and diversity.

6.6.3 ENVIRONMENTAL EFFECTS ANALYSIS

Site preparation, construction, and subsequent ongoing usage and maintenance (operation) of the Cambridge interchange and connector roads may impact avifauna in a variety of ways:

SITE PREPARATION

- Direct loss of nesting and foraging habitat due to vegetation removal in advance of construction activities;
- Fragmentation of suitable habitat, particularly for forested areas;
- Sensory disturbance from increased noise and activity in the area may decrease avifauna utilization; and
- Incidental harm to avifauna or their nests from equipment during site clearing and grading.

CONSTRUCTION

- Incidental harm to avifauna or their nests from equipment during construction activities;
- Increased ground vibration and equipment noise during construction activities may cause sensory disruption;
- Waste generated and stored on-site may attract disturbance-tolerant scavenger species such as American Crow; and
- Potential for the unintended creation of suitable nesting or roosting habitat for Barn Swallows, Rock Pigeons, and other species known to nest or roost on man-made structures such as bridges or culverts.

OPERATION

- Increased vehicular activity may cause direct avian mortality from vehicular collisions;
- Potential increase of populations of disturbance-tolerant species such as European Starling, American Robin, and Rock Pigeon. These species may compete with native forest and shrub species commonly encountered within the PDA;
- Streetlights in the new interchange area may add additional sensory disruption; and,
- Degradation of roadside wetland habitat through increased road runoff.

While the Project has potential to reduce available terrestrial avian habitat, the current land use and condition within nearly half of the LAA (~140 ha) is comprised agricultural operations, residential homes, or other disturbed areas that may be considered low quality habitat and unlikely to support large populations of birds or priority species. Furthermore, the loss of suitable bird habitat within the PDA is likely to be non-limiting to avian species, as similar suitable habitat (i.e., shrub wetlands, mixed-wood and deciduous forest) is widely available nearby in the LAA and RAA.

Short-term effects include temporary disruption to avian species and risk of incidental harm are related primarily to site preparation and construction phases. The long-term effects, which includes permanent habitat loss or increased risk of vehicle collisions, are considered to be low in magnitude given the availability of habitat in the surrounding areas.

6.6.4 MITIGATION MEASURES

Proposed mitigation measures to offset potential adverse effects to avian wildlife during all phases of the Project are outlined below:

- Minimizing PDA footprint to the smallest extent possible to avoid disturbance to suitable avian habitat;
- Implementation of EPP, including dust suppression, spill response, and maintenance of vehicles and equipment;
- Clearing and grubbing should only be conducted in the areas necessary to complete the Project;
- Vegetation removals should be completed outside of the breeding bird season (April 1st – August 30th) to avoid potential harm to migratory birds or their nests, as outlined in the *Migratory Birds Convention Act*, 1994. If clearing is required during this time, nest surveys, with approval from NSDNRR and ECCC, can be carried out by a qualified ornithologist prior to clearing;
- If nests are found during a nest survey, an appropriate buffer shall be established and any clearing or disruptive activities will be avoided until the nest has been confirmed to be inactive by a qualified ornithologist;
- If raptor nests are found within forested areas to be cleared, even outside of the breeding season, a buffer zone must be placed around the nest. NSDNRR should be consulted to determine appropriate buffer distance, duration, and other mitigation measures;
- Utilization of trash receptacles and good housekeeping practices to avoid attracting wildlife;
- Construction lighting should be restricted to areas where it is necessary and should be directed downwards, if practical, to reduce attraction of nocturnal birds;
- Staff and workers encouraged to refrain from entering the surrounding natural environment during construction phases of the work; and
- Roadside vegetation should be maintained to limit nesting opportunities along roadside.

6.6.5 SIGNIFICANCE OF RESIDUAL EFFECTS

Recommended mitigation measures and anticipated residual environmental effects following the implementation of mitigation measures are summarized in Table 6-6. With the successful implementation of the recommended mitigation measures, the Project activities, including the maintenance and operational phases, are not anticipated to result in significant adverse effects to avifauna, including priority species.

Table 6-6 Residual effects – avifauna (including priority species)

PROJECT VEC INTERACTIONS	MITIGATION AND COMPENSATION MEASURES	NATURE OF EFFECT	SIGNIFICANCE CRITERIA FOR RESIDUAL ENVIRONMENTAL EFFECTS						RESIDUAL EFFECT	SIGNIFICANCE
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological And Social Context		
Clearing and grubbing	-Minimize Project footprint to smallest extent required to avoid sensitive habitats -Conduct clearing outside of breeding bird season -Conduct nest surveys if vegetation clearing occurs during breeding season (April 1 – August 30) -Implementation of EPP	A	L	PDA	P	C	IR	MD	Habitat loss, disturbance	Not Significant
Heavy machinery operation (noise, emissions, leaks, vibrations)	-Ensure machinery is properly inspected and maintained -Development of spill response plan	A	L	PDA, LAA	P	C	IR	MD	Disturbance	Not Significant
Ambient lighting (night construction	-Properly illuminate work areas and avoid light trespass into adjacent natural features -Avoid night work near sensitive habitats during the breeding season	A	L	PDA, LAA	ST	S	R	LD	None expected	Not Significant
Disturbance or destruction of migratory bird nests	-Implementation of EPP outlining bird protection and mitigation measures	A	L	PDA, LAA	ST	S	R	LD	None expected	Not Significant
Human-wildlife interactions	-Utilize trash receptacles and keep construction areas free of food waste -Avoid entering natural habitats outside of designated construction areas	A	N	PDA	ST	S	R	LD	None expected	Not Significant
Roadside vegetation maintenance	-None required	A	L	PDA	ST	S	IR	LD	Disturbance, incidental harm to birds and nests	Not Significant
Traffic collisions	-Implementation of an EPP -Maintain roadside vegetation to limit nesting opportunities	A	L	PDA	P	C	R	LD	Habitat loss, incidental harm/mortality	Not Significant

PROJECT VEC INTERACTIONS	MITIGATION AND COMPENSATION MEASURES	NATURE OF EFFECT	SIGNIFICANCE CRITERIA FOR RESIDUAL ENVIRONMENTAL EFFECTS						RESIDUAL EFFECT	SIGNIFICANCE
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological And Social Context		
Creation of suitable structural habitats (culverts, bridges)	-Implementation of EPP addressing maintenance of infrastructure and environmental awareness training	P	L	PDA, LAA	LT	C	R	LD	Nesting habitat creation	Not Significant

LEGEND
Nature of Effect: (A – Adverse) (P – Positive)
Magnitude: (N – Negligeable) (L – Low) (M – Medium) (H – High)
Geographic Extent: (PDA – Project Development Area) (LAA – Local Assessment Area) (RAA – Regional Assessment Area)
Duration: (ST – Short-Term) (MT -Medium-Term) (LT – Long Term) (P – Permanent)
Frequency: (O – Once) (S-Sporadic) (R – Regular) (C-Continuous)
Reversibility: (R – Reversible) (IR – Irreversible)
Ecological and Social Context: (LD – Low Disturbance) (MD – Medium Disturbance) (HD – High Disturbance)

6.7 WETLANDS

6.7.1 VEC DESCRIPTION AND BOUNDARIES

Wetlands were selected as a valued component (VEC) because they are known to provide important habitat for fish and a variety of SoCC, as well as providing various ecological services to the environment and society. The total wetland area within the Project site is estimated at approximately 50.9 hectares (ha) and makes up approximately 16% of the LAA (307 ha).

The spatial boundaries used for the assessment of effects upon wetlands include the LAA, with extra emphasis on those wetlands that are projected to interact with the PDA.

6.7.2 SIGNIFICANCE DEFINITION

A significant adverse effect on wetlands is defined as an effect that is likely to cause a permanent, uncompensated net loss of wetland habitat and function.

A positive effect is one that may enhance the quality of wetland habitat or function, increase species diversity, or increase the area of valued habitat.

6.7.3 ENVIRONMENTAL EFFECTS ANALYSIS

Site preparation, construction, and subsequent ongoing usage and maintenance of the Cambridge interchange and connector roads may impact wetland habitat in a variety of ways:

SITE PREPARATION

- Increased potential for events of sedimentation or erosion

CONSTRUCTION

- Direct habitat loss for plant, wildlife, and fish species loss due to partial or complete in-filling (up to 8.57 ha worst case);
- Loss or reduction of wetland functions;
- Alteration of wetland hydrology; and
- Fragmentation of wetland habitat.
- Changes to groundwater resources or regime;
- Introduction of invasive or alien species;
- Nutrient or salt loading; and
- Increased frequency of flooding of wetland habitat.

OPERATION

- Recurring road salt or/and deleterious substance release from winter maintenance and leaks from commercial and passenger vehicles.

Many of the above effects are considered short-term and relate mainly to the construction phase of the Project. Some effects are considered long-term, but are low magnitude. This relates mostly to in-filling or fragmentation of wetland habitat. Table 6-7 summarizes the areas of wetland located directly within the PDA which may be directly or indirectly affected. Once available, detailed site and bridge designs, specifically for grading and watercourse crossings, will better identify wetland impacts and quantify the amount of compensation required to offset the wetland and fish habitat losses.

Table 6-7 Summary of wetland impact area within the PDA

WETLAND ID	WETLAND TYPE	AREA WITHIN PDA (HA)	TOTAL DELINEATED AREA (HA)
WL1	Forested swamp / fen complex	3.73	22.7
WL2 *	Riparian shrub swamp (along Coleman Brook)	1.06	7.26
WL3	Forested swamp	0.29	0.29
WL4	Vernal pool	0.00	0.04
WL5	Forested swamp	0.18	0.39
WL6	Forested swamp	0.32	0.71
WL7	Riparian shrub swamp	0.00	2.55
WL8	Forested swamp	0.00	0.08
WL9	Forested swamp	1.61	5.84
WL10 *	Riparian graminoid marsh (along Cornwallis River)	1.43**	7.35
WL11	Riparian shrub swamp	0.00	3.65
WL12	Vernal pool	0.00	0.006
TOTAL WETLAND AREA		8.57	50.86

* fish-bearing wetland

** worst-case estimate; bridge design may significantly reduce total impact

Mitigation of the long-term hydrological effects are considered during the design phase of the Project by implementing appropriate water control structures for the specific situation. Additional nutrient or contaminant loading may be apparent if the new interchange incorporates ditches that receive surface water from nearby agricultural operations and drain into wetland areas intersecting the ROW.

6.7.4 MITIGATION MEASURES

Proposed mitigation measures to offset potential adverse effects to wetland habitat during all phases of the Project are outlined below:

- Pre-construction surveys will be completed to identify locations for avoidance or mitigation;
- All necessary permits and approvals will be obtained and available on-site;
- To the extent practical, existing surface drainage patterns will be maintained in the PDA;
- Disturbances to wetland and drainage edges will be minimized to the extent possible during the detailed design, site preparation, and construction phases;

- To the extent practical, construction in wetlands will be scheduled to occur under dry or frozen ground conditions;
- Any extra workspace required near drainage edges will be separated from the top of bank by a minimum of 30 m;
- Culverts and bridges will be installed, as necessary, to maintain drainage and fish passage (where applicable);
- Use temporary diversion berms or other methods, as required, to regulate drainage from construction areas;
- Use of sprayers or equivalent to reduce dust in wetland areas during the construction phase;
- Re-fueling and staging areas are to be located no less than 60 m from wetlands to reduce accidental spill potential;
- Construction vehicles used for the transfer of materials on or off the site will utilize bed covers to reduce potential sedimentation in transit;
- Wetland monitoring programs within partially-altered wetlands before and during construction and 5 years post-construction will aid in identifying current or residual effects, adapting mitigation measures, and confirming fish habitat and wetland compensation;
- Implementation and adherence of suitable ESC measures, and regular inspection of the controls;
- Construction monitoring and rain-event inspections;
- Re-seeding or re-vegetation of areas impacted by construction when possible;
- Vegetation clearing is to be completed outside of the migratory bird nesting season;
- Inspection of vehicles and equipment for leaks or contaminants with potential for release into the surrounding environment prior to entering the Project site;
- Storage of petroleum or other deleterious substances on site should be contained to a designated and secure location on the site at least 100 m away from water features or wetlands;
- Material piles (if present) should be located away from water features or wetlands, with appropriate ESC measures implemented surrounding them; and,
- Wetland compensation to offset the loss of wetland habitat and meet the goals of the NS Wetland Conservation Policy and terms and conditions of EA and Wetland Alteration Approvals. NSDPW has developed wetland compensation projects and banks in advance of unavoidable habitat loss by its construction projects, and actively collaborates with the Mi'kmaq of Nova Scotia and local, provincial and national groups that focus on wetland habitat restoration to identify new projects.

6.7.5 SIGNIFICANCE OF RESIDUAL EFFECTS

The residual effects on wetlands are anticipated to be not significant following the implementation of proposed mitigation measures. Table 6-8 outlines the potential Project and VEC interactions, corresponding mitigation measures, and the anticipated residual effects and significance.

Table 6-8 Residual effects – wetland habitat

PROJECT VEC INTERACTIONS	MITIGATION AND COMPENSATION MEASURES	NATURE OF EFFECT	SIGNIFICANCE CRITERIA FOR RESIDUAL ENVIRONMENTAL EFFECTS						RESIDUAL EFFECT	SIGNIFICANCE
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological And Social Context		
Direct wetland alteration (infilling, draining, flooding, altering function, altering groundwater recharge capacity)	-Ensure removal or introduction of materials does not affect wetland processes or hydrology to the extent possible. -Create “Work in Dry” plan and implement when possible -Wetland avoidance during planning phase to minimize project interactions where possible -Culverts and bridges should be installed and maintained, where necessary, to maintain drainage and fish passage -Obtain and comply with all necessary regulatory approvals relating to wetland alteration -Minimum 2:1 compensation for non-fish-bearing wetland loss and 3:1 compensation for fish-bearing wetland habitat -Confirm compensation following completion of a five-year post-construction monitoring program	A	M	PDA	ST-LT	S	R	LD/MD	Disturbance, loss of natural wetland habitat, net increase to overall wetland habitat (compensation)	Not Significant
Heavy machinery operation (impacts to water quality from dust, sediments, accidents, and contamination)	-ESC measures -Designated refuelling sites at least 60 m from wetlands -Spill kits kept accessible and a contaminant spill plan is in place -Use of dust control measures	A	L	PDA	ST	S	R	LD	Disturbance	Not Significant

PROJECT VEC INTERACTIONS	MITIGATION AND COMPENSATION MEASURES	NATURE OF EFFECT	SIGNIFICANCE CRITERIA FOR RESIDUAL ENVIRONMENTAL EFFECTS						RESIDUAL EFFECT	SIGNIFICANCE
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological And Social Context		
Construction traffic (impacts to water quality from dust, sediments, accidents and contamination)	-Ensure construction vehicles are equipped with spill kits, and that a contaminant spill action plan is in place -Ensure ESC measures are in place prior to commencement of hauling.	A	L	PDA, LAA	ST	R	R	LD	Disturbance	Not Significant
Introduction of invasive species to wetland habitat	-Manage vegetation growth, remove invasives as directed by project invasive species management plan	A	L	PDA	MT	S	R	LD	Disturbance to native plants	Not Significant
Surface run-off (construction)	-ESC measures to be placed in newly constructed ditches upstream of wetland habitat -Implement and maintain a 30 m vegetated buffer surrounding wetland habitat where possible -Rain event monitoring and surface water sampling to ensure implemented measures are effective	A	L	PDA	MT	S	R	LD	None expected	Not Significant
Surface run-off (operation and maintenance)	-Maintain buffer within ROW to limit and slow run-off of nutrients and sediment -Follow NSDPW guidelines for application of road salt, herbicides, and vegetation management	A	L	LAA	LT	S	R	LD	None expected	Not Significant

LEGEND
Nature of Effect: (A – Adverse) (P – Positive)
Magnitude: (N – Negligeable) (L – Low) (M – Medium) (H – High)
Geographic Extent: (PDA – Project Development Area) (LAA – Local Assessment Area) (RAA – Regional Assessment Area)
Duration: (ST – Short-Term) (MT -Medium-Term) (LT – Long Term) (P – Permanent)
Frequency: (O – Once) (S-Sporadic) (R – Regular) (C-Continuous)
Reversibility: (R – Reversible) (IR – Irreversible)
Ecological and Social Context: (LD – Low Disturbance) (MD – Medium Disturbance) (HD – High Disturbance)

6.8 FISH AND FISH HABITAT

6.8.1 VEC DESCRIPTION AND BOUNDARIES

Fish, fish habitat and surface water are considered valued ecosystem components for several reasons including sport, recreational and traditional harvesting of fish, ecosystem stability and forage opportunities for several species of terrestrial and avian fauna. Boundaries of the VEC assessment include watercourses found within the PDA and waters in the LAA. Fish-bearing watercourses identified within this Project area include:

- Cornwallis River; and,
- Coleman Brook.

The Cornwallis River and Coleman Brook are extensively used for agriculture and recreation. Both watercourses have historically been a valuable resource to Mi'kmaw communities in the area as fishing and harvesting grounds.

6.8.2 SIGNIFICANCE DEFINITION

A significant adverse effect on fish and fish habitat is defined as an effect that results in:

- Harmful alteration, disruption or destruction of fish habitat (as defined under the *Fisheries Act*) that occurs as a result of Project activities without federal approval, or that cannot be remedied with an appropriate offsetting plan;
- Deposition of a deleterious substance into the aquatic environment, under Section 36(3) of the *Fisheries Act*; August 2019;
- An exceedance of water quality guidelines outlined in the conditions of approval; or
- Death, harm harassment or capture of a species listed as extirpated, endangered, or threatened under Schedule 1 of *SARA*.

A positive effect is one that enhances the quality or area of habitat or increases species diversity.

6.8.3 ENVIRONMENTAL EFFECTS ANALYSIS

Site preparation, construction, and subsequent ongoing usage and maintenance (operation) of the Cambridge interchange and connector roads may impact fish habitat in a variety of ways:

SITE PREPARATION

- Potential erosion or sedimentation events during clearing and grubbing;
- Introduction of invasive or alien species in the riparian area;
- Increased surface water temperatures in areas where riparian vegetation is removed;
- Accidental spill or release of deleterious substances from heavy machinery or commercial trucks; and,
- Excessive silt loading may alter substrate within watercourses, degrading fishing habitat.

CONSTRUCTION

- Direct habitat loss due to partial or complete in-filling;
- Increased potential for events of sedimentation or erosion;
- Changes to surface water resources or regime;
- Introduction of invasive or alien species in the riparian area;
- Introduction of deleterious substances to surface water via leaks or spills from construction vehicles;
- In-stream works related to bridge or culvert construction may alter the bed or bank of a watercourse. These effects are typically restricted to the footprint of the bridge or culvert structure;
- Potential reduction in access for boats or other pleasure-craft during construction;
- Incorrectly installed water control structures may cause barriers to fish passage; and,
- Construction vehicle damage to the buffer zone adjacent to watercourses that could facilitate erosion or bank failures; and water sprayed by spraying trucks may contain high levels of silt. This water could deposit silt into nearby surface water features.

OPERATION

- Recurring road salt and or deleterious substance release from winter maintenance and leaks from commercial and passenger vehicles which may alter surface water quality;
- Culvert structures located within the Project area may see a build-up of debris which should be inspected and cleared annually if flow issues are identified; and
- Additional inputs of surface water from new interchange ditches may influence water quality during and following precipitation events.

6.8.4 MITIGATION MEASURES

Several mitigation measures may be implemented at different stages of the Project life. Mitigation measures with potential to be utilized during the life of the Project include:

- In-stream works will be limited to the provincially recognized construction season (June 1st to September 30th);
- Silt fencing and or straw spreading / seeding in areas with potential for erosion or siltation events;
- Pumping of silt-laden water to more distant areas during the site preparation and construction phases;
- Fish rescue may be required within the construction footprint of in-stream structures during the construction phase;
- Planned avoidance of surface water features during the design stages may reduce potential impacts in the site preparation and construction phases;
- Any temporarily stockpiled soil, debris or other excess materials, and any construction-related materials, will be properly contained (e.g., within silt fencing) in areas separated at least 30 m from watercourses;
- Measures shall be taken to ensure flow is maintained during any potential in-stream works;
- Any materials being used in the water must be handled and treated in a manner that prevents the release or leaching of a deleterious substance into the water;

- Year-round routine monitoring of ESC and buffer zones established to protect watercourse banks;
- Riparian areas (if altered) should be immediately protected from further damage and erosion until the area is revegetated,
- Fish habitat offsetting to meet the requirements of the *Fisheries Act*. NSDPW has developed fish habitat projects and banks in advance of unavoidable habitat loss by its construction projects, and actively collaborates with the Mi'kmaq of Nova Scotia and local, provincial and national groups that focus on fish and fish habitat restoration to identify new projects. Future habitat offsetting opportunities could potentially be undertaken within the Cornwallis River watershed to address site-specific fish habitat degradation issues. The installation of instream enhancement structures such as digger logs can improve water quality through increasing dissolved oxygen levels, sorting fines to improve spawning habitat, increasing pool habitats and available cover. Additionally, sandwanding techniques can be explored to remove the significant percentage of fines in this area and improve spawning habitat. Riparian planting projects could potentially address the lack of stream shade and low bank stabilization, reducing the high erosion potential in the Cornwallis River sites.

6.8.5 SIGNIFICANCE OF RESIDUAL EFFECTS

The residual effects on fish and fish habitat, as well as surface water quality and quantity are anticipated to be not significant following the implementation of proposed mitigation measures. Table 6-9 outlines the potential Project and VEC interactions, corresponding mitigation measures, and the anticipated residual effects and significance.

Table 6-9 Residual effects – fish and fish habitat

PROJECT VEC INTERACTIONS	MITIGATION AND COMPENSATION MEASURES	NATURE OF EFFECT	SIGNIFICANCE CRITERIA FOR RESIDUAL ENVIRONMENTAL EFFECTS						RESIDUAL EFFECT	SIGNIFICANCE
			MAGNITUDE	GEOGRAPHIC EXTENT	DURATION	FREQUENCY	REVERSIBILITY	ECOLOGICAL AND SOCIAL CONTEXT		
Direct watercourse alteration (infilling, draining, structure construction)	-Compliance with all NSECC and DFO permits -Create "Work in Dry" plan and implement when possible -In-water work to be conducted during June 1st – September 30th) -Watercourse avoidance during planning phase to minimize Project interactions where possible -Obtain and comply with all necessary regulatory approvals relating to wetland alteration -Confirm Habitat Offsetting Project Plan for un-avoidable loss or damage to fish habitat -Fish rescue in construction areas	A	M	PDA	ST-LT	S	R	LD/MD	Disturbance, Habitat loss	Not Significant
Clearing and grubbing	-Limit watercourse crossings to the least amount required -Locate watercourse crossings in least disruptive areas as feasible -Ensure ESC measures are in place prior to the commencement of work.	A	L	PDA	ST	S	R	LD	Riparian habitat degradation	Not Significant
Construction vehicle traffic (impacts to water quality from dust, sediments, accidents and contamination)	-Maintain a vegetated buffer zone. -Ensure vehicles are equipped with spill kits, and that a contaminant spill action plan is in place -Ensure ESC measures are in place where appropriate prior to commencement of hauling	A	L	PDA, LAA	ST	R	R	LD	Disturbance	Not Significant

PROJECT VEC INTERACTIONS	MITIGATION AND COMPENSATION MEASURES	NATURE OF EFFECT	SIGNIFICANCE CRITERIA FOR RESIDUAL ENVIRONMENTAL EFFECTS							RESIDUAL EFFECT	SIGNIFICANCE
			MAGNITUDE	GEOGRAPHIC EXTENT	DURATION	FREQUENCY	REVERSIBILITY	ECOLOGICAL AND SOCIAL CONTEXT			
Heavy machinery operation	-Maintain ESC measures -Inspection and maintenance of equipment and vehicles -Store materials and fuel appropriately in upland areas away from the watercourse	A	L	PDA	ST	S	R	LD		None expected	Not Significant
Introduction of invasive species to fish and wetland habitat	-Manage vegetation growth, remove invasives where present	A	L	PDA	MT	S	R	LD		None expected	Not Significant
Surface run-off and nutrient loading (construction)	-ESC measures to be placed in newly constructed roadside ditches upstream of watercourse confluences -Implement and maintain a 30 m vegetated buffer surrounding watercourse habitat where possible -Rain event monitoring and surface water sampling to ensure implemented measures are effective during site preparation and construction	A	L	PDA	MT	S	R	LD		None expected	Not Significant

LEGEND
Nature of Effect: (A – Adverse) (P – Positive)
Magnitude: (N – Negligeable) (L – Low) (M – Medium) (H – High)
Geographic Extent: (PDA – Project Development Area) (LAA – Local Assessment Area) (RAA – Regional Assessment Area)
Duration: (ST – Short-Term) (MT -Medium-Term) (LT – Long Term) (P – Permanent)
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Reversibility: (R – Reversible) (IR – Irreversible)
Ecological and Social Context: (LD – Low Disturbance) (MD – Medium Disturbance) (HD – High Disturbance)

6.9 ECONOMY AND LAND USE

6.9.1 VEC DESCRIPTION AND BOUNDARIES

VECs associated with this Project include existing and potential future land uses, as well as the local economy. Spatial boundaries for potential VECs in terms of existing and planned land uses are within the PDA and LAA, where direct land use impacts may result from the project, as well as those which are adjacent to the Project area. Economic impacts are typically viewed at a community scale, and for the purposes of this report, have been assessed primarily at the RAA level.

6.9.2 SIGNIFICANCE DEFINITION

A significant adverse effect on the economy and land use is defined as:

- A decrease in the output of the local economy associated with a change in land use;
- A sustained change in existing patterns and land uses (e.g., residential, commercial, industrial, institutional, recreational, etc.) that adversely affects all or a portion of a community's use and enjoyment of the lands; or
- The introduction of a new land use that is inconsistent with the Municipal Planning Strategy designations and long-term land use objectives.

A positive effect would be one that is consistent with the Municipal Planning Strategy designations and results in a long-term increase in economic activity.

6.9.3 ENVIRONMENTAL EFFECTS ANALYSIS

SITE PREPARATION PHASE

No effects are anticipated to occur as a result of the site preparation phase activities.

CONSTRUCTION PHASE

Direct effects on existing and planned land uses as a result of the construction phase of the Project are expected to be minimal within the PDA. Within the LAA, adjacent land uses such as agricultural and industrial areas which are set back from the location of planned construction activities and are not anticipated to be impacted by construction. There is a residential development located to the east of the proposed ROW along Andringa Drive which could experience some temporary adverse impacts due to construction noise, dust and other emissions. This area is zoned as a residential area and is also designated for this purpose in the future. Sections 6.1 and 6.2 address specific air quality and acoustic environmental impacts; these mitigation measures will address temporary construction impacts on these adjacent land uses.

Adverse effects on the local economy as a result of the construction phase are expected to be limited to disruptions as a result of construction-related traffic and possible flagging operations. However, as the corridor being developed is within a largely undeveloped area, disruptions would be limited to intersection improvements where the new corridor meets Highway 101, Trunk 1 and Country Home Road.

Conversely, the construction phase will bring workers into the area who will require lodging, food, and fuel. Machinery and equipment supplies and repairs may be sourced and completed locally. The influx of workers and associated supplies and services will provide a benefit to local businesses.

OPERATION AND MAINTENANCE PHASE

Direct effects on existing and planned land uses are expected to be largely limited to the residential development located along Andringa Drive. It is expected that this neighbourhood would see an overall increase in traffic noise levels because of regular use and maintenance of the new road. Section 6.1 and Section 6.2 address specific air quality and acoustic environment impact; mitigation measures to address the permanent impacts on these adjacent land uses have been developed and are presented in their respective sections.

There is an existing multi-use trail, Harvest Moon Trail, which follows the old rail corridor north of Trunk 1 which will be impacted by the South Connector Road portion of the project. A grade-separated structure will be constructed to allow separation between the two uses. The use of the trail will not be negatively impacted and no reduction in public use of the trail is anticipated due to the Project.

Economic impacts resulting from the Project at the RAA level are anticipated to be positive, due to improvements in traffic flow along Trunk 1, which is a significant commercial corridor serving several small communities between Berwick and Kentville. As noted at the beginning of the report, the anticipated significant reduction in truck traffic traveling to industrial and commercial business areas as a result of this new interchange will alleviate delays at driveways and side streets, including at local businesses along the Trunk 1 corridor. Dedicated highway access for industrial, commercial, and agricultural businesses is anticipated to benefit those industries. Improved access and connectivity within adjacent lands (currently landlocked and inaccessible) will benefit AVFN and the local municipality.

6.9.4 MITIGATION MEASURES

Mitigation measures to minimize impacts from the construction phase on the adjacent residential area include planning largely disruptive activities (i.e. blasting) during daytime hours where feasible and limiting performing nighttime work in this area unless unavoidable. Placement of laydown areas, asphalt plant locations and equipment storage are not currently known and therefore further measures to specifically address potential negative impacts will be detailed later in the process.

The potential for disruption of active transportation use of the Harvest Moon Trail will be mitigated using a structure to allow continuity of the trail beneath the new South Connector Road. This design allows for both motorized and non-motorized trail users the ability to legally travel under the road and continue along the trail network.

6.9.5 SIGNIFICANCE OF RESIDUAL EFFECTS

There are no anticipated direct residual effects on existing and planned land uses in the PDA and LAA.

Indirect adverse effects on land uses such as the nearby residential community described are addressed within Section 6.1 and Section 6.2, including mitigation measures and residual effects.

6.10 TRADITIONAL USE OF LAND AND RESOURCES

6.10.1 VEC DESCRIPTION AND BOUNDARIES

VECs associated with this Project include Indigenous traditional use of resources such as those used for hunting, fishing, and harvesting country foods as well as the Indigenous traditional uses of land which include but are not limited to fishing, hunting camps, ceremonies, and logging. The identified VECs were chosen based on their cultural and socio-economic significance to the Mi'kmaq of Nova Scotia. Spatial boundaries for the identified VECs include the PDA and LAA to account for direct impacts within and

immediately surrounding the Project area as these overlap with the AVFN reserve lands. The RAA has also been considered to better account for impacts on the socio-economic and cultural environment.

The VECs may be impacted during the construction and operation phases of the Project. As a result, the temporal boundary begins during site clearance anticipated in 2023 or early 2024 and extends indefinitely, although most interactions affecting traditional land use and resources are likely to occur during site clearance and construction (i.e., late 2023 to Spring 2026).

6.10.2 SIGNIFICANCE DEFINITION

A significant adverse effect on traditional use of land and resources is defined as one which results in a detrimental long-term change in current use of the land and resources for traditional purposes by the Mi'kmaq of Nova Scotia.

A positive effect is one which results in improved access to land and resources for traditional purposes by the Mi'kmaq of Nova Scotia.

6.10.3 ENVIRONMENTAL EFFECTS ANALYSIS

Direct effects on traditional land and resource use are expected to be minimal within the PDA. Potential environmental effects during site preparation and construction are outlined below and may cause temporary disturbance to wildlife and/or impact harvest areas. Similar to the adjacent lands in the LAA, the vast majority of traditional lands within the PDA are located outside the immediate construction site and are not anticipated to be impacted during construction.

Potential environmental effects during the operation and maintenance phases are also expected to be minimal and largely confined to the PDA. There is the potential for runoff from vehicle traffic and road maintenance to impact harvest sites in direct proximity to the interchange and connector roads. Conversely, a positive economic impact is anticipated from an RAA level as the project will increase assess to the community and promote the safety of community members while engaging in tradition land and resource use.

NSDPW's current knowledge of traditional land and resource use will be supplemented once the MEKS is completed. NSDPW will consider all information about potential adverse effects on Aboriginal and treaty rights that are identified in the MEKS when advancing its project design and construction work. Adverse impacts to Aboriginal and treaty rights will also be addressed through continuing consultation on the project, which will extend beyond the EA phase.

SITE PREPARATION

- Reduction or fragmentation of wildlife and/or vegetation habitat function;
- Sedimentation or erosion;
- Noise pollution; and
- Introduction of invasive and alien species.

CONSTRUCTION

- Temporary loss of access to traditional use areas located within PDA;
- Infilling of wetland habitat and loss of associated traditional features;
- Nutrient and/or salt-loading;
- Release of hazardous or deleterious substance; and
- Noise pollution.

OPERATION

- Salt-loading;
- Release of hazardous or deleterious substance (i.e., oil from vehicles); and
- Habitat fragmentation.

As the Project is not predicted to cause significant impacts on fish, plants, water, or land use, there are no anticipated significant adverse effects on traditional land or resource use.

6.10.4 MITIGATION MEASURES

Mitigation measures for impacts on fish, plants, water, and land use are previously discussed in Section 6. NSDPW will continue to engage with the Mi'kmaq of Nova Scotia to monitor for minimal effects.

6.10.5 SIGNIFICANCE OF RESIDUAL EFFECTS

There are no anticipated significant residual effects on traditional land or resource use in the PDA and LAA.

6.11 ARCHAEOLOGY AND HERITAGE RESOURCES

6.11.1 VEC DESCRIPTION AND BOUNDARIES

Archaeology and heritage resources include any features and artefacts of scientific, historical and/or cultural/heritage significance. These may include, but are not limited to, ancient burial grounds and historic settlements.

The Project ARIA included a historic background study, engagement with the Archaeological Research Division at KMKNO-ARD, and field reconnaissance, the results of which are summarized below. The background study confirmed that Mi'kmaq have occupied territory in Nova Scotia since time immemorial. The Maritime Archaeological Resource Inventory was accessed on 08 April 2021, and it was determined that there are no recorded archaeological sites within 5 km of the Project area, although this is likely due to the lack of archaeological surveys in the area. The nearest known archaeological sites are located just outside this boundary, at approximately 6 km from the Project area. These findings are consistent with the response from the KMKNO-ARD on 12 April 2021.

Shovel testing of the PDA commenced in fall 2022. Assessment work is still ongoing and therefore has not yet been reviewed and approved by CCTH. Work is scheduled to resume in spring 2023.

There is potential for the Project to interact with the identified VECs during specific phases such as site preparation and roadbed development and/or in the event of accidents such as uncontrolled fires. As such, the temporal boundary has been identified as late 2023 to Spring 2026, when construction is expected to be complete.

6.11.2 SIGNIFICANCE DEFINITION

A significant adverse effect on archaeological and heritage resources is defined as one which results in a permanent disturbance or destruction of an archaeological, cultural or heritage resource considered by provincial heritage regulators or the Mi'kmaq of Nova Scotia to be of major importance where this effect is not mitigated or compensated.

A positive effect is one that results in enhanced understanding of local, regional, or cultural heritage through increased knowledge, or provides physical protection for a site that might otherwise have been destroyed through natural or non-Project anthropogenic events, in the absence of the Project.

6.11.3 ENVIRONMENTAL EFFECTS ANALYSIS

Activities that disturb the physical environment include but are not limited to site clearing, grubbing, grading, trenching, excavation, drilling, coring, infilling, movement of heavy equipment, use of the area for laydown, or any activities that remove, displace, or disturb large quantities of fill from native soil as this can have significant adverse effects on archaeological and heritage resources. If not managed responsibly, these activities could result in the permanent loss or damage of irreplaceable resources, including those of scientific, cultural, and spiritual value along with the knowledge that could have been gained from them.

6.11.4 MITIGATION MEASURES

The ARIA outlines several mitigation measures to be addressed prior to ground disturbance to identify the presence or absence of archaeological resources. These measures vary based on the level of archaeological potential for each of the identified areas within the study site and have been summarized below.

Additionally, an Archaeological Contingency Plan (ACP) was developed in collaboration with appropriate development personnel, regulatory bodies, and the Culture and Heritage Development Division of NSCCTH in compliance with the *Special Places Protection Act*. The ACP outlines the necessary course of action should an accidental or unexpected discovery of archaeological and historic resources occur as a result of the proposed development.

MITIGATION MEASURES

- Shovel testing at 5 m intervals in areas of high L'nuk archaeological potential if construction activities are expected to cause physical disturbance to the land;
- Shovel testing at 10 m intervals in areas of moderate L'nuk archaeological potential if construction activities are expected to cause physical disturbance to the land;
- Conduct archaeological monitoring to mitigate and document any remaining archaeological features in areas of elevated historical potential if construction activities are expected to cause physical disturbance to the land;
- Hire a qualified archaeologist to conduct an archaeological assessment if the impact area extends beyond the currently understood range; and
- Cease all activities and contact the Coordinator of Special Places if archaeological resources are uncovered and an archaeologist is not already present.

CONTINGENCY PLAN

- Prior to construction, contractors should receive training from the Project Archaeologist in how to identify and protect archaeological resources that may be discovered;
- The Project Archaeologist, or qualified representative, will monitor excavation works in areas of elevated historic potential (based on the results of the archaeological shovel testing program), to ensure the protection of potential buried archaeological resources during construction;
- If contractors discover archaeological or heritage resources, they must stop work immediately and contact the Project Archaeologist and Provincial Coordinator of Special Places. The Provincial Coordinator of Special Places will identify next steps, such as implementing an exclusion zone or necessary control measures to protect the discovery;
    - If avoidance is not possible, salvage or emergency excavation may be required, pending the approval of a Heritage Research Permit under the Special Places Protection Act.

    - If the discovery is thought to be of Mi'kmaq origin an appropriate mitigation plan will be developed with the NSCCTH, the KMKNO-ARD, and the AVFN.
- Prior to project commencement, a "Care of Artifacts Plan" should be developed and submitted to the NSCCTH, the HMKNO-ARD, and AVFN to identify the protocols in place should artifacts of Mi'kmaq origin be discovered; and
- In the unlikely discovery of human remains, construction must stop immediately, the Project Archaeologist and Environmental Monitor must be notified, and site security must be established. In this case, it is imperative that the crew does not cover the site with fill but instead cover any exposed bone with a plastic sheet or like object. The Project Archaeologist will notify the appropriate agencies and negotiations will be held to determine how the remains will be handled.
    - The responsible agencies and identified protocols will differ depending on whether the remains are of Mi'kmaq or modern origin.

6.11.5 SIGNIFICANCE OF RESIDUAL EFFECTS

No significant adverse residual effects are anticipated. In the event of the discovery of any archaeology or heritage resources there are mitigation measures and a contingency plan in place to prevent significant residual effects.

6.12 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

6.12.1 SEVERE WEATHER

Severe weather may pose several challenges throughout the Project lifecycle, including impacts during site preparation, construction, and maintenance and operation.

During site preparation and construction, severe precipitation events can cause significant runoff resulting in nutrient loading and/or increased sedimentation in receiving watercourses. Severe precipitation events may also cause erosion and/or damage to temporary infrastructure such as access roads, delaying construction. Extreme weather such as freezing temperatures, hail, ice, snow, wind, and fog may also delay construction and create visual and/or physical impairment making it unsafe to operate heavy equipment. Similarly, exposure to extreme cold or heat may invoke health hazards including but not limited to hyper-/hypo-thermia.

During maintenance and operation, severe precipitation events can cause erosion, which in extreme circumstances may damage infrastructure (e.g., wash out portions of the road). Severe precipitation may also increase runoff resulting in nutrient and/or salt loading, or chemical leaching due to operational discharge. Extreme weather may cause unsafe conditions and navigational hazards placing crew and recreational users at risk (e.g., fallen trees, debris, ice). Moving forward, it is essential to conduct proper road maintenance and monitor for potential changes that may impact the Project and its users long-term.

<u>MITIGATION MEASURES</u>

- Stabilize erodible material and implement sediment controls;
- Ensure and maintain appropriate drainage, water crossings, and water management infrastructure (remove debris);
- Construct a shoulder or suitable buffer to limit roadside erosion;
- Provide regular road maintenance;
- Provide an advisory service for motorists and appropriate signage;

- Reinforce areas that are prone to flash floods and/or freezing;
- Plan construction during periods where severe cold or precipitation are less likely;
- Monitor the environment and position temporary barriers in advance of impending storms. Stop construction until it is safe to do so if severe weather threatens the planned activities;
- Ensure all personnel on site during construction are wearing the appropriate PPE; and
- Inclusion of severe weather mitigation measures in the EPP.

6.12.2 CLIMATE CHANGE

Effects from climate change on the proposed Highway 101 Cambridge Interchange and Connector Roads are similar to those identified in Section 6.12.1 as climate change is likely to increase the severity and frequency of severe weather events (NSE 2011a). There is an increased risk of flooding in low lying areas and freezing in areas close to rivers and wetlands. Climate change is also predicted to increase the number of freeze-thaw cycles which may deteriorate infrastructure and cause ruts and cracks to form in the pavement (NSE 2011a). It can be expected that climate change will continue to exacerbate bio-physical impacts on the project. It is also anticipated to increase the frequency and extent of road maintenance required in the future.

As the project is not expected to be significantly impacted by climate change, an adaptation plan is not required (NSE 2011b). Mitigation measures for severe weather may still apply as outlined in Section 6.12.1.

6.12.3 SIGNIFICANCE OF EFFECTS

Impacts from severe weather and climate change are anticipated to be of low significance on the Project as the Project area is protected from marine influences and is therefore subject to more stable conditions (Section 5.1.5). The proposed Highway 101 Cambridge Interchange and Connector Roads are designed with the above hazards in mind and appropriate mitigation measures are in place to combat infrastructure vulnerability and alleviate potential impacts throughout the duration of the Project lifecycle.

6.13 CUMULATIVE EFFECTS

Cumulative effects are the encompassing changes to the environment that are anticipated as a result of the Project, including future operational use. The cumulative effects are based on the effects and impacts identified in the previous sections. The potential cumulative environmental effects from the proposed Project may result in:

- Improvements in local economy and land use following completion of the Project;
- Reduction of GHG emissions due to improved travel times;
- Reduced groundwater quality and quantity;
- Direct loss of flora, and alterations of habitat including landscape fragmentation and spread of invasive species;
- Direct loss of fauna and habitat, as well as increased risk of vehicle collisions and indirect effects from habitat fragmentation, and potential disruption to wildlife corridors;
- Decrease in biodiversity;
- Overall reduction in wetland habitat and indirect impacts to water quality and flood retention; and
- Reduced surface water quality from increase of impervious surfaces collecting stormwater runoff and pollutants.

With the implementation of mitigation and monitoring measures outlined in the previous sections and in Section 7, the residual cumulative effects are expected to be minimal.

6.13.1 OTHER UNDERTAKINGS IN THE AREA

A review of other undertakings in the area that may also result in adverse effects must be conducted under the provincial Environmental Assessment Regulations. Other undertakings in the area may include existing, approved, or on-going construction or alteration of land uses.

As outlined in Section 5.3.3, existing land uses in the LAA are primarily forested/natural lands and agricultural fields. Other land uses within the LAA and RAA include commercial, residential, and industrial; all of which are located primarily along Trunk 1 and connecting roads.

Waterville and Cambridge have both been identified as Growth Centres in the Village of Cornwallis Square and have recently seen a new business park and commercial operations within the area. It is anticipated that additional commercial, industrial, and residential development will occur within the designated zoning areas (Figure 11) over time – although unlikely to result in significant changes in community population growth or industry composition.

Community planning by-laws and development plans do not indicate any planned projects that are expected to act in combination with the environmental effects of the proposed Project.

7 MONITORING, FOLLOW-UP, AND MITIGATION

The mitigation measures and monitoring programs outlined in Section 6 have been recommended to protect against or limit the adverse effects resulting from the Project. The recommended mitigation and monitoring programs will be the responsibility of NSDPW and to be implemented into contractual agreements with subcontractors. The mitigation and monitoring plan shall be developed in consultation with NSDPW's EPP Manual and should also be Project-specific. The monitoring plan shall also incorporate all EA Condition of Approval mitigation and monitoring requirements.

Table 7-1 Summary of mitigation and monitoring recommendations

VEC	PROPOSED MITIGATION	PROPOSED MONITORING
Air Quality	▪ Implementation of EPP to minimize air particulates (i.e., speed limits, dust suppressants). ▪ Implement and maintain ESC measures. ▪ Inspect and maintain machinery and equipment. ▪ Stabilize or cover erodible materials. ▪ Transported loose material should be loaded and unloaded properly and covered while in transit.	▪ Monitoring of contractor-controlled equipment to ensure it is properly maintained and in good working order. ▪ Dust monitoring according to NSECC guidelines may be conducted if complaints are received. ▪ Collaboration with local industry to ensure compliance with regulatory requirements and industry best practices
Acoustic Environment	▪ Avoid noisy evening and nighttime construction activities near receptors that are likely to experience noise exceedances during those periods (Refer to Table 6-2). ▪ Routine inspection of machinery and construction vehicles to ensure noise levels are acceptable. Any faulty mufflers or other sound dampening equipment should be replaced if necessary. ▪ Keep idling of construction equipment to a minimum as necessary and maintain equipment in good working order to reduce noise from construction activities. ▪ Locate noisy equipment, such as generators, away from noise receptors where possible. ▪ Awareness training for machine and vehicle operators on techniques to reduce noise emissions. ▪ Where required and practical, the contract documents shall include these recommendations and general best management practice guidelines, as well as identify the receptors in the contract package.	▪ Monitoring of contractor-controlled equipment to ensure it is properly maintained and in good working order. ▪ Noise monitoring at receptor locations if complaints are received. ▪ Collaboration with local industry to ensure compliance with regulatory requirements and industry best practices.

VEC	PROPOSED MITIGATION	PROPOSED MONITORING
	▪ All reasonable attempts will be made to reduce noise. ▪ Implement a complaint management process. If persistent noise complaints occur, develop specific noise mitigation measures to reduce these impacts.	
Groundwater	▪ Pre-blast well inventory of water wells within 500 m of the highway. ▪ Avoid blasting within 500 m of residential wells. ▪ Implementation of mitigation outlined in: o Standard Specification; Highway Construction and Maintenance (NSDPW 1997) o Generic EPP for the Construction of 100 Series Highways (NSDPW 2007) o NSDPW's Salt Management Plan ▪ Use of mechanical vegetation control where possible and limit use of herbicides.	▪ Water well survey of wells within 500 m of highway; survey to include analysis for potable water parameters in following NSECC sampling guidelines. ▪ Implement a monitoring plan to restore damaged wells or provide potable water as needed. ▪ Remedial action plan may be required as a component to the monitoring program. ▪ Post-construction well water monitoring (if required, pending results of well survey).
Terrestrial Habitat and Vegetation	▪ Minimize Project footprint, leave mature forested habitats intact where possible. ▪ Roadway grading should direct runoff away from sensitive habitat features (i.e. mature forest stands) ▪ Salvage topsoil for site restoration where possible. ▪ Inspect and maintain vehicles and machinery. ▪ Implementation of site specific EPP, which includes dust control and spill response. ▪ Implementation and maintenance of ESC measures. ▪ Implement Invasive Species Plan. ▪ Vegetation maintenance should follow NSDPW best practices. ▪ Winter road maintenance should follow NSDPW standards.	▪ Environmental protection measures should be monitored during site preparation and construction phases of the Project.

VEC	PROPOSED MITIGATION	PROPOSED MONITORING
Terrestrial Wildlife	▪ Evaluation of Wood Turtle habitat usage (scheduled spring 2023). ▪ Implementation of Wood Turtle protection measures into road and construction design where appropriate. ▪ Conduct in-water work during June 1st to September 30th to avoid potential disturbance to hibernating turtles. ▪ Minimize Project footprint, leave forested habitats intact where possible. ▪ Implementation and maintenance of ESC measures. ▪ Avoid vegetation clearing and grubbing during sensitive timing windows for wildlife. ▪ Clear blasting areas of wildlife; use airhorns prior to blasting to alert wildlife and allow them to safely flee the area. ▪ Limit use of construction lighting; construction and road lighting should be directed downward and away from terrestrial habitats to limit light trespass. ▪ Implementation of Site-Specific EPP, including dust control, spill response, and maintenance of vehicles and equipment. ▪ Utilize trash receptacles and practice good housekeeping to limit attractants.	▪ Environmental protection measures should be monitored during site preparation, construction phases of the Project.
Avifauna	▪ Minimize Project footprint to smallest extent required. ▪ Avoidance of vegetation clearing during breeding bird season (April 1st – August 30th) ▪ Implementation of Site-Specific EPP, including dust control, spill response, and maintenance of vehicles and equipment. o EPP should include environmental awareness training, including procedures if active bird nests are found during site preparation and construction ▪ Limit excess noise and construction lighting near natural areas to avoid disturbance to avifauna. ▪ Utilize trash receptacles and practice good housekeeping to limit human-bird interactions during construction.	▪ Consideration of monitoring for wildlife usage of new culverts and bridges, particularly for Barn Swallow (SAR).

VEC	PROPOSED MITIGATION	PROPOSED MONITORING
	▪ Avoid entering natural habitats outside of construction areas, particularly during breeding season. ▪ Routine roadside vegetation maintenance to limit nesting opportunities and potential collisions.	
Wetland	▪ Avoidance of wetlands to extent possible. ▪ All necessary permits and approvals will be obtained and available on-site. ▪ Wetland compensation to offset the loss of wetland habitat and meet the goals of the NS Wetland Conservation Policy and terms and conditions of EA and Wetland Alteration Approvals. NSDPW has developed wetland compensation projects and banks in advance of unavoidable habitat loss by its construction projects, and actively collaborates with the Mi'kmaq of Nova Scotia and local, provincial, and national groups that focus on wetland habitat restoration to identify new projects. ▪ Construction in wetlands to be completed under dry or frozen conditions to the extent possible. ▪ Culverts and bridges should be installed and maintained, where necessary, to maintain drainage. ▪ Use temporary diversion berms or other methods, as required, to regulate drainage from construction areas. ▪ Implementation and adherence of suitable ESC measures, and regular inspection of the controls. ▪ Re-seeding or re-vegetation of areas impacted by construction when possible. ▪ Implementation of EPP, including measures for dust control, spill response, inspection and maintenance of vehicles, fuel and substance storage, and refueling areas. ▪ Manage vegetation growth and control of invasive species as directed by Invasive Species Management Plan. ▪ Maintain buffer within ROW to limit and slow run-off of nutrients and sediment. ▪ Adhere to NSDPW guidelines and procedures for application of road salt, herbicides, and vegetation management.	▪ Compliance with wetland monitoring provisions of NSECC wetland alteration approvals including vegetation quadrats and water level monitoring. ▪ Construction and rain-event monitoring and inspections of ESC measures. ▪ Wetland monitoring programs within partially-altered wetlands before and during construction and 5 years post-construction will aid in identifying current or residual effects, adapting mitigation measures, and confirming wetland compensation.

VEC	PROPOSED MITIGATION	PROPOSED MONITORING
Fish and Fish Habitat	▪ All necessary permits, approvals, and authorizations will be obtained and available on-site. ▪ Any in-stream waterworks (if required) will be limited to the provincially recognised construction season (June 1st to September 30th). ▪ Minimize watercourse crossings to least extent possible. ▪ Create "Work in Dry" plan and implement when possible. ▪ Installation and maintenance of ESC measures. ▪ Maintain a vegetated buffer zone during construction where feasible. ▪ Inspect ESC measures during and following precipitation events totalling over 7 mm per hour. ▪ Fish rescue within construction footprint of any in-stream structures. ▪ Implementation of EPP, including measures for dust control, spill response, inspection and maintenance of vehicles, fuel and substance storage, and refueling areas. ▪ Vehicles and equipment should be maintained and inspected before use near watercourses. ▪ Manage vegetation growth and remove invasive species where present. ▪ Fish habitat offsetting to meet the requirements of the *Fisheries Act*. NSDPW has developed fish habitat projects and banks in advance of unavoidable habitat loss by its construction projects, and actively collaborates with the Mi'kmaq of Nova Scotia and local, provincial, and national groups that focus on fish and fish habitat restoration to identify new projects.	▪ Environmental protection measures, including rain events, should be monitored during site preparation and construction phases of the Project until riparian vegetation is re-established. ▪ Consider fish rescue in situations where habitat may be altered significantly. ▪ Compliance with DFO Fisheries Act authorizations and letters of advice, including the monitoring of fish habitat offsetting projects.
Economy and Land Use	▪ Where feasible, limit highly disruptive work (i.e. blasting) near residential areas to daytime hours. ▪ Ensuring access to Harvest Moon Trail north of Trunk 1.	▪ No specific monitoring is recommended.
Traditional Use of Land and Resources	▪ Implementation of Site-Specific EPP. ▪ See mitigation measures for Air Quality, Noise, natural environment VECs, Land Use, and Archaeology.	▪ See monitoring requirements for Air Quality, Noise, natural environment VECs, Land Use, and Archaeology.

VEC	PROPOSED MITIGATION	PROPOSED MONITORING

Archaeology	▪ Implement shovel testing as recommended in areas of high and moderate L'nuk archaeological potential.
	  ○ Completed in Fall 2022; results pending regulatory review and approval.
	▪ Additional archaeological assessments if impact area expands beyond current PDA.
	▪ Cease all activities and contact Coordinator of Special Places if archaeological resources or human remains are uncovered and an archaeologist is not present.
	▪ Implementation of contingency plan measures, including:
	  ○ Archaeological awareness training.
	  ○ Emergency work and communication plan if archaeological resources or human remains are uncovered.
		▪ Excavation monitoring by Project Archaeologist at select locations identified in contingency plan.
		▪ Monitoring and reporting requirements as identified in the contingency plan.

8 SUMMARY OF RESIDUAL EFFECTS AND CONCLUSIONS

The potential adverse effects, resulting from all activities and phases associated with the development of the Project, were assessed. The assessment included the physical environment (ground water, surface water, air quality, noise, etc.), biological environment (terrestrial habitat and wildlife, wetlands, fish and fish habitat, SAR, etc.), and the socio-economic environment (local communities, First Nations communities, cultural and archaeological resources, etc.), and evaluated the potential interactions between the Project and environment. Mitigation measures and monitoring recommendations have been developed to avoid or limit adverse effects. With the successful implementation of the recommendations, no significant adverse residual effects are anticipated from the construction and operation of the Project.

The assessment also evaluated potential effects that environmental conditions, such as severe weather and climate change, may have on the Projects, effects from potential other projects within the RAA, and the cumulative effects to the broader environment. Similarly, no significant adverse effects are expected from the completion of the Project.

The successful completion of the Project is expected to result in an overall decrease in GHG emissions due to the reduction of vehicle idling and improved traffic efficiencies. The installation of bridges or culverts may provide incidental nesting structures for Barn Swallow – a SAR known to occur in the LAA. During the construction phase, workers will require food, lodging, and equipment services/repairs from local businesses. Furthermore, the Project will create dedicated highway access for industrial and commercial traffic, thereby generating time and fuel savings for all traffic and bypassing residential areas along Trunk 1. This will in turn make the existing Trunk 1 safer for residents and road users, and increase the lifespan of the existing roadway and structures. Improving access in the Cambridge Station area will support the area's economic drivers (agri-food and manufacturing) and spur new economic development in areas that are current landlocked and inaccessible for development, including AVFN.

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