

Environmental Study Report

Schedule 'C' Municipal Class Environmental Assessment for
Twenty Mile Creek Arch Bridge Replacement on Regional Road 81 in the
Town of Lincoln

Prepared for:

Niagara Region

16 June 2022



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16 June 2022

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**Environmental Study Report for Twenty Mile Creek Bridge Replacement -
Schedule 'C' Municipal Class Environmental Assessment (Phases 1 - 4)**

Dear Mr. Guthrie,

Please accept this Environmental Study Report for the Twenty Mile Creek Bridge Replacement project. This report has been developed to document the planning and consultation process for Twenty Mile Creek Bridge Replacement in accordance with the Municipal Class Environmental Assessment process. This report documents the rationale and background to the project, existing conditions in the vicinity of the subject bridge, the planning, design and consultation process leading to the selection of preferred design, anticipated positive and negative environmental effects, proposed mitigation measures and future works and monitoring requirements.

If you have any questions, please contact the undersigned.

Sincerely,

**Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited**

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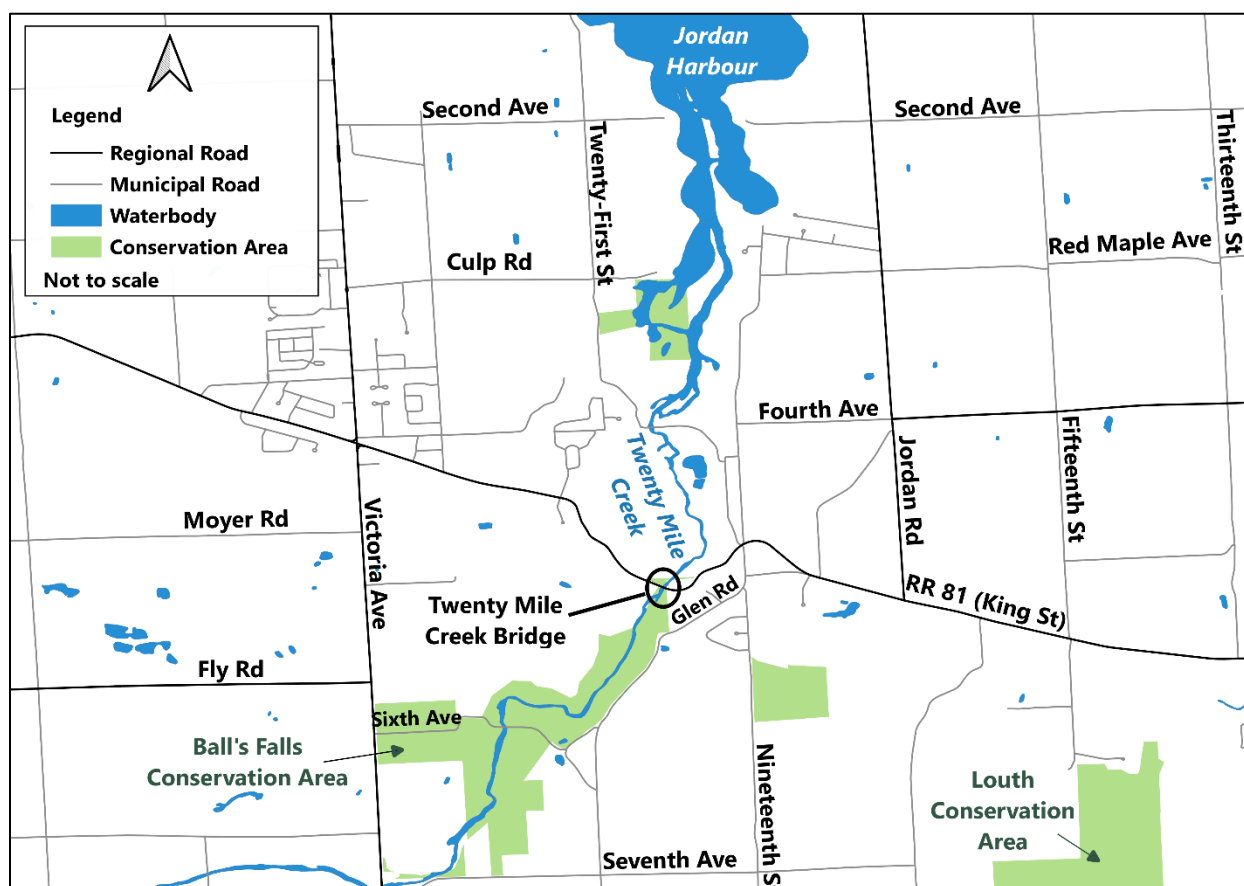
Executive Summary

Introduction

The Regional Municipality of Niagara (Niagara Region) has completed a Municipal Class Environmental Assessment (Class EA / the Study) for the replacement of the Twenty Mile Creek Arch Bridge, which is located approximately 550 m west of Nineteenth Street where Regional Road 81 crosses Twenty Mile Creek in the Town of Lincoln.

The Class EA Study was conducted in accordance with the requirements for a Schedule 'C' Project (Phases 1 to 4) as outlined in the Municipal Engineers Association's Class EA document (Municipal Engineers Association, October 2000, as amended in 2007, 2011 & 2015).

The general location of the bridge is shown in the figure below.



Class EA Phase 1: Problem or Opportunity

The Twenty Mile Creek Arch Bridge was constructed in 1940. It is located on Regional Road 81 (King Street), which presently functions as a two-lane arterial road serving east-west traffic flows. A Rehabilitation / Replacement Planning Report was prepared in June 2010, which identified that the existing structure is not sufficient for current design loads and is deteriorating (Hatch Mott MacDonald, 2010). This report recommended a full bridge replacement. A subsequent biennial bridge inspection was undertaken in 2017 for this bridge confirming the recommendation of the 2010 report (ELLIS Engineering Inc, 2018). Another biennial bridge inspection was completed in 2019, confirming the need for bridge replacement (ELLIS Engineering Inc., 2020).

As part of the Class EA Phase 1, the following Problem and Opportunity Statement was developed:

The Twenty Mile Creek Arch Bridge, constructed in 1940, consists of a three-span reinforced concrete arch rigid frame structure, located on Regional Road 81 in the Town of Lincoln. The bridge crosses over Twenty Mile Creek and is primarily within an area of residential, commercial, and recreational land use. A replacement strategy is necessary to address the deteriorating condition of the bridge as identified in the Region's Biennial Bridge Inspection Reports.

While addressing the structural issues identified, Niagara Region is also taking the opportunity to address the and improve overall public safety for auto users, cyclists and pedestrians. The improvements will provide an opportunity to achieve the Region's active transportation objectives by providing space on the structure for a safe cycling and pedestrian facility.

Policy Context

The following policy documents were reviewed to determine their applicability to this project:

- Provincial Policy Statement, 2020
- Growth Plan, 2019 (amended in 2020)
- Niagara Escarpment Plan, 2017
- Greenbelt Plan, 2017
- Niagara Region Official Plan, 2014
- Niagara Region Transportation Master Plan, 2017

- Town of Lincoln Transportation Master Plan and Active Transportation Strategy, 2019
- Twenty Mile Creek Watershed Plan, 2006
- Niagara Peninsula Conservation Authority Policy Document: Policies for the Administration of Ontario Regulation 155/06 and the Planning Act, 2018

Existing and Future Conditions

Existing conditions and future conditions (where applicable) were described for the following components:

- Transportation (Road Network and Pedestrian and Cycling Network)
- Social and Economic Environment (Land-use and Tourism)
- Cultural Environment (Built Heritage Resources and Cultural Heritage Landscape and Archaeological Resources)
- Natural Environment (Terrestrial Ecosystem; Aquatic Ecosystem; Flooding Hazards; Stormwater/Drainage; Groundwater; Drinking Water Source; and Soil)
- Technical Environment (Utilities)

Class EA Phase 2: Alternative Solutions

In accordance with the requirements of Phase 2 of the Class EA process, the following alternative solutions were identified:

Alternative 1: Do Nothing: This option was included as a basis for comparison to other alternatives and would maintain the status quo for the bridge moving forward. This option would see a continued deterioration of the structure over time and will result in increased maintenance costs as well as potential bridge closure in the future.

Alternative 2: Bridge Rehabilitation: This option would include repairs of the existing structure in order to correct the structural deficiencies noted in the various inspections undertaken. Although repairs would extend the lifespan of the bridge, they would not provide a long-term solution to the crossing deficiencies.

Alternative 3: Bridge Replacement: This option would generally involve replacement of the structure with a new multi-span bridge with a new concrete slab on steel girder structure. It is anticipated that the existing bridge piers could be utilized for the new structure and adapted as needed. This option would result in traffic and pedestrian improvements to the crossing of Twenty Mile Creek. Enhancements examined by the

engineering team include the addition of a wider sidewalk, bicycle lanes and a higher clearance for the trail crossing under the bridge.

To identify the impacts and advantages of each alternative solution, evaluation criteria were developed within each of the categories related to transportation, socio-economic, natural, and cultural environments, and technical and cost considerations. These criteria were chosen based on their ability to identify potential positive and negative effects of each alternative and distinguish the advantages and disadvantages between them.

Preferred Solution: Based on the review of existing and future conditions, the assessment of alternative solutions, as well as consultation with the public, Indigenous Nations, government review agencies, and key stakeholders, Alternative 3: Replacement of the Structure, was identified as the preferred solution. Alternatives for implementing the Preferred Solution were then developed (alternative design concepts).

Class EA Phase 3: Alternative Design Concepts

The alternative design concepts were identified for the following elements of the project:

- Road Alignment Alternatives
- Road Cross-section Alternatives
- Bridge Structure Alternatives

Similar to Class EA Phase 2, evaluation criteria were developed within each of the categories related to transportation, socio-economic, natural, and cultural environments, and technical and cost considerations.

Preferred Design: Based on the evaluation of alternatives, maintaining the existing road alignment with widening at the bridge location was identified as the preferred road alignment. In terms of road cross-section, the urban roadway cross-section was identified as preferred. This road cross-section would include two 3.50 m travel lanes, a 2.20 m shoulder on the south side of the roadway and a 1.0 m shoulder on the north side. A 3.00 m asphalt multi-use path will be provided on the north side, separated by a parapet barrier wall with the railing between the pathway and the roadway. Lastly, a three-span concrete slab on steel girder bridge was identified as the preferred bridge structure. The steel girders will be prismatic, i.e., the steel girders will have a constant depth. New abutments will be constructed, and existing piers will be left in place and rehabilitated. To accommodate the new bridge, the piers will be built up with concrete to increase the height of the piers and extended to the north to allow for the bridge widening.

Description of the Preferred Design

Please refer to Appendix G of this report for the preferred design drawings. Due to the large size, the drawings could not be included herein.

Proposed Horizontal and Vertical Alignments for the Road: The proposed roadway alignment maintains the existing roadway centreline and existing centreline vertical profile throughout the project limits. Minor adjustments have been made to ensure that proposed horizontal radii and vertical curves meet design requirements for the intended design speed of 50km/hr. At the location of the Twenty Mile Creek Bridge, the existing roadway horizontal centreline is maintained to minimize structural modifications and impacts to the creek embankments. The proposed roadway width has been widened from the existing to approximately 14 metres to provide safe space for all road users (drivers, pedestrians, cyclists) and to accommodate the proposed multi-use pathway.

The proposed horizontal and vertical alignments meet the requirements of the TAC Geometric Design Guide for Canadian Roads for a 50 km/h roadway design speed as per existing conditions.

Proposed Typical Road Cross-Section: The proposed road cross-section at bridge slightly differs from the proposed cross-section at the road approaches. The proposed road cross-section at the bridge location includes widening of the existing bridge deck to a width of 14.05 metres with a slight shift to the north side to accommodate the multi-use path. Further to the east and west of the bridge, the proposed road cross-section only includes two 3.5 metre wide vehicular traffic lanes with 0.5 metre wide curb and gutter and a 3.0 metre wide multi-use path on the north side. The multi-use path could be connected in the future with an active transportation facility to be implemented on Regional Road 81 (King Street) from Nineteenth Street to the east to Brookside Drive to the west, as identified in the Niagara Region's Transportation Master Plan. As noted before, the type and timeline for the implementation of the future cycling facility will be determined via a separate undertaking.

Proposed Bridge Design: The proposed bridge structure is a three-span structure with 10.3 metres long end spans and a 25.4 metres long centre span. When compared to the existing bridge, the centre span will be the same length, but the end spans have been lengthened somewhat to reduce uplift at the abutments. It will have a concrete slab on steel I-girder substructure with semi-integral or integral abutments. Depending on the results of the geotechnical investigation, the abutment foundations will be supported on shallow spread footings or a piled foundation. Excavation will be required for the shallow spread footings or a pile foundation. The existing piers will be left in place and rehabilitated. To accommodate the new bridge, the piers will be built up with concrete

to increase the height of the piers, and extended to the north to allow for the bridge widening. Some excavation will be required to extend the piers to the north. Concrete wingwalls will be constructed at the four corners of the bridge. Approach slabs will be provided at each end of the bridge with a sleeper slab and expansion joint on one end.

Construction Approach and Staging: The construction of this project will utilize a temporary modular bridge to maintain one lane of traffic throughout most of the construction. A short-term full closure of the bridge will be required to finalize the construction. To minimize traffic related impacts, efforts will be made to limit the closure of the bridge to a weekend. Depending on the time of the year, if the weekend closure is not a preferred time, then a closure during weekdays could be considered. The Niagara Region will coordinate with the Town of Lincoln (including EMS/Fire Department) for bridge closure.

Preliminary Cost Estimate of Proposed Works: The preliminary cost estimate for the bridge replacement and the associated road works is \$6.26 million. The estimated high-level initial construction cost of the new structure is \$5.6 million, while the estimated high-level construction cost for the associated road works and drainage works is approximately \$660,000.

It is important to note that this cost estimate is based on preliminary design and is subject to refinement during detailed design phase. Current industry cost trends are uncertain due to various significant issues affecting the marketplace, including lingering Covid19 supply chain issues and severe oil price fluctuations.

Timing of Proposed Works: The table below represents a high-level schedule, as anticipated at the time of preparation of this report. Ultimate timing of various project activities and construction will be determined during the detailed design phase of this project. The timing of proposed works will be subject to the acquisition of various permits and approvals.

Niagara Region will ensure that all required permits and approvals have been obtained prior to initiating the construction. Niagara Region will also ensure that the project construction schedule adheres to regulatory timing restrictions (e.g., in-water works timing restrictions).

Preliminary Schedule of Proposed Works

Project Activity	Timeline
Complete Detailed Design and Obtain Permits	2022-2023
Issue for Tender	2023
Construction	2023

Potential Environmental Effects, Mitigation Measures, Future Commitments and Monitoring

Based on the existing conditions inventory within the Study Area and the proposed project works, potential effects were identified, and mitigation measures were proposed to avoid or minimize impacts. In addition, commitments for additional work and permits were identified as well as monitoring during construction.

Consultation

Consultation is a key component of the Municipal Class EA process. As part of the consultation process for this Class EA Study, a number of consultation tools were used to identify, notify, inform and provide a platform to the public, government agencies, stakeholders and Indigenous Nations to provide feedback throughout the course of this study. These included:

- A Study Contact List was developed at the commencement of this Study that included contacts that may have an interest in this study. This list was used to circulate Study notifications at key points of contact. The Study Contact List included contacts from the following groups: Indigenous Nations, federal agencies, provincial agencies, Niagara Region, Town of Lincoln, Niagara Peninsula Conservation Authority, Emergency Service Providers, School Boards, Active Transportation Committee, Lincoln Chamber of Commerce, Utility Providers, Elected Officials and special interest groups.
- Posting of Study notices in the local newspaper, Niagara Region's website, and social media pages, and distribution to the contacts on the Study Contact List. Study notices included: Notice of Study Commencement and Online Public Information Centre #1, and Notice of Public Information Centre #2.

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- Meeting with agencies (Ministry of Heritage, Sport, Tourism and Culture Industries and Ontario Heritage Trust).
- Two online Public Information Centres.
- Email circulation of Study Notices, Project Summary and Stage 1 Archaeological Assessment to the Indigenous Nations. Phone call follow-ups were also made. The following Indigenous Nations were contacted during this Class EA Study: Mississaugas of the Credit First Nation, Six Nations of the Grand River, and Haudenosaunee Development Institute.
- Draft Environmental Study Report was shared with Indigenous Nations, government agencies and utility companies for review and comment.

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Appendices

Appendix A: Rehabilitation/Replacement Planning Report (2010) and Municipal Bridge Appraisal (2017)

Appendix B: Built Heritage and Cultural Landscape Assessment Report (2021)

Appendix C: Heritage Impact Assessment Report (2022)

Appendix D: Stage 1 Archaeological Assessment Report (2020)

Appendix E: Natural Environment Assessment Report (2022)

Appendix F: Hydrologic and Hydraulic Assessment Report (2020) and Hydraulic Assessment of Bridge Alternatives (2021)

Appendix G: Preferred Design Drawings

Appendix H: Study Contact List

Appendix I: Study Notices

Appendix J: Agency Consultation

Appendix K: Indigenous Consultation

Appendix L: Public Information Centre #1 Materials

Appendix M: Public Information Centre #2 Materials

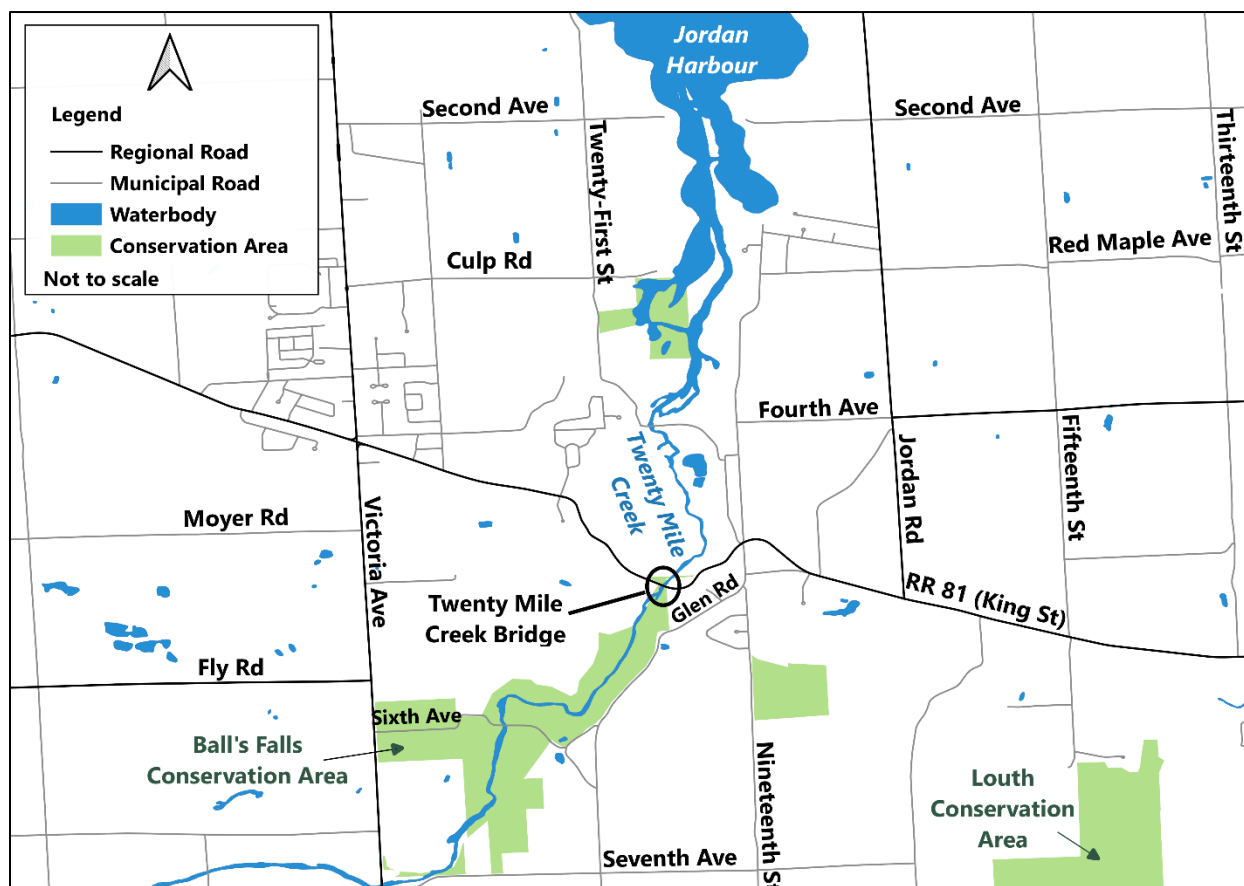
Appendix N: Draft Environmental Study Report Review

1.0 Introduction

1.1 Study Introduction

The Regional Municipality of Niagara (Niagara Region) has completed a Municipal Class Environmental Assessment (Class EA / the Study) for the replacement of the Twenty Mile Creek Arch Bridge, which is located approximately 550 m west of Nineteenth Street where Regional Road 81 crosses Twenty Mile Creek in the Town of Lincoln. The general location of the bridge is shown in Figure 1-1.

Figure 1-1: Study Area



1.2 Study Background

The Twenty Mile Creek Arch Bridge was constructed in 1940. It is located on Regional Road 81 (King Street), which presently functions as a two-lane arterial road serving east-west traffic. A Rehabilitation / Replacement Planning Report was prepared in June 2010, which identified that the existing structure is not sufficient for current

design loads, and is undergoing deterioration (Hatch Mott MacDonald, 2010). This report recommended a full bridge replacement. A subsequent biennial bridge inspection was completed in 2017 confirming the recommendation of the 2010 report (ELLIS Engineering Inc, 2018). Another biennial bridge inspection was completed in 2019, confirming the need for bridge replacement (ELLIS Engineering Inc., 2020). Summaries of findings from these reports are provided in Section 3.1 of this report.

In addition to the poor condition, the existing bridge does not provide a dedicated and safe facility for cyclists. The provincial and regional policy documents promote street designs that incorporate various modes of transportation as well as connectivity within and among transportation systems. Specifically, Niagara Region's Transportation Master Plan identified a future cycling Facility for King Street (from Brookside Drive to Nineteenth Street) through the valley in Jordan (IBI Group et al. (a), 2017).

Given these issues, the Niagara Region carried out this Class EA Study to identify a new bridge structure that would address concerns associated with the bridge condition and also accommodate multiple modes of transportation, people of all ages and abilities, and support adjacent land uses. The roadway over the bridge was designed in accordance with two key documents: *Niagara Region's Complete Streets Vision and Direction for a Changing Region* (June 2017) and the *Complete Streets Design Guidelines* (June 2017).

It is important to note that the scope of this Class EA was limited to identifying a new bridge structure and associated design of roadway and approaches. Provision of an active transportation facility on Regional Road 81 (King Street) further to the east and west of Twenty Mile Creek Bridge and up to Nineteenth Street to the east and Brookside Drive to the west (as identified in the Niagara Region's Transportation Master Plan), will be explored by the Niagara Region in future.

The Class EA Study was conducted in accordance with the requirements for a Schedule 'C' Project (Phases 1 to 4) as outlined in the Municipal Engineers Association's Class EA document (Municipal Engineers Association, October 2000, as amended in 2007, 2011 & 2015).

2.0 Environmental Assessment

2.1 Municipal Class Environmental Assessment Process

The Ontario Environmental Assessment Act (R.S.O. 1990, c. E.18; EA Act) (Ontario, 1990) was put into place to provide for the protection, conservation and wise management of the environment within the province. The EA Act applies to all projects being undertaken by provincial, municipal or other public bodies within the province (unless explicitly exempted). It defines the environmental assessment works that must be completed prior to commencement of any undertaking, as well as the proponent's obligations to consult with all affected and/or interested parties. Under the EA Act, projects are classified as exempted, subject to an approved Class EA process, or subject to a full Individual Environmental Assessment.

The Class EA process is a mechanism by which planning, and approval of municipal infrastructure is provided in an efficient, timely, economical and environmentally responsible manner. It represents a consistent, streamlined and easily understood process for planning and implementing municipal infrastructure projects.

The Municipal Class EA process is an approved process under the EA Act. All municipalities in Ontario are required to follow this approved process for the infrastructure planning projects. This project is classified as being subject to the Class EA process. It was carried out according to the requirements outlined in the Municipal Engineers Association document titled Municipal Class Environmental Assessment (Municipal Engineers Association, October 2000, as amended in 2007, 2011 & 2015).

Consistent with the Class EA, the study approach was designed to meet the following objectives:

- Protection of the environment, including natural, social and economic components of the environment.
- Participation of a broad range of stakeholders in the study process to allow for sharing of ideas, education, testing of creative solutions and developing alternatives.
- Documentation of the study process in compliance with all phases of the Class EA process.

The Class EA process classifies projects according to their level of complexity and potential environmental impacts. These are termed "Schedules" and are summarized below. A flow chart showing the Municipal Class EA process is provided in Figure 2-1.

Schedules A and A+ includes projects that involve minor modifications to existing facilities. Environmental effects of these projects are generally small. These projects are exempted from the requirements of the Environmental Assessment Act (Ontario, 1990).

Schedule B includes projects that involve improvements and minor expansion to existing facilities. There is a potential for some adverse environmental impacts and, therefore, the proponent is required to proceed through a screening process, including consultation with those affected. Schedule B projects are required to proceed through Phases 1, 2 and 5 of the Class EA process.

Schedule C includes projects that involve construction of new facilities and major expansion of existing facilities. These projects proceed through the environmental assessment planning process outlined in the Class EA document. These projects are required to fulfil the requirements of all five phases of the Class EA process.

A description of the Class EA planning phases is provided below:

Phase 1 – Problem or Opportunity Statement: Identify the problem (deficiency) or opportunity.

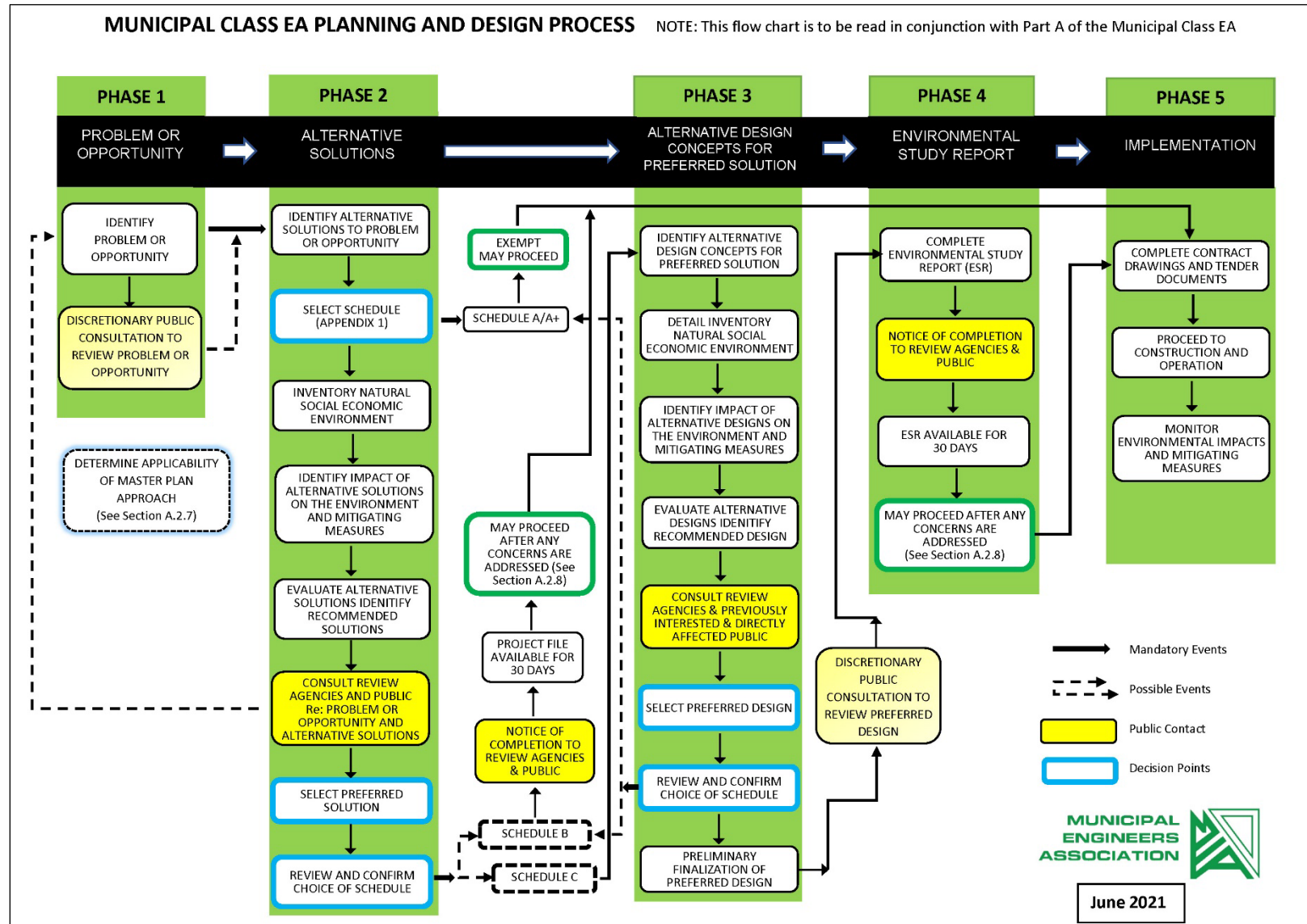
Phase 2 – Alternative Solutions: Identify and evaluate alternative solutions to address the problem or opportunity by taking into consideration the existing environment, and establish the preferred solution considering public and review agency input.

Phase 3 – Alternative Design Concepts for the Preferred Solution: Identify Alternative Design Concepts for the preferred solution implementation by taking into consideration the existing environment and establish the preferred design concept by considering public and review agency input.

Phase 4 – Environment Study Report: Document the Environmental Assessment including the design and consultation process in an ESR for public review.

Phase 5 – Implementation: Complete detailed design and required additional investigations, obtain permits and approvals, and proceed to construction and operation. Monitor construction for adherence to environmental provisions and commitments. Where special conditions dictate, also monitor the operation of the completed facility.

Figure 2-1: Municipal Class Environmental Assessment Process



2.2 Environmental Study Report

This report was developed to document Phases 1 – 4 of the Class EA process for this project. This report is divided into following sections:

Section 1.0 provides introduction to the study.

Section 2.0 discusses the study process.

Section 3.0 outlines the problem and opportunity statement.

Section 4.0 discusses the various provincial, regional and local municipal policies that are applicable to this project.

Section 5.0 provides a description of the environment within the Study Area, including existing and future conditions.

Section 6.0 discusses the alternative solutions that were identified and evaluated to identify a preferred solution to address the problem and opportunity.

Section 7.0 summarizes the alternative design concepts for the preferred solution, that were identified and evaluated to identify a preferred design.

Section 8.0 provides a detailed description of the preferred design, including the preliminary cost estimate, implementation strategy, and timing of the proposed works.

Section 9.0 identifies the project's potential effects and proposed mitigation measures.

Section 10.0 outlines the commitments for future work, including required additional investigations and permits/approvals and the monitoring to be conducted prior, during and after the construction.

Section 11.0 provides details of the consultation program that was executed for this study, which involved consultation with the Indigenous Nations, public, impacted property owners, government agencies, and key stakeholders.

Section 12.0 lists all the documents cited throughout the report.

3.0 Class EA Phase 1: Problem or Opportunity

3.1 Justification / Need for Bridge Replacement

The first phase in the Municipal Class EA process is the identification of problem and opportunity statement. The Municipal Class EA document notes that the municipalities generally undertake projects in response to certain identified problems or deficiencies. In other cases, there may be opportunities which need to be addressed. Previous studies/reports undertaken by a proponent may be available to assist in defining the problem. Therefore, as part of the Class EA Phase 1, a clear problem and opportunity statement should be identified for the proposed project. As noted earlier in this report, two previous reports recommended the replacement of the Twenty Mile Creek Arch Bridge. In addition, a site visit was completed in 2019 as part of this Class EA Study. A summary of findings from the previous two reports and photographs taken during 2019 site visit are provided below:

3.1.1 Rehabilitation/Replacement Planning Report (2010)

A Rehabilitation / Replacement Planning Report was completed in 2010. It identified that the existing bridge is not sufficient for current design loads. It further identified that the bridge deck has been exposed to water and chloride penetration for an extended period of time, that is now resulting in accelerated concrete deterioration and corrosion of the reinforcing steel. The 2010 report recommended a full replacement of the Twenty Mile Creek Arch Bridge (Hatch Mott MacDonald, 2010). This report is provided in Appendix A.

3.1.2 Biennial Bridge Inspections (2017 and 2019)

In 2017 and 2019, the Niagara Region completed biennial bridge inspections for the Twenty Mile Creek Arch Bridge. The inspection reports are provided in Appendix A. These reports confirmed the need for bridge replacement (ELLIS Engineering Inc, 2018; ELLIS Engineering Inc., 2020). The results of these inspections are summarized below (ELLIS Engineering Inc, 2018):

- The steel railings are in poor condition with various areas of severe corrosion and severe section loss.
- The sidewalks and curbs are generally in poor condition with various spalls, delaminated concrete, and areas of settlement.

- The steel-beam guide rails on the approaches are in fair to good condition. The asphalt wearing surface is in good condition. There is erosion at the west end of the north railing.
- The East Approach Arch is generally in fair to poor condition. There are various narrow radial cracks along the arch, and with various longitudinal cracks with severe leakage and efflorescent [salt] staining along the west side of the arch. There is an area of severe spalling, exposed corroded reinforcing, concrete disintegration and leakage at the north and south ends of the east pier. There is a wide crack in the north and south headwalls between the east and centre spans with evidence of rotation of the headwalls, and there are medium cracks in the headwalls over the east span with areas of severe concrete disintegration at the connection between the arch and head wall at the southwest corner. There is severe erosion at the north end of the east pier.
- The West Approach Arch is generally in fair to poor condition. At the east wall, there is severe cracking, efflorescent [salt] staining, and leakage. There are various narrow radial cracks along the arch soffit. There is severe leakage and concrete disintegration along the joints between the arch and the headwalls, and there is a wide crack in the north and south headwalls between the west and centre spans with evidence of rotation of the headwalls. Severe spalls with exposed corroded reinforcing are present at the south face of the west pier.
- The Centre Span Arch is generally in fair to poor condition. The bridge deck soffit is in fair to poor condition with extensive longitudinal/radial narrow to wide cracking with efflorescent [salt] staining and leakage throughout the soffit. There is a medium spall at the centre of the arch near the south fascia. There are three wide transverse cracks near mid-span, and they extend into the headwalls, and there is severe cracking, concrete disintegration and leakage at the joints between the arch and the headwalls with the deterioration most severe near the piers. Severe spalling, concrete disintegration and leakage is present on the exterior faces of the piers. There are several areas of light to medium concrete deterioration and delaminations along the south edge of the centre arch. The top of the east footing is exposed.

3.1.3 Structural Site Visit (2019)

A site visit was completed by Wood in 2019 to visually inspect the existing bridge structure. A few photographs taken during the 2019 site visit are provided on the following page. These photographs show deficiencies in the existing structure.

Photographs showing deficiencies in the Twenty Mile Creek Arch Bridge



3.2 Problem and Opportunity Statement

Based on the above information, the following Problem and Opportunity Statement was identified:

Twenty Mile Creek Arch Bridge, constructed in 1940, consists of a three-span reinforced concrete arch rigid frame, located on Regional Road 81 in the Town of Lincoln. The bridge crosses over Twenty Mile Creek and is primarily within an area of residential, commercial, and recreational land use. A replacement strategy is necessary to address the deteriorating condition of the bridge as identified in the Region's Biennial Bridge Inspection Reports.

To address the aging infrastructure, the Niagara Region is taking the opportunity to address the structural issues identified and improve overall public safety for auto users, cyclists and pedestrians. The improvements will also provide an opportunity to achieve the Niagara Region's active transportation objectives by providing space on the structure for a safe cycling and pedestrian facility.

4.0 Policy Context

4.1 Government of Ontario Policies and Plans

4.1.1 Provincial Policy Statement (2020)

The Provincial Policy Statement (PPS) (2020) provides policy direction for appropriate development while protecting resources of provincial interest, public health and safety, and the quality of the natural and built environment. The PPS supports improved land use planning and management, which contributes to a more effective and efficient land use planning system (Ministry of Municipal Affairs and Housing, 2020). Section 3 of the PPS requires that decisions affecting planning matters “shall be consistent with” policy statements under the Planning Act, 1990. The following infrastructure related policies of the PPS are relevant to this project:

1.6 Infrastructure and Public Service Facilities

1.6.1 Infrastructure and public service facilities shall be provided in an efficient manner that prepares for the impacts of a changing climate while accommodating projected needs

1.6.7.1 Transportation systems should be provided which are safe, energy efficient, facilitate the movement of people and goods, and are appropriate to address projected needs

2.1 Natural Heritage

2.1.1 Natural features and areas shall be protected for the long term

2.1.2 The diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features

3.1 Natural Hazards

3.1.3 Planning authorities shall prepare for the impacts of a changing climate that may increase the risk associated with natural hazards.

2.6 Cultural Heritage and Archaeology

2.6.1: Significant built heritage resources and significant cultural heritage landscapes shall be conserved

Applicability: This project is consistent with the objectives of the PPS, 2020, as it proposes transportation infrastructure to promote safe movement of vehicles, pedestrians and cyclists. The Class EA considered flooding/stormwater, hydraulic capacity of the proposed structure and identified natural and cultural heritage and archaeological resources and addressed impacts on those resources and proposed mitigation measures, as appropriate.

4.1.2 Growth Plan (2019, amended in 2020)

The Growth Plan for the Greater Golden Horseshoe – A Place to Grow, provides the framework for implementing the Provincial Government’s vision for building strong, prosperous communities by better managing growth to the year 2041 in the expanding Greater Toronto and Hamilton Area (Ministry of Municipal Affairs and Housing, 2019, Amendment 1 (2020)).

The Growth Plan, 2019 (amended in 2020) contains specific policies and directions regarding transportation infrastructure, land use planning, urban form, housing, natural heritage and resource protection to be considered by municipalities in their planning activities. The Growth Plan provides direction on where growth can occur, the form of future development and future population and employment forecasts.

Section 3.2 - Policies for Infrastructure to Support Growth:

- *Subsection 3.2.2.2 - The transportation system within the GGH [Greater Golden Horseshoe] will be planned and managed to:*
 - *b) offer a balance of transportation choices that reduces reliance upon the automobile and promotes transit and active transportation;*
 - *d) offer multimodal access to jobs, housing, schools, cultural, and recreational opportunities, and goods and services*
- *Subsection 3.2.2.3 - In the design, refurbishment, or reconstruction of the existing and planned street network, a complete streets approach will be adopted that ensures the needs and safety of all road users are considered and appropriately accommodated."*

In addition to above, Section 4.2 of the Growth Plan, 2019 (amended in 2020), provides policies for the protection of matters of provincial interest. Of these, policies related to

the protection of Natural Heritage System, Cultural Heritage Resources and Climate Change are of relevance to this project.

Applicability: This project conforms with the objectives of the Growth Plan, 2019 (amended in 2020), as it proposes improvements to existing infrastructure to promote safe movement of vehicles, pedestrians and cyclists. The Class EA considered flooding/stormwater, hydraulic capacity of the proposed structure and identified natural and cultural heritage and archaeological resources and addressed impacts on those resources and proposed mitigation measures, as appropriate.

4.1.3 Niagara Escarpment Plan (2017)

The Niagara Escarpment Plan (NEP) serves as a framework of objectives and policies to strike a balance between development, protection and the enjoyment of the Niagara Escarpment landform feature and the resources it supports (Niagara Escarpment Commission, 2017). The NEP is administered by the Niagara Escarpment Commission (NEC).

The NEP (2017) works in conjunction with the *Oak Ridges Moraine Conservation Act*, 2001, the Greenbelt Plan, and Greater Golden Horseshoe Growth Plan for where and how future population and employment growth should be accommodated. Together, all four (4) provincial plans build on the Provincial Policy Statement.

Policy 2.6.2 e) of the Niagara Escarpment Plan notes that development is not permitted in key hydrologic features with the exception of infrastructure, where the project has been deemed necessary to the public interest after all other alternatives have been considered. In addition, Policy 2.12 (2) and (5) require that the infrastructure shall be sited and designed to minimize the negative impact on the Escarpment environment, and Escarpment Natural Areas, unless the project has been deemed necessary to the public interest after all other alternatives have been considered.

In addition, Part 2.12, subsections 2 and 5 to again confirm that the construction approach will limit impact to the Escarpment Natural Area, will minimize the negative impact on the Escarpment and that all other alternatives have been considered in justifying that the project is necessary to the public interest.

Applicability to the Project: Twenty Mile Creek Arch Bridge is located within the area of Niagara Escarpment Development Control. In addition, the location of the Twenty Mile Creek Arch Bridge is designated as Escarpment Natural Area and abuts the Niagara Escarpment Parks and Open Space System.

Based on consultation with the Niagara Escarpment Commission, a permit will be required prior to conducting bridge replacement works.

4.1.4 Greenbelt Plan (2017)

The Greenbelt Plan (2017) was introduced to help shape the future of the Ontario's Greater Golden Horseshoe region by identifying where urbanization should not occur in order to provide permanent protection to the agricultural land base, as well as the ecological and hydrological features and functions occurring on the landscape (Ministry of Municipal Affairs and Housing, 2017). The Greenbelt Plan, together with the Oak Ridges Moraine Conservation Plan and the Niagara Escarpment Plan, identifies where urbanization should not occur in order to provide permanent protection to the agricultural land base and the ecological and hydrological features, areas and functions occurring on this landscape. The Greenbelt Plan includes lands within, and builds upon the ecological protections provided by, the Niagara Escarpment Plan and the Oak Ridges Moraine Conservation Plan.

Applicability to the Project: The Twenty Mile Creek Arch Bridge is located outside of the Greenbelt Land Use Designations (Protected Countryside and Urban River Valley). As such, the policies of Greenbelt Plan do not apply to this project.

4.2 Niagara Region Policies and Plans

4.2.1 Niagara Region Official Plan (2014)

The Niagara Region Official Plan (2014) contains objectives, policies and mapping that implement the Niagara Region's approach to managing growth, growing the economy, protecting the natural environment, resources and agricultural land, and providing necessary infrastructure (Niagara Region, 2014). It is important to note that the Niagara Region is in the process of developing a new Official Plan.

Policies from the following chapters of the Niagara Region Official Plan apply to this project: Chapter 7 – Natural Environment, Chapter 9 – Transportation and Chapter 10 – Creative Niagara (10.C.2.1 Built Heritage Resources, Cultural Heritage Landscapes and Archaeological Resources).

Applicability to the Project: Policies of the Niagara Region Official Plan contributed to the identification of natural environment, built heritage resources, cultural heritage landscapes and archaeological resources.

4.2.2 Niagara Region Transportation Master Plan (2017)

The Niagara Region Transportation Master Plan (2017) is a strategic planning document that sets out an action plan to address future transportation needs through an integrated network of pedestrian and cycling facilities, transit, roads and highways (IBI Group et al. (a), 2017). The major components of the TMP are: the Regional Road System; Transportation Demand Management; Transportation Systems Management; Public Transit Active Transportation; Complete Streets; and Goods Movement.

The Niagara Region's Transportation Master Plan identified a future cycling facility for Regional Road 81 from Nineteenth Street to Brookside Drive (IBI Group et al. (a), 2017).

Applicability to the Project: This project proposes active transportation infrastructure on Twenty Mile Creek Bridge while addressing complete streets concepts in accordance with the Niagara Region's Complete Streets Design Guidelines (June 2017) (IBI Group et al. (b), 2017).

4.3 Town of Lincoln Policies and Plans

4.3.1 Town of Lincoln Transportation Master Plan and Active Transportation Strategy (2019)

The Town of Lincoln Transportation Master Plan and the accompanying Active Transportation Strategy provide long-range transportation plan to help plan for the movement of people and goods. It will be used to guide for future decision making, planning, design, operations and maintenance of the Town's transportation network until the year 2031 and beyond. There are four (4) key transportation areas addressed as part of this plan: roads, walking and cycling, goods movement and transit.

The Town of Lincoln's Active Transportation Strategy identified a proposed Buffered Paved Shoulder for King Street, west of Nineteenth Street.

Applicability to the Project: This project proposes active transportation infrastructure on Twenty Mile Creek Bridge while addressing complete streets concepts.

4.4 Niagara Peninsula Conservation Authority Policies and Plans

4.4.1 Twenty Mile Creek Watershed Plan (2006)

The Twenty Mile Creek Watershed Plan provides a systematic strategy to guide development, identify and recommend alternative and preferred restoration programs, and strengthen stewardship and partnerships in the watershed. The Watershed Plan noted that the priority should be placed on protecting and enhancing the riparian cover along the Twenty Mile Creek (Niagara Peninsula Conservation Authority, 2006).

Applicability to the Project: This project is designed to minimize impacts on the natural environment. Where vegetation removal is required, appropriate replacement vegetation will be specified during the detailed design phase.

4.4.2 Niagara Peninsula Conservation Authority (NPCA) Policy Document: Policies for the Administration of Ontario Regulation 155/06 and the Planning Act (2018)

The NPCA Policy Document: Policies for the Administration of Ontario Regulation 155/06 and the Planning Act (September 2018) provides principles, objectives, and policies for the administration of the NPCA's mandate under Ontario Regulation 155/06, as well as its delegated roles and responsibilities within the planning and approvals process.

The NPCA Policy Document: Policies for the Administration of Ontario Regulation 155/06 and the Planning Act (September 2018) provides principles, objectives, and policies for the administration of the NPCA's mandate under Ontario Regulation 155/06, as well as its delegated roles and responsibilities within the planning and approvals process.

Policy 4.2.2 permits infrastructure within flood plain areas provided that an approval under the Environmental Assessment Act, and that the approved engineering designs recognize and, where necessary, address the flooding potential at the site.

Applicability to the Project: The Twenty Mile Creek Bridge is located within the regulated area and floodplain area associated with Twenty Mile Creek. Accordingly, a permit will be required from the NPCA for the proposed bridge replacement works.

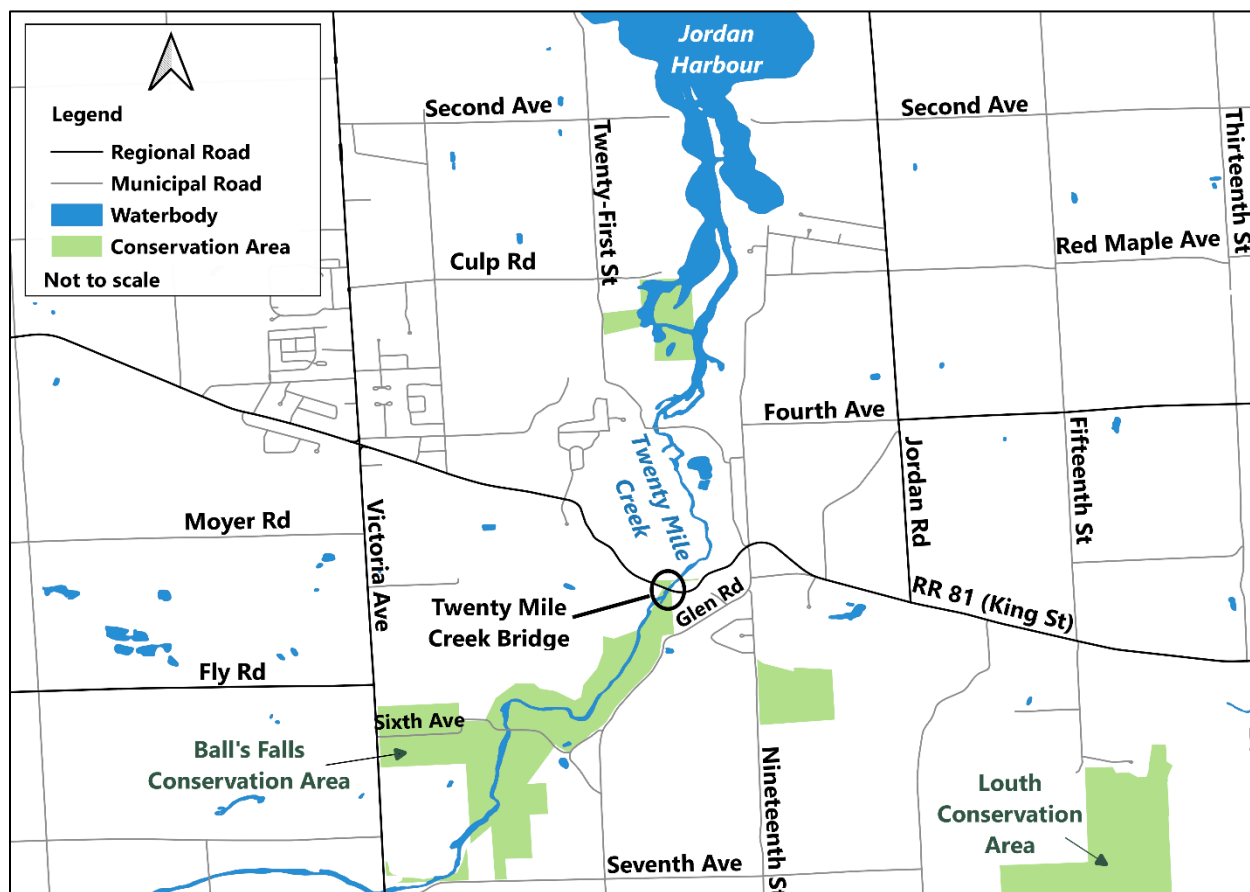
5.0 Description of the Environment (Existing and Future Conditions)

5.1 Transportation

5.1.1 Existing Road Network

The Twenty Mile Creek Arch Bridge was constructed in 1940. It is located on Regional Road 81 (King Street) where it crosses Twenty Mile Creek, approximately 550m west of Nineteenth Street, in the Town of Lincoln (Figure 5-1). Regional Road 81 (King Street) presently functions as a two-lane arterial road serving east/west traffic with an average annual daily traffic of 5800. The nearest intersecting roads include Nineteenth Street and Brookside Drive. Regional Road 81 (King Street) intersects with Nineteenth Street approximately 550 metres to the east, and it intersects with Brookside Drive approximately 845 metres to the west.

Figure 5-1: Location of Twenty Mile Creek Arch Bridge



5.1.2 Future Road Network

There is one known future road improvement project in the vicinity of the Twenty Mile Creek Bridge, that is, the Jordan Village Improvement Project. This project is being planned by the Town of Lincoln and will include the following road improvements to Jordan Village (Town of Lincoln, 2021).

- New signalized intersection at King Street and Nineteenth Street
- Pedestrian Square at Main Street and King Street
- Integration with new Jordan Museum and existing commercial district
- Increased neighbourhood appeal through landscaping and roadway pavers
- Focus on investing in the local tree canopy
- Wayfinding pillars and signage
- Improved decorative streetlighting
- Dedicated cycling facilities and increased pedestrian connectivity
- Community parking lot and arrival zone

5.1.3 Existing Pedestrian and Cycling Network

The existing Twenty Mile Creek Bridge provides sidewalks on both sides of the structure (Figure 5-2). These sidewalks do not extend further to the east or the west of the bridge. The 2017 and 2019 biennial bridge inspections identified that the sidewalks and curbs are generally in poor condition.

In addition to the sidewalks, the existing bridge includes a pedestrian pathway under the east arch. The access to the pedestrian path is provided via stairs from the Jordan Hollow Park, located to the east side of the bridge (Figure 5-3 and Figure 5-4). The pedestrian path provides connection to Twenty Valley Trail, which extends from the Balls Falls Conservation Area to Lake Ontario. Discussion regarding recreational land-uses is provided in Section 5.1.1 below.

Figure 5-2: Existing Traffic Lanes and Sidewalks on Twenty Mile Creek Arch Bridge



Figure 5-3: Access to the Pedestrian Path located under the Bridge



Figure 5-4: Pedestrian Path Located Under the Bridge



5.1.4 Future Pedestrian and Cyclist Network

The Niagara Region's Transportation Master Plan identified a future cycling facility for Regional Road 81 from Nineteenth Street to Brookside Drive (IBI Group et al. (a), 2017).

It is important to note that the scope of this Class EA was limited to identifying a new structure for Twenty Mile Creek Arch Bridge replacement to address structural issues and associated design of roadway and approaches to provide facility for additional modes of transportation (i.e., walking and cycling). Provision of an active transportation facility on Regional Road 81 (King Street) further to the east and west of Twenty Mile Creek Bridge and up to Nineteenth Street to the east and Brookside Drive to the west (as identified in the Niagara Region's Transportation Master Plan), will be explored by the Niagara Region in future. Timing for such an undertaking is not identified at this stage.

In addition to above, based on consultation with the Ontario Heritage Trust, the Study Team learned that the Trust is planning to undertake a feasibility study to formalize a section of the Twenty Valley Trail between Jordan Hollow Park and the Jordan Historical Museum. As part of these works, the Trust may also consider completing some creek restoration work. Consultation with Ontario Heritage Trust is discussed in Section 11.1.

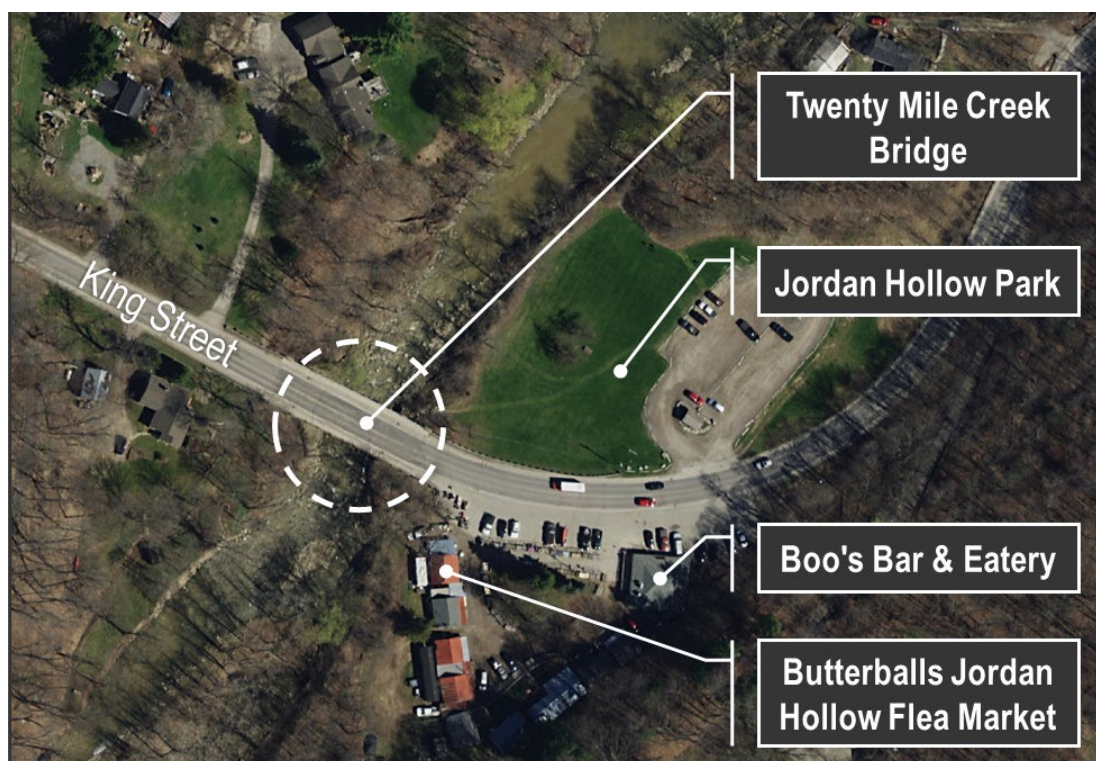
5.2 Social and Economic Environment

5.2.1 Land-use

The Twenty Mile Creek Bridge is located in an area identified in the Niagara Region's Official Plan as Twenty Valley / Jordan Harbour Tourism Area (Niagara Region, 2014). This area is renowned for its scenic lands and waters, natural environment, cultural heritage experiences and superb wine touring. For the purposes of providing context, key attractions/places within the Twenty Valley/Jordan Harbour Tourism Area include: Vineland Central Business District; Jordan Village; Jordan Station; Prudhomme's; Jordan Harbour; and the Ball's Falls Heritage Conservation Area.

Key land-uses adjacent to the Twenty Mile Creek Bridge are shown in Figure 5-5. As shown in this figure, the Regional Road 81 (King Street) provides access to commercial, recreational and residential land-uses in the immediate vicinity of the subject bridge. These land-uses are discussed in subsections below.

Figure 5-5: Key Land Uses adjacent to Twenty Mile Creek Bridge



5.2.1.1 Recreational Land-uses

Jordan Hollow Park is located immediately to the northeast of the Twenty Mile Creek Bridge. The Town of Lincoln, in partnership with a group of Indigenous and

environmental stakeholders, is leading the development of a park enhancement plan, which will include new trees and plantings, lawn areas, paved pathways, site furnishings, art, interpretive elements, and other enhancements (Town of Lincoln, 2020).

For the purposes of providing context, other notable recreational landmarks within one kilometre radius around the subject bridge include Ball's Falls Conservation Area and Harmony Resorts.

Figure 5-6: Jordan Hollow Park Located to the East of Twenty Mile Creek Bridge



5.2.1.2 Residential Land-uses

Residential land-uses located immediately to the west of the Twenty Mile Creek Bridge include single family residential with driveway access on Regional Road 81 (King Street). Further to the west, Brookside Drive provides access to a residential subdivision.

5.2.1.3 Commercial Land-uses

Commercial land-uses are located immediately to the southeast of the bridge and include Jordan Hollow Flea Market and a Bar & Eatery (Figure 5-7).

Figure 5-7: Commercial Land-uses Located to the Southeast of Twenty Mile Creek Bridge



5.2.1.4 Institutional Land-uses

There are no institutional land-uses located in close proximity to the Twenty Mile Creek Bridge. However, it is important to note that the Town of Lincoln Fire Station #4 is located, approximately 118 metres north of the King Street/Nineteenth Street intersection. As part of the consultation process, the Town of Lincoln's Fire Rescue identified the need for maintaining the access across the bridge during construction. Consultation with Lincoln Fire Rescue is discussed in Section 11.1. Maintenance of vehicular access during construction staging is discussed in Section 8.4.

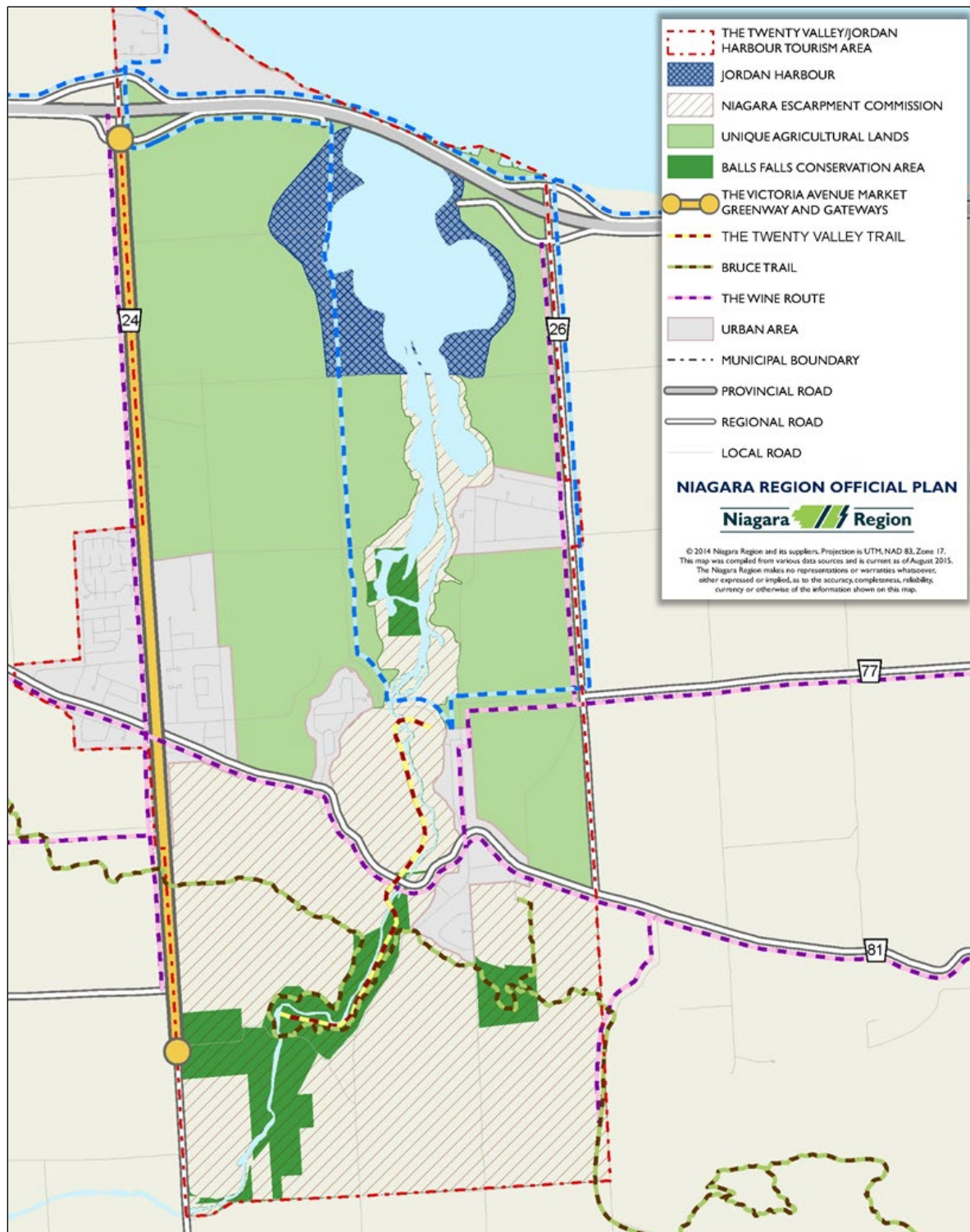
5.2.2 Tourism

Schedule F of the Niagara Region's Official Plan (The Twenty Valley/Jordan Harbour Tourism Area) identifies Highway 81 as "The Wine Route". Further, the Twenty Mile Creek Bridge is located in Twenty Valley/Jordan Harbour Tourism Area (Niagara Region, 2014). It is a goal of the Niagara Region to increase the economic benefit from tourism in the Twenty Valley/Jordan Harbour Tourism Area, while maintaining and enhancing its

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natural and cultural heritage resources (Niagara Region, 2014). An excerpt from the Schedule F of the Niagara Region's Official Plan is provided in Figure 5-8.

Figure 5-8: Excerpt from Schedule F - The Twenty Valley/Jordan Harbour Tourism Area - Regional Official Plan



5.3 Cultural Environment

5.3.1 Built Heritage Resources and Cultural Heritage Landscape

A Built Heritage and Cultural Landscape Assessment Report was completed in December 2019 in support of this Class EA Study. The purpose of this assessment was to evaluate the Twenty Mile Creek Arch Bridge and the lands located within the immediate vicinity of the bridge for potential as a Cultural Heritage Landscape or part thereof. This assessment was completed in accordance with Ontario Regulation 9/06 under the Ontario Heritage Act, as amended in 2005 and the guidelines presented in Ministry of Heritage, Sport, Tourism and Culture Industries' Ontario Heritage Tool Kit.

As part of the Built Heritage & Cultural Landscape Assessment, the existing Twenty Mile Creek Arch Bridge and the lands located within the immediate vicinity of the bridge were evaluated for their potential for cultural heritage value or interest, and as a Cultural Heritage Landscape or part thereof. This Built Heritage and Cultural Landscape Assessment concluded that:

- a) The Twenty Mile Creek Arch Bridge in Jordan Hollow is of Cultural Heritage Value or Interest (CHVI) because of the following reasons:
 - o It has design or physical value as an early and representative example of the Reinforced Concrete Rigid Frames Bridge style and construction method.
 - o It has historical or associative value for its direct association with and demonstration/reflection of the work of Arthur Sedgwick, who was the Chief Bridge Engineer for the Department of Highways Ontario (DHO) and is credited with introducing the Concrete Rigid Frame Bridge style in Canada.
 - o It has contextual value for its role in maintaining and supporting the character of an area as a historic transportation route.
 - o It has contextual value for its crossing over the 20 Mile Creek as a historic transportation route, which is physically, functionally, and historically linked to its surroundings.
- b) King Street/Regional Road 81, which runs across the bridge between Nineteenth Street & Brookside Drive, constitutes part of a Cultural Heritage Landscape (CHL).
 - o The bridge, together with King Street/Regional Road 81 constitutes an evolved cultural landscape, in that it forms part of a historic crossing which was once part of an old Iroquois Trail. In addition, many of the developed

properties along Regional Road 81 in the area historically known as Dwarf Village (now Jordan Hollow Park), constitute parts of this landscape that contribute to its potential CHVI.

- o The section of King Street/Regional Road 81 between Nineteenth Street & Brookside Drive – constitutes an evolved cultural landscape, in that it resulted from an initial social, economic, and administrative imperative (i.e., linking the surrounding peninsular communities with roads), and has developed by association with, and in response to, its natural environment (i.e., the 20 Mile Creek and the Jordan Hollow). The valley lands of the hollow, and the 20 Mile Creek contribute to the CHL. The Twenty Mile Creek helped contribute to the settlement of communities in the area, as evidenced from the records of various mills along its extent.
- c) There are no designated or listed heritage properties adjacent/contiguous to the Twenty Mile Creek Arch Bridge or within the identified study area along Regional Road 81 between Nineteenth Street and Brookside Drive.
- d) The property municipally addressed as 3738 Main Street has been recommended for inclusion on the Town's municipal heritage register and for designation by Town of Lincoln staff. This property has been identified and evaluated by Town staff as a Character Defining Resource.
- e) The property municipally addressed as 2987 King Street has been recommended for inclusion on the Town's municipal heritage register by Town of Lincoln staff. This property has been identified and evaluated by Town staff as a Character Supporting Resource.
- f) Other properties municipally addressed as 2964 King Street (Jordan Hollow Park), 2998 King Street (the restaurant located to the east of bridge), 3038 King Street, 3127 King Street, and 3156 King Street have potential cultural heritage value.

The replacement of the Twenty Mile Creek Arch Bridge will result in potential impacts to Cultural Heritage Resources. Therefore, a Heritage Impact Assessment was recommended in order to assess the impact of the replacement of the bridge and surrounding cultural heritage landscape, and to recommend mitigation measures or alternative approaches to conserve the heritage attributes of the resource/landscape.

Based on the above recommendation, a Heritage Impact Assessment was completed to specify project's impacts on cultural heritage resources and recommend mitigation measures. Impacts and mitigation measures from the Heritage Impact Assessment are provided in Section 9.3.

Built Heritage and Cultural Landscape Assessment Report is provided in Appendix B, and the Heritage Impact Assessment Report is provided in Appendix C.

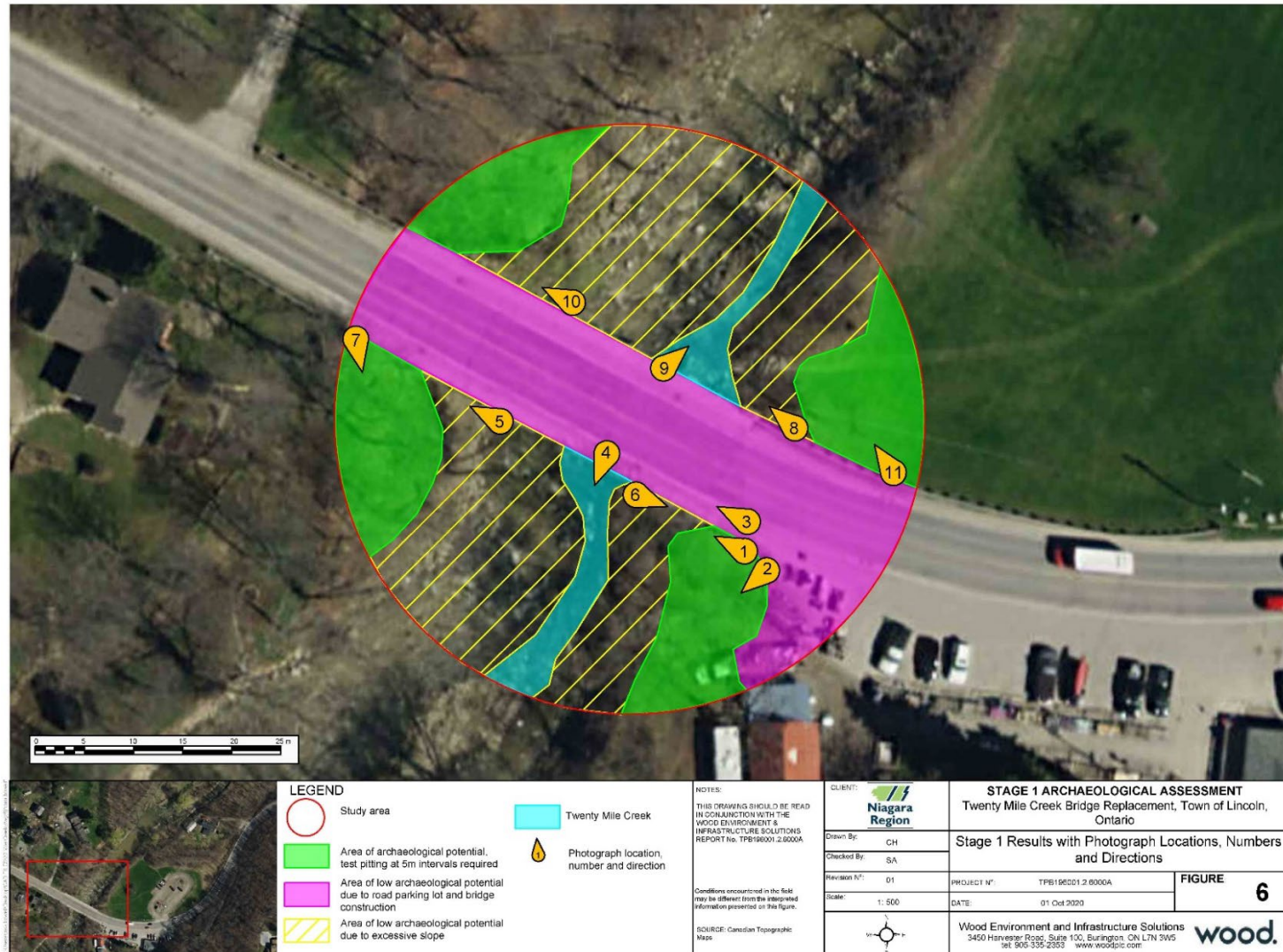
5.3.2 Archaeological Resources

A Stage 1 archaeological assessment was carried out in accordance with the Ontario Ministry of Heritage, Sport, Tourism and Culture Industries' ("MHSTCI") 2011 Standards and Guidelines for Consultant Archaeologists. The project information was acknowledged by the MHSTCI with the issuance of PIF number P354-0060-2020 (Stage 1) extended to 30 September 2020. The Stage 1 archaeological assessment identified that undisturbed portions of lands adjacent to the bridge have archaeological potential and warrant Stage 2 property assessment for three principal reasons: 1) the presence of a natural water source – Twenty Mile Creek; 2) the known presence of eighteen archaeological sites within a 1-km radius; and 3) the close proximity of the historical settlement of Jordan Village and the location of the study area on a main transportation road. The areas of archaeological potential will require a Stage 2 Archaeological Assessment prior to any land disturbance activities. The areas of archaeological potential are shown on Figure 5-9. The Stage 2 Archaeological Assessment will be completed during detailed design phase of the project.

The Stage 1 Archaeological Assessment Report was shared with the local Indigenous Nations for review and comment. Indigenous consultation is discussed in Section 11.4.

The Stage 1 Archaeological Assessment Report is provided in Appendix D.

Figure 5-9: Areas of Archaeological Potential



Photos referenced in Figure 6 can be found in the Stage 1 AA report in Appendix D.

5.4 Natural Environment

The section provides a description of existing conditions related to the following:

- Aquatic Ecosystem
- Terrestrial Ecosystem
- Flooding Hazards
- Stormwater
- Groundwater
- Drinking Water Source
- Soil

5.4.1 Aquatic Ecosystem

The aquatic Study Area for this report was defined as the area from 200 m downstream to 50 m upstream of the bridge, subdivided into Detailed and General Assessment Zones. The Study Area for aquatic ecosystem assessment is shown in Figure 5-10.

A detailed description of methodology of aquatic ecosystem assessment and results are provided in the Natural Environment Assessment Report (Appendix E).

5.4.1.1 Secondary Source Information Review

The following secondary sources were reviewed to develop an understanding of existing aquatic ecosystem within the Study Area:

- Federal aquatic SAR mapping (Fisheries and Oceans Canada, 2021);
- MNDMNRF GeoHub LIO (LIO) Aquatic Resource Area (ARA) Database (Ministry of Northern Development, Mines, Natural Resources and Forestry, 2021);
- Species at Risk Public Registry database (Species At Risk Act, 2002);
- Twenty Mile Creek Watershed Plan (Niagara Peninsula Conservation Authority, 2006)

5.4.1.2 Field Investigations

Qualified Wood staff completed aquatic habitat and fish community surveys in 2019 and 2020. The aquatic habitat assessment was completed on 18 November 2019 following the Ministry of Transportation (MTO) Environmental Guide for Fish and Fish Habitat (Ministry of Transportation Ontario, 2013). The assessment included detailed

assessments 50 m downstream to 20 metres upstream, with general assessments 50 to 200 metres downstream and 20 to 50 metres upstream (Figure 5-10). Summer and fall fish community surveys were completed on 3 September 2020 (902 electrofishing seconds) and 7 December 2020 (1,600 electrofishing seconds), respectively (Table 5-1). Fish community surveys were completed using a Halltech backpack electrofisher with one person netting. As required, a licence to collect fish for scientific purposes was received from the MN DMNR prior to fishing (#GL2020-1636), and a mandatory report was submitted to MN DMNR, on 22 January 2021, after completion of the fish surveys.

Table 5-1: Summary of Aquatic Surveys

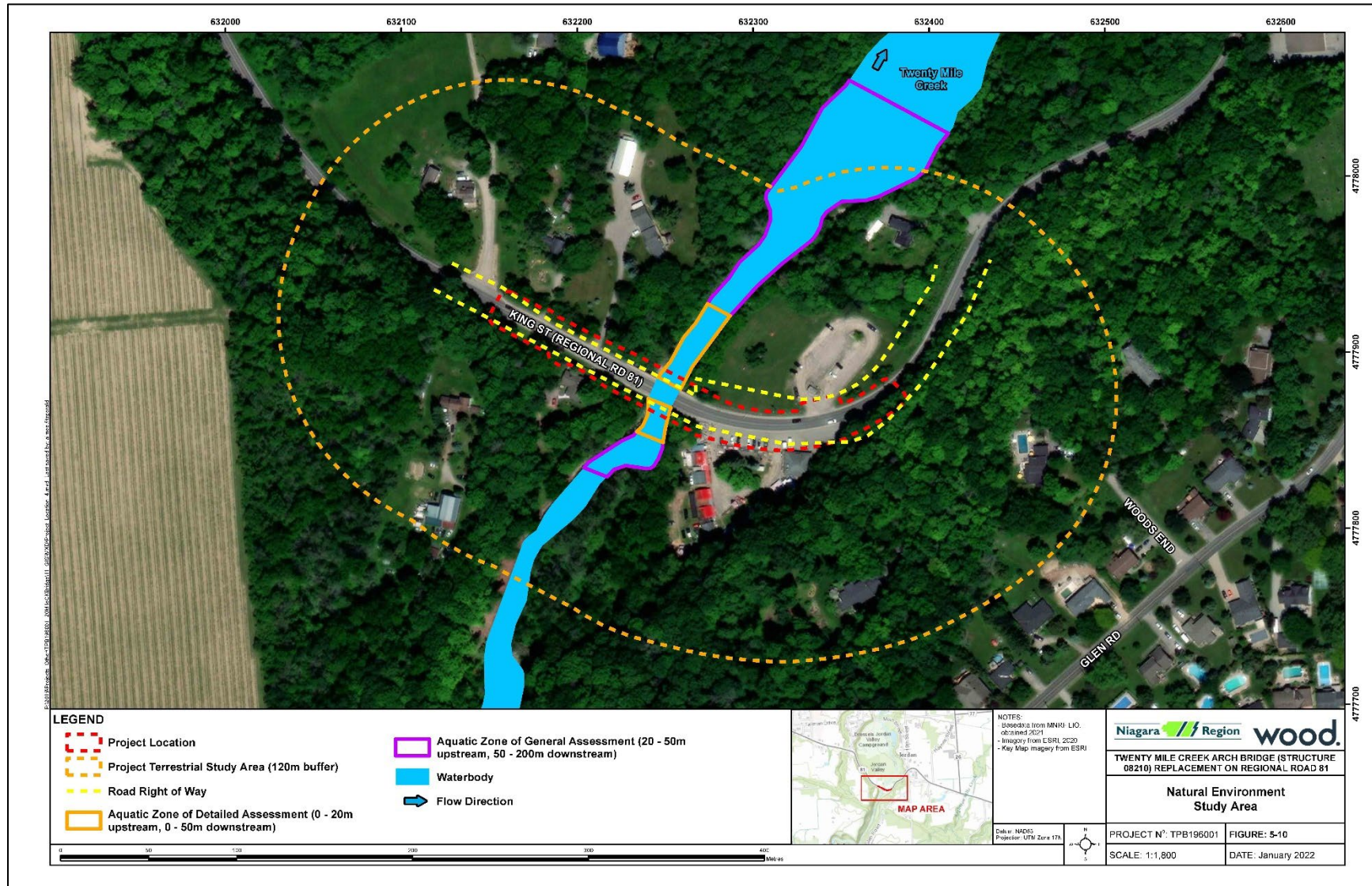
Field Survey Completed	Date
Aquatic Habitat Assessment	18 November 2019
Summer Fish Community Survey	3 September 2020
Fall Fish Community Survey	7 December 2020

5.4.1.3 Aquatic Ecosystem

Twenty Mile Creek is located within the Twenty Mile Creek watershed, the second-largest watershed within the jurisdiction of the NPCA. It is located in the City of Hamilton and the Regional Municipality of Niagara, including the Town of Lincoln, Township of West Lincoln, and Town of Grimsby. The watershed is divided into subwatersheds with Twenty Mile Creek located within the Twenty Mile Creek subwatershed. The main branch of Twenty Mile Creek originates in the former municipality of Glanbrook (now City of Hamilton), and the creek outlets to Lake Ontario at Jordan Harbour in the Town of Lincoln. Within the Study Area, the Twenty Mile Creek flows under the Twenty Mile Creek Bridge from south to north.

The Twenty Mile Creek subwatershed's main land use is agriculture, and the crops grown include corn, wheat, and grapes for wine (Niagara Peninsula Conservation Authority, 2006). The Twenty Mile Creek is identified as warmwater creek with Type I and II habitat. Type I habitat contains sensitive fish species and/or habitat. Type II habitat is important to the fish community, but it is below its productive capacity. The fish community in this creek is comprised of species that are tolerant of the creek's warm water thermal regime.

Figure 5-10: Natural Environment Study Area



Summer base flow in Twenty Mile Creek and most of its tributaries is very low with no base flow upstream of the Niagara Escarpment during the summer months. Baseflow is low to non-existent in the summer due to a combination of factors related to land use such as loss of storage in forested areas, soil compaction, soil loss, and tile drainage. There may also be surface water losses via bedrock fractures and karst features (Niagara Peninsula Conservation Authority, 2006).

As noted in Section 5.4.1.2, aquatic habitat assessment was completed on 18 November 2019 which included detailed assessments 50 m downstream to 20 metres upstream, with general assessments 50 to 200 metres downstream and 20 to 50 metres upstream (Figure 5-10). Summer and fall fish community surveys were completed on 3 September 2020 (902 electrofishing seconds) and 7 December 2020 (1,600 electrofishing seconds), respectively (Table 5-1). Aquatic conditions for the assessed reach of the creek are summarized below and illustrated on the map provided in Figure 5-11, and select photographs provided in Figure 5-12 to Figure 5-15.

Within the assessed reach, Twenty Mile Creek was identified to be representative of a naturalized system with a morphology that primarily consists of riffles and runs. During field investigations in fall of 2019 and 2020, the mean wetted depth ranged between 0.25 m and 0.7 m throughout the assessed reach (Figure 5-12 and Figure 5-13). During summer 2020 field investigation, the assessed channel was predominantly dry with small, shallow, isolated pockets of water present (Figure 5-14 and Figure 5-15). This observation is consistent with the information provided in the Twenty Mile Creek Watershed Plan, which noted that there is no base flow in Twenty Mile Creek upstream of the Niagara Escarpment during the summer months (Niagara Peninsula Conservation Authority, 2006). Substrates within the assessed channel were mainly comprised of cobble, with boulder and gravel present in order of dominance.

Figure 5-11: Aquatic Conditions

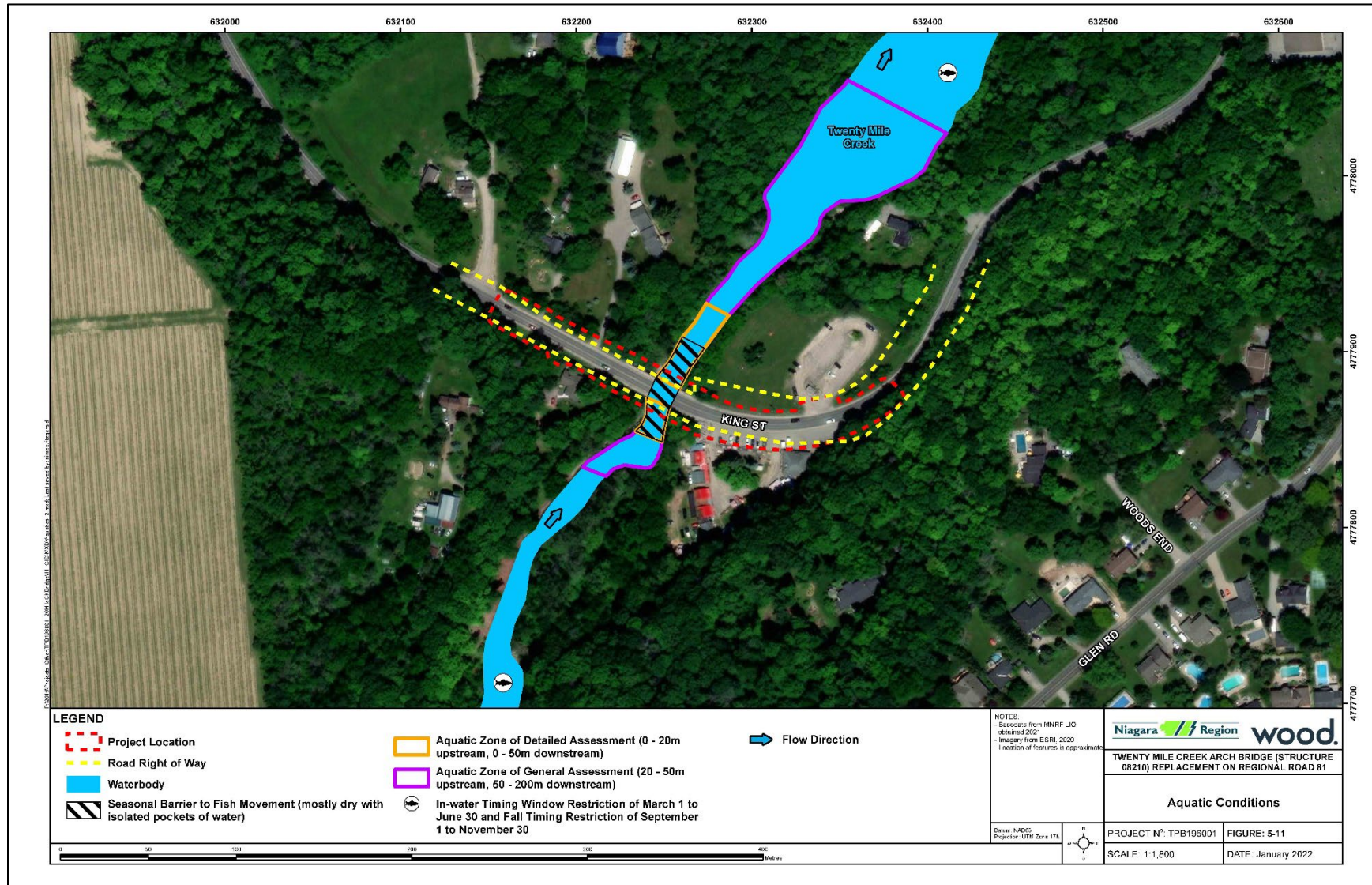


Figure 5-12: Twenty Mile Creek Conditions in November 2019 (upstream from the bridge)



Figure 5-14: Twenty Mile Creek Conditions in September 2020 (upstream from the bridge)



Figure 5-13: Twenty Mile Creek Conditions in November 2019 (downstream from under the bridge)



Figure 5-15: Twenty Mile Creek Conditions in September 2020 (downstream from under the bridge)



5.4.2 Terrestrial Ecosystem

A 120 metres buffer around the bridge and adjacent roadway approaches was identified as the Study Area for Terrestrial Ecosystem Assessment. Terrestrial surveys were completed within the vicinity of the bridge and the adjacent area was included in the secondary source review. Terrestrial Study Area is shown on Figure 5-10.

The Study Area is situated within Ecoregion 7E, the Lake Erie-Lake Ontario Ecoregion, which occupies the southern portion of Ontario. Flora and fauna of this ecoregion are the most diverse in Canada. This ecoregion is the most imperiled in Canada due to the amount of natural habitat drained, cut, and converted into agricultural and suburban land uses (Crins, 2009).

A detailed description of methodology of terrestrial ecosystem assessment and results are provided in the Natural Environment Assessment Report (Appendix E).

5.4.2.1 Secondary Source Information Review

Secondary sources, wildlife atlases, and databases were reviewed to ascertain terrestrial and aquatic information relative to the Study Area. Information relevant to the Study Area included the locations of Natural Heritage System (NHS) features (e.g., PSWs, ANSIs, Environmentally Significant Areas, and vegetation types) as well as records of SAR occurrences. Sources reviewed included, but are not limited to:

- The Ontario Breeding Birds Second Atlas (2001 to 2005) (OBBA) 10 x 10 km survey square 17PH37 (Cadman, Sutherland, Beck, Lepage, & Couturier, 2007);
- eBird (eBird, 2021);
- iNaturalist (iNaturalist, 2021);
- The Atlas of the Mammals of Ontario (AMO) (Dobbyn, 1994);
- The Ontario Reptile and Amphibian Atlas (ORAA) 10 x 10 km survey square 17PH37 (Ontario Nature, 2021);
- The Ontario Butterfly Atlas (OBA) 10 x 10 km survey square 17PH37 (MacNaughton, 2021);
- Species at Risk in Ontario (SARO) List (Endangered Species Act, 2007);
- Ministry of Northern Development, Natural Resources and Forestry (MNDMNR) Natural Heritage Information Centre (NHIC) database square (1 km x 1 km) encompassing the Project includes (square 17PH3277 (Ministry of Northern Development, Mines, Natural Resources and Forestry, 2021);

- Species at Risk Public Registry database (Species At Risk Act, 2002);
- Bat species profiles and range maps for the province of Ontario provided by Bat Conservation International, Inc. (Bat Conservation International, Inc, 2021);
- Twenty Mile Creek Watershed Plan (Niagara Peninsula Conservation Authority, 2006);
- NPCA Natural Areas Inventory (Niagara Peninsula Conservation Authority, 2010) and,
- Topographic data extracted from Land Information Ontario (Ministry of Northern Development, Mines, Natural Resources and Forestry, 2021).

An overview of the NHS identified through the secondary source review process is provided in Figure 5-16 to Figure 5-19.

Figure 5-16: Natural Heritage Features (Provincial)

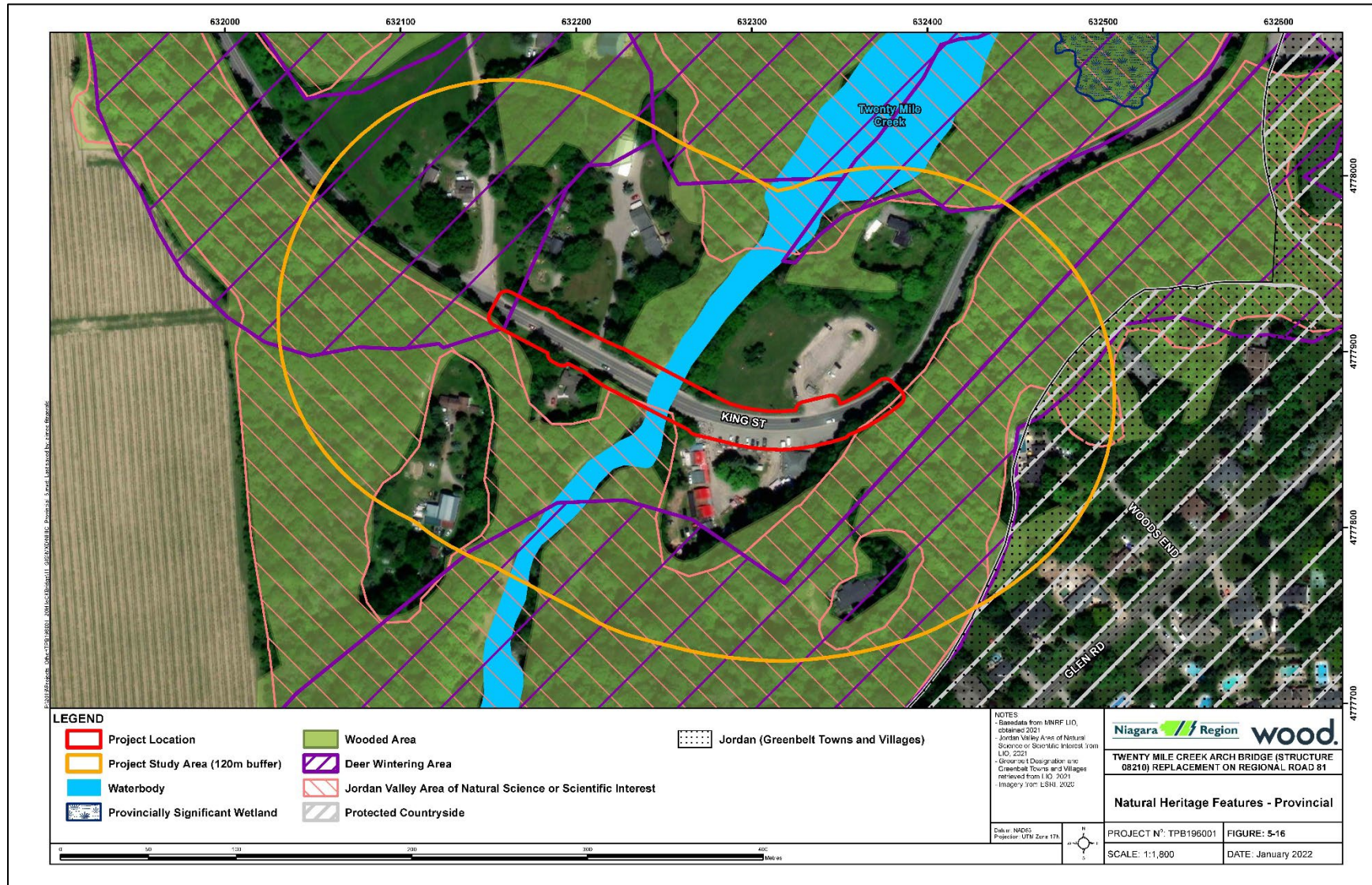


Figure 5-17: Natural Heritage Features (Niagara Region)

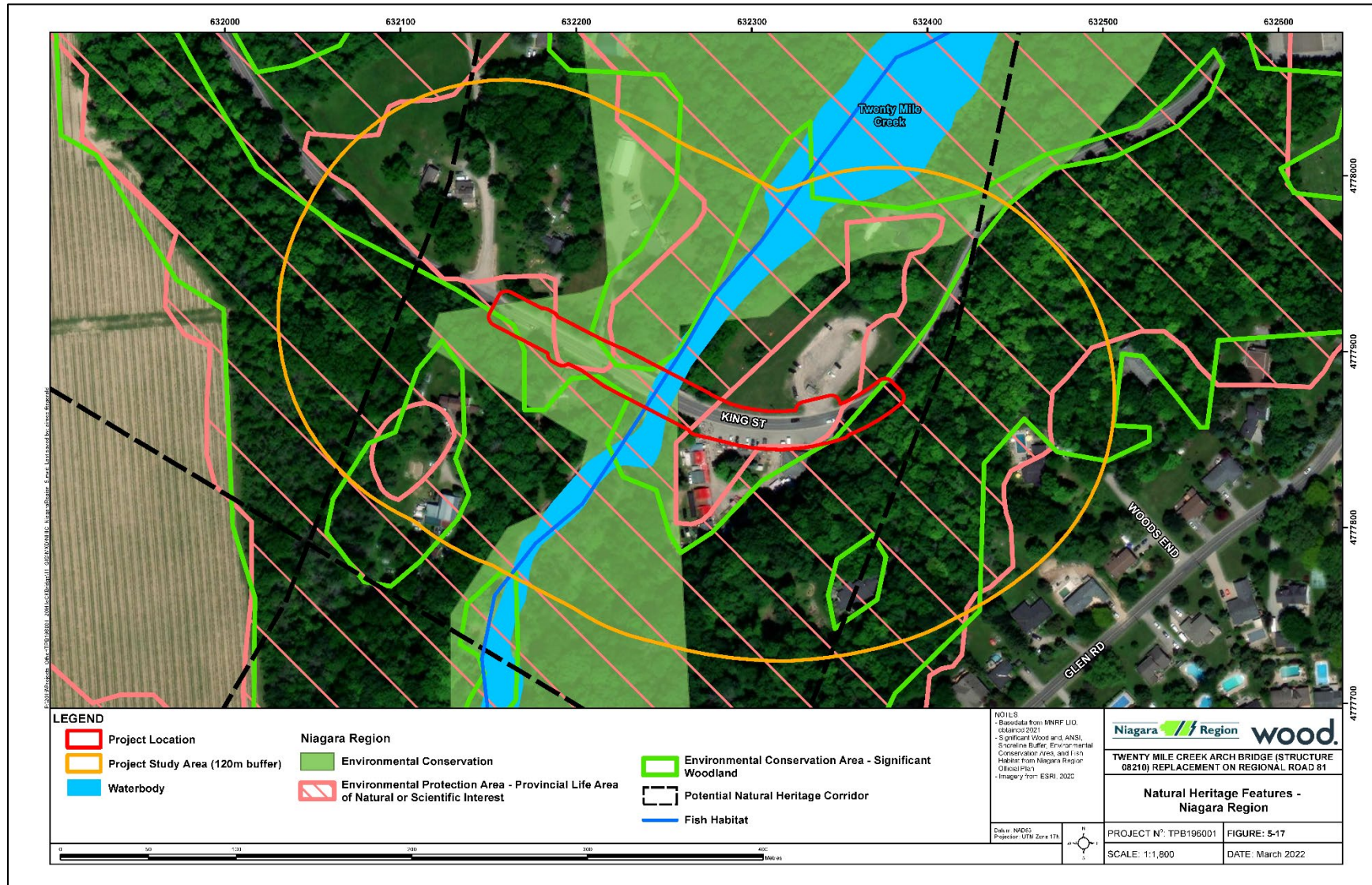
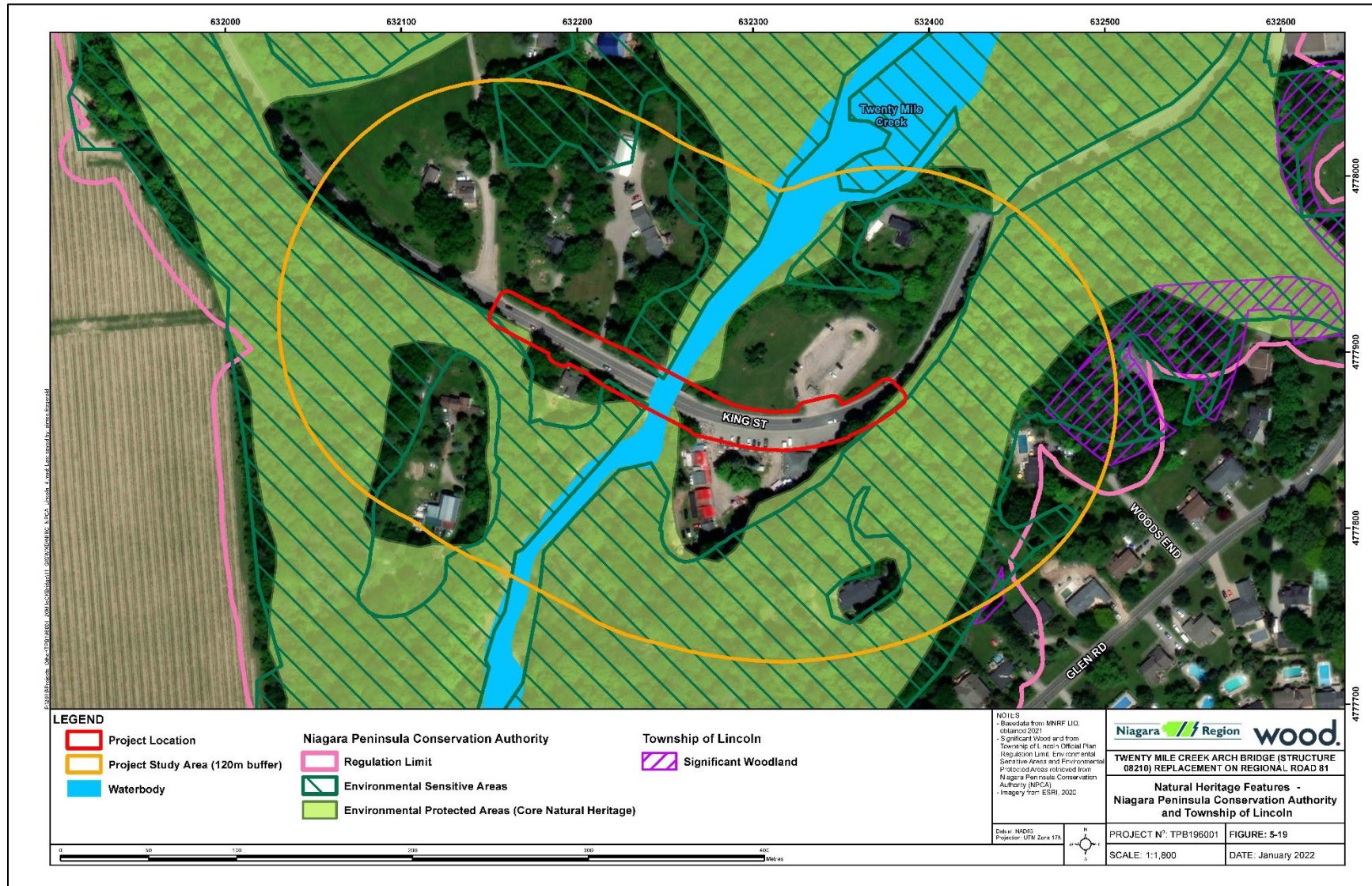


Figure 5-18: Niagara Escarpment Plan Designations



Figure 5-19: Natural Heritage Features - Niagara Peninsula Conservation Authority and Township of Lincoln



5.4.2.2 Field Investigations

Terrestrial surveys included vegetation communities and plant inventory, Butternut tree assessment, bat maternity roost surveys, breeding bird surveys, and amphibian call surveys. The Terrestrial Surveys were conducted by a qualified biologist and arborist. A summary of dates, weather, and surveyors is provided in Table 5-2. A brief description of methodology of each investigation type is provided below.

Table 5-2: Summary of Terrestrial Surveys

Field Survey(s) Completed	Date
Fall Ecological Land Classification Survey	25 September 2019
Leaf off bat maternity roost survey, 1 st round of amphibian call survey	8 April 2020
2 nd round of amphibian call survey	2 May 2020
3 rd round of amphibian call survey	3 June 2020
1 st round of breeding bird survey, Summer Ecological Land Classification, Leaf on bat maternity roost survey	4 June 2020
Butternut tree assessment, 2 nd round of breeding bird survey	19 June 2020

5.4.2.3 Vegetation Communities and Plant Communities

Initially, high-level ELC data was provided to Wood by the NPCA (Figure 5-20) with the information confirmed and/or updated by qualified Wood biologists via field investigations. The following vegetation communities were delineated within the Study Area:

- Manicured;
- Mineral Treed Bluff Ecosite (BLT1);
- Fresh-moist Willow Deciduous Forest (FOD 7-3);
- Fresh-moist Sugar Maple Hardwood Deciduous Forest (FOD6-5);
- Fresh-moist Forb Meadow Ecosite (MEFM-4);

- Deciduous Forest (FOD);
- Open Aquatic (OAO) (i.e., Twenty Mile Creek).

Vegetation communities within the Study Area are illustrated on Figure 5-21, and a brief description of the vegetation communities is provided below.

Wood field investigations identified 11 species within the manicured community. The manicured communities are mostly residential and retail lawns. A manicured park is located on the northeast side of the Twenty Mile Creek Bridge (Figure 5-21). The manicured communities were not completely sampled due to a lack of Permission to Enter on private properties. Tree species included planted Honey Locust, Common Apple, and Sycamore. The Honey Locust was planted in a manicured park to provide shade to the picnic tables. The ground cover was mostly mowed Kentucky Bluegrass and various weeds such as White Clover, Common Plantain, and Black Medick.

A Mineral Treed Bluff (BLT1) plant community was observed along Twenty Mile Creek, northeast, southeast and southwest of the bridge (Figure 5-21). One Butternut tree was found within this community (Butternut 1 - Figure 5-24). The community had steep slopes ranging from 3 to 7 m in height. Historical erosion from the flooding of Twenty Mile Creek created these steep slopes, which are stabilized by trees. The canopy layer was mostly Silver Maple, with lesser amounts of White Ash, and Bitternut Hickory. Below the canopy, the subcanopy contained Black Walnut, Sugar Maple, and White Ash. The sparse understory was mostly Chokecherry and Japanese Honeysuckle. The ground layer consisted of Garlic Mustard, Dame's Rock, and Heart-leave Aster. Some invasive species such as Dame's Rocket, Japanese Honeysuckle, and Lesser Periwinkle were found in the Mineral Treed Bluff. Garden waste from the surrounding manicured areas was also found to be dumped into the Bluff. This likely is how Lesser Periwinkle colonized the community. A hiking trail that follows along the east side of Twenty Mile Creek is within the Mineral Treed Bluff.

A Fresh-moist Willow Lowland Deciduous Forest Type (FOD7-3) was present beside the river on the southeast side (Figure 5-21). This is another forest community that would experience more flooding than most of the other ELC communities, as it was within the floodplain of Twenty Mile Creek. The forest here was dominated by a willow species, with lower amounts of Manitoba Maple, Eastern Cottonwood, and Large-toothed Aspen. Pooling water from previous flooding events was present during the field investigation. The substory was comprised of the same tree species found in the canopy. The understory included Bittersweet Nightshade, Purple-flowering Raspberry, and Grey Dogwood. The ground layer was dominated by Stinging Nettle, Spotted Jewelweed, and Water Smartweed. The locally rare (Niagara Peninsula Conservation Authority, 2010; Oldham, 2017) and naturally growing Butterfly Milkweed was found in this community.

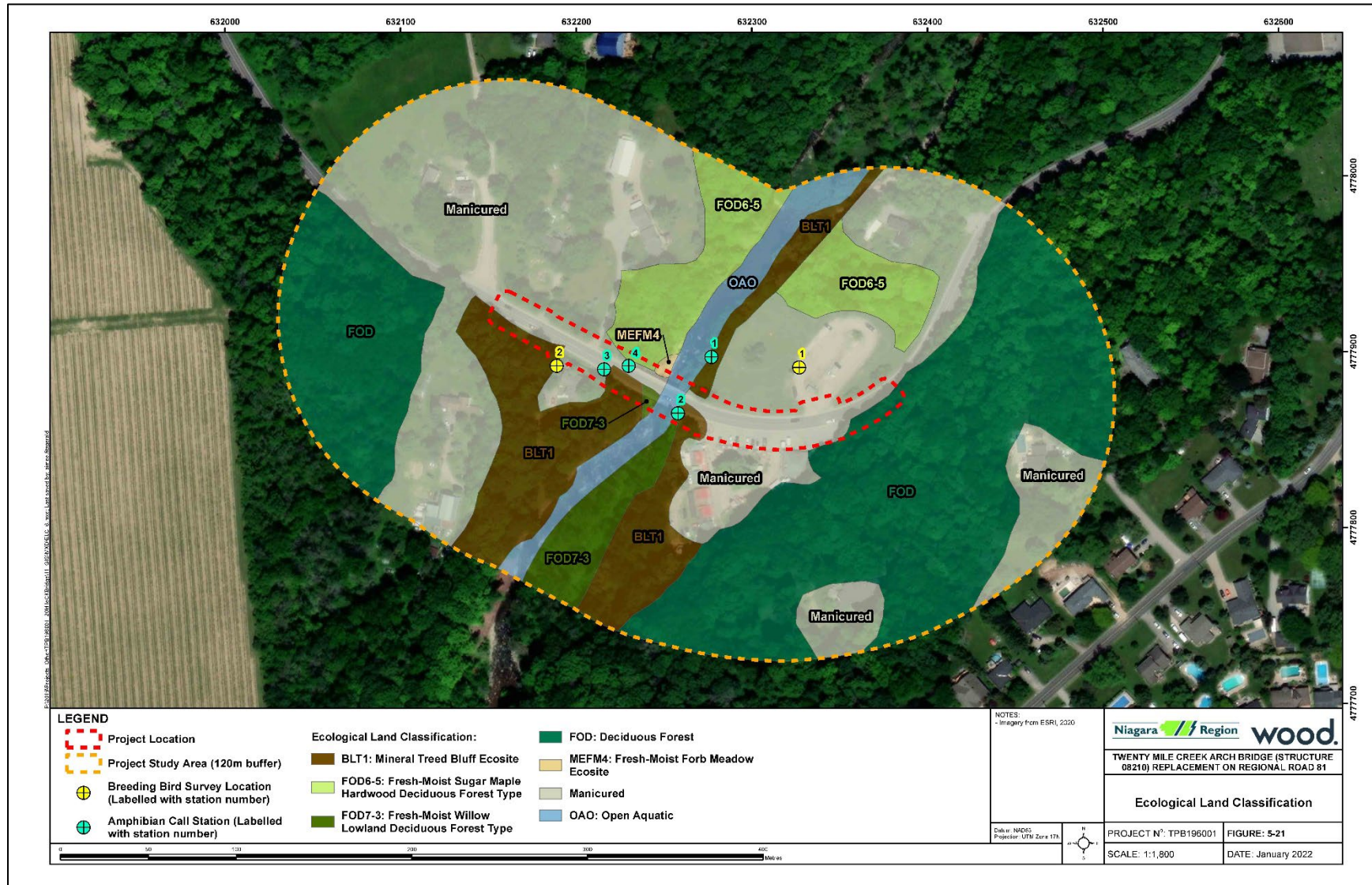
Fresh-moist Sugar Maple Hardwood Deciduous Forest Type (FOD6-5) community is in two locations; between the creek and the manicured property on the northwest side of the bridge and on the northeast side of the bridge north of the park adjacent to the Bluff (Figure 5-21). Sugar Maple dominated the canopy, other tree species present including Silver Maple, Bitternut Hickory, and Basswood. The subcanopy contained White Ash and Sugar Maple. The understory included Riverbank Grape, Black Raspberry, and European Euonymus. One Butternut was found in this community (Butternut 2 - Figure 5-24). May-apple, Wild Lily-of-the-valley, and Zigzag Goldenrod were common in the understory.

A small Fresh-moist Forb Meadow (MEFM4) was found on the northwest corner of the intersection of Twenty Mile Creek and the bridge. The only tree species found in this community was Eastern Cottonwood. The Eastern Cottonwood was in the canopy. Below this was a dense understory layer filled with Tall Goldenrod, New England Aster, and Great Ragweed. The understory also contained Reed Canary Grass and Spotted Jewelweed. This community would frequently be disturbed by flooding, thus preventing the establishment of trees.

Figure 5-20: Ecological Land Classification based on Niagara Peninsula Conservation Authority



Figure 5-21: Ecological Land Classification based on Field Investigations by Wood



5.4.2.3.1 Species at Risk Plants (Butternut)

As noted above, two Butternut trees were identified within the Study Area through vegetation community assessment and plant inventory. For the purpose of this report, these trees were named as Butternut 1 and Butternut 2. The location of the two Butternut trees is shown on Figure 5-24.

Butternut 1 was assessed as a pure Butternut using the Field Identification of Butternut Hybrids form (Ontario Ministry of Natural Resources and Forestry, 2014), scoring zero. The traits used to assess the score were leaf length and color of the bar fissures on mature trees. These two traits were used because none of the other traits could be accurately assessed as the tree was tall and on the edge of a steep slope. The DBH of the tree was 39 cm, and the stem was 10 m long below the crown. Generally, it was in poor condition, with many open and sooty cankers from the roots to greater than 2 m up the stem. The live crown was placed at 75% alive. This tree is located just outside of the south end of the Study Area.

Figure 5-22: Photo of Butternut 1 (20 June 2020)



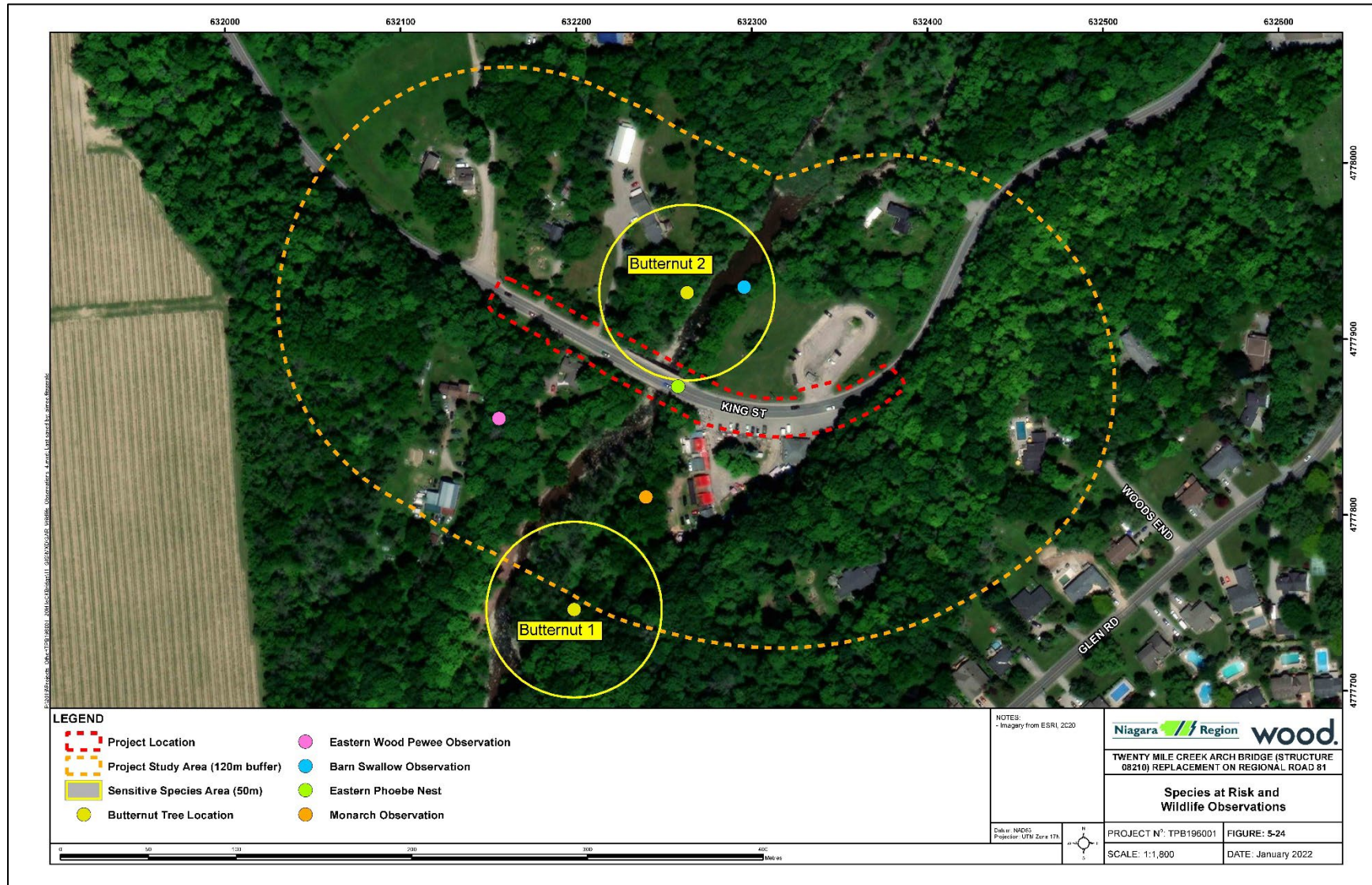
Butternut 2 scored a zero, indicating that it was also pure Butternut on the Field Identification of Butternut Hybrids form (Ontario Ministry of Natural Resources and Forestry, 2014). This tree had been dead for several years so the only trait that could be evaluated was the colour of bark fissures. All the other traits could not be evaluated due to the decaying state of the tree. This tree had a DBH of 10 cm and a stem length of 3 m below the crown. The tree was located 45 m north from the subject bridge along Twenty Mile Creek (Figure 5-24).

Figure 5-23: Photo of Butternut 2 (20 June 2020)



True Butternuts and their habitat are protected under the Ontario *Endangered Species Act* (ESA) (Ontario Ministry of Natural Resources and Forestry, 2014). As part of the review of this draft report, the MECP advised that there is a new regulation for Butternut in Ontario ([Ontario Regulation 830/21](#)). The Ministry also advised that the ESA does not apply to dead Butternut trees. Past research shows that the bulk of the Butternut seedlings that established themselves did so within 25 to 50 m from the parent tree (Hewitt, N., and M. Kellman., 2002). Ontario's Butternut Recovery Strategy recommends that the area considered in developing a habitat regulation for Butternut include a minimum radius of 25 m from the base of the stem of the tree, irrespective of the tree's size (Poisson, G., and M. Ursic, 2013). As noted above, Butternut 1 and Butternut 2 are located more than 25 m from the subject bridge (Figure 5-24).

Figure 5-24: Species at Risk and Wildlife Observations



5.4.2.4 Wildlife

5.4.2.4.1 Fish and Mussels

A total of thirty fish and two mussel species were identified within Twenty Mile Creek through Wood fish community surveys, agency consultation and online databases. Fourteen fish species were collected during the fish community surveys, including Rainbow Trout during the fall 2020 survey. One provincially Special Concern fish and two provincially Threatened mussels were identified through online databases and agency consultation. They are as follows:

- Grass Pickerel – Special Concern;
- Lilliput Mussel – Threatened; and
- Mapleleaf Mussel – Special Concern.

Aquatic SAR are discussed further in Section 5.3.3.2.6.

5.4.2.4.2 Birds

Combining the OBBA, eBird, and NHIC lists resulted in 110 identified species of birds, including five Threatened and three Special Concern SAR potentially within the Study Area. Given the vegetative characteristics and habitat suitability observed during the field investigations, there is a high probability for SAR birds, as well as other nesting birds, to occur within the Study Area. A summary of those SAR birds are as follows:

- Barn Swallow – Threatened;
- Bank Swallow – Threatened;
- Bobolink – Threatened;
- Chimney Swift – Threatened;
- Eastern Meadowlark – Threatened;
- Red-headed Woodpecker – Special Concern;
- Common Nighthawk – Special Concern;
- Eastern Wood-pewee – Special Concern;
- Peregrine Falcon – Special Concern; and
- Wood Thrush – Special Concern.

A total of 21 bird species were recorded during Breeding Bird Surveys, including one Threatened SAR (Barn Swallow) and one species of Special Concern (Eastern Wood-pewee). A Carolina Wren, a Carolinian forest indicator, was found in the Study Area. Further to this, the bridge and the nearby banks of Twenty Mile creek were searched for the presence of birds' nests, namely Barn Swallow and Bank Swallow. No nests of these species were found. Species at Risk are further discussed in Section 5.3.3.2.6 below.

A total of two bird species, American Robin and Eastern Phoebe, were confirmed breeding in the Study Area. The Eastern Phoebe was found building a nest on a storm sewer on the north side of the bridge where the trail goes under the bridge. The only bird identified as probably breeding in the Study Area was Cedar Waxwing. Most of the birds observed were possibly breeding in the Study Area. These birds included:

- Blue Jay;
- Brown-headed Cowbird;
- Baltimore Oriole;
- Belted Kingfisher;
- Carolina Wren;
- Chipping Sparrow;
- Common Grackle;
- Downy Woodpecker;
- Eastern Wood-pewee;
- Gray Catbird;
- Great Crested Flycatcher;
- House Sparrow;
- Mourning Dove;
- Northern Cardinal;
- Northern Flicker;
- Red-bellied Woodpecker;
- Red-eyed Vireo;
- Rose-breasted Grosbeak;
- Song Sparrow; and,
- White-breasted Nuthatch.

Only Barn Swallow was observed to have no evidence of breeding in the Study Area. Barn Swallows were seen foraging over the north portion of the Creek in the Study Area (Figure 5-24). The Eastern Wood-pewee was heard calling from the tree bluff community on the southeast side of the intersection of Regional Road 81, and Twenty Mile Creek (Figure 5-24). The Eastern Wood-pewee was observed and an indicator species of Significant Wildlife Habitat.

5.4.2.4.3 Mammals

A total of 41 species of mammals have habitat ranges that overlap the Study Area, as reported in the AMO (Dobbyn, 1994). Bat Conservation International (BCI) ranges for bats in Ontario include seven species whose ranges encompass the Study Area (Bat Conservation International, Inc, 2021; Bat Conservation International, Inc, 2021). It is important to note that the exact locations of species occurrences are not available from

either the atlas or BCI. A total of four mammal SAR were identified through the background information review, all of which are Endangered bats. Species at Risk are further discussed in Section 5.3.3.2.6.

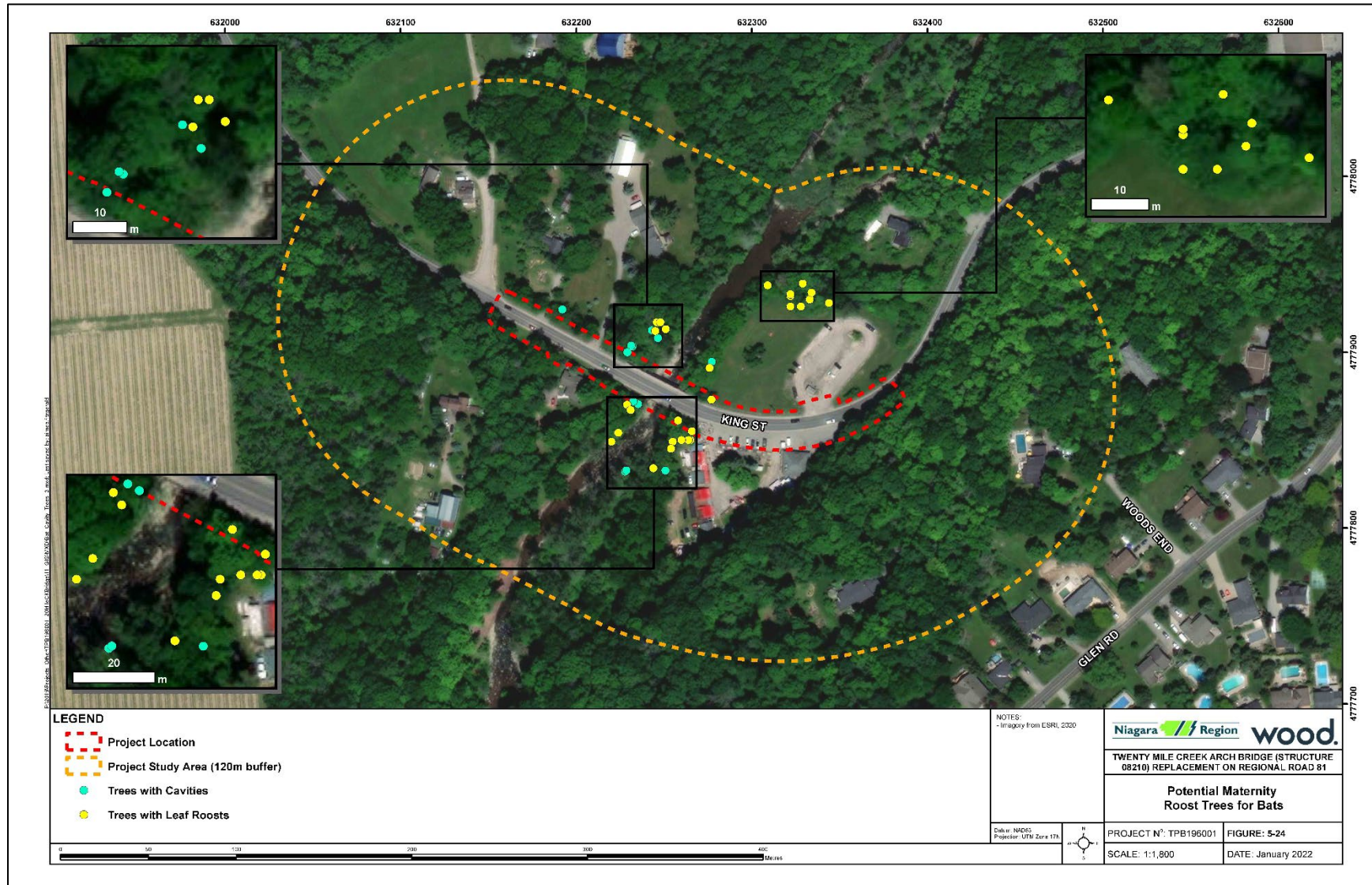
Given the vegetative characteristics and habitat suitability observed during the field investigations, there is a high probability for SAR bats, as well as non-SAR bats, to occur in the Study Area (Refer to Table 5-3).

To further characterize potentially suitable bat habitat within the Study Area, bat maternity roost surveys were undertaken. A total of 41 maternity roost trees were found within the Study Area. A total of 12 trees were found to have possible roosting cavities, and 29 were trees with potential leaf roosts. Trees with possible roosting cavities were large (most above 30 cm DBH) and were comprised of mostly Sugar Maple. Most of the potential roosting cavities trees were found to be alive (decay class 1 to 3). The potential leaf roosting trees were mostly Sugar Maple and had a wide range of sizes, from 13 to 53 cm DBH. The potential leaf roosting trees were mostly healthy (decay class 1 and 2). A snag density of 70/ha was present within the Study Area, which meets the requirements for Significant Wildlife Habitat. The locations of these maternity roost trees are shown on Figure 5-25.

Incidental wildlife observations included Northern Raccoon, Eastern Gray Squirrel, Eastern Chipmunk, and Red Squirrel. LIO identified most of the forest around the periphery of the Study Area as deer wintering area.

A complete list of mammals identified through the background information review and field investigations is provided in Appendix D of the Natural Environment Assessment Report.

Figure 5-25: Potential Maternity Roost Trees for Bats



5.4.2.4.4 Reptiles and Amphibians

A total of 21 species of amphibians and reptiles were reported in the ORAA (Ontario Nature, 2021) square that encompasses the Study Area. This includes one Endangered snake, one Endangered lizard, and one Special Concern reptile. They are as follows:

- Snapping Turtle – Special Concern;
- Five-line Skink - Endangered; and,
- Gray Ratsnake – Endangered.

Five-line Skink and Gray Ratsnake are very rare in Niagara Region and likely do not occur in the Study Area. Five-line Skink was last seen in 1935 in the general area, and the Gray Ratsnake was last seen in 1988 in the general area. Species at risk are further discussed in Section 5.3.3.2.6.

Two amphibian call surveys were completed within the Study Area, though no amphibians were recorded during these surveys. Additionally, the Study Area was searched for the presence of vernal pools and wetlands, which may provide suitable breeding habitat. Pooling water that breeding amphibians could use was found in the Fresh-moist Willow Lowland Deciduous Forest Type. One frog species and one snake species were recorded incidentally during field investigations. A Green Frog was seen in the Fresh-moist Willow Lowland Deciduous Forest Type. A Northern Watersnake was seen on two different field investigations, once basking in vegetation on the Bluff and once in the creek and on the adjacent cobble.

A complete list of all reptiles and amphibians identified through the background information review and field investigations is provided in Appendix D of the Natural Environmental Assessment Report. It is important to note that the exact locations of species occurrences are not available from the Atlas. Given the characteristics of the Study Area, there is a moderate probability for most of the species documented to be present in the vicinity of the bridge.

5.4.2.4.5 Butterflies

Wood staff observed two butterfly species incidentally within the Study Area, Eastern Tiger Swallowtail and Monarch. Monarch is listed as Special Concern in Ontario and was seen flying along the Treed Bluff (Figure 5-24). Monarch is an indicator species of Significant Wildlife Habitat migratory butterfly stopover areas (Ontario Ministry of Natural Resources and Forestry, 2015) with Monarch discussed in Section 5.3.3.2.6. The Ontario Butterfly Atlas identified 63 species, with Monarch being the only SAR (MacNaughton, 2021). It is important to note that the exact locations of species occurrences are not available from the Atlas (MacNaughton, 2021). Consequently, it is

possible that some of these species reported in the Ontario Butterfly Atlas do not occur in the Study Area but have been reported in the much larger Atlas square.

5.4.2.4.6 Species at Risk and Species of Conservation Concern

A Species at Risk Screening was completed as part of the development of the Natural Environment Assessment. This assessment was completed based on field investigations and secondary source information. This screening described probabilities of occurrence of species at risk based on an assessment of each species' habitat preferences/needs in conjunction with background information and field investigations. The probabilities of occurrence were defined as 'High', 'Moderate', 'Low', and 'None'.

The Species at Risk Screening identified three species at risk as confirmed, four have a high probability of occurrence, four a low to moderate and eight have a low potential for habitat or occur in the Study Area. Detailed screening is provided in Table 5-3.

It is important to recognize that additional species at risk may come into the area, or species already occurring in the area may be up-listed at any time.

Table 5-3: Species at Risk Potential Occurrence

Species Name, Status (SARA, ESA, S-Rank), and Data Source	Preferred Habitat	Potential for SAR Habitat / Occurrence in the Study Area
Birds		
Bank Swallow (<i>Riparia riparia</i>) SARA: Threatened ESA: Threatened S-Rank: S4B Source: Ontario Breeding Bird Atlas	Bank Swallows nest in burrows in natural and human-made settings where there are vertical faces in silt and sand deposits. Many nests are on banks of rivers and lakes, but they are also found in active sand and gravel pits or former ones where the banks remain suitable (Falconer, 2016).	Low to Moderate – Reported near the Study Area by the OBBA. There are some steep banks along the creek, but the banks seemed to be solid material. No evidence of nesting was found during the field surveys. Breeding bird surveys did not find this species to be in the Study Area.
Barn Swallow (<i>Hirundo rustica</i>) SARA: Threatened ESA: Threatened S-Rank: S4B Source: Ontario Breeding Bird Atlas and Wood	Barn Swallows have shifted largely to nesting in and on artificial structures, including buildings, bridges, and road culverts, and prefer various open habitats for foraging including grassy fields, pastures, agricultural crops, and over open water (Heagy, et al., 2014).	Confirmed – Reported near the Study Area by OBBA and seen by Wood in the Study Area and foraging habitat is in the Study Area (Figure 5-22). The Twenty Mile Creek Bridge was searched during the field surveys and no nests were found. The bridge does not appear to provide suitable breeding habitat. Breeding bird surveys did not find this species to be breeding in the Study Area.
Bobolink (<i>Dolichonyx oryzivorus</i>) SARA: Threatened ESA: Threatened S-Rank: S4B Source: Ontario Breeding Bird Atlas	Bobolink nest primarily in forage crops, hayfields, and associated pastures. Bobolink also occur in wet prairie, graminoid peatlands and abandoned fields dominated by tall grasses, no-till cropland, small-grain fields, reed beds and irrigated fields in arid regions. The species does not generally occupy fields of row crops such as corn, soybean and wheat, pastures in valleys with high shrub density or intensively grazed pastures (McCracken, et al., 2013).	Low – Reported near the Study Area by OBBA. No breeding habitat is present. Breeding bird surveys did not find this species in the Study Area.
Chimney Swift (<i>Chaetura pelagica</i>) SARA: Threatened ESA: Threatened S-Rank: S4B, S4N Source: Ontario Breeding Bird Atlas	Chimney swifts forage aerially over virtually any habitat. Nesting and roosting take place in a dark sheltered spot with vertical surfaces to cling to. This may include large hollow trees, chimneys, and other structures (COSEWIC, 2007).	Moderate – Reported near the Project Study Area by OBBA. Foraging habitat may be present in the Study Area. Breeding bird surveys did not find this species to be in the Study Area.
Eastern Meadowlark (<i>Sturnella magna</i>) SARA: Threatened	Eastern Meadowlarks nest in a variety of open grassy habitats, preferring native grasslands, pastures, and savannahs. Larger	Low – Reported near the Study Area by OBBA. No breeding habitat is present. Breeding bird surveys did

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Species Name, Status (SARA, ESA, S-Rank), and Data Source	Preferred Habitat	Potential for SAR Habitat / Occurrence in the Study Area
ESA: Threatened S-Rank: S4B Source: Ontario Breeding Bird Atlas	tracts of grassland are preferred (McCracken, et al., 2013).	not find this species in the Study Area.
Eastern Wood-pewee (<i>Contopus virens</i>) SARA: Special Concern ESA: Special Concern S-Rank: S4B Source: Ontario Breeding Bird Atlas and Wood	Eastern Wood-pewee breed in mature to intermediate-aged forests with an open understory, often being associated with clearings and edges. Migrants may occur in a wide variety of habitats (COSEWIC, 2012).	Confirmed – Reported near the Study Area by OBBA. Deciduous woods along the Twenty Mile Creek valley provides breeding habitat (Figure 5-22).
Red-headed Woodpecker (<i>Melanerpes erythrocephalus</i>) SARA: Threatened ESA: Special Concern S-Rank: S4B Source: Ontario Breeding Bird Atlas	Uses a variety of habitats including roadsides, pastures, forest edges, and grasslands (COSEWIC, 2007).	Low to Moderate – Reported near the Study Area by OBBA. Deciduous woods in the vicinity of the bridge could provide breeding habitat. Breeding bird surveys did not find this species in the Study Area.
Wood Thrush (<i>Hylocichla mustelina</i>) SARA: Threatened ESA: Special Concern S-Rank: S4B Source: Ontario Breeding Bird Atlas	Wood Thrush breed in mature or second growth deciduous and mixed wood forests. They prefer forests with dense understory and large continuous areas of forest but are not reliant on this (COSEWIC, 2012a).	Low to Moderate – Reported near the Study Area by OBBA. Deciduous woods in the vicinity of the bridge could provide breeding habitat. Breeding bird surveys did not find this species in the Study Area.
Reptiles		
Common Five-lined Skink (Carolinian Population) (<i>Plestiodon fasciatus</i>) SARA: Endangered ESA: Endangered S-Rank: S3 Source: Ontario Amphibian and Reptile Atlas	Generally, occur near dunes, fields, and deciduous forests. This species is generally associated with relatively open environments (Ministry of the Environment, Conservation and Parks, 2021)	Low – Reported near the Study Area by ORAA. This species was last reported in the area in 1935 and is likely no longer in the area.
Gray Ratsnake (<i>Pantherophis spiloides</i>) SARA: Endangered ESA: Endangered S-Rank: S1 Source: Ontario Amphibian and Reptile Atlas	Uses a variety of habitat including forests and edge habitats. Edge habitats include old fields, meadows, and marshes (Kraus, Hutchinson, Thompson, & Prior, 2010).	Low – Reported near the Study Area by ORAA. This species was last reported in the area in 1988 and is likely no longer in the area.

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Species Name, Status (SARA, ESA, S-Rank), and Data Source	Preferred Habitat	Potential for SAR Habitat / Occurrence in the Study Area
Snapping Turtle (<i>Chelydra serpentina</i>) SARA: Special Concern ESA: Special Concern S-Rank: S4 Source: Ontario Amphibian and Reptile Atlas	Snapping Turtles prefer slow-moving waters with a soft mud bottom and dense aquatic vegetation. Established populations are most often located in ponds, sloughs, shallow bays or river edges and slow streams and wetlands. Individuals can also exist in developed areas (e.g., golf course ponds, irrigation canals); however, it is unlikely that populations persist in such habitats. Snapping Turtles can occur in highly polluted waterways, but environmental contamination is known to limit reproductive success (COSEWIC, 2008).	High – Reported near the Project Study Area by ORAA. Habitat can be found in the Study Area using the Creek.
Mammals		
Tri-colored Bat (<i>Perimyotis subflavus</i>) SARA: Endangered ESA: Endangered S-Rank: S3 Source: Atlas of the Mammals of Ontario (OMA)	Within treed habitats, Tri-colored Bat primarily roosts in tree foliage (mainly within oak leaves). Leaf roosts are shaped like umbrellas with a "roof" and a hollow core where bats rest. Studies have shown that oak leaves are a preferred roost site. Maple leaves are also selected, although less commonly. It is thought that Tri-colored Bat may prefer roost trees in more open woodlands, as opposed to deep woods. Roosts in tree cavity are used less frequently than Myotis species (Ontario Ministry of Natural Resources, 2011).	High – Reported near the Study Area by AMO. Bat maternity roost surveys found a high density of possible roost trees in the Study Area.
Little Brown Myotis (<i>Myotis lucifugus</i>) SARA: Endangered ESA: Endangered S-Rank: S3 Source: Atlas of the Mammals of Ontario	The Little Brown Myotis is widespread throughout the southern half of Canada and is especially associated with humans, often forming nursery colonies in buildings, attics, and other man-made structures. Little Brown Myotis forage over water where their diet consists of aquatic insects, mainly midges, mosquitoes, mayflies, and caddisflies. They also feed over forest trails, cliff faces, meadows, and farmland where they consume a wide variety of insects, from moths and beetles to crane flies (Ontario	High – Reported near the Study Area by AMO. Bat maternity roost surveys found a high density of possible roost trees in the Study Area.

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Species Name, Status (SARA, ESA, S-Rank), and Data Source	Preferred Habitat	Potential for SAR Habitat / Occurrence in the Study Area
	Ministry of Natural Resources, 2011).	
Northern Myotis (<i>Myotis septentrionalis</i>) SARA: Endangered ESA: Endangered S-Rank: S3 Source: Atlas of the Mammals of Ontario	The Northern Myotis is one of the less common species found to hibernate in Ontario. This species is closely associated with woodlands and uses trees as maternity sites (Ontario Ministry of Natural Resources, 2011).	High – Reported near the Study Area by AMO. Bat maternity roost surveys found a high density of possible roost trees in the Study Area.
Eastern Small-footed Myotis (<i>Myotis leibii</i>) SARA: No status ESA: Endangered S-Rank: S2S3 Source: Atlas of the Mammals of Ontario	The Eastern Small-footed Myotis is one of the less common species found to hibernate in Ontario. Caves and mines serve as significant hibernacula while streams and ponds serve as foraging areas (Ontario Ministry of Natural Resources, 2011).	High – Reported near the Study Area by AMO. Bat maternity roost surveys found a high density of possible roost trees in the Study Area.
Invertebrates		
Monarch (<i>Danaus plexippus</i>) SARA: Special Concern ESA: Special Concern S-Rank: S2N, S4B Source: Ontario Butterfly Atlas and Wood	Monarch is very widely distributed across North America and found in a wide variety of habitats. Monarchs require Milkweeds (<i>Asclepias</i>) to lay their eggs and will use a variety of other flowers for adult food (COSEWIC, 2016).	Confirmed – Reported by the Butterfly Atlas as present within the general vicinity Observed by Wood flying in the Study Area. Can use a variety of habitats when migrating.
Aquatic Species		
Grass Pickerel (<i>Esox americanus vermiculatus</i>) SARA: Special Concern ESA: Special Concern S-Rank: S3 Source: DFO, NHIC	Generally, occur in wetlands with warm, shallow water and an abundance of aquatic plants; occur in the St. Lawrence River, Lake Ontario, Lake Erie, and Lake Huron (COSSARO, 2021).	Low to Moderate – Identified as potentially occurring within Twenty Mile Creek, within the entire Study Area, on DFO aquatic SAR mapping. However, aquatic vegetation is minimal within the Study Area. Not observed during field investigations. May pass through the Study Area if suitable habitat is present upstream and/or downstream.
Lilliput Mussel (<i>Toxolasma parvum</i>) SARA: Endangered ESA: Threatened S-Rank: S1 Source: DFO	A mosaic of habits including large to small rivers, wetlands, lakes, and ponds. Usually in areas with soft substrates like silt, sand, and mud (COSSARO, 2013).	Low – Identified as potentially occurring within Twenty Mile Creek, within the entire Study Area, on DFO aquatic SAR mapping. However, substrate is not suitable within the Study Area. Not observed during field investigations.

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Species Name, Status (SARA, ESA, S-Rank), and Data Source	Preferred Habitat	Potential for SAR Habitat / Occurrence in the Study Area
Mapleleaf Mussel (<i>Quadrula fragosa</i>) SARA: Threatened ESA: Special Concern S-Rank: S2 Source: DFO, NHIC	Medium to large rivers with slow to moderate flows. The substrates are usually sand or gravel (COSSARO, 2017).	Low – Identified as potentially occurring within Twenty Mile Creek, within the entire Study Area, on DFO aquatic SAR mapping. Predominantly cobble substrate not suitable for species. Fast flows observed during fall survey also not suitable. Not observed during field investigations.
Plants		
Butternut (<i>Juglans cinerea</i>) SARA: Endangered ESA: Endangered S-Rank: S3? Source: Wood	Generally, grows in rich, moist, and well-drained soils often found along streams. It may also be found on well-drained gravel sites, especially those made up of limestone. It is also found, though seldomly, on dry, rocky, and sterile soils. In Ontario, the Butternut generally grows alone or in small groups in deciduous forests as well as in hedgerows (Poisson, 2013).	Confirmed – Two Butternuts were found. Butternut 1 was found just outside the Study area along the Bluff, while Butternut 2 was found in the floodplain north of the subject bridge (Figure 5-22).
Green Dragon (<i>Arisaema dracontium</i>) SARA: Special Concern ESA: Special Concern S-Rank: S3 Source: NHIC (2002)	Grows in moist deciduous woods along watercourses (Donley, Jalavan, & Overbeeke, 2013)	Low – Reported within the NHIC square encompassing the Study Area. The Twenty Mile Creek valley could provide habitat for this species. Vegetation surveys did not find this species.
Red Mulberry (<i>Morus Rubra</i>) SARA: Endangered ESA: Endangered S-Rank: S2 Source: NHIC (1998)	The Red Mulberry is rare in Ontario and is often associated with forested valleys and floodplains (Ministry of the Environment, Conservation, and Parks, 2021).	Low – Reported within the NHIC square encompassing the Study Area. The Twenty Mile Creek valley could provide habitat for this species. Vegetation surveys did not find this species.

5.4.2.5 Natural Heritage System

The Natural Heritage System includes natural areas (e.g., wildlife habitat) wetlands, valleys, SAR habitat, and watercourse corridors. Some features that make up the Natural Heritage System are of higher quality than others and may be considered significant. A review of the Natural Heritage System is provided in the following sections.

5.4.2.5.1 Significant Wetland and Fish Habitat

Wetlands are defined as areas that are seasonally or permanently covered by shallow water, as well as lands where the water table is close to or at the surface (Lee, et al., 1998). A significant wetland is an area identified as a PSW by the MNRF using evaluation procedures established by the Province, as amended from time to time (Lee, et al., 1998).

Fish habitats are identified as spawning grounds and nursery, rearing, food supply, and migration areas on which fish depend directly and or indirectly to carry out their life processes (Lee, et al., 1998). Fish habitats commonly occur in many natural heritage areas such as wetlands, valleylands, woodlands and ANSIs.

Based on a review of secondary source material and available online databases, there are no PSWs located within the Study Area. There is a PSW located approximately 100 m northwest of the subject bridge, outside of the Study Area (Figure 5-11). Aquatic Surveys found fish habitat in the within the Creek.

5.4.2.5.2 Significant Woodlands

Woodlands are treed areas that provide environmental or economic benefits such as erosion prevention, water retention, recreation, and the sustainable harvest of woodland products. Woodlands include treed areas, woodlots, or forested areas, and vary in their level of significance (Ministry of Municipal Affairs and Housing, 2020). Woodland significance is typically determined by evaluating key criteria which relate to woodland size, ecological function, uncommon woodland species, and economic and social value.

Based on the field investigations and review of secondary source material, there are woodlands located within the Study Area. The Niagara Region Official Plan identified Environmental Conservation Area - Significant Woodlands in the Study Area (Figure 5-12) (Niagara Region, 2014). The woodlands found along the escarpment on the east and west side of the Study Area are labelled as Significant Woodland by the Region in the Official Plan mapping; the only areas that are not Significant Woodland are the manicured areas (Figure 5-12).

The Town of Lincoln Official Plan mapping identifies Significant Woodland on the west side of the Study Area but not in the Project Location (Town of Lincoln, 2014) (Figure 5-19).

5.4.2.5.3 Significant Valleylands

The PPS (Ministry of Municipal Affairs and Housing, 2020) identifies Significant Valleylands as a “natural area that occurs in a valley or landform depression that has “water” for some period of the year”. Based on field investigations, the Twenty Mile Creek is identified as a Significant Valleyland.

5.4.2.5.4 Areas of Natural and Scientific Interest

The PPS (Ministry of Municipal Affairs and Housing, 2020) defines ANSIs as areas of land and water containing natural landscapes or features that have been identified as having life science or earth science values related to protection, scientific study, or education. Those listed as provincially significant life science ANSIs are the best examples of that natural heritage feature in the Province (Ministry of Natural Resources, 2010). In contrast, earth science ANSIs are representative examples of geological processes in Ontario (i.e., exposed bedrock on road cuts, fossils, and landforms) (Ministry of Natural Resources, 2010).

Based on a review of secondary source material and available online databases, there is a life science provincial ANSI within the Project Location and Study Area. Most of the Project Location and Study Area, except for identified manicured areas, are part of a life science provincial the Jordan Valley Life Science ANSI (Figure 5-11).

5.4.2.5.5 Significant Wildlife Habitat

Wildlife habitat is defined as areas where plants, animals, and other organisms live and can find adequate amounts of food, water, shelter, and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a point in their annual life cycle and those areas which are important to migratory and non-migratory species. Wildlife habitat is considered “significant” if it is deemed ecologically important in terms of feature, function, representation, or amount, and contributing to the quality and diversity of an identifiable geographic area or NHS (Ministry of Municipal Affairs and Housing, 2020). According to the SWHCS for Ecoregion 7E (Ontario Ministry of Natural Resources and Forestry, 2015), Significant Wildlife Habitat consists of:

- Seasonal concentration area for animals;
- Rare vegetation communities;

- Specialized habitat for wildlife;
- Habitat for species of conservation concern; and,
- Animal movement corridors.

The probabilities of Significant Wildlife Habitat occurring is described as; candidate, confirmed, or not present. Candidate Significant Wildlife Habitat means a potential area of wildlife habitat that may be considered significant using procedures established or accepted by MNRMNR with the use of ELC. Confirmed Significant Wildlife Habitat means an area of significant wildlife habitat verified using procedures established or accepted by MNRF.

Seasonal Concentration Areas

Seasonal concentration areas are those habitats where large numbers of a single species or many species congregate at one (or several) times a year. The SWHCS for Ecoregion 7E outlines a series of seasonal concentration areas. Based on the vegetation communities identified during the ELC field investigations and secondary sources, there are five candidate and one confirmed seasonal concentration areas within the Study Area:

- Raptor Winter Area
- Bat Maternity Colonies - Candidate
- Turtle Wintering Areas - Candidate
- Reptile Hibernaculum – Candidate
- Migratory Butterfly Stopover Area – Candidate
- Landbird Migratory Stopover Area – Candidate
- Deer Winter Congregation Areas – Confirmed

5.4.2.5.6 Rare Vegetation Communities

Rare vegetation communities are those that contain provincially rare vegetation communities or those which are rare to the area. One of the most important criteria for determining a rare vegetation community is the current representation of the community within a planning area based on its area relative to the total landscape or the number of examples within the planning area. The Natural Heritage Information Centre (NHIC) uses a system that considers the provincial rank of a species or community type as a tool to prioritize protection efforts (S-Rank) (Ontario Ministry of Natural Resources and Forestry, 2015). The information used to create the Significant Wildlife Habitat screening is based on the vegetation communities identified during ELC

field investigations and information from secondary sources. No confirmed rare vegetation communities were found during vegetation communities or plant inventory surveys.

5.4.2.5.7 Specialized Habitats for Wildlife

Specialized habitats for wildlife consist of that which support wildlife that has highly specific habitat requirements (e.g., nesting habitat – vernal pools), those areas that contain high species and community diversity and those which provide habitat that can greatly enhance species survival (Ontario Ministry of Natural Resources, 2000). Like seasonal concentration areas, the assumptions and presence of specialized habitats for wildlife are based on vegetation community presence and indicator species found during field surveys and from secondary sources. The following two candidate specialized habitats for wildlife are possibly in the Study Area:

- Bald Eagle and Osprey Nesting Foraging and Perching habitat – Candidate
- Turtle Nesting Habitat – Candidate
- Woodland Raptor Nesting Habitat - Candidate

5.4.2.5.8 Habitats for Species of Conservation Concern

Habitats for species of conservation concern are those that contain species that are rare or substantially declining and are rare or uncommon in the planning area. These habitats are associated with provincially rare wildlife species (i.e., species with S-Ranks S1, S2 or S3) and/or wildlife species listed under the ESA as Special Concern.

Species of Special Concern that are known to occur within areas that overlap the Study Area with a moderate, or high likelihood of occurring or confirmed occurrence within the Study Area are identified below:

- Eastern Wood-pewee;
- Red-headed Woodpecker;
- Wood Thrush;
- Snapping Turtle;
- Monarch;
- Grass Pickerel; and,
- Green Dragon.

An evaluation of potential occurrences of these species within the Study Area was completed in Table 5-3. Eastern Wood-pewee and Monarch were found in the Study Area. The Eastern Wood-pewee was heard in the Bluff on the southwest corner of the bridge, while Monarch was found on the Bluff on the southeast corner (Figure 5-24). Habitat for species of conservation concern is confirmed to occur in the Project Location.

The species that are not ranked as Special Concern under the ESA but have a S-Rank of S1 to S3 that have yet to have their habitat described included Honey Locust (S3), Shiny Wedgegrass (S1), Slim flowered Muhly (S2), Eastern Few-fruited Sedge (S3) and Virginia Bluebells (S3).

The Honey Locust was in the manicured park on the northeast corner of the subject bridge. This tree is thought to have been planted because it is of a smaller size and the species is commonly planted as a shade tree due to its high tolerance to disturbance. These trees are not considered significant habitat for species of conservation concern.

Linking Significant Wildlife Habitat on site is completed by defining the area of the habitat to the finest ELC scale that protects the habitat form and function. The Bluff (BLT1) is confirmed Significant Wildlife Habitat due to the presence of Special Concern species.

5.4.2.5.9 Animal Movement Corridors

Animal movement corridors are habitats that link two or more wildlife habitats that are critical to the maintenance of a population of a particular species or group of species. The key ecological function of wildlife movement corridors is to enable wildlife to move between areas of significant habitat or core natural areas with minimum mortality. Animal movement corridors can provide critical links between shelter, feeding, watering, growing and nesting locations (Lee, et al., 1998). Animal movement corridors only include amphibian movement corridors in Ecoregion 7E and are only determined based on identifying significant amphibian breeding habitat.

As no significant amphibian breeding habitat was identified, no animal movement corridor Significant Wildlife Habitat has been delineated; this does not discount potential Natural Heritage Corridor mapping by the Niagara Region. The Region maps Twenty Mile Creek as a movement corridor (Figure 5-12).

With regards to Animal Movement Corridors, Significant Wildlife Habitat Criteria Schedules For Ecoregion 7E (2015) states that: Corridors should consist of native vegetation with a diversity of community layers. Corridors unbroken by roads, waterways or bodies, and undeveloped areas are most significant. Shorter corridors are more significant than longer corridors; however, amphibians must get to and from their summer and breeding habitat.

5.4.3 Flooding Hazards

Flood plains are usually low-lands adjoining a watercourse which has been or may be subject to flooding. Lands which are subject to flooding or may be subject to flooding are referred to as flooding hazards. In most cases, the NPCA defines the flood hazard as the 100-year event. The 100-year flood event is a frequency-based flood event that is determined through analysis of precipitation, snow melt, or a combination thereof, having a return period of once every 100-year on average (or having a 1% chance of occurring or being exceeded in any given year). The 100-year flood event is the minimum acceptable standard (in Ontario) for defining the regulatory floodplain.

The floodplain mapping for the main branch of Twenty Mile Creek was completed by the NPCA in 2005 based on the 100-year flood event. This mapping is used by the NPCA to regulate development in the floodplain as mandated by Ontario Regulation 155/06 (Development, Interference with Wetlands and Alterations to Shorelines and Watercourses). This regulation allows the NPCA to prohibit, regulate or provide permission for straightening, changing, diverting or interfering in any way with the existing channel of a river, creek, stream, watercourse, or changing or interfering with a wetland; and prohibit, regulate or provide permission for development for the control of flooding, erosion, dynamic beaches, pollution or the conservation of land that may be affected by the development.

A review of the NPCA's floodplain mapping indicates that the lands associated with the Twenty Mile Creek, including the lands at the location of the subject bridge, are identified as floodplain lands and regulated areas (Niagara Peninsula Conservation Authority, 2021). See Figure 5-14.

A hydrology and hydraulic assessment was completed to determine if the existing bridge is sufficient to maintain flows as per the current Ministry of Transportation Ontario (MTO) hydraulic design criteria for culverts under bridge crossings. The Hydrologic and Hydraulic Assessment Report is provided in Appendix F. The following data sources were used in to complete this assessment:

- Floodplain Mapping Twenty Mile Creek Watershed Study (Niagara Peninsula Conservation Authority, 2007a)
- Twenty Mile Creek HEC-HMS Hydrology Model (Niagara Peninsula Conservation Authority, 2007b)
- Twenty Mile Creek HEC-RAS Hydraulic Model (Niagara Peninsula Conservation Authority, 2007)
- Existing Bridge Drawings (MTO Bridge Office, 1935)

The hydrologic and hydraulic assessment for the existing structure concluded that the structure is safe to convey the interpolated 50-year design flow (that is 119.21 m³/s) with respect to freeboard and clearance as well as the 100-year flow (that is 186.4 m³/s). There was no instance of overtopping based on the above flows.

The assessment recommended that the replacement bridge structure options should either match or be slightly larger than the existing structure to meet the freeboard and clearance criteria as set by the MTO for the 100-year storm event.

The Hydrologic and Hydraulic Assessment Report noted that the span and rise of the bridge structure as coded into the HEC-RAS model provided by the NPCA does not appear to correspond with the drawings of the existing bridge structure. The existing bridge structure drawings indicate that the existing bridge dimensions are 24.81 m span x 2.81 m rise, whereas the HEC-RAS model shows differing values for both upstream (12.9 m span x 4.90 m rise) and downstream (18.9 m span x 6.95 m rise) bridge dimensions. As part of the hydrologic and hydraulic assessment, Wood revised this to match the existing conditions on site.

5.4.4 Stormwater (Road Drainage)

The section of the Regional Road 81 (from Nineteenth Street to Brookside Drive) includes catch basins and storm sewers. The storm sewers discharge directly into the Twenty Mile Creek.

During detailed design, if required, a CCTV Inspection will be completed to determine the condition of existing storm sewers. In addition, further assessment will be completed during detailed design to determine the capacity of storm sewers and the outfall to convey stormwater and the need for stormwater quality treatment.

5.4.5 Groundwater

A hydrogeological assessment was not completed as part of this Class EA Study. A hydrogeological assessment will be completed during detailed design phase of this project.

5.4.6 Drinking Water Source

The Clean Water Act, 2006 is intended to protect existing and future sources of drinking water. Under this legislation, various vulnerable areas have been delineated around surface water intakes and wellheads for every municipal residential drinking water system that is located in a Source Protection Area (Government of Ontario, 2006).

Source Protection Plans have been developed to contain policies to address the significant drinking water threats.

Twenty Mile Creek Bridge is located in Niagara Peninsula Source Protection Area. Within this source protection area, municipal drinking water is derived exclusively from surface water sources. The surface water sources include six Water Treatment Plants, which are owned and operated by the Niagara Region. These six plants with surface water intakes within the Niagara Peninsula Source Protection Area supply over 80% of the population. The remaining 20% of the population is supplied by private drinking water systems such as residential wells and cisterns. There are no municipal wells in the Niagara Peninsula Source Protection Area and therefore no Wellhead Protection Areas (Niagara Peninsula Source Protection Committee, 2014).

In the Niagara Peninsula Source Protection Area, activities that are considered significant drinking water threats only occur in the vulnerable areas around municipal water treatment plant intakes. These vulnerable areas are known as Intake Protection Zones (IPZs). Three types of IPZs were delineated: IPZ-1, IPZ-2, and IPZ 3. Niagara Peninsula Source Protection Plan policies apply within these three IPZs.

A review of source water protection mapping indicate that the Twenty Mile Creek Bridge is not located in any of the IPZs within the Niagara Peninsula Source Protection Area (Ministry of the Environment, Conservation and Parks, 2021; Niagara Peninsula Source Protection Committee, 2014; Niagara Region, 2014).

5.4.7 Soil

For the purposes of developing a basic understanding of the existing soil and subsurface conditions in the area, a review of secondary information sources was completed. The subject bridge is located within Haldimand Clay Plain physiographic region. Bedrock Geology Map 2544 available through Ontario Geological Survey identifies underlying bedrock at the bridge location as Sandstone, shale, dolostone, siltstone of the Lockport Formation (Ontario Geological Survey, 1991). The soils in the vicinity of the bridge are primarily silty clay (Niagara Peninsula Conservation Authority, 2006).

A geotechnical investigation was not completed as part of the Class EA Study. A geotechnical investigation will be completed during detailed design phase of the project to determine subsurface conditions.

5.5 Technical Environment

5.5.1 Utilities

Existing aerial hydro and bell utilities run along the north side of King Street throughout the roadway and along the south side of King Street in front of the commercial property at 2980 King Street. Utility companies were contacted as part of this Class EA Study. Utility consultation is summarized in Section 11.3.

6.0 Class EA Phase 2: Identification and Evaluation of Alternative Solutions

Phase 2 of the Class EA process identifies various reasonable solutions to address the problem and opportunity identified in Phase 1. The potential solutions are then evaluated against environment, social and technical factors. Based on the evaluation, the preliminary preferred solution is presented to the public for input and review.

6.1 Identification of Alternatives Solutions

The following alternatives have been identified for consideration in addressing the problems and opportunities discussed above:

Alternative 1: Do Nothing - Leave the Twenty Mile Creek Arch Bridge on Regional Road 81 in its current state. This alternative will result in continuing deterioration of the pre-existing structure.

Alternative 2: Rehabilitation of the Structure - Complete rehabilitation of the pre-existing structure as required to maintain vehicular access with minimal disruption to traffic.

Alternative 3: Replacement of the Structure – New two-lane vehicle bridge using existing or alternative bridge alignment.

6.2 Evaluation Criteria

As part of Phase 2 of the Municipal Class EA process, the following evaluation criteria was developed.

Table 6-1: Evaluation Criteria for Alternative Solutions

Component	Description
Natural Environment	Potential impact to natural environment, including aquatic and terrestrial species and habitats Potential impact to stormwater and hydrology
Social Environment	Potential impact to residents, property, community facilities, public parks or businesses within or adjacent to the study corridor

Component	Description
	Potential impact on archaeological and built heritage resources
Technical	Ability to improve vehicular and active transportation safety Ensure the structure meets current structural adequacy in accordance with Canadian Highway Design Bridge Code (CHDBC) Ability to improve life span of structure Continued bridge inspection requirements and ongoing maintenance Ability to minimize construction constraints and complexity
Plans & Policies	Conformity with Regional plans and policies Conformity with relevant policies of Niagara Escarpment Plan (2017) Complies to recommendation of past bridge assessment reports
Costs	Anticipated capital costs for construction and maintenance

6.3 Evaluation of Alternative Solutions

Table 6-2 provides a description of the evaluation criteria used in the evaluation of alternative solutions. The alternatives were assigned a colour based on the scoring system presented below:

Alternatives Scoring System	
Lowest negative impacts or greatest benefits	
Moderate negative impacts and benefits	
Highest negative impacts or lowest benefits	

Table 6-2: Evaluation of Alternative Solutions

Category & Criteria	Alternative Solution 1: Do Nothing	Alternative Solution 2: Rehabilitation of the Structure	Alternative Solution 3: Replacement of the Structure
Natural Environment			
Potential impact on terrestrial species and habitats	Banks are relatively stable in the study area, therefore no long-term vegetation impacts. Footings or cracks may provide nesting, roosting, hibernacula for critters (bats, snakes, etc.).	Deliberate removal of vegetation/trees for staging/access areas. Minor positive impact - a restoration plan for removals.	Deliberate removal of vegetation/trees for staging/access/footprint. Minor positive impact - a restoration plan for removals. The bank face may provide habitat for birds that nest in banks, such as Bank Swallow and Belted Kingfisher. Tree removal may impact bird habitat.
Potential impact on aquatic species and habitats	No impacts to aquatic species or habitat.	Erosion and Sediment Control considerations, spills during construction, any in-water works that could cause direct harm to aquatic life: In- water work impedes fish passage Potential for debris to fall into the creek Exposure of protected soils and increased erosion and sediment mobilization resulting from equipment and machinery operating adjacent to the watercourse Leaks/spills of petroleum products, hydraulic fluids and/or oil/grease into the watercourse Contaminants into the watercourse can disrupt aquatic life processes – reduced respiratory functions and feeding efficiencies, direct acute toxic effects Habitat compensation potential is high - salmon migratory run. Spring timing restriction of March 1-June 30 and fall timing restriction of September 1-November 30 (i.e., in-water work should be avoided).	Erosion and Sediment Control considerations, spills during construction, any in-water works that could cause direct harm to aquatic life: In- water work impedes fish passage Potential for debris to fall into the creek Exposure of protected soils and increased erosion and sediment mobilization resulting from equipment and machinery operating adjacent to the watercourse Leaks/spills of petroleum products, hydraulic fluids and/or oil/grease into the watercourse Contaminants into the watercourse can disrupt aquatic life processes – reduced respiratory functions and feeding efficiencies, direct acute toxic effects Habitat compensation potential is high - salmon migratory run. Spring timing restriction of March 1-June 30 and fall timing restriction of September 1-November 30 (i.e., in-water work should be avoided).

Category & Criteria	Alternative Solution 1: Do Nothing	Alternative Solution 2: Rehabilitation of the Structure	Alternative Solution 3: Replacement of the Structure
Potential impact to stormwater and hydrology	No hydraulic impacts to Twenty Mile Creek flood levels expected as overall structure size and conveyance capacity will remain the same. No stormwater quality or quantity control measures in place.	No hydraulic impacts to Twenty Mile Creek flood levels expected as overall structure size and conveyance capacity will remain the same.No hydraulic impacts to Twenty Mile Creek flood levels expected as overall structure size and conveyance capacity will remain the same.	New structure will adhere to all guidelines and requirements. No hydraulic impacts to Twenty Mile Creek flood levels expected as overall structure size and conveyance capacity will remain the same. Proposed structure to have increased width (2 m +/-), resulting in a slight increase in the overall hard surface or impervious area. Stormwater quantity peak flow control not expected to be required given the size of the upstream watershed. Stormwater quality control measures to be implemented for the net increase in impervious area. Some erosion control may be required at discharge points. Options include a localized oil grit separator (OGS) unit, or potentially infiltration at the ends of the structure, subject to detailed design and grading.
Social Environment			
Potential impact to residents, property, community facilities, public parks or businesses	No impact to residents, property, community facilities, public parks, or businesses within or adjacent to the study corridor.	Temporary construction impacts to residents, property, community facilities, public parks, institutions, or businesses within or adjacent to the study area during rehabilitation work.	Temporary construction impacts to residents, property, community facilities, public parks, institutions, or businesses within or adjacent to the study area during replacement of structure. Permanent property acquisition may be required for construction of new bridge and/or road realignment.
Cultural Environment			
Potential impact on archaeological resources	No archaeological impacts.	No archaeological impacts.	Potential archaeological impacts depending on the location of the new structure. Stage 2 archaeological assessment will be undertaken to determine impacts and potential mitigation measures will be identified.
Potential impact on built heritage resources	Doing nothing will result in continuing deterioration of the existing structure that may require emergency	The 20 Mile Creek Bridge is identified as having significant cultural heritage value/interest and	The 20 Mile Creek Bridge is identified as having significant cultural heritage value/interest and the replacement of the structure will require a further Heritage Impact Assessment. Potential mitigation

Category & Criteria	Alternative Solution 1: Do Nothing	Alternative Solution 2: Rehabilitation of the Structure	Alternative Solution 3: Replacement of the Structure
	repairs that have direct impact on significant cultural heritage value of the structure.	rehabilitation will help preserve the bridge's cultural heritage identity.	measures will include designing the new bridge with references to existing bridge design (i.e. arch, green railing) and including a plaque to commemorate existing bridge design.
Technical Considerations			
Ability to improve vehicular and active transportation safety	No improvement from existing condition for vehicular and active transportation safety.	Opportunity to improve vehicular and active transportation safety within existing bridge platform.	Opportunity to improve vehicular and active transportation safety. Opportunity to provide wider bridge to accommodate active transportation.
Structure meets current structural adequacy in accordance with CHDBC	Existing deteriorated bridge condition is of structural safety concern. Structure does not meet CHDBC requirements.	Rehabilitation would resolve structural bridge condition safety; however, issues may rise again. Rehabilitation will temporarily allow structure to meet CHDBC requirements.	Replacement would resolve all structural bridge safety issues. New structure will meet all regulations as per CHDBC.
Ability to improve life span of structure	Expected service life requires immediate attention.	Service life will increase between 30-40 years with rehabilitation work.	New bridge will be designed with a service life of 75 years.
Continued bridge inspection requirements and ongoing maintenance	Immediate maintenance measures are necessary.	Regular inspection and maintenance required.	Regular inspection with limited immediate maintenance required.
Ability to minimize construction constraints and complexity	No construction involved.	Rehabilitation to be completed under staged traffic conditions.	Potential construction constraints and complexity. Will need to stage construction.
Plans & Policies			
Conformity with Regional Plans and Policies	Does not conform with rural typology as per Complete Streets Vision and Direction for a Changing Region (June 2017) and the Complete Streets Design Guidelines (June 2017) due to the lack of active transportation facilities (No multi-use path or paved shoulder).	Partially conforms with rural typology (i.e. wide lane widths, paved shoulder for cycling) as per Complete Streets Vision and Direction for a Changing Region (June 2017) and the Complete Streets Design Guidelines (June 2017).	Conforms with rural typology (i.e. wide lane widths, paved shoulder for cycling) as per Complete Streets Vision and Direction for a Changing Region (June 2017) and the Complete Streets Design Guidelines (June 2017).
Conformity with the relevant policies of Niagara Escarpment Plan (2017)	Part 2.12.5 of the Niagara Escarpment Plan (2017) states that the infrastructure shall avoid Escarpment Natural Areas, unless the project has been deemed necessary to the public interest after all other alternatives have been considered. The project has been deemed necessary for public interest. The Class EA Study will consider impacts to the	Part 2.12.5 of the Niagara Escarpment Plan (2017) states that the infrastructure shall avoid Escarpment Natural Areas, unless the project has been deemed necessary to the public interest after all other alternatives have been considered. The project has been deemed necessary for public interest. The Class EA Study will consider impacts to the	Part 2.12.5 of the Niagara Escarpment Plan (2017) states that the infrastructure shall avoid Escarpment Natural Areas, unless the project has been deemed necessary to the public interest after all other alternatives have been considered. The project has been deemed necessary for public interest. The Class EA Study will consider impacts to the

Category & Criteria	Alternative Solution 1: Do Nothing	Alternative Solution 2: Rehabilitation of the Structure	Alternative Solution 3: Replacement of the Structure
	natural areas, and identify a design that has least impacts and propose mitigation measures to reduce impacts on natural areas.	natural areas, and identify a design that has least impacts and propose mitigation measures to reduce impacts on natural areas.	natural areas, and identify a design that has least impacts and propose mitigation measures to reduce impacts on natural areas.
Consideration to the recommendation of past bridge assessment reports	Does not comply with the recommendations of the Rehabilitation / Replacement Planning Report (2010) and biennial bridge inspections (2017 and 2019).	Does not comply with the recommendations of the Rehabilitation / Replacement Planning Report (2010) and biennial bridge inspections (2017 and 2019).	Complies with the recommendations of the Rehabilitation / Replacement Planning Report (2010) and biennial bridge inspections (2017 and 2019).
Cost Considerations			
Anticipated capital costs for construction	No capital cost.	Total cost will be approximately \$2.0 million for rehabilitation works.	Total cost will be approximately \$4.5 million.
Anticipated capital costs for maintenance	Require significant maintenance to address ongoing deficiencies.	Future capital expenditure would be required for rehabilitation works due to existing condition and future inspection and maintenances.	New bridge with limited maintenance required
Recommendation	Not Preferred	Not Preferred	Preferred

6.4 Preferred Solution

Based on the review of existing and future conditions, the assessment of alternative solutions, as well as consultation with stakeholders, the Alternative 3: Replacement of the Structure was identified as the preferred solutions. Alternative 3 was identified as the preferred solution for the following reasons:

- It provides an opportunity to improve active transportation by providing a wider bridge to accommodate active transportation (1.5 m paved bike lane shoulders along the proposed roadway)
- It resolves all structural bridge safety issues and meets current regulation standards
- It complies with rural typology (wide lane widths and paved shoulder for cycling) as per Regional policies
- It has limited immediate maintenance cost.
- It has a longer service life than the rehabilitation option (approximately 75 years), which is consistent with the recommendations from the Rehabilitation / Replacement Planning Report (2010) and biennial bridge inspections (2017 and 2019).
- With proper environmental constraint avoidance and mitigation planning, the benefits of the preferred alternative outweigh its potential impacts.

7.0 Class EA Phase 3: Identification and Evaluation of Alternative Designs

Phase 3 of the Municipal Class EA process involves development and evaluation of alternative design concepts for the preferred solution. For this project, bridge replacement was identified as preferred solution.

The alternative design concepts were identified for the road alignment, road cross-section and bridge structure. To identify the impacts and advantages of each alternative design concept related to each alternative, evaluation criteria were developed within each of the categories related to transportation, socio-economic, natural, and cultural environments and technical and cost considerations. These criteria were chosen based on their ability to identify potential positive and negative effects of each alternative and distinguish the advantages and disadvantages between them.

The alternatives were assigned a colour based on the scoring system presented below:

Alternatives Scoring System	
Lowest negative impacts or greatest benefits	
Moderate negative impacts and benefits	
Highest negative impacts or lowest benefits	

Following sub-sections discuss the alternative design concepts, their evaluation process and the preferred design concept for Twenty Mile Creek Arch Bridge Replacement.

7.1 Road Alignment Alternatives

7.1.1 Identification of Road Alignment Alternatives

The following four road alignment alternatives were developed:

Road Alignment Alternative 1 - Maintain Existing Centreline Alignment: This alternative maintains the proposed roadway and bridge at the existing alignment and the bridge will be widened on both side of existing roadway.

Road Alignment Alternative 2 - Shift Centreline Alignment 8m North: This alternative will allow construction of bridge in a staged approach, constructing half of the proposed structure northerly of the existing.

Road Alignment Alternative 3 - Shift Centreline Alignment 14m North: This alternative will fully shift the proposed roadway and bridge north of the existing alignment.

Road Alignment Alternative 4 - Shift Centreline Alignment 14m South: This alternative will fully shift the proposed roadway and bridge south of the existing alignment.

Figure 7-1: Road Alignment Alternative 1

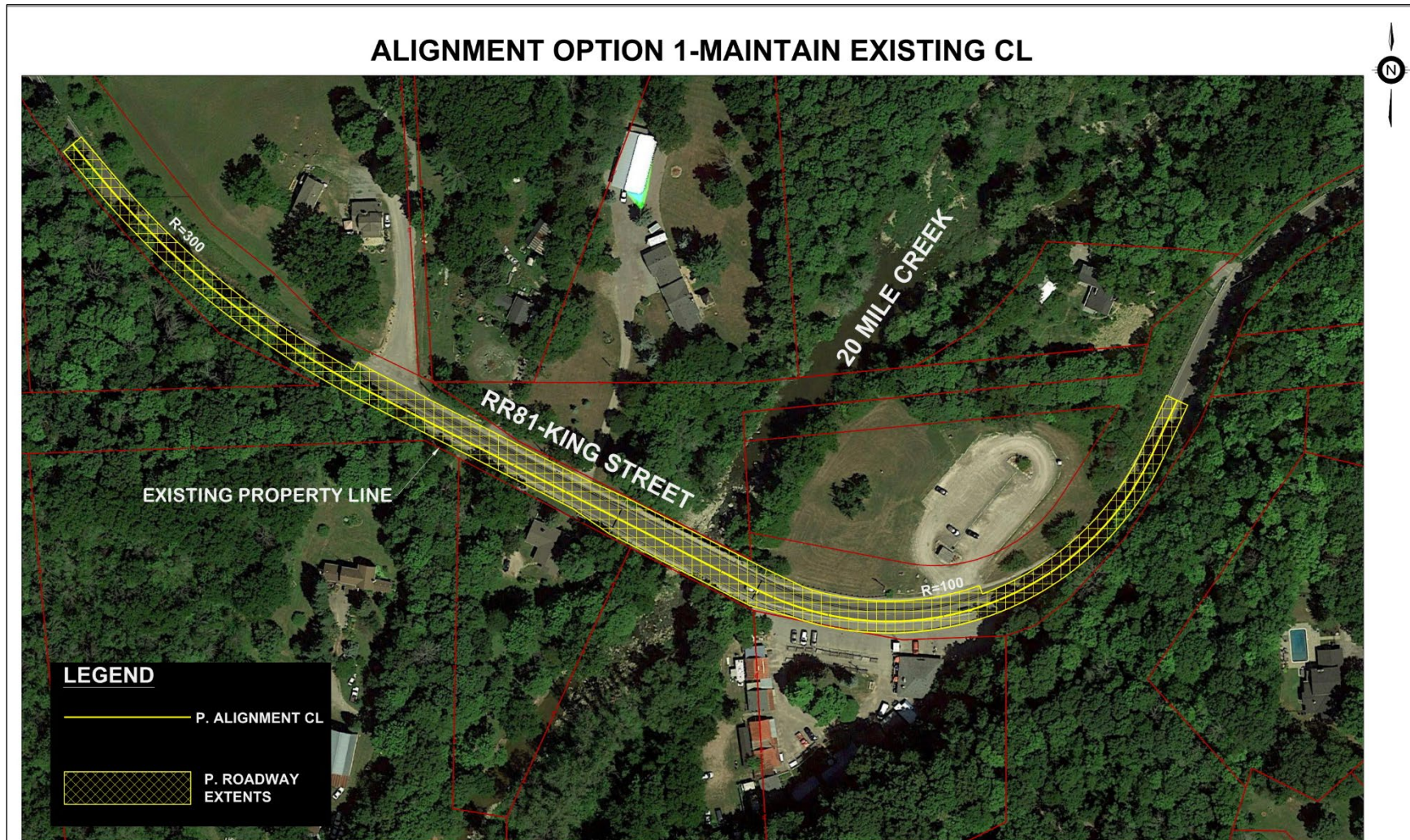


Figure 7-2: Road Alignment Alternative 2

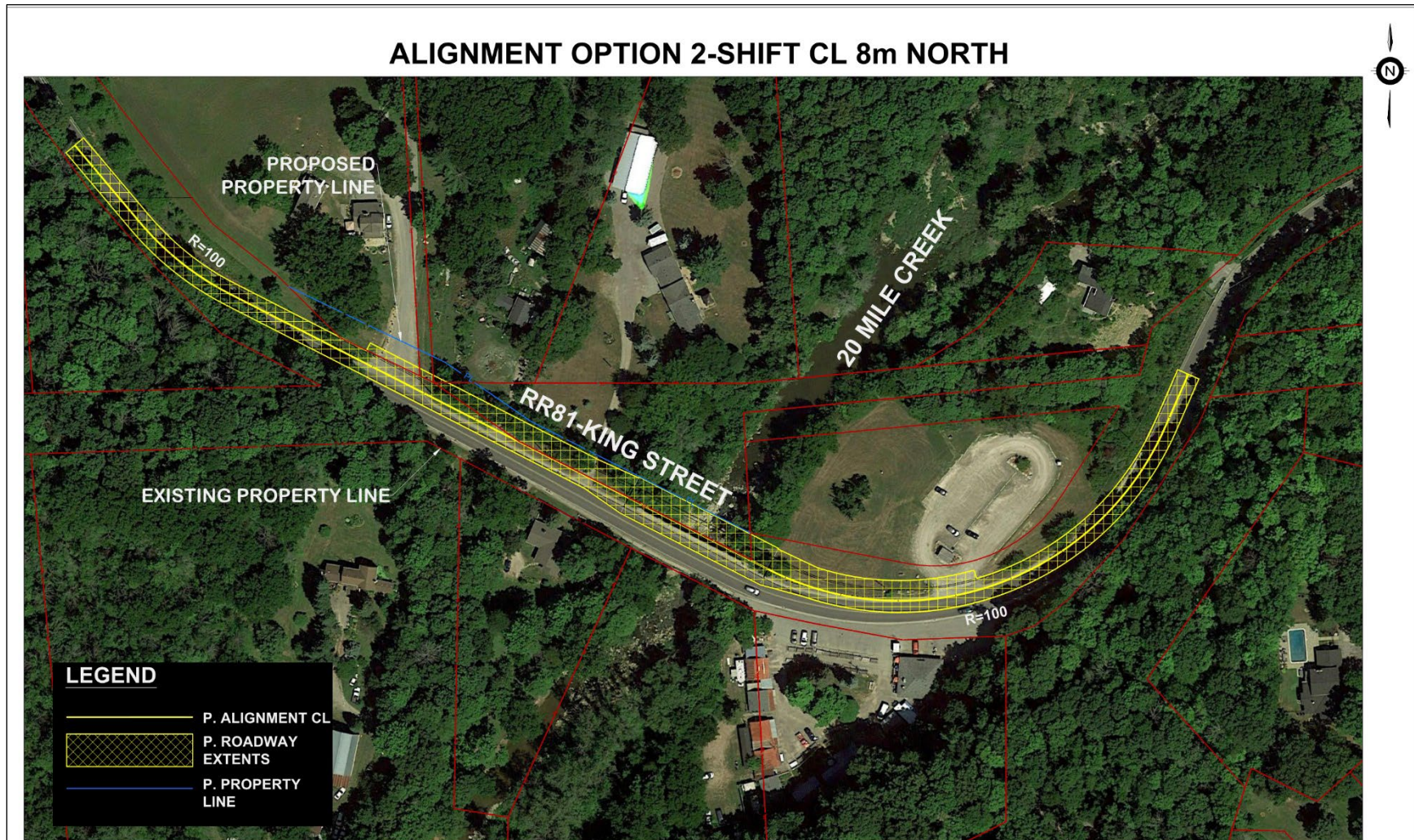


Figure 7-3: Road Alignment Alternative 3

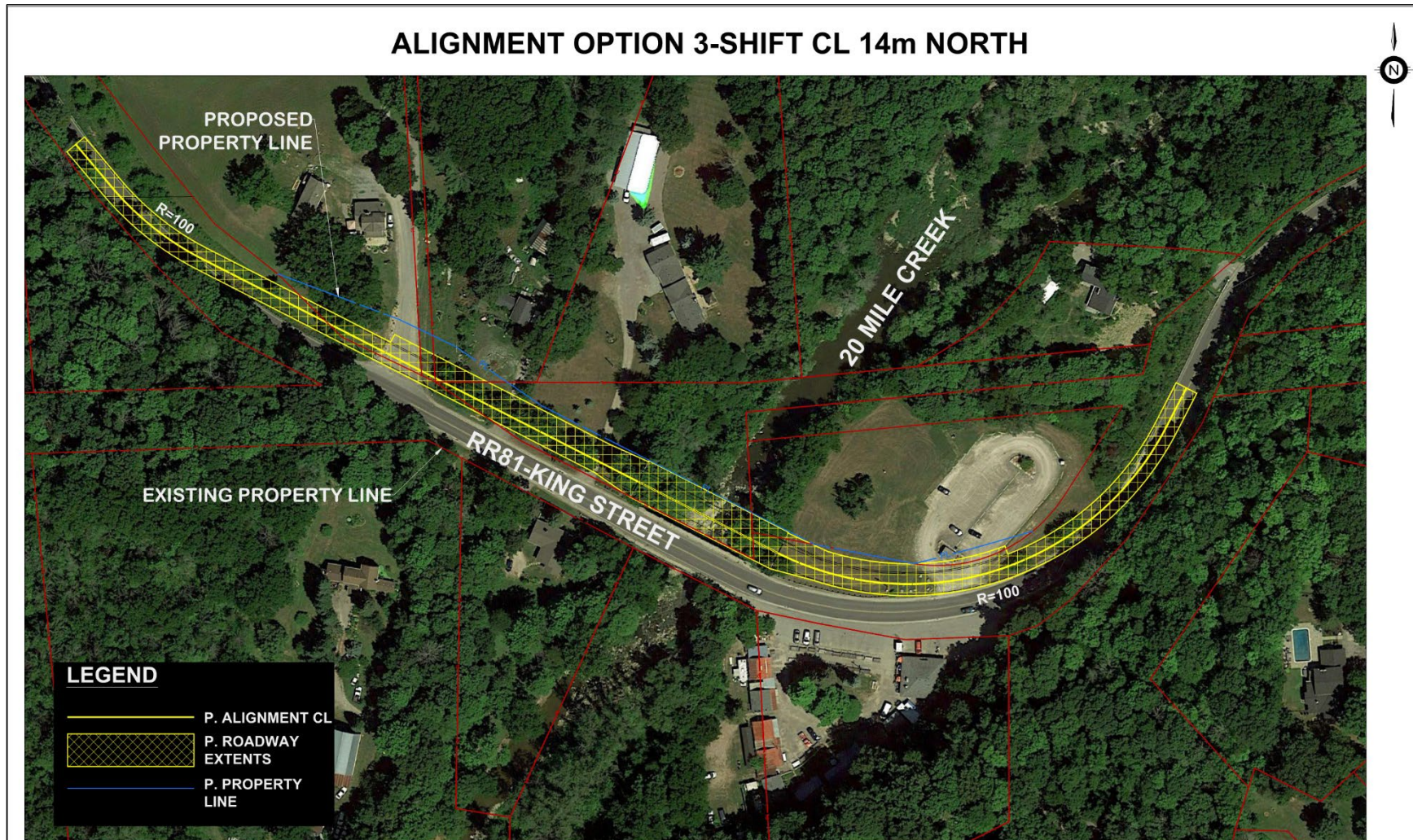
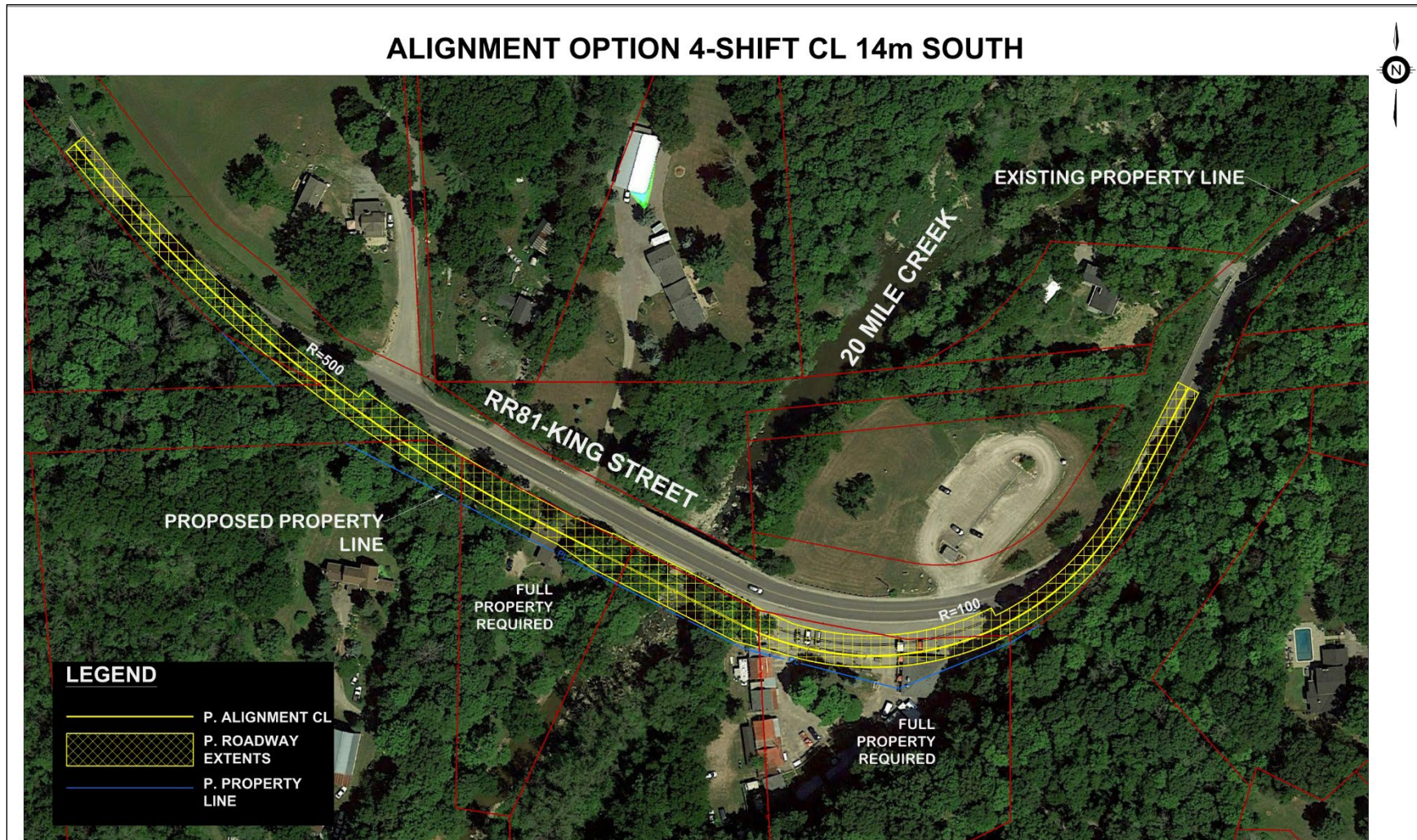


Figure 7-4: Road Alignment Alternative 4



7.1.2 Evaluation Criteria for Road Alignment Alternatives

The evaluation criteria for road alignment alternatives are provided in Table 7-1 below.

Table 7-1: Evaluation Criteria for Alignment Alternatives

Factor	Evaluation Criteria
Socio-economic Environment	Private Property Requirements: Amount of property required
Natural Environment	Terrestrial Environment: Impacts on terrestrial resources (vegetation, wooded areas/trees and wildlife) Aquatic Environment: Impacts on fish and fish habitat
Cultural Environment	Archaeological Resources: Impacts on lands identified to retain potential archaeological resources Built Heritage and Cultural Resources: Impacts on built heritage resources and cultural heritage landscapes
Technical / Engineering / Constructability	Utilities: Impacts on utilities Implementation: Impacts associated with project implementation Construction Traffic Impact: Traffic impacts during construction. Roadway Geometry and Grading Impacts: Assessment of roadway horizontal alignment meeting design standards. Impacts of grading on adjacent lands. Safety: Impact to roadway safety including sightlines and roadside safety.

7.1.3 Evaluation of Road Alignment Alternatives

The evaluation of road alignment alternatives is discussed in Table 7-2.

Table 7-2: Evaluation of Alignment Alternatives

Evaluation Criteria	Alignment Alternative 1: Maintain Existing Centreline Alignment	Alignment Alternative 2: Shift Centreline Alignment 8m North	Alignment Alternative 3: Shift Centreline Alignment 14m North	Alignment Alternative 4: Shift Centreline Alignment 14m South
Socio-economic Environment				
Property Requirements	No property taking is anticipated.	Minor property requirements on the north side.	More property is required on north side for alignment shift.	More property is required on south side for alignment shift
Natural Environment				
Terrestrial Environment	There will be lowest amount of removal of vegetation/areas identified as Significant Woodland. Mitigation measures are being proposed to avoid/minimize impacts on terrestrial environment.	There will be higher amount of removal of vegetation/areas identified as Significant Woodland. Mitigation measures are being proposed to avoid/minimize impacts on terrestrial environment.	There will be highest amount of removal of vegetation/areas identified as Significant Woodland. Mitigation measures are being proposed to avoid/minimize impacts on terrestrial environment.	There will be highest amount of removal of vegetation/areas identified as Significant Woodland. Mitigation measures are being proposed to avoid/minimize impacts on terrestrial environment.
Aquatic Environment	There is a potential for impacts on fish and fish habitat, regardless of the alignment; however, this alternative would have the lowest amounts of impacts associated with clearing. There will be potential for the introduction of deleterious substances into the water (sediment, fluids/lubricants from industrial equipment) resulting in the displacement of aquatic species. There will be potential for destruction of habitat and/or channel stability and/or alterations to habitat form, function and feeding efficiencies due to construction activities and alterations to banks. Direct acute toxic effects, increases in stress responses and/or delayed impacts resulting from chronic exposure or persistence of contaminants in the environment. Mitigation measures are being proposed to avoid/minimize impacts on aquatic environment.	There is a potential for impacts on fish and fish habitat, regardless of the alignment. There will be potential for the introduction of deleterious substances into the water (sediment, fluids/lubricants from industrial equipment) resulting in the displacement of aquatic species. There will be potential for destruction of habitat and/or channel stability and/or alterations to habitat form, function and feeding efficiencies due to construction activities and alterations to banks. Direct acute toxic effects, increases in stress responses and/or delayed impacts resulting from chronic exposure or persistence of contaminants in the environment. Mitigation measures are being proposed to avoid/minimize impacts on aquatic environment.	There is a potential for impacts on fish and fish habitat, regardless of the alignment. There will be potential for the introduction of deleterious substances into the water (sediment, fluids/lubricants from industrial equipment) resulting in the displacement of aquatic species. There will be potential for destruction of habitat and/or channel stability and/or alterations to habitat form, function and feeding efficiencies due to construction activities and alterations to banks. Direct acute toxic effects, increases in stress responses and/or delayed impacts resulting from chronic exposure or persistence of contaminants in the environment. Mitigation measures are being proposed to avoid/minimize impacts on aquatic environment.	There is a potential for impacts on fish and fish habitat, regardless of the alignment. There will be potential for the introduction of deleterious substances into the water (sediment, fluids/lubricants from industrial equipment) resulting in the displacement of aquatic species. There will be potential for destruction of habitat and/or channel stability and/or alterations to habitat form, function and feeding efficiencies due to construction activities and alterations to banks. Direct acute toxic effects, increases in stress responses and/or delayed impacts resulting from chronic exposure or persistence of contaminants in the environment. Mitigation measures are being proposed to avoid/minimize impacts on aquatic environment.

Evaluation Criteria	Alignment Alternative 1: Maintain Existing Centreline Alignment	Alignment Alternative 2: Shift Centreline Alignment 8m North	Alignment Alternative 3: Shift Centreline Alignment 14m North	Alignment Alternative 4: Shift Centreline Alignment 14m South
Cultural Environment				
Archaeological Resources	Disturbance is expected in areas identified to retain archaeological potential. A Stage 2 Archaeological Assessment will be completed during detailed design to identify any archaeological resources and to propose any mitigation measures that may be required.	Disturbance is expected in areas identified to retain archaeological potential. A Stage 2 Archaeological Assessment will be completed during detailed design to identify any archaeological resources and to propose any mitigation measures that may be required.	Disturbance is expected in areas identified to retain archaeological potential. A Stage 2 Archaeological Assessment will be completed during detailed design to identify any archaeological resources and to propose any mitigation measures that may be required.	Disturbance is expected in areas identified to retain archaeological potential. A Stage 2 Archaeological Assessment will be completed during detailed design to identify any archaeological resources and to propose any mitigation measures that may be required.
Built Heritage and Cultural Resources	The 20 Mile Creek Bridge is identified as having significant cultural heritage value/interest. Where possible, the new bridge will be designed with references to existing bridge design.	The 20 Mile Creek Bridge is identified as having significant cultural heritage value/interest. Where possible, the new bridge will be designed with references to existing bridge design.	The 20 Mile Creek Bridge is identified as having significant cultural heritage value/interest. Where possible, the new bridge will be designed with references to existing bridge design.	The 20 Mile Creek Bridge is identified as having significant cultural heritage value/interest. Where possible, the new bridge will be designed with references to existing bridge design.
Technical / Engineering / Constructability				
Utilities	Existing aerial hydro and bell utilities run along the north side of King Street throughout the roadway and along the south side of King Street in front of the private property at 2980 King Street. Minor impacts to the existing aerial hydro lines may be minimized or mitigated with detailed grading adjustments.	A partial alignment shift to the North will impact all hydro and bell aerial utility poles and utility lines on the North side of King Street. Poles will require utility relocation. Although there are no anticipated impacts to utilities to the south from this option, relocation of utility poles on the North may cause additional relocation of poles on the south in front of 2980 King Street to meet aerial cable alignment requirements.	A full alignment shift to the North will impact all hydro and bell aerial utility poles and utility lines on the North side of King Street. Poles will require utility relocation. Although there are no anticipated impacts to utilities to the south from this option, relocation of utility poles on the North may cause additional relocation of poles on the south in front of 2980 King Street to meet aerial cable alignment requirements.	A full alignment shift to the South will impact all hydro and bell aerial utility poles and utility lines on the South side of King Street. Poles will require utility relocation. Although there are no anticipated impacts to utilities to the north from this option, relocation of utility poles on the south may cause additional relocation of poles on the north side of King Street to meet aerial cable alignment requirements.
Implementation	Maintaining existing alignment integrates with the Town's future development of Jordan Hollow Park with very minimal grading impact. Businesses at 2980 King Street on the south side of the roadway will be maintained with minor driveway grading impacts.	Partial alignment shift northward impacts the Town's future development of Jordan Hollow Park with moderate grading impacts. Less land will be available for future park development. Businesses at 2980 King Street on the south side of the roadway will be maintained by extending the existing driveway to the proposed roadway.	Full alignment shift northward significantly impacts the Town's future development of Jordan Hollow Park with significant grading impacts. A large portion of the park will be taken up by the roadway and less land will be available for future park development. Businesses at 2980 King Street on the south side of the roadway will be maintained by extension of driveway to	Full alignment shift southward will not impact the Town's future development of Jordan Hollow Park. Significant impacts to businesses at 2980 King Street on the south side of the roadway which may require full property purchase.

Evaluation Criteria	Alignment Alternative 1: Maintain Existing Centreline Alignment	Alignment Alternative 2: Shift Centreline Alignment 8m North	Alignment Alternative 3: Shift Centreline Alignment 14m North	Alignment Alternative 4: Shift Centreline Alignment 14m South
			the proposed roadway.	
Construction Traffic Impact	Single lane of traffic will be maintained during construction. A temporary modular bridge will be utilized over the existing bridge to maintain traffic while constructing half of the new bridge structure. Access for emergency vehicles will be maintained at all times during construction.	Partial northward shift of the alignment will allow construction of half of the bridge while maintaining traffic on the existing roadway. Traffic will then be shifted to the newly constructed half of the bridge (maintaining a single lane of traffic) during construction of the south half of the road. Access for emergency vehicles will be maintained at all times during construction.	Full northward shift of the alignment will allow construction of the proposed bridge offline of the existing and maintain existing traffic flow during construction. Access for emergency vehicles will be maintained at all times during construction.	Full southward shift of the alignment will allow construction of the proposed bridge offline of the existing and maintain existing traffic flow during construction. Access for emergency vehicles will be maintained at all times during construction.
Roadway Geometry and Grading Impacts	Existing alignment being maintained which meets TAC design standard requirements for a 50km/hr design speed. Maintaining existing alignment utilizes existing terrain and minimizes fill, excavation, and regrading along the roadway and specifically adjacent to the existing creek embankments north and south of the bridge.	Proposed alignment has been designed to meet TAC design standard requirements for a 50km/hr design speed. Proposed alignment layout partially utilizes existing terrain. Moderate fill, excavation and regrading will be required throughout the roadway specifically adjacent to the existing creek embankment north of the bridge.	Proposed alignment has been designed to meet TAC design standard requirements for a 50km/hr design speed. Proposed alignment shifts the roadway completely north of the existing roadway platform. Increased fill and/or excavation will be required throughout the roadway specifically adjacent to the existing creek embankment north of the bridge.	Proposed alignment has been designed to meet TAC design standard requirements for a 50km/hr design speed. Proposed alignment shifts the roadway completely south of the existing roadway platform. Increased fill and/or excavation will be required throughout the roadway specifically adjacent to the existing creek embankment south of the bridge.
Safety	Proposed horizontal curves follow existing roadway alignment, sightlines impacts/changes are minimal. This alignment meets all required sightlines and sight-distance requirements for the proposed design speed.	Proposed horizontal curve east of bridge slightly longer than existing. While the alignment provides all required sightlines and sight-distance requirements for the design speed this alignment will slightly reduce sight distances along the curve for vehicles as compared to Alternative 1.	Proposed horizontal curve east of bridge slightly longer than existing. While the alignment provides all required sightlines and sight-distance requirements for the design speed this alignment will slightly reduce sight distances along the curve for vehicles as compared to Alternative 1.	Proposed horizontal curve east of bridge slightly longer than existing, this will slightly reduce sight distances along the curve for vehicles. West of bridge the proposed alignment shifts to another horizontal curve as opposed to a tangent section like existing. This will reduce sight distances along the curve for vehicles west of the bridge.
Recommendation	Preferred	Not Preferred	Not Preferred	Not Preferred

7.1.4 Preferred Road Alignment

Based on the evaluation presented in Table 7-2, Road Alignment Alternative 1 (Maintain Existing Centreline Alignment) was identified as the preferred road alignment. This alternative maintains the proposed roadway and bridge at the existing alignment and the bridge will be widened on both side of existing roadway. The preferred road alignment is shown in Figure 7-1.

7.2 Road Cross-Section (Active Transportation) Alternatives

7.2.1 Identification of Road Cross-Section Alternatives

The following four alternative road cross-section alternatives were developed:

Cross-Section Alternative 1 – Sidewalks and On Road Paved Shoulders: Urban roadway cross-section with two 3.50 m travel lanes and 1.50 m on-road paved bike lanes/shoulders. 1.50 m concrete sidewalks will be provided on both sides of the road adjacent to concrete curb and gutter.

Cross-Section Alternative 2 – Separated Multi-use Path: Urban roadway cross-section with two 3.50 m travel lanes with 2.20 m shoulder on south side and 1.0 m shoulder on north side. A 3.00 m asphalt multi-use path will be provided on the north side separated by a parapet barrier wall with railing.

Cross-Section Alternative 3 – Multi-use Path (Non-separated): Urban roadway cross-section with two 3.50 m travel lanes, curb and gutters and 1.0 m paved shoulder on both sides. A 1.0 m bridge side clearance is provided on the south side for the curb and gutter design. A 3.00 m asphalt multi-use path will be provided on the north side adjacent to the curb and gutter.

Figure 7-5: Road Cross-Section Alternative 1

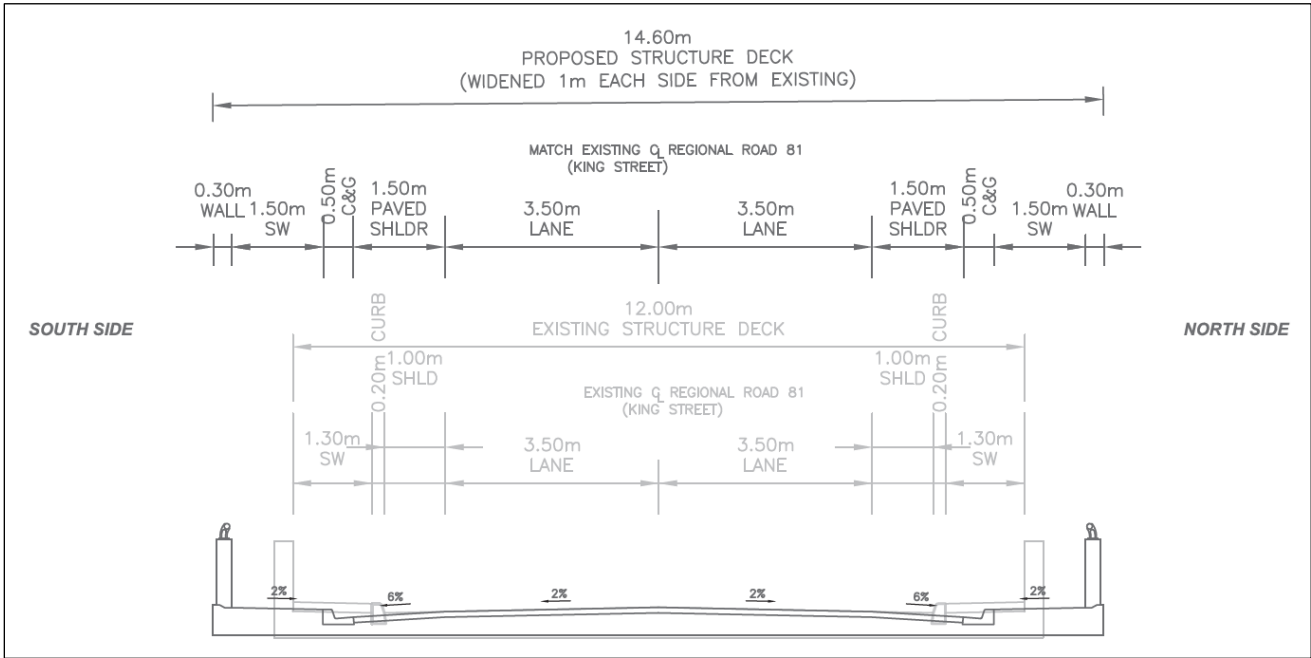


Figure 7-6: Road Cross-Section Alternative 2

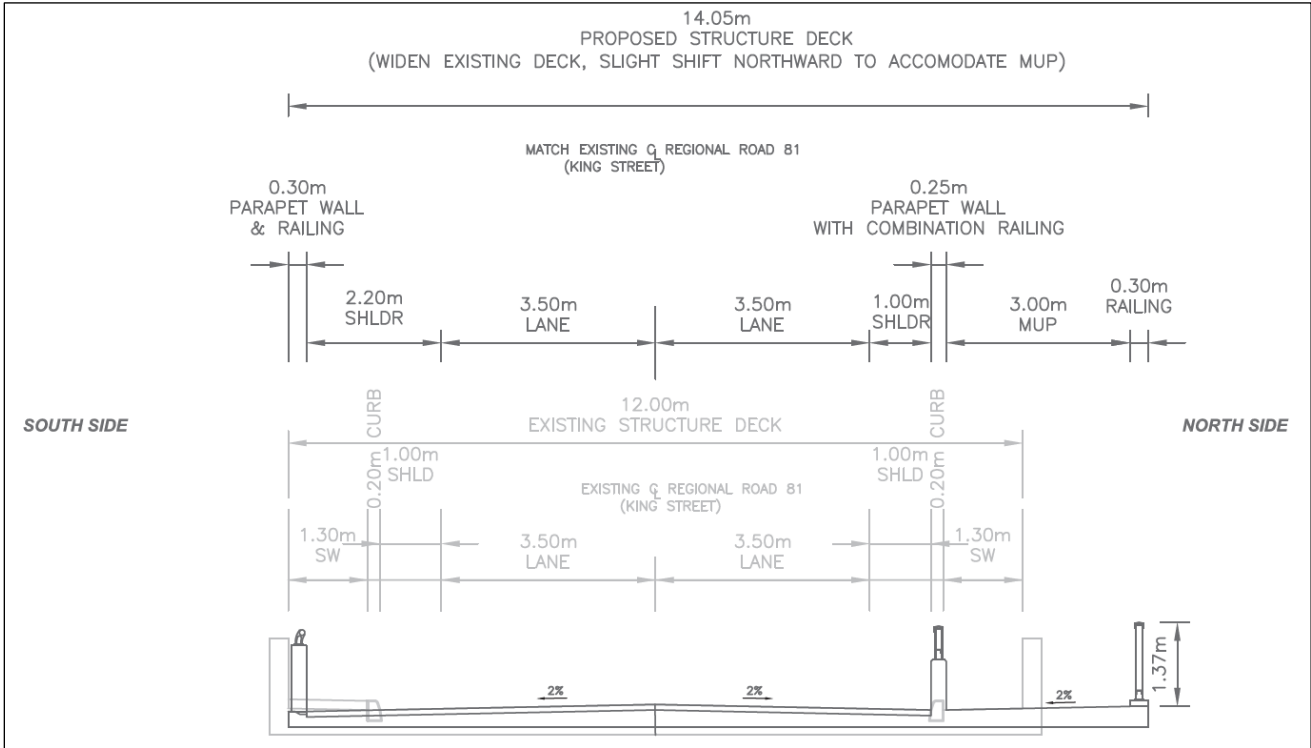
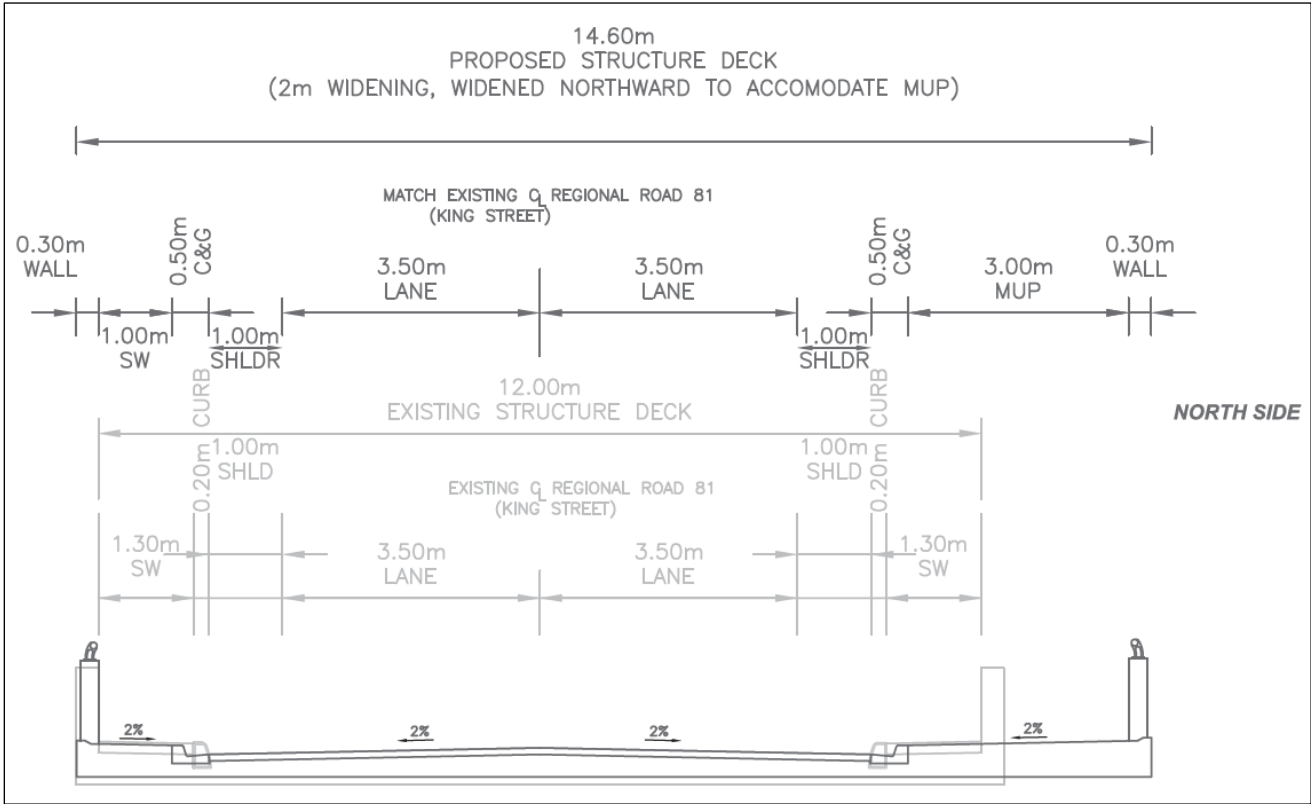


Figure 7-7: Road Cross-Section Alternative 3



7.2.2 Evaluation Criteria for Road Cross-Section Alternatives

The evaluation criteria for road cross-section alternatives are provided in Table 7-3 below.

Table 7-3: Evaluation Criteria for Road Cross-Section Alternatives

Factor	Evaluation Criteria
Socio-economic Environment	Accessibility: Potential to provide opportunities to improve accessibility and reduce barriers in the built environment
Technical / Engineering / Constructability	Constructability: Ability to construct with minimal impacts to road users Stormwater Management: Varied requirement for stormwater quality management for increased impervious area Cross Section Geometry and Roadway Safety: Cross section design adhering the design guidelines and standards. Potential to improve road safety with pedestrian and cyclists. Active Transportation: Potential to incorporate active transportation facilities for walking and cycling and safety of active transportation users Complete Streets: Ability to meet Niagara Region's Complete Streets Design Guidelines (June 2017)
Cost	Construction Cost: Cost to construct Operations and Maintenance Cost: Cost to operate and maintain

7.2.3 Evaluation of Road Cross-Section Alternatives

The evaluation of road alignment alternatives is discussed in Table 7-4.

Table 7-4: Evaluation of Road Cross-Section Alternatives

Evaluation Criteria	Cross-Section Alternative 1: Sidewalks and On Road Paved Shoulders	Cross-Section Alternative 2: Separated Multi-use Path	Cross-Section Alternative 3: Multi-use Path (Non-separated)
Socio-economic Environment			
Accessibility	The proposed roadway cross section will allow driveway access for businesses at 2980 King Street on the south side of the roadway with minor driveway grading impacts. Reconstruction of the existing concrete sidewalk at the driveway entrance to Jordan Hollow park will require driveway entrance regrading. Depressed concrete curb and gutter will be incorporated at all driveway entrances as per provincial standard specifications. Due to the lack of existing cycling infrastructure adjacent to the project area, proposed paved shoulders will taper to existing edge of pavement to allow cyclists to merge onto the proposed active transportation shoulders or back onto the existing roadway. Proposed paved shoulders will start from the park entrance on the North and in front of 2980 King Street on the south to allow active transportation access to the roadway from the park and private businesses. Paved shoulders will terminate west of the bridge to allow cyclists to merge back onto the existing roadway. Due to the paved shoulders being placed adjacent to the vehicular travel lanes, cyclist awareness and appropriate shoulder checks will be critical at all merge points to ensure safety. This poses a potential conflict point between cyclists and vehicles.	The proposed roadway cross section will allow driveway access for businesses at 2980 King Street on the south side of the roadway with minor driveway grading impacts. A portion of the existing driveway entrance at Jordan Hollow park will be taken up by the proposed paved multi-use pathway on the north side. Driveway entrance to the park from the roadway will be regraded as required. Depressed concrete curb and gutter will be incorporated at all driveway entrances as per provincial standard specifications. Due to the lack of existing cycling infrastructure adjacent to the project area, the proposed paved multi-use pathway will start form the park entrance and terminate at the west limit of the existing driveway entrance to 3121 King Street. At the start and end points of the multi-use pathway, depressed concrete curb and gutter will be placed to allow cyclists to merge onto the proposed active transportation pathway or back onto the existing roadway. The separation of the multi-use pathway from the roadway will provide cyclists a clear sightline of vehicular traffic and allow for a safer merge onto the roadway. This will reduce conflict points between cyclists and vehicles.	The proposed roadway cross section will allow driveway access for businesses at 2980 King Street on the south side of the roadway with minor driveway grading impacts. A portion of the existing driveway entrance at Jordan Hollow park will be taken up by the proposed paved multi-use pathway on the north side. Driveway entrance to the park from the roadway will be regraded as required. Depressed concrete curb and gutter will be incorporated at all driveway entrances as per provincial standard specifications. Due to the lack of existing cycling infrastructure adjacent to the project area, the proposed paved multi-use pathway will start form the park entrance and terminate at the west limit of the existing driveway entrance to 3121 King Street. At the start and end points of the multi-use pathway, depressed concrete curb and gutter will be placed to allow cyclists to merge onto the proposed active transportation pathway or back onto the existing roadway. The separation of the multi-use pathway from the roadway will provide cyclists a clear sightline of vehicular traffic and allow for a safer merge onto the roadway. This will reduce conflict points between cyclists and vehicles.

Evaluation Criteria	Cross-Section Alternative 1: Sidewalks and On Road Paved Shoulders	Cross-Section Alternative 2: Separated Multi-use Path	Cross-Section Alternative 3: Multi-use Path (Non-separated)
Technical / Engineering / Constructability			
Constructability	Proposed roadway cross section allows for temporary staging with one lane of traffic for emergency vehicles using temporary modular bridge. During temporary staging and roadwork, pedestrians and cyclists will need to use the concrete sidewalk. Concrete sidewalk is insufficient width to safely accommodate both cyclists and pedestrians.	Proposed roadway cross section allows for temporary staging with one lane of traffic for emergency vehicles using temporary modular bridge. During temporary staging, and roadwork both pedestrians and cyclists can use the proposed multi-use path as it is offset from the roadway.	Proposed roadway cross section allows for temporary staging with one lane of traffic for emergency vehicles using temporary modular bridge. During temporary staging, and roadwork both pedestrians and cyclists can use the proposed multi-use path as it is offset from the roadway.
Stormwater Management	The proposed cross-section width is increasing from approximately 12.5 m to 14.60 m, hence stormwater quality treatment will be required as a minimum for the area of net increase of impervious coverage (i.e. 2.10 m times the length of the new bridge); the approaches are assumed to match the existing areas and where shifted, the old road will be removed and landscaped. The marginal increase in area is not expected to create any significant negative increase in local peak flows or volumes, and no increase in the watershed peak flow, hence stormwater quantity controls are not proposed to be required.	The proposed cross-section width is increasing from approximately 12.5 m to 14.05 m, hence stormwater quality treatment will be required as a minimum for the area of net increase of impervious coverage (i.e. 0.55 m times the length of the new bridge); the approaches are assumed to match the existing areas and where shifted, the old road surface will be removed and landscaped. The marginal increase in area is not expected to create any significant negative increase in local peak flows or volumes, and no increase in the watershed peak flow, hence stormwater quantity controls are not proposed to be required.	The proposed cross-section width is increasing from approximately 12.5 m to 14.60 m, hence stormwater quality treatment will be required as a minimum for the area of net increase of impervious coverage (i.e. 2.10 m times the length of the new bridge); the approaches are assumed to match the existing areas and where shifted, the old road surface will be removed and landscaped. The marginal increase in area is not expected to create any significant negative increase in local peak flows or volumes, and no increase in the watershed peak flow, hence stormwater quantity controls are not proposed to be required.
Cross Section Geometry and Roadway Safety	Proposed 3.5m vehicular lane widths meet regional design standards and provide sufficient width for private and goods movement vehicles. Asphalt surface proposed at 2% cross fall and 3% subgrade cross fall to accommodate drainage. Concrete curbs and gutters in conjunction with storm sewer catch basins will collect roadway surface drainage similar to existing conditions. Paved shoulders will provide adequate clearance from vehicles to bridge walls Due to roadside safety hazards posed by the proposed bridge walls and creek embankment, roadside steel beam guiderail safety barriers and energy attenuator end terminals will be required. For this cross-section alternative, roadside	Proposed 3.5m vehicular lane widths meet regional design standards and provide sufficient width for private and goods movement vehicles. Asphalt surface proposed at 2% cross fall and 3% subgrade cross fall to accommodate drainage. Concrete curbs and gutters in conjunction with storm sewer catch basins will collect roadway surface drainage similar to existing conditions. Paved shoulders will provide adequate clearance from vehicles to bridge walls. Proposed multi-use pathway will be sloped towards the roadway to direct drainage to the existing storm sewer system. Due to roadside safety hazards posed by the proposed bridge walls and creek embankment,	Proposed 3.5m vehicular lane widths meet regional design standards and provide sufficient width for private and goods movement vehicles. Asphalt surface proposed at 2% cross fall and 3% subgrade cross fall to accommodate drainage. Concrete curbs and gutters in conjunction with storm sewer catch basins will collect roadway surface drainage similar to existing conditions. Paved shoulders will provide adequate clearance from vehicles to bridge walls. Proposed multi-use pathway will be sloped towards the roadway to direct drainage to the existing storm sewer system. Due to roadside safety hazards posed by the proposed bridge walls and creek embankment,

Evaluation Criteria	Cross-Section Alternative 1: Sidewalks and On Road Paved Shoulders	Cross-Section Alternative 2: Separated Multi-use Path	Cross-Section Alternative 3: Multi-use Path (Non-separated)
	protection steel beam guiderail will need to be placed outside of the concrete sidewalk to connect with bridge walls, due to this grading beyond the concrete sidewalk will be required to accommodate the posts.	roadside steel beam guiderail safety barriers and energy attenuator end terminals will be required. For this cross-section alternative, roadside protection steel beam guiderail can be placed in a grass boulevard between the multi-use pathway and roadside curb. Guide rails can connect to the inner structural parapet walls and minimize proposed grading beyond the multi-use pathway.	roadside steel beam guiderail safety barriers and energy attenuator end terminals will be required. For this cross section alternative roadside protection steel beam guiderail will be placed outside of the multi-use pathway and roadside curb. Guide rails will be connected to the bridge walls, due to this additional proposed grading beyond the multi-use pathway will be required to accommodate the posts.
Active Transportation	On-road paved shoulders can be utilized by cyclists in the project area and provide connectivity for the Region's cycling network. Inclusion of these lanes will provide continuity for future adjacent roadway improvement projects by the Region and the Town of Lincoln. 1.5 paved shoulders provided as per regional standards. Paved shoulders will provide adequate width for cyclists to travel adjacent to vehicular traffic. No painted buffer will be provided between cyclists and vehicular traffic. 1.50m concrete sidewalks as per municipal and provincial standards are adequate for pedestrian use however insufficient width for shared pedestrian and cyclist use. There may be a possibility of recreational cyclists utilizing the sidewalk due to unfamiliarity and reluctance of on-road cycling lanes.	3.0m asphalt multi-use path meets provincial cycling standards to provide adequate width for shared pedestrian & cyclist use. Asphalt pathway provides a smooth surface conducive to rider comfort. Proposed structural barriers along the bridge allow for full delineation and fully separate to provide protection to cyclists and pedestrians from vehicular traffic. Railings provided on structural walls adhere to standard requirements and protect cyclists and pedestrians from creek embankments. Multi-use pathway on the north can be integrated with the existing Jordan Hollow park and future park redevelopment that is being proposed by the Town of Lincoln (Town of Lincoln, 2020). This will allow connectivity for park users to utilize active transportation facilities along the roadway.	3.0m asphalt multi-use path meets provincial cycling standards to provide adequate width for shared pedestrian & cyclist use. Asphalt pathway provides a smooth surface conducive to rider comfort. Proposed roadway shoulders provide horizontal clearance from travelled lanes to the multi-use pathway. No physical barrier protection is provided in this design alternative for multi-use pathway users from vehicular traffic. Multi-use pathway on the north can be integrated with the existing Jordan Hollow park and future park redevelopment that is being proposed by the Town of Lincoln (Town of Lincoln, 2020). This will allow connectivity for park users to utilize active transportation facilities along the roadway.

Evaluation Criteria	Cross-Section Alternative 1: Sidewalks and On Road Paved Shoulders	Cross-Section Alternative 2: Separated Multi-use Path	Cross-Section Alternative 3: Multi-use Path (Non-separated)
Complete Streets	Proposed lane, shoulder and sidewalk widths meet minimum required widths as per Niagara Region's complete street design guidelines. The proposed cross section features meet the requirements of a rural-road typology as per the Niagara Region complete street design guidelines (IBI Group et al., 2017). Lane widths, accommodation of cyclists and proposed grassed boulevards have all been incorporated into the design cross section. Although the complete street guidelines do not require curb and gutter for a rural road typology, standard width roadside concrete curb and gutters and storm sewer catch basins will be reinstated equivalent to existing conditions.	Proposed lane widths and active transportation multi use pathway meet minimum required widths as per Niagara Region's complete street design guidelines. The proposed cross section features meet the requirements of a rural-road typology as per the Niagara Region complete street design guidelines (IBI Group et al., 2017). Lane widths, inclusion of a paved a multi-use pathway and proposed grassed boulevards have all been incorporated into the design cross section. Although the complete street guidelines do not require curb and gutter for a rural road typology, standard width roadside concrete curb and gutters and storm sewer catch basins will be reinstated equivalent to existing conditions.	Proposed lane widths and active transportation multi use pathway meet minimum required widths as per Niagara Region's complete street design guidelines. The proposed cross section features meet the requirements of a rural-road typology as per the Niagara Region complete street design guidelines (IBI Group et al., 2017). Lane widths, inclusion of a paved a multi-use pathway and proposed grassed boulevards have all been incorporated into the design cross section. Although the complete street guidelines do not require curb and gutter for a rural road typology, standard width roadside concrete curb and gutters and storm sewer catch basins will be reinstated equivalent to existing conditions.
Cost			
Construction Cost	Similar width of structure and construction costs as compared to Alternative 3.	Narrowest bridge width which reduces overall construction costs. Additional increased costs is required for construction of structural barrier walls with protective railings.	Similar width of structure and construction costs as compared to Alternative 1.
Operations and Maintenance Cost	Lowest operating cost as maintenance of shoulders will occur with roadway maintenance.	Highest operating cost for maintenance of separated multi-use pathway, landscaped boulevard, structural barriers and protective railings.	Increased operating cost for maintenance of multi-use pathway and landscaped boulevards.
Recommendation	Not Preferred	Preferred	Not Preferred

7.2.4 Preferred Road Cross-Section

Based on the evaluation presented in Table 7-4, Road Cross-Section Alternative 2 (Separated Multi-use Path) was identified as the preferred road cross-section. This urban roadway cross section would include two 3.50 m travel lanes, a 2.20 m shoulder on south side of the roadway and 1.0 m shoulder on north side. A 3.00 m asphalt multi-use path will be provided on the north side separated by a parapet barrier wall with railing between the pathway and the roadway. The preferred road cross-section is shown in Figure 7-6.

7.3 Bridge Structure Alternatives

7.3.1 Identification of Bridge Structure Alternatives

The following two bridge structure alternatives were developed:

Bridge Structure Alternative 1 - Three-span concrete slab on steel parabolic arched shaped girder bridge: The steel girders will have a parabolic arched shape with similar geometry to the shape of the existing concrete arch. New abutments will be constructed, existing piers will be left in place and built-up and extended to accommodate the new bridge. This bridge alternative will follow the preferred alignment and maintain the preferred road cross section evaluation discussed in Section 7.1.4 and Section 7.2.4. The existing pedestrian path under the bridge will be maintained.

Bridge Structure Alternative 2 - Three-span concrete slab on steel girder bridge: The steel girders will be prismatic, i.e. the steel girders will have a constant depth. New abutments will be constructed, existing piers will be left in place and built-up and extended to accommodate the new bridge. This bridge alternative will follow the preferred alignment and maintain the preferred road cross section evaluation discussed in Section 7.1.4 and Section 7.2.4. The existing pedestrian path under the bridge will be maintained.

Figure 7-8: Bridge Structure Alternative 1

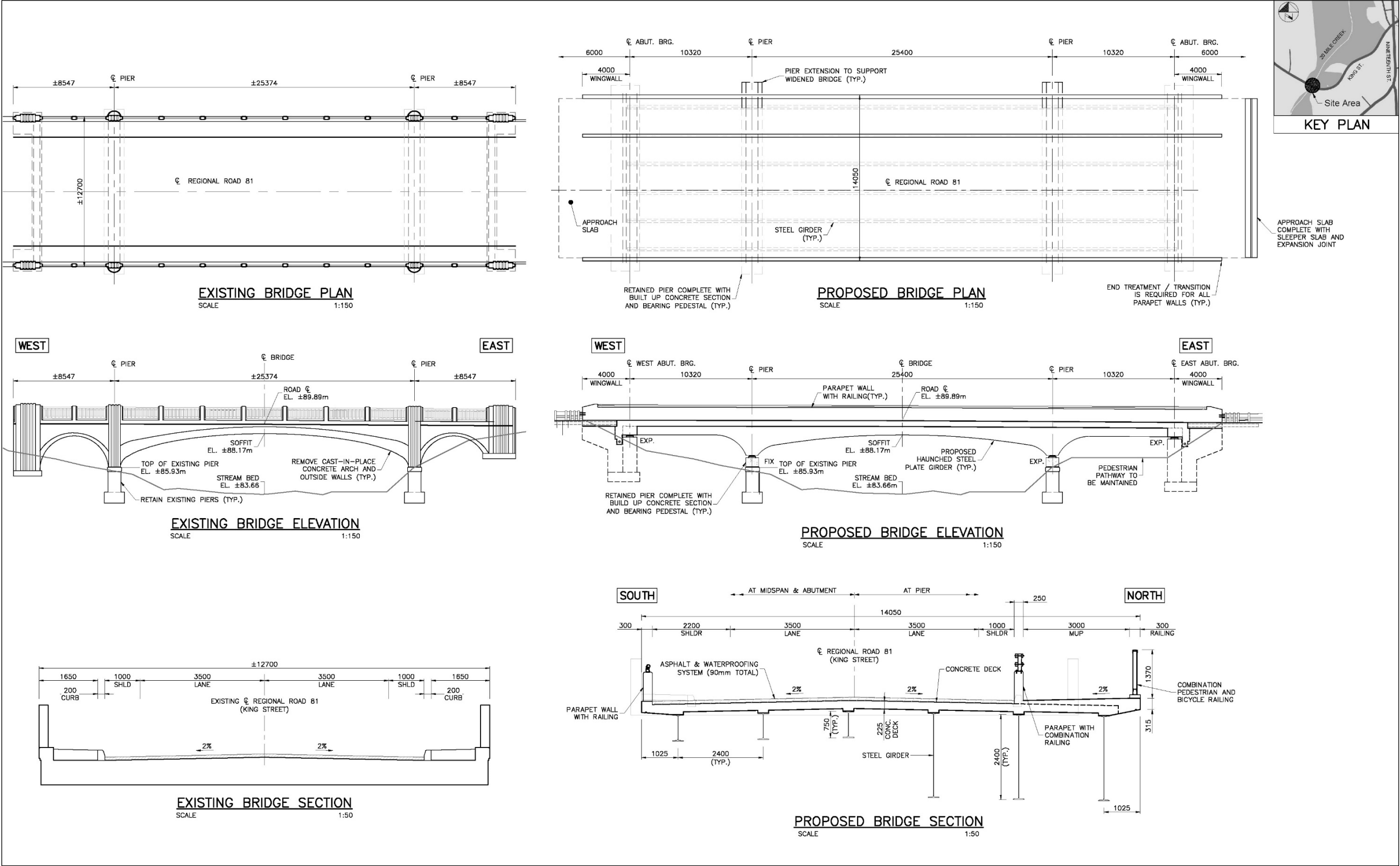
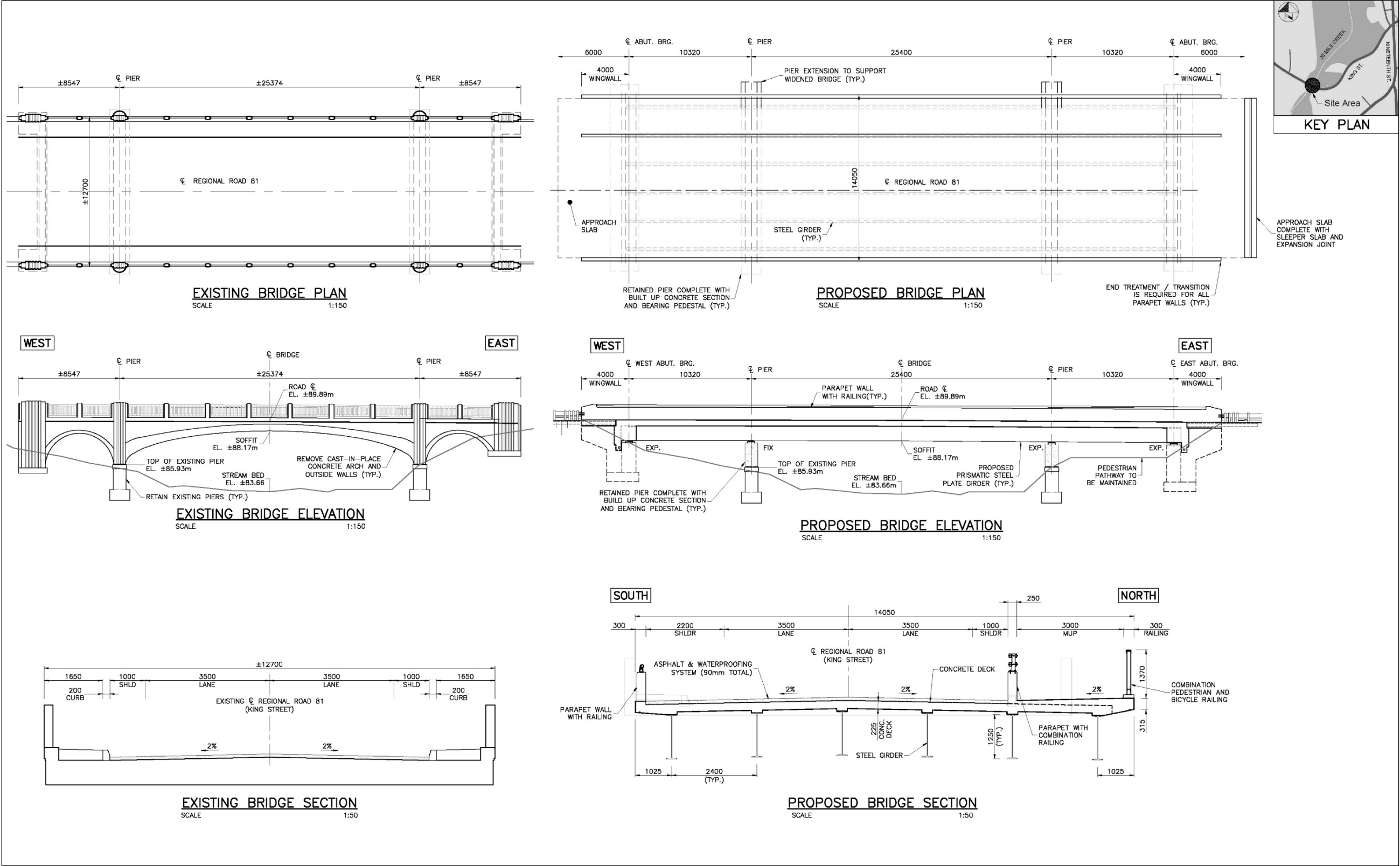


Figure 7-9: Bridge Structure Alternative 2



7.3.2 Evaluation Criteria for Bridge Structure Alternatives

The evaluation criteria for bridge structure alternatives are provided in Table 7-5 below.

Table 7-5: Evaluation Criteria for Bridge Structure Alternatives

Factor	Evaluation Criteria
Socio-economic Environment	Aesthetics: Potential to provide aesthetic design
Natural Environment	Terrestrial Environment: Impacts on terrestrial resources (vegetation, wooded areas/trees and wildlife) Aquatic Environment: Impacts on fish and fish habitat
Cultural Environment	Archaeological Resources: Impacts on lands identified to retain potential archaeological resources Cultural Heritage: Potential for the bridge design to provide cultural heritage value similar to the existing bridge
Technical / Engineering / Constructability	Constructability: Potential constructability concerns due to the bridge structure design Construction Traffic Impact: Impacts to traffic during construction. Existing Pier Stability: Ability for stabilization of existing piers Construction Safety: Construction safety concerns Hydraulic Capacity: Hydraulic capacity of proposed structure
Cost	Construction Cost: Cost to construct Maintenance Cost: Cost to maintain

7.3.3 Hydraulic Assessment of Bridge Structure Alternatives

A hydraulic assessment was completed for the two structural alternatives.

7.3.3.1 Hydraulic Assessment of Bridge Structure Alternative 1

The Alternative 1 proposed condition bridge incorporates a parabolic arch in the deck, and the piers are proposed in the same location as the existing bridge. The bridge has the same ground surface elevation and the top elevation for the centerline of the road as the existing condition model. The width of the bridge is increased to 14.05 m and the shape of the bridge is slightly different. The following table shows the flow discharge and the water surface elevation for return periods of 2, 5, and 100 years.

Table 7-6: Alternative 1 Proposed Condition Flow Discharge and Water Surface Elevation

Return Period	Water Surface Elevation (m)	Q (m ³ /s)
2-year	85.11	29.34
5-year	85.61	58.73
100-year	86.86	186.40

As Table 7-6 shows the maximum modelled change in the water surface elevation would be 0.01 m, which is negligible.

7.3.3.2 Hydraulic Assessment of Bridge Structure Alternative 2

The Alternative 2 proposed condition bridge incorporates a more rectangular opening configuration, with the piers in the same location at the existing bridge. The bridge has the same ground surface elevation and the top elevation for the centerline of the road as Alternative 1 and the existing condition model. The width of the bridge is 14.05 m which is the same as Alternative 1 but the shape of the bridge is different. The following table shows the flow and the water surface elevation for return periods of 2, 5, and 100 years.

Table 7-7: Alternative 2 Proposed Condition Flow Discharge and Water Surface Elevation

Return Period	Water Surface Elevation (m)	Q (m ³ /s)
2-year	85.11	29.34
5-year	85.61	58.73

Return Period	Water Surface Elevation (m)	Q (m ³ /s)
100-year	86.86	186.40

As Table 7-7 shows, the water surface elevation and the flow would be the same as Alternative 1, with a maximum difference in elevation of 0.01 m compared to the existing bridge.

7.3.4 Evaluation of Bridge Structure Alternatives

The evaluation of bridge structure alternatives is discussed in Table 7-8.

Table 7-8: Evaluation of Bride Structure Alternatives

Evaluation Criteria	Bridge Structure Alternative 1: Three-span concrete slab on steel parabolic arched shaped girder bridge	Bridge Structure Alternative 2: Three-span concrete slab on steel girder bridge
Socio-economic Environment		
Aesthetics	An architectural facing of the parapet wall could be provided. An architectural railing on the outside of the Multi-use Path will also be provided. The proposed bridge will not be a signature or landmark type bridge. The existing pedestrian path under the bridge will be maintained.	An architectural facing of the parapet wall could be provided. An architectural railing on the outside of the Multi-use Path will also be provided. The proposed bridge will not be a signature or landmark type bridge. The existing pedestrian path under the bridge will be maintained.
Natural Environment		
Terrestrial Environment	There will be moderate amount of removal of vegetation/areas identified as Significant Woodland. Mitigation measures are being proposed to avoid/minimize impacts on terrestrial environment.	There will be moderate amount of removal of vegetation/areas identified as Significant Woodland. Mitigation measures are being proposed to avoid/minimize impacts on terrestrial environment.
Aquatic Environment	There is a potential for impacts on fish and fish habitat, regardless of the bridge structure. There will be potential for the introduction of deleterious substances into the water (sediment, fluids/lubricants from industrial equipment) resulting in the displacement of aquatic species. There will be potential for destruction of habitat and/or channel stability and/or alterations to habitat form, function and feeding efficiencies due to construction activities and alterations to banks. Direct acute toxic effects, increases in stress responses and/or delayed impacts resulting from chronic exposure or persistence of contaminants in the environment. Mitigation measures are being proposed to avoid/minimize impacts on aquatic environment.	There is a potential for impacts on fish and fish habitat, regardless of the bridge structure. There will be potential for the introduction of deleterious substances into the water (sediment, fluids/lubricants from industrial equipment) resulting in the displacement of aquatic species. There will be potential for destruction of habitat and/or channel stability and/or alterations to habitat form, function and feeding efficiencies due to construction activities and alterations to banks. Direct acute toxic effects, increases in stress responses and/or delayed impacts resulting from chronic exposure or persistence of contaminants in the environment. Mitigation measures are being proposed to avoid/minimize impacts on aquatic environment.
Cultural Environment		
Archaeological Resources	Disturbance is expected in areas identified to retain archaeological potential. A Stage 2 Archaeological Assessment will be completed during detailed design to identify any archaeological resources and to propose any mitigation measures that may be required.	Disturbance is expected in areas identified to retain archaeological potential. A Stage 2 Archaeological Assessment will be completed during detailed design to identify any archaeological resources and to propose any mitigation measures that may be required.
Cultural Heritage	The parabolic haunched steel girder shape provides a sympathetic design to the existing concrete arch shape with the girders transitioning from deeper at the abutment and pier supports to shallower at the middle of the spans. However, although the soffit geometry will be similar, the new bridge is still a different bridge type and will not closely resemble the existing bridge. Where possible, the design elements associated with the existing bridge (e.g., railings) will be incorporated into the new bridge during detailed design phase of the project. In addition, opportunity for the development of a commemorative strategy, such as plaquing, will be considered.	The prismatic constant depth steel girders do not have a sympathetic design to the existing concrete arch shape. Where possible, the design elements associated with the existing bridge (e.g., railings) will be incorporated into the new bridge during detailed design phase of the project. In addition, opportunity for the development of a commemorative strategy, such as plaquing, will be considered.

Evaluation Criteria	Bridge Structure Alternative 1: Three-span concrete slab on steel parabolic arched shaped girder bridge	Bridge Structure Alternative 2: Three-span concrete slab on steel girder bridge
Engineering/Constructability		
Constructability	The parabolic steel girders would require a large crane to lower them into place. This requires a large area to stage a crane on both sides of the proposed bridge. The parabolic steel girder is more difficult to fabricate when compared to a shallower prismatic girder due to the varying section depth and the deep section at the supports. It is also less stable during installation.	If the steel girders require launching, a long staging area for the girder launching is required. This work could potentially be staged from the west side of the bridge. The prismatic steel girder is easier to fabricate when compared to the parabolic steel girder. It is also more stable during installation due to constant depth.
Construction Traffic Impact	During lifting operations of the steel girders, temporary lane closures may be required to facilitate the placement of girders near the single lane of traffic A short-term full closure of traffic will be required during the construction of the concrete deck closure strip. Coordination with emergency services will be required to ensure services are maintained.	If girders are installed via a launching operation, no impacts to the single lane of traffic are anticipated. A short-term full closure of traffic will be required during the construction of the concrete deck closure strip. Coordination with emergency services will be required to ensure services are maintained.
Construction Safety	Due to the requirement to lift steel girders with large cranes, there is a higher risk of construction related incidents during the lifting and placing operation when compared to a launching operation.	The prismatic girders can be either be lifted with a crane or launched from one or both ends. A launching installation would have a lower risk of construction related incidents when compared to a lifting operation with a crane.
Existing Pier Support	The existing piers would have to be built-up slightly (around 0.7 m) to accommodate the new haunched girders. Less stability issues for the pier foundations are anticipated for the permanent bridge case when compared to Alternative 2.	The existing piers would have to be built-up significantly (around 2 m) to accommodate the prismatic girders. There is potential for stability concerns for the pier foundations which may require additional work to extend and/or stabilize the pier footings.
Hydraulic Capacity	Matching the horizontal location of the existing piers and matching the opening width or span, in combination with approximately matching the opening rise and the parabolic arched geometry or configuration to match the existing opening, means that this alternative will match the existing hydraulic capacity.	Matching the horizontal location of the existing piers and matching the opening width or span, in combination with increasing the total opening area with a rectangular opening and average rise, means that this alternative will marginally improve the hydraulic capacity.
Cost		
Construction Cost	The initial construction cost is approximately \$5.6 million including existing structure removal, the temporary modular bridge and staging, and the construction of the new structure. The fabrication of girders is more expensive than Alternative 2 but the modification of existing piers is less expensive. Overall, the construction cost is approximately \$300k higher than Alternative 2.	Approximate \$5.3 million construction cost including removal of existing structure, temporary modular bridge and staging, and construction of new structure. The modification of existing piers and additional stabilization measures are more expensive than Alternative 1 but the fabrication of girders is less expensive. Overall, the construction cost is approximately \$300k lower than Alternative 1.

Evaluation Criteria	Bridge Structure Alternative 1: Three-span concrete slab on steel parabolic arched shaped girder bridge	Bridge Structure Alternative 2: Three-span concrete slab on steel girder bridge
Maintenance Cost	The approximate lifetime rehabilitation costs based on two minor rehabilitation projects and one major rehabilitation project over the 75-year lifespan is \$2.5 million.	The approximate lifetime rehabilitation costs based on two minor rehabilitation projects and one major rehabilitation project over the 75-year lifespan is \$2.6 million.
Recommendation	Not Preferred	Preferred

7.3.5 Preferred Bridge Structure

Based on the evaluation presented in Table 7-8, Bridge Structure Alternative 2 (Three-span concrete slab on steel girder bridge) was identified as the preferred bridge structure. In the bridge structure, steel girders will be prismatic, i.e., the steel girders will have a constant depth. New abutments will be constructed, existing piers will be left in place and built-up and extended to accommodate the new bridge. The bridge will follow the preferred alignment and maintain the preferred road cross section presented in Section 7.1.4 and Section 7.2.4, respectively. The existing pedestrian path under the bridge will be maintained. The preferred bridge structure is shown in Figure 7-9.

8.0 Description of Preferred Design

8.1 Proposed Horizontal and Vertical Alignments for the Road

The proposed roadway alignment maintains the existing roadway centreline and existing centreline vertical profile throughout the project limits. Minor adjustments have been made to ensure that proposed horizontal radii and vertical curves meet design requirements for the intended design speed of 50km/hr. At the location of the Twenty Mile Creek Bridge, the existing roadway horizontal centreline is maintained to minimize structural modifications and impacts to the creek embankments. The proposed roadway width has been widened from the existing to approximately 14 metres to provide safe space for all road users (drivers, pedestrians, cyclists) and to accommodate the proposed multi-use pathway. The proposed widening and multi-use pathway integrates with the Town of Lincoln's future development of Jordan Hollow Park and maintains the driveway access with very minimal grading impact on the Jordan Hollow Park property. Driveway access to the businesses on the south side of the roadway will be maintained with minor driveway grading impacts. During the detailed design grading impacts will be determined and optimized to ensure that there will be no property required outside of the road right-of-way.

The proposed horizontal and vertical alignments meet the requirements of the TAC Geometric Design Guide for Canadian Roads for a 50 km/h roadway design speed . Table 8-1 provides the proposed roadway design criteria.

The proposed design maintains the existing centreline alignment for the majority of the roadway and only proposes minor adjustments to the roadway centreline profile. Further, the design utilizes existing terrain and minimizes fill, excavation, and regrading along the roadway and specifically adjacent to the existing river embankments north and south of the bridge.

Proposed horizontal curves of the road alignment follow the existing roadway alignment, and as such, sightline impacts/changes will be minimal. The proposed horizontal alignment and vertical profile meet all required sightlines and sight-distance requirements for the proposed design speed. Further refinement of the profile will be carried out during the detailed design phase of the project. The roll plan showing the proposed roadway plan and profile alignment is provided in Appendix G.

Table 8-1: Proposed Roadway Design Criteria

	Minimum Design Standard Requirement [50 kilometre per hour design speed]	Design Standard / Reference
Roadway Classification	Rural	
Number of Through Lanes	2	
Design Speed (Kph)	50	
Posted Speed (Kph)	50	Based on Niagara Region's direction. This is acceptable practice for rehabilitation / reconstruction projects on older roads without established design speeds as per TAC Geometric Design Guide 2017 (Chapter 2 – Section 2.3.6.4)
Minimum Stopping Sight Distance (m)	65	Table 2.5.2 TAC Geometric Design Guide 2017
Minimum 'K' Factor to Provide SSD	Crest – 7 Sag – 13	Table 3.3.2 and 3.3.4 TAC Geometric Design Guide 2017
Road Grades Minimum	Level Grade Acceptable provided roadway is adequately crowned (TAC) Minimum grade of 0.4% along centreline and gutter (Region)	Section 3.3.2.5 TAC Geometric Design Guide 2017, Niagara Region Roadway Standards
Minimum Radius (m)	100m	Table 3.2.3 & Equation 3.2.3 TAC Geometric Design Guide 2017
Lane Widths	3.5m (Min.) 1.5m Bike Lanes (Min.)	Niagara Region Roadway Standards, Complete Streets Guideline

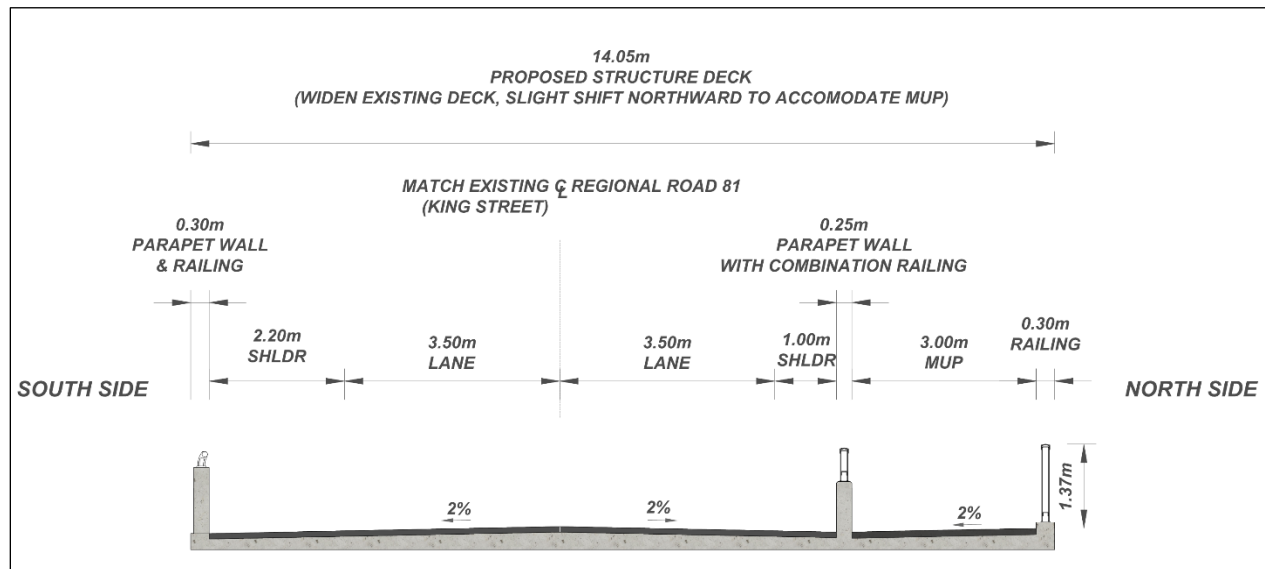
	Minimum Design Standard Requirement [50 kilometre per hour design speed]	Design Standard / Reference
Sidewalk Width (m)	1.5	Niagara Region Roadway Standards
Multi-Use Pathway Width (m)	3.0m for Bi-Directional Shared Use Pedestrian/Cyclist facility	Table 5.3.5 TAC Geometric Design Guide 2017
R.O.W. WIDTH (m)	26m ROW	Niagara Region Roadway Standards, Complete Streets Guideline
Shoulder width (m)	Rural roadways without curb will include shoulders as per MTO standards	Niagara Region Roadway Standards, Complete Streets Guideline & MTO Standards

8.2 Proposed Typical Road Cross-Section

The design elements for the proposed typical road cross-section at the bridge location are shown in Figure 8-1.

The proposed road cross-section at the bridge transitions to the proposed cross-section at the road approaches. The proposed road cross-section at the bridge location includes widening of the existing bridge deck to a width of 14.05 metres with a slight shift to the north side to accommodate the multi-use path (Figure 8-1). Further to the east and west of the bridge, the proposed road cross-section only includes two 3.5 metre wide vehicular traffic lanes with 0.5 metre wide curb and gutters and a 3.0 metre wide multi-use path on the north side. The multi-use path could be connected with an active transportation facility in the future to the east and west of the bridge. As noted before, provision of an active transportation facility on Regional Road 81 (King Street) further to the east and west of Twenty Mile Creek Bridge and up to Nineteenth Street to the east and Brookside Drive to the west (as identified in the Niagara Region's Transportation Master Plan), will be explored by the Niagara Region in future.

Figure 8-1: Proposed Typical Road Cross-Section at Twenty Mile Creek Bridge



The proposed road cross-section advances one of the objectives of the Niagara Region's Transportation Master Plan by providing a pedestrian and cycling facility in accordance with the complete streets approach. The proposed road cross-section will accommodate both pedestrians and cyclists, via a dedicated 3.0 metre wide multi-use path on the north side of the bridge. A parapet wall will separate the multi-use path from the vehicular traffic lanes, providing a safe space for pedestrians and cyclists. The pedestrians and cyclists may share the same space on the multi-use path. Signage in accordance with MTO's OTM traffic and active transportation standards will be provided to reduce any potential conflicts between pedestrians and cyclists.

Figure 8-2: Shared Pathway Sign



8.3 Proposed Bridge Design

The proposed bridge structure is a three-span structure with 10.3 metres long end spans and a 25.4 metres long middle span. When compared to the existing bridge, the middle span will be the same length, but the end spans have been lengthened somewhat to reduce uplift at the abutments. It will have a concrete slab on steel I-girder substructure with semi-integral or integral abutments. Depending on the results of the geotechnical investigation, the abutment foundations will be supported on shallow spread footings or a piled foundation. Excavation will be required for the shallow spread footings or a pile foundation. The existing piers will be rehabilitated and built up to support the bridge structure. The existing piers will be extended to the north to accommodate the new wider structure. Some excavation will be required to extend the piers to the north. Concrete wingwalls will be constructed at the four corners of the bridge. Approach slabs will be provided at each end of the bridge with a sleeper slab and expansion joint on one end.

The barrier systems will consist of a parapet wall with railing on the south side of the bridge, a parapet wall with combination rail between the north traffic lane and the multi-use path, and a combination pedestrian and cyclist railing on the north side of the structure. The parapet wall sections will be designed with consideration for architectural appeal (e.g., stone form liner textured detail), which would enhance the aesthetics of the bridge. An example of parapet wall with stone form liner is shown in Figure 8-3.

The existing pedestrian pathway beneath the east span providing access along Twenty Mile Creek below the bridge will be reinstated after the new bridge is completed. The Preliminary General Arrangement drawing for the proposed replacement bridge is provided in Appendix G.

Figure 8-3: Example of Parapet Wall with Stone Form Liner¹



¹¹ Photo Location and Credit: [Regional Road 81 east of Ninth Street \(Google Maps\)](#)

8.4 Construction Approach and Staging

The bridge will be replaced in three main stages, as outlined below:

Pre Stage 1: The existing north barrier wall above the sidewalk will be removed to make room for temporary bridge.

Stage 1: A temporary modular bridge will be installed on the north side of the existing bridge to help maintain a single lane of traffic in alternating directions throughout the construction. The south half of the existing structure will be removed, and the south half of the new structure will be constructed. An example of the temporary bridge is shown in Figure 8-4. The fill in the existing arch will be excavated and removed. It is anticipated that the existing arch will be sawcut into longitudinal segments and lifted off in pieces with a crane or other large equipment. A sealed platform will be suspended from the remaining portion of the existing structure to catch any affluent from sawcutting and any debris, and the platform will be progressively retrieved as the stage one removal progresses.

Stage 2: The single lane alternating traffic will be shifted from the temporary bridge to the newly constructed south half of the bridge. The north half of the existing bridge will be removed, and the north half of the new structure will be constructed, leaving a 600 millimetre wide opening between newly constructed portions. The removal of the north side of the bridge will follow the same approach as that of the south half described in Stage 1. The debris platform will be partially suspended from the new girders and existing arch.

Stage 3: Short-term full closure of bridge will be required to construct 600 millimetre wide "closure strip" which will complete the new bridge. To minimize traffic related impacts, efforts will be made to limit the closure of the bridge to a weekend. The closure is expected to be for one weekend in order to place and cure the concrete. Depending on the time of the year, if the weekend closure is not a preferred time, then a closure during weekdays could be considered. The Niagara Region should coordinate with the Town of Lincoln (including EMS/Fire Department) for bridge closure. The paving and waterproofing of the closure strip can be done with short-term partial closures while still allowing one lane to pass.

Final Stage: Traffic will be restored to the new bridge, one lane in each direction.

Figure 8-4: Example of Temporary Modular Bridge²²



8.5 Preliminary Cost Estimate of Proposed Works

The preliminary cost estimate for the bridge replacement and the associated road construction works is be \$6.26 million. The estimated high-level initial construction cost of the new structure is \$5.6 million, while the estimated high-level construction cost for the associated road works and drainage works is anticipated to be approximately \$660,000.

It is important to note that this cost estimate is based on preliminary design and is subject to refinement during detailed design phase. Given the current industry environment due to the lingering supply chain impacts of Covid19, as well as volatile oil prices, there is a significant degree of uncertainty associated with all industry costs estimates. Breakdown of cost estimate is provided in the table below:

²² Photo Credit: [McElhanney \(Replacement of the Fort Nelson River Bridge\)](#)

Table 8-2: Preliminary Cost Estimate of Proposed Works³

Item Description	Estimated Cost
Bridge Replacement Works	
Traffic Control, Debris Containment, Access & Protection	\$300,000
Removal of Existing Structure	\$794,700
Temporary Modular Bridge	\$623,000
New Bridge	\$2,949,000
20% Contingency	\$933,340
Sub-total	\$5,600,040
Road Works	
General Items (Traffic Control, Mobilization, Erosion and Sediment Control, Tree Protection)	\$65,000
Roadwork	\$347,460
Storm Sewers/Drainage	\$70,700
Existing Roadway Removals	\$67,250
20% Contingency	\$110,082
Sub-total	\$660,492
Total	\$6,260,532

8.6 Timing of Proposed Works

Table 83 outlines high-level schedule of project activities. The table below represents a high-level schedule, as anticipated at the time of preparation of this report. Ultimate timing of various project activities and construction will be determined during the

³ Once the preferred design was confirmed following the Public Information Centre #2, the cost estimate for the preferred design was further reviewed and refined, and contingency was added to the cost estimate.

detailed design phase of this project. The timing of proposed works will be subject to the acquisition of various permits and approvals.

The Niagara Region will ensure that all required permits and approvals have been obtained prior to initiating the construction. The Niagara Region will also ensure that the project construction schedule adheres to regulatory timing restrictions (e.g., in-water works timing restrictions).

Table 8-3: Preliminary Schedule of Proposed Works

Project Activity	Timeline
Complete Detailed Design and Obtain Permits	2022-2023
Issue for Tender	2023
Construction	2023

9.0 Potential Environmental Effects and Mitigation Measures

9.1 Transportation

9.1.1 Road Network

9.1.1.1 Potential Effects

Vehicular traffic access across the bridge will be maintained during majority of the project construction. As noted in Section 8.7, a Temporary Modular Bridge will be installed on the north side of the bridge prior to starting the construction. This temporary bridge will help maintain a single lane of traffic in alternating directions throughout the first stage of construction while the south half of the new bridge is being constructed. During the second stage of construction, a single lane of alternating traffic will be on the south half of the new bridge while the north half is being constructed. A short-term full closure of the bridge will be required to construct 600 millimetre wide “closure strip”, which will complete the new bridge.

The overall benefit of the bridge replacement is that it will improve overall public safety for auto users, cyclists and pedestrians in long-term.

No operational or maintenance related effects are anticipated to the road network following the replacement of the bridge. Occasional bridge and road maintenance may be required in long-term, however, it is not anticipated to have significant effects on the traffic.

9.1.1.2 Mitigation Measures

Following measures are being proposed for the detailed design and construction phases:

- To minimize traffic related impacts, efforts should be made to limit the full closure of the bridge to a weekend closure. Depending on the time of the year, if the weekend closure is not a preferred time, then a closure during weekdays could be considered. The Niagara Region should coordinate with the Town of Lincoln (including EMS/Fire Department) for bridge closure.
- During detailed design, Construction Phasing Plan, Construction Staging Plan and Traffic Management Plan should be developed to be included in the Tender Documents. These plans should identify how construction could be phased and

staged, and how vehicular, pedestrian and cycling traffic could be managed during construction, recognizing the need for maintaining traffic flow for emergency vehicles during construction

- The road users (including, area residents, businesses, local schools, emergency service providers (e.g., Lincoln Fire) and other key parties) should be notified of proposed construction well in advance. Attempts should be made to inform residents and businesses in a larger area, not just in the immediate vicinity of the subject bridge. Construction notifications could be issued via means to be determined by the Niagara Region, and may include mailout of direct letters to the area residents and businesses, installation of signages, newspaper ads, notification posting on the Niagara Region's website, and social media platforms (e.g., Facebook and Twitter)

9.1.2 Pedestrian and Cycling Network

9.1.2.1 Potential Effects

Consistent with the vehicular traffic, access for pedestrian and cyclists will be maintained across the bridge during majority of the project construction. With the implementation of the temporary modular bridge, one sidewalk will remain open for pedestrian and vehicular traffic lanes will be available for cyclists.

The access through the existing pedestrian path under the bridge will be temporarily impacted during the construction, however, the path will be maintained as part of the overall bridge replacement works.

Overall, the project will improve the pedestrian and cycling experience. The installation of a multi-use path and dedicated pedestrian sidewalk will provide a safe space for pedestrian and cyclists in accordance with the Niagara Region's Complete Streets Guidelines (IBI Group et al. (b), 2017).

9.1.2.2 Mitigation Measures

Following measures are being proposed for the detailed design and construction phases:

- Pedestrian traffic from the Jordan Hollow Park to the south to the businesses on the north side will be maintained.
- During detailed design, Construction Phasing Plan, Construction Staging Plan and Traffic Management Plan should be developed to be included in the Tender Documents. These plans should identify how construction could be phased and staged, and how vehicular, pedestrian and cycling traffic could be managed

during construction, recognizing the need for maintaining traffic flow for emergency vehicles during construction. These plans should also identify a safe detour route as an alternative for the pedestrian path under the bridge, which will be temporarily affected during construction

- The road users (including, area residents, businesses, local schools, emergency service providers (e.g., Lincoln Fire) and other key parties) should be notified of proposed construction well in advance. Attempts should be made to inform residents and businesses in a larger area, not just in the immediate vicinity of the subject bridge. Construction notifications could be issued via means to be determined by the Niagara Region, and may include mailout of direct letters to the area residents and businesses, installation of signages, newspaper ads, notification posting on the Niagara Region's website, and social media platforms (e.g., Facebook and Twitter)

9.2 Social and Economic Environment

9.2.1 Land-use

9.2.1.1 Potential Effects

The project was designed to avoid impacts on private properties as well as the Jordan Hollow Park (owned and managed by the Town of Lincoln). Based on the preferred design, no property taking is required outside of the Niagara Region road right-of-way for the proposed bridge replacement and roadway works.

In order to construct the road, there will be temporary impacts on adjacent properties to align the grade of the proposed works with the existing grade of the adjacent properties. Grading limits will be identified during detailed design phase of the project.

In addition, there will be need for land for temporary laydown areas to store and assemble construction equipment and materials. The size of temporary laydown areas will be identified during detailed design phase of the project. If the need for temporary laydown areas is required on private properties and/or the Jordan Hollow Park, the Niagara Region will consult and negotiate with the property owners to obtain permission to enter, as may be required. Jordan Hollow Park will remain open to vehicular traffic during construction.

9.2.1.2 Mitigation Measures

Following measures are being proposed for the detailed design and construction phases:

- During detailed design, the Project Team should confirm that the property taking is not required. In case, where property is required, compensation will be required to obtain the property. Compensation will be provided by the Niagara Region to the property owner for property acquisition. Compensation will be based on appraisals completed by the Niagara Region.
- During detailed design, the project design should be finalized with effort to avoid grading related impacts on the private properties, to the extent possible. Property or easement will be acquired by the Niagara Region for the grading work.
- During detailed design, Construction Staging Plan should be developed such that impacts to private and other public properties should be avoided, including obstruction to driveway access. Where possible, road right-of-way should be used for temporary laydown areas and construction access. If additional land is required for construction access and/or laydown areas, prior permission to enter should be obtained from the property owners in the vicinity of the subject bridge (e.g., the Town of Lincoln for Jordan Hollow Park).
- The road users (including, area residents, businesses, local schools, emergency service providers (e.g., Lincoln Fire) and other key parties) should be notified of proposed construction well in advance. Attempts should be made to inform residents and businesses in a larger area, not just in the immediate vicinity of the subject bridge. Construction notifications could be issued via means to be determined by the Niagara Region, and may include mailout of direct letters to the area residents and businesses, installation of signages, newspaper ads, notification posting on the Niagara Region's website, and social media platforms (e.g., Facebook and Twitter).

9.2.2 Tourism

9.2.2.1 Potential Effects

Temporary construction related disruptions are anticipated. As noted below, traffic access will be maintained throughout the construction.

No negative effects are anticipated on area tourism during operation and maintenance phases. Once completed, the new bridge and roadway will improve user experience and enjoyment through provision of a safe space for all users (drivers, pedestrians, and cyclists).

9.2.2.2 Mitigation Measures

As noted above, vehicular traffic access across the bridge will be maintained during majority of the project construction. Further, it is being proposed that advances

construction notification be issued to inform the road users of the proposed construction. As such, no additional measures are required.

9.2.3 Noise

9.2.3.1 Potential Effects

The properties in the close vicinity of the Twenty Mile Creek Bridge will experience higher noise levels during construction. Noise effects during construction will be associated with excavation, drilling, vehicular truck traffic and operation of heavy machinery. These impacts will be temporary in nature and largely unavoidable.

The replacement of the Twenty Mile Creek Arch Bridge as per the preferred design is not predicted to increase noise from traffic operations. Therefore, no traffic operation noise mitigation measures are required.

9.2.3.2 Mitigation Measures

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

- All equipment should be properly maintained to limit noise emissions. As such, all construction equipment should be operated with effective muffling devices that are in good working order
- There should be explicit indication in contract documents that Contractors are expected to comply with all applicable requirements of the contract and Town of Lincoln Noise Control By-law
- The Contract documents should contain a provision that any initial noise complaint will trigger verification that the general noise control measures agreed to above are in effect

9.2.4 Air Quality

9.2.4.1 Potential Effects

The construction activities are anticipated to affect the local air quality. These effects include dust from various material handling operations and combustion emissions from construction equipment. Such emissions will be of a temporary nature and the effects are not predicted to move far from the immediate vicinity of the construction activities.

No effects on air quality are anticipated during operation and maintenance phases. Once the bridge replacement work is complete, the air quality conditions are anticipated

to return to existing conditions. Therefore, no measures are proposed to avoid or minimize the effects on air quality during project operation and maintenance phases.

9.2.4.2 Mitigation Measures

Recommendations for mitigation measures for reducing construction related air quality impacts are discussed in the "Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities" (Cheminfo Services Inc., 2005). Standard mitigation measures and non-chloride dust suppressants identified in this document should be utilized during construction to mitigate impacts on air quality. Typical mitigation measures include the following:

- Scheduling of construction works to consider weather forecast to take advantage of precipitation for natural dust suppression
- Construction activities and the site should be monitored for wind direction and weather conditions to ensure that high-impact activities be reduced when the wind is blowing consistently towards nearby critical and sensitive receptors. Visible fugitive dust should also be monitored and immediate action should be taken to determine the root-cause in order to counteract this
- Each area of the construction site should be graded separately (i.e., not all at once), timed to coincide with the actual construction in that area. This allows vegetation and cover to remain intact within the construction zone, until just prior to construction occurring on that segment of the construction site
- Construction activities should be scheduled and planned to limit areas of exposed soil at any given time (i.e., clear vegetation, but strategically grub)
- Site layout should be planned to maximize separation from machinery and dust-causing activities
- Ensure that equipment (and adequate water supply, if applicable) required for dust control and trained workers are available at work site prior to commencing construction activities with potential for dust generation
- Exposed ground surfaces should be stabilized with non-erodible material as soon as practicably possible after construction in the affected area where soil surfaces will remain exposed for extended periods
- Construction vehicles / machinery and equipment should be in good repair, equipped with emission controls, as applicable, properly maintained and operated within regulatory requirements
- A minimal number of machines operating in any one area should be carefully considered during construction activities

- Minimize idling of equipment and trucks located in queuing areas in proximity of residences and other establishments

9.3 Cultural Environment

9.3.1 Built Heritage Resources and Cultural Heritage Landscape

9.3.1.1 Potential Effects

As discussed in Section 5.2.1, a Heritage Impact Assessment was completed to specify project's effects on cultural heritage resources and proposed mitigation measures. Effects were examined based on the descriptions of potential negative impacts provided in the Ontario Heritage Toolkit (InfoSheet #5), including:

- **Destruction** of any, or part of any, heritage attributes or features.
- **Alteration** that is not sympathetic or is incompatible with the historic fabric or appearance.
- **Shadows** created that alter the appearance of a heritage attribute or change the visibility of a natural feature or plantings, such as a garden.
- **Isolation** of a heritage attribute from its surrounding environment, context or a significant relationship.
- **Direct or indirect obstruction of significant views or vistas** within, from, or of built and natural features.
- **A change in land use** such as rezoning a battlefield from open space to residential use, allowing new development or site alteration to fill in the formerly open spaces. Land disturbances such as a change in grade that alters soils and drainage patterns that adversely affect an archaeological resource.
- **Land disturbances** such as a change in grade that alters soils and drainage patterns that adversely affect an archaeological resource.

The Heritage Impact Assessment provided following examination of potential effects on Twenty Mile Creek Arch Bridge and the adjacent cultural heritage landscape (Jordan Hollow CHL):

Destruction: The removal of the bridge is a direct impact on the structure itself. However, the bridge is proposed to be replaced with a new structure. Degree of impact would be moderate to high. Mitigation will be required. In terms of impacts on the

Jordan Hollow CHL, the replaced bridge will maintain a crossing at the historic location. There will be minor impacts on the Jordan Hollow CHL.

Alteration: The proposed works will alter the bridge by replacing most of the structure with a new one. Degree of impact would be moderate. Mitigation will be required. In terms of impacts to Jordan Hollow CHL, while the project will result in the construction of a new bridge at this location, attributes will be maintained.

Shadows: Shadow impacts will not be caused by the proposed works. Degree of impact would be none. No mitigation is required.

Isolation: While the bridge is proposed to be replaced, a new bridge in the location will continue to support and retain the heritage attributes associated with the CHL. No mitigation is required. The proposed works will alter the broader surrounding area both during and as a result of construction (the new bridge extends out further than the existing) but will not result in isolation of the attributes of the bridge significance. While the bridge is proposed to be replaced, a new bridge in the same location will continue the significance of the area and transportation route.

Direct or indirect obstruction of significant views: No significant views to / from the bridge were identified. Views up and down the Creek will continue to be maintained. No mitigation is required. Views of the Jordan Hollow landform will continue to be maintained, as will views up and down the Creek.

A change in land use: There are no proposed changes to the lands use as a result of the project. No mitigation is required.

Land disturbance: Land disturbances are planned as a result of the proposed bridge construction project. While the existing piers will be retained, works on the shore / banks and adjacent areas are planned.

Works will be completed within the road right-of-way. Impacts to private properties are not anticipated. Any grading-related impacts to private property may be minor in nature and will be identified during detailed design. Degree of impact would be minor. In terms of impacts to Jordan Hollow CHL, broader land disturbances to accommodate the adjusted road will be temporary in nature and restored afterwards.

Given the above evaluation, moderate impacts as it relates to destruction and alteration of the bridge will result from the replacement of the bridge structure, and minor temporary impacts are anticipated as a result of land disturbance within the broader cultural heritage landscape. Mitigation recommendations are discussed below.

9.3.1.2 Mitigation Measures

Following mitigation measures were recommended in the Heritage Impact Assessment:

- Replacement of the bridge utilizing the same alignment and existing piers. Doing so will ensure the historic connection is maintained, providing for pedestrian and vehicular traffic, while maintaining the same alignment as the existing bridge.
- Consider an open railing design where feasible, so that views up and down Twenty Mile Creek are maintained.
- Prior to demolition of existing structure, it is recommended that the existing Twenty Mile Creek Arch Bridge be documented through the preparation of a heritage documentation report. The report should include high-resolution digital photos, original design documents and a history of the bridge and study area. The documentation report can then be provided to the local archives in order to supplement the historic record for the area and provide for conservation through documentation. This should be completed during detailed design.
- A commemorative plaque should be designed during detailed design to commemorate the Indigenous history and culture, and history of the area and of the bridge. The digital photos and engineering drawings could be utilized to highlight the bridge superstructure on the commemorative plaque. In addition, the Niagara Region and the Town of Lincoln could explore opportunities to integrate the commemorative plaque with the future Jordan Hollow Indigenous Cultural Park. This commemorative plaque will be installed during construction of the bridge.

9.3.2 Archaeological Resources

9.3.2.1 Potential Effects

As discussed in Section 5.2.2, a Stage 1 archaeological assessment was carried out in accordance with the MHSTCI's 2011 Standards and Guidelines for Consultant Archaeologists. The Stage 1 background study identified that undisturbed portions of lands adjacent to the bridge have archaeological potential. During construction, there may be a potential of uncovering archaeological resources.

9.3.2.2 Mitigation Measures

The areas of archaeological potential will require a Stage 2 Archaeological Assessment prior to any land disturbance activities. The areas of archaeological potential are shown on **Figure 5-5**. A Stage 2 Archaeological Assessment will be completed during detailed design phase of this project. Based on the results of the field investigation, the Stage 2

Archaeological Assessment will recommend next steps, which could include additional stages of Archaeological Assessment. Archaeological concerns are not considered addressed until all recommended archaeological assessment has been completed, and the reports have been entered onto the Ontario Public Registry of Archaeological Reports.

The Niagara Region is committed to continued engagement with the local Indigenous Nations. To continue to engage with the local Indigenous Nations, the Niagara Region will invite the following Nations to participate in the monitoring of the Stage 2 Archaeological Assessment fieldwork and report review:

- Mississaugas of the Credit First Nation
- Six Nations of the Grand River
- Haudenosaunee Development Institute, on behalf of Haudenosaunee Confederacy

Following standard measures will apply:

- Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the Ontario Heritage Act. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and inform the MHSTCI and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of the Ontario Heritage Act.
- The Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33 requires that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Bereavement Authority of Ontario. If human remains are encountered, all activities must cease immediately and the local police as well as the Registrar, Burials of the Ministry of Government and Consumer Services (416-326-8800) must be contacted. In situations where human remains are associated with archaeological resources, MHSTCI should also be notified to ensure that the site is not subject to unlicensed alterations which would be a contravention of the Ontario Heritage Act.
- Archaeological sites recommended for further archaeological fieldwork or protection remain subject to Section 48 (1) of the Ontario Heritage Act and may not be altered, or have artifacts removed from them, except by a person holding an archaeological license.

9.4 Natural Environment

The following sub-sections identify potential negative effects on the terrestrial and aquatic environments as a result of the proposed construction work associated with the Project and recommend avoidance and mitigation measures. It should be noted that the effects assessment as presented herein was completed based on the preliminary design that was available at the time of preparation of this report. Design changes, as the Project develops through the detailed design phase, may require review of impacts and mitigation measures during detailed design phase.

Project footprint consists of the areas where vegetation removal is anticipated to be required for the Project based on the preliminary design. For the purposes of this report, the Study Team applied a 5 m buffer to the preferred design footprint to consider potential grading limits. The grading impacts will be confirmed during the detailed design phase of the project. As a conservative approach, all vegetation overlapped by the Project footprint was assumed to be permanently removed during construction.

Potential impacts on NHS features and other aspects of the natural environment due to the Project works may be short-term (i.e., occurring during construction and resolving a short time after construction) or long-term (i.e., lasting effects of construction or effects resulting from the altered ground). Potential negative impacts can be minimized by implementing mitigation measures during construction and incorporating long-term mitigation measures into the project design.

9.4.1 Aquatic Ecosystem

Based on the preliminary design, no in-water works are proposed at this time; however, work near water and below the High-Water Mark (HWM) may be required. Any in-water works should be avoided from 1 March to 30 June and 1 September to 30 November of any given year to protect critical life stages of the resident fish species. This in-water works timing window was identified by the MNDMNR.

Aquatic habitat conditions may not support fish during times of low precipitation (i.e., summer) when the construction activities may be planned as portions of the channel within 50 m of the bridge were dry during the summer field investigation completed by Wood. This observation is consistent with the information provided in the Twenty Mile Creek Watershed Plan, which noted that there is no base flow in Twenty Mile Creek upstream of the Niagara Escarpment during the summer months (Niagara Peninsula Conservation Authority, 2006).

Works are not anticipated to have an effect or cause serious harm to the value of the fishery; however, further Project details (e.g., the project temporary and/or permanent footprint in or near water, the Project approach to construction, etc.) are required to determine the full extent of work in relation to the aquatic features within the Study Area and support any further permitting requirements including the Fisheries Act and SARA, if required. BMPs and general mitigation measures are proposed to minimize effects on the aquatic environment; however, additional BMPs and mitigation measures may be recommended as Project details become available during detailed design.

The need for creating a dry work area within the creek was not confirmed at the time of preparation of this report. During the detailed design phase, it should be confirmed whether there is need to create a dry work area within the creek (for example, to work on piers), and appropriate measures should be identified (e.g., use of temporary cofferdam for work area isolation). The information related to the access route(s) to construction areas was not available at the time of preparation of this report and should be confirmed during detailed design.

Further, as noted in Section 5.3.3.2.1, one provincially Special Concern fish species and two provincially Threatened mussels were identified through online databases and agency consultation. These species are Grass Pickerel (Special Concern); Lilliput Mussel (Threatened) and Mapleleaf Mussel (Special Concern). Given the habitat conditions noted in Table 5-3, there is low potential for these species at risk to occur within the Study Area. With the implementation of in-water works timing windows and mitigation measures proposed below, the impacts on aquatic species at risk are not anticipated.

9.4.1.1 Potential Effects

Potential short-term effects on aquatic resources during construction may include the following:

- Debris and/or deleterious substances may enter the watercourse during construction activities by falling from the work overhead or going down the banks along the channel. This may result in requiring isolation for a part of the watercourse to clean up and thus inhibiting fish passage. Additionally, this could isolate fish temporarily from habitat. Harmful substances could impede breathing of fish and cause death.
- Temporary dewatering of the work area may be necessary during the construction phase. Details of this will be determined during the Detailed Design phase of the project. If work area isolation and dewatering is not managed properly, there is potential for impacts on fish and fish habitat through death of fish, introduction of sediments and increased turbidity.

- During construction, there is potential for disturbance to fish and mussel species as well as their habitat. Construction activities have the potential to introduce sediment and increase turbidity within the watercourse. The activities may also disturb the banks and associated riparian vegetation.

Potential long-term effects on aquatic resources may include the following:

- Increased suspended sediment loads from construction activities and exposed margins of the watercourse. These increases have the potential of adversely affecting form and function of the stream channel as well as resident and migratory fish species utilization of the habitat, which can decrease the suitability of the watercourse for spawning, egg survival, feeding and reproduction.

9.4.1.2 Mitigation Measures

At the time of preparation of this report, it was not confirmed whether in or near water works will be required during construction. Once the project design has advanced during detailed design phase, the need for in-water works should be confirmed and appropriate mitigation measures should be developed and implemented to avoid harmful alteration and/or destruction of fish habitat. At a minimum, the following measures will apply:

- In-water works should be avoided from 1 March to 30 June and 1 September to 30 November of any given year to protect critical life stages of the resident fish species as identified by the MNDMNR. This timing window will allow for resident fish communities to complete their spawning without construction disturbance.
- A debris containment system should be installed to catch material which may fall into the watercourse during work on the bridge above.
- Erosion and sediment control fence around the perimeter of the work and storage areas should be installed prior to construction activities and maintained throughout to prevent material from moving down the banks into the channel.
- Screens should also be utilized during dewatering activities (if required) following the DFO Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater.
- Limit vegetation removal during Project works and proper revegetation where vegetation removal occur can reduce the potential for bare soil and sediment entering the watercourse.
- Keep equipment and vehicles out of the creek channel to reduce the potential for a harmful alteration to fish habitat.

- Vehicles should arrive clean and refueling and maintenance should be conducted at least 30 m away from the watercourse to prevent deleterious substances from entering the watercourse.
- If it is determined that in-water works need to occur, fish relocations may be required prior to construction activities. A Scientific License to Collect Fish Authorization, under the FWCA, should be submitted to the MNDMNRF in order to relocate any species within the in-water works area.
- If it is determined that in-water works are required, and due to the potential presence of aquatic SAR species within the Study Area, correspondence will be initiated with MECP in order to determine any permitting needs under the ESA. In addition, the Request for Review submission to DFO will identify any SAR permitting requirements.

9.4.2 Terrestrial Ecosystem

As noted before, potential effects on natural environment and mitigation measures were identified based on the preliminary design and information about the proposed works available at the time of preparation of this report. Preliminary effects on terrestrial ecosystem and recommended measures are outlined below. These effects and measures should be reviewed and refined/confirmed during detailed design phase when the project design has advanced, and a fulsome understanding of project works has been developed.

9.4.2.1 Potential Effects

Potential Effects on Migratory Birds

- Removal of one inactive Eastern Phoebe nest, which is protected under the MBCA, will occur.
- Most species of birds in Canada are protected under the Migratory Birds Convention Act (MBCA), 1994, through the Migratory Birds Regulations and the Migratory Birds Sanctuary Guidelines. These policies and regulations ensure the protection of listed migratory bird species, their nests, eggs and offspring. The MBCA prohibits harm or destruction of migratory birds and their nests. Removal of vegetation to accommodate the construction of the project could directly harm nesting birds.

Potential Effects on Wildlife

- During site preparation and construction wildlife may enter the work area and be at risk for mortality.

- Construction activity may cause localized, short-term increases in noise and vibrations, which could disturb wildlife and deter animals from the area. Wildlife could also be disturbed by artificial lighting if construction occurs outside of daylight hours.

Effects on Species at Risk Bats

- There are several potential maternity roost trees located in within and adjacent to the Project Location (refer to Figure 5-25). During construction, removal of potential bat maternity trees may result in potential harm to Species at Risk bats.

Effects on Butternut Trees

Two Butternut trees were found during the vegetation community and plant inventory surveys. The location of these trees is identified on Figure 5-24. Butternut 1 was found just outside the Study area along the Bluff on the south side, while Butternut 2 was found in the floodplain north of the subject bridge.

Butternut 1 was assessed as a pure Butternut using the Field Identification of Butternut Hybrids form (Ontario Ministry of Natural Resources and Forestry, 2014), scoring zero. Butternut 2 scored a zero, indicating that it was a pure Butternut on the Field Identification of Butternut Hybrids form (Ontario Ministry of Natural Resources and Forestry, 2014), although only one trait could be evaluated given its state. This tree has a 10 cm DBH and was appeared to be dead for some time as vines had grown onto its canopy. The tree was located 45 m north from the Project Location along Twenty Mile Creek (Figure 5-24). Given that Butternut 2 is located within 50 m of the subject bridge and given its conditions (i.e., assumed dead), the Ministry of the Environment, Conservation and Parks should be contacted during detailed design to confirm that no requirements under Endangered Species Act are triggered.

Other Direct Effects

Other direct effects of the project works may include:

- Staging of equipment may encroach into adjacent natural areas beyond the proposed Project Location which may result in vegetation damage or loss;
- Disturbed areas and vegetation loss (e.g., trampling vegetation);
- Soil compaction from equipment, access routes, or laydown areas;
- Focal clearing and grubbing of vegetation to promote access and demolition;
- Introduction of invasive and/or non-localized plant material from previous construction sites and disturbance activities;

- Dust from work activities may settle on vegetation;
- Contamination of vegetation communities due to the unplanned release or discharge of deleterious substances to the environment, including fuels (diesel and propane), lubricants (engine oil, transmission oil, etc.), and coolants (ethylene glycol);
- Changes to or contamination of the PSW downstream of the Study Area, ANSI, SWH, Significant Valleyland, Significant Woodland from runoff of sediment exposed from construction, and vegetation removal; and,
- Disturbance to wildlife through noise and possible mortality through conflicts with construction equipment.
- As a result of proposed works, tree damage may occur and removal of some trees may be required.
- Most of the confirmed SWH is located outside the Project Location (see Figure 5-11). A very small portion of Deer Winter Congregation Areas Confirmed SWH overlaps with the proposed construction footprint, which primarily includes roadside trees along residential properties. Accordingly, no impacts are anticipated on the Deer Winter Congregation Areas Confirmed SWH adjacent to the Project Location.

9.4.2.2 Mitigation Measures

Mitigation Measures for Migratory Birds

- It is recommended that the in-active Eastern Phoebe nest be removed prior to netting the structure, which must occur outside of the breeding bird window (April 1st to August 31st).
- To avoid potential delays to construction (i.e., nesting under the bridge), it is recommended that the Niagara Region take a proactive approach and net the area over the stormwater management pipe under the east arch of the bridge in advance of the core breeding timing window – prior to 1 April. Netting should be half inch by half inch 19-gauge galvanized wire mesh (referred to as “hardware cloth” or “bird screen”) because it is reliable and durable. It is readily available at hardware stores or from wire mesh suppliers. Nylon netting or mist netting should not be used for exclusion because birds can become entangled and be injured or die while trapped. Other materials such as plastic tarps, plastic mesh and geotextile fabrics require more maintenance because wind and inclement weather can cause the fabric to shift or tear, which will create gaps and may allow access.

- To prevent harm to nesting birds, removal of woody vegetation (i.e., trees and shrubs) should be conducted outside of the typical bird nesting period in this area (April 1st to August 31st). These timing constraints should not be perceived as absolutes. This period represents the core breeding period, although some species may nest in March and September. Ultimately, the objective from a compliance perspective is to not circumvent the MBCA and its regulations. Due diligence measures should be implemented and documented for any nest searching efforts, including record control, to ensure compliance with the MBCA.
- For activities (including vegetation removal) that must occur during bird nesting season, surveys to identify nesting activity should be completed by an experienced Avian Biologist within 24 hours of scheduled work activities. The Avian Biologist conducting the nest sweeps must be able to identify birds by species and be knowledgeable of nesting seasons and activities for appropriate species. Due to the uncertainty that lies with nest sweeps during construction, especially during leaf-on conditions, it is, as noted, recommended that all vegetation clearing activities occur outside the above-noted bird nesting window. In the event that bird nests protected under the MBCA, FWCA or ESA are encountered during construction, work must stop in the vicinity of the sighting until further direction is provided. These species and their nests must not be disturbed, tormented, injured in any way, destroyed, and/or separated from young. A protective buffer area should be established around the nest and should be determined in consultation with a qualified avian biologist, as well as the MNMNR, MECP and/or Canadian Wildlife Service (CWS), as necessary. Nest surveys should only be completed in simple habitats such as singular trees or a small and well-defined area. Complex habitats such as vegetation communities with layers and dense foliage reduce the certainty of capturing all potential breeding.

Mitigation Measures for Wildlife

- The brush piles and other moveable habitat features in the area should be relocated before construction. As feasible, the work area should be surrounded by a silt (exclusion) fence within 48 hours of the commencement of construction activities to keep wildlife out of the site. The exclusion fencing should be examined daily and repaired as needed to ensure it functions as intended.
- Construction personnel should watch for wildlife attempting to enter the work area. In the event wildlife are encountered, work shall stop, and the appropriate personnel shall be notified accordingly (e.g., site engineer, and government agency).

- Due to the potential for turtle and snake habitat in the vicinity of the subject bridge, an Application for a Wildlife Scientific Collector's Authorization, under the FWCA, should be submitted to the MNDMNRF. This permit is required to relocate any wildlife (i.e., turtles, snakes, or amphibians) found in the vicinity of the subject bridge during the work activities. The contractor is responsible for the permitting and completion of the wildlife rescue and relocation work. All work must be completed by a qualified biologist.
- In order to prevent impacts to wildlife as a result of noise and vibrations, equipment idling should be kept to a minimum during construction. Minimizing equipment idling will also reduce carbon emissions and reduce the overall carbon footprint of construction. Construction outside of daylight hours should be avoided.

Mitigation Measures for Species at Risk Bats

- All vegetation and tree removal must occur outside of the bat maternity roosting window (March 31- September 30) to avoid impacts to Species at Risk bats.
- During detailed design phase, once the construction footprint is confirmed, an Information Gathering Form should be completed and submitted to the Ministry of the Environment, Conservation and Parks to receive advice on next steps related to potential for effects on the potential habitat for Species at Risk Bats.

Mitigation Measures for Butternut Trees

Butternuts and their habitat are protected under the ESA (Ontario Ministry of Natural Resources and Forestry, 2014). The habitat of a Butternut is described in the Recovery Strategy for the Butternut in Ontario as a minimum of a 25 m radius buffer from the base of the stem of the tree to:

- Ensure that the habitat conditions required for the survival of each tree can be maintained, including area for the potential growth of trees that may survive to maturity;
- Ensure that habitat for regeneration that occurs within this radius is also protected; and
- Prevent exposure of the rooting zone, alteration of the soil nutrient content, alteration of the soil chemistry and acidity levels, the addition of deleterious substances, soil compaction, and reduction of air and water penetration into the soil.

- The location of the two butternut trees should be identified on the design drawings to ensure that potential impacts to these trees are avoided during construction;
- Should any SAR be encountered on site during Project implementation, the MECP should be contacted immediately.

Mitigation Measures for Other Direct Effects

Most impacts can be mitigated with an appropriate Erosion and Sediment Control Plan, including dewatering, if necessary, and a construction staging and project phasing plan. In general:

- All work zones must be clearly marked on detailed design drawings.
- Staging, and access areas should be minimized as feasible to avoid disturbing the natural environment beyond the proposed disturbance limit;
- Equipment, materials and associated materials should be operated, stored and maintained in such a manner that prevents any deleterious substance from entering the natural environment as indicated in OPSS 182, OPSS 517 and OPSS 805;
- Access to any natural areas outside of the Project Location should be prohibited to the extent possible to ensure the protection of these areas; this includes temporary access. A sediment control fence should be installed around the perimeter of the work area to provide a visual barrier and to isolate wildlife from the work area;
- Ensure a Spill Management Plan (including spill kit materials, instructions regarding their use, education of staff, and emergency contact numbers) is present on-site at all times for implementation in the event of an accidental spill. All spills are to be reported to the MECP Spills Action Centre (SAC) at 1 800-268-6060;
- Ensure that machinery arrives on site in a clean condition and is maintained free of fluid leaks, invasive species and noxious weeds; and local regulatory authorities should be identified and their contact information should be made available on site during construction. Local regulatory authorities include the MECP, DFO, MNDMNRF, NPCA, the Niagara Region, Town of Lincoln, and local emergency service providers.
- Staging and access areas should be minimized as much as feasible to avoid disturbance to the natural environment;

- Implement drip pans under equipment (i.e., generators, pumps, etc.) in operation within the work areas. If refueling and staggng occurs on tree roots, a root zone protection should apply;
- Any refueling should be undertaken at least 30 m from any watercourse or any other surface drainage feature; to the greatest extent possible given the limitations imposed by the site layout;
- Temporarily store, handle, and dispose of all materials used or generated (e.g., organics, soils, construction waste and debris, etc.) during site preparation, construction, and clean-up in a manner that prevents their entry to any watercourse. To the extent possible, restrict the temporary on-site storage of sediment generated as part of the Project works;
- An Erosion and Sediment Control Plan should be developed and implemented, consistent with the Erosion and Sediment Control Guideline for Urban Construction, (Toronto and Region Conservation Authority, 2019), and current OPSS and Ontario Provincial Standard Drawings prior to construction. The ESC Plan should be designed to contain/isolate the work area, manage site drainage/runoff, and prevent erosion of exposed soils and migration of sediment. The ESC measures should be implemented prior to commencement of works, and maintained through all phases of the Project, until vegetation is re-established, and all disturbed ground is permanently stabilized with a vegetative cover. An ESC Plan should be prepared as part of the detailed design drawing package. The ESC Plan should illustrate the layout of the proposed ESC measures to be implemented during construction; and
- ESC measures should include:
 - Installation of effective ESC measures before starting work to prevent sediment from entering natural areas. Sediment control barriers (e.g., silt fence) should be installed around the perimeter of the work area, including any areas designated as staging/storage areas. The silt fence will also prohibit wildlife from entering the work areas. The fencing must be installed in advance of the turtle nesting season (i.e., May – July).
 - The contractor should implement a debris containment system to avoid debris falling into the watercourse during the bridge removal activities;
 - Regular inspection and maintenance of ESC measures and structures during construction; and
 - Removal of non-biodegradable ESC materials once the site is stabilized.

- During detailed design phase, tree inventory should be completed and a Tree Protection and Replacement Plan should be prepared to identify trees that may require removal and to protect the remaining trees. Mitigation for the loss of trees should occur in the form of replacement trees and shrubs. Replacement vegetation must be native species and suited to the local hydrology and soils of the area they are planted.

9.4.3 Flooding Hazards

9.4.3.1 Potential Effects

As discussed in Section 5.4.3, the Twenty Mile Creek Bridge is located in a regulated area and floodplain area associated with Twenty Mile Creek. During project construction activities, there may be potential for interfering with floodplain through cut and fill activities.

For the operations and maintenance phase, the new bridge will marginally improve the hydraulic capacity of the crossing.

9.4.3.2 Mitigation Measures

During detailed design and prior to starting construction activities, a permit under Ontario Regulation 155/06 will be obtained from the Niagara Peninsula Conservation Authority to ensure that project does not pose any effects on the flooding hazard.

9.4.4 Stormwater Management

9.4.4.1 Potential Effects

During the construction of the project, there is a potential for short-term negative effects on the quality of surface water due to erosion and sedimentation; entry of debris from the demolition of the existing bridge structure; contamination by oils, gasoline, grease and other materials from construction equipment, materials storage and handling.

During the operation and maintenance phase, there is potential for increased stormwater runoff, due to the increase in impervious area, specifically at the bridge location.

9.4.4.2 Mitigation Measures

During construction, mitigation measures outlined in Section 9.4.1.2 should be implemented to avoid and/or minimize potential for effects on the stormwater quantity.

As discussed in Section 5.3.6, during detailed design, if required, a CCTV Inspection will be completed to determine the condition of existing storm sewers. In addition, further assessment will be completed during detailed design to determine the capacity of storm sewers and the outfall to convey stormwater and the need for stormwater quality treatment. If the need for improvements to the stormwater quantity conveyance and/or stormwater quality treatments are identified, those improvements will be incorporated during detailed design.

9.4.5 Groundwater

9.4.5.1 Potential Effects

As discussed in Section 8.0, excavation will be required during construction to install abutment foundations. There may be potential to encounter groundwater during construction.

9.4.5.2 Mitigation Measures

A preliminary investigation will be completed during detailed design phase to determine the requirement for an Environmental Activity and Sector Registry (EASR) or a Permit to Take Water (PTTW) to support the bridge replacement. Should an EASR or PTTW be required, a detailed hydrogeological investigation will be completed to support the registration of an EASR or an application for a PTTW. The hydrogeological assessment will also identify any impacts on groundwater and will propose mitigation measures.

9.4.6 Drinking Water Source

9.4.6.1 Potential Effects

As noted in Section 5.4.5, the subject bridge is located within an area of Highly Vulnerable Aquifers. Potential effects during construction may be associated with accidental spills/leakage of fluids from construction machinery.

9.4.6.2 Mitigation Measures

Best management practices should be implemented during construction to prevent any fuel lubricants and fluid spills resulting from construction activities and manage any unanticipated occurrences that could result in impacts to groundwater. All spills that could potentially cause damage to the environment will be reported to the Spills Action Centre of the Ministry of the Environment, Conservation, and Parks (800-268-6060).

9.4.7 Climate Change

9.4.7.1 Potential Effects

In 2017, the Ministry of the Environment, Conservation and Parks issued a guide that provides information for proponents to consider impacts of climate change on proposed undertaking and vice versa when carrying out the environmental assessments (Ministry of the Environment, Conservation and Parks, 2017). The guide requires proponents to take into account the following:

- the project's expected production of greenhouse gas emissions and impacts on carbon sinks (climate change mitigation)
- resilience or vulnerability of the undertaking to changing climatic conditions (climate change adaptation)

During the construction of the project, there will be a temporary increase in greenhouse gas emissions as a result of operation of construction machinery and equipment.

From a climate change adaptation perspective, the proposed bridge is designed to convey stormwater flows up to 100-year storms. This increases bridge's resiliency to the effects of flooding, which is a key hazard associated with climate change.

9.4.7.2 Mitigation Measures

In order to minimize emission of greenhouse gases during project construction, idling of construction vehicles and equipment should be minimized. In addition, construction vehicles and equipment should be in good working order. This will help reduce inefficiencies in the operation of the construction vehicles and equipment.

9.4.8 Soil

9.4.8.1 Potential Effects

During construction, there is potential for soil compaction from construction activities, such as, equipment movement, access routes, or laydown areas. In addition, there is potential for soil contamination due to accidental spills/leakage of fluids from construction machinery. During construction, there may also be excavated soil/materials that could not be used on site and may require removal. There may also be need for importing additional soil on site.

9.4.8.2 Mitigation Measures

During construction, mitigation measures outlined in Section 9.4.2.2 should be implemented to avoid and/or minimize potential for effects on the soil, including soil compaction and soil contamination.

Management of excess soil (including excavation, transportation, temporary storage, and disposal) will be completed in accordance with O. Reg. 406/19 and the ministry's current guidance document titled "Management of Excess Soil – A Guide for Best Management Practices" (2014). The amount of excavated soil and/or imported soil will be determined during detailed design phase through the development of a Soil Management and Fille Management Plan.

9.5 Technical Environment

9.5.1 Utilities

9.5.1.1 Potential Effects

There may be potential for conflict with utilities during construction of the project.

9.5.1.2 Mitigation Measures

Utility impacts should be confirmed during detailed design. In case if utility relocation is required, the utility providers should be consulted, and utility relocation should be coordinated. If there are no/minor grading related effects on utilities, the utility providers should be contacted to inform them of these effects.

10.0 Commitments for Additional Work

10.1 Commitments for Technical Work

Table 10-1 summarizes the commitments for additional work that will need to be addressed prior to construction.

Table 10-1: Commitments for Additional Work

Category	Commitment
Transportation	During detailed design, Construction Phasing Plan, Construction Staging Plan and Traffic Management Plan should be developed to be included in the Tender Documents. These plans should identify how construction could be phased and staged, and how vehicular, pedestrian and cycling traffic could be managed during construction, recognizing the need for maintaining traffic flow for emergency vehicles during construction. These plans should also identify a safe detour route as an alternative for the pedestrian path under the bridge, which will be temporarily affected during construction.
	The road users (including, area residents, businesses, local schools, emergency service providers (e.g., Lincoln Fire) and other key parties) should be notified of proposed construction well in advance. The Niagara Region should coordinate with the Town of Lincoln (including EMS/Fire Department) for bridge closure. Attempts should be made to inform residents and businesses in a larger area, not just in the immediate vicinity of the subject bridge. Construction notifications could be issued via means to be determined by the Niagara Region, and may include mailout of direct letters to the area residents and businesses, installation of signages, newspaper ads, notification posting on the Niagara Region’s website, and social media platforms (e.g., Facebook and Twitter)
	During detailed design, the Project Team should review, refine (if required) and incorporate mitigation measures from Section 9.1 of this report into project planning and contract documents to avoid/minimize impacts on the transportation network.
Social and Economic Environment	During detailed design, the Project Team should confirm that the property taking is not required. In case, where property is required, compensation will be required to obtain the property. Compensation will be provided by the Niagara Region to the property owner for property acquisition. Compensation will be based on appraisals completed by the Niagara Region.
	During detailed design, the project design should be finalized with effort to avoid grading related impacts on the private properties, to the extent possible. Property or easement will be acquired by the Niagara Region for the grading work.
	During detailed design, Construction Staging Plan should be developed such that impacts to private and other public properties should be avoided, including obstruction to driveway access. Where possible, road right-of-way should be used for temporary laydown areas and construction access. If additional land is required for construction access and/or laydown areas, prior permission to enter should be obtained from the property owners in the vicinity of the subject bridge (e.g., the Town of Lincoln for Jordan Hollow Park).
	During detailed design, the Project Team should include note in the contract documents that Contractors are expected to comply with all applicable requirements of the contract and Town of Lincoln Noise Control By-law.

Category	Commitment
	During detailed design, the Project Team should ensure that the Contract documents contain a provision that any initial noise complaint will trigger verification that the general noise control measures agreed to above are in effect.
	During detailed design, the Project Team should review, refine (if required) and incorporate mitigation measures from Section 9.2 of this report into project planning and contract documents to avoid/minimize impacts on the social and economic environment.
Cultural Environment	During detailed design, Project Team should consider an open railing design for the bridge, where feasible, so that views of the Twenty Mile Creek are maintained.
	During detailed design and prior to demolition of existing structure, it is recommended that the existing Twenty Mile Creek Arch Bridge be documented through the preparation of a heritage documentation report. The report should include high-resolution digital photos, original design documents and a history of the bridge and study area. The documentation report can then be provided to the local archives in order to supplement the historic record for the area and provide for conservation through documentation.
	A commemorative plaque should be designed during detailed design to commemorate the Indigenous history and culture, and history of the area and of the bridge. The digital photos and engineering drawings could be utilized to highlight the bridge superstructure on the commemorative plaque. In addition, the Niagara Region and the Town of Lincoln could explore opportunities to integrate the commemorative plaque with the future Jordan Hollow Indigenous Cultural Park. This commemorative plaque will be installed during construction of the bridge.
	A Stage 2 Archaeological Assessment should be completed during detailed design phase of this project. Additional stages of archaeological assessment may be required, based on the findings and recommendations of the Stage 2. Archaeological concerns are not considered addressed until all recommended archaeological assessment has been completed, and the reports have been entered onto the Ontario Public Registry of Archaeological Reports.
	The following Indigenous Nations should be invited to participate in the monitoring of the Stage 2 Archaeological Assessment fieldwork (and any additional archaeological assessment, if required) and report review: • Mississaugas of the Credit First Nation • Six Nations of the Grand River • Haudenosaunee Development Institute, on behalf of Haudenosaunee Confederacy
	During detailed design, the Project Team should review, refine (if required) and incorporate mitigation measures from Section 9.3 of this report into project planning and contract documents to avoid/minimize impacts on the cultural environment.
	Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the Ontario Heritage Act. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and inform the MHSTCI and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of the Ontario Heritage Act.
	The Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33 requires that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Bereavement Authority of Ontario. If human remains are encountered, all activities must cease immediately and the local

Category	Commitment
	police as well as the Registrar, Burials of the Ministry of Government and Consumer Services (416-326-8800) must be contacted. In situations where human remains are associated with archaeological resources, MHSTCI should also be notified to ensure that the site is not subject to unlicensed alterations which would be a contravention of the Ontario Heritage Act.
	Archaeological sites recommended for further archaeological fieldwork or protection remain subject to Section 48 (1) of the Ontario Heritage Act and may not be altered, or have artifacts removed from them, except by a person holding an archaeological license.
Natural Environment	Potential effects on natural environment and recommended measures outlined in Section 9.4 of this report are based on preliminary design. These effects and recommended measures should be reviewed and confirmed (or refined, if needed).
	During detailed design, Project Team should confirm whether in-water works area required (e.g., creating dry work area using cofferdams).
	At the time of preparation of this report, it was not confirmed whether in or near water works will be required during construction. Once the project design has advanced during detailed design phase, the need for in-water works should be confirmed and appropriate mitigation measures should be developed and implemented to avoid harmful alteration and/or destruction of fish habitat. A request for review form should be submitted to Fisheries and Oceans Canada to receive advice on mitigation measures and to confirm that an authorization under Fisheries Act is not required.
	If it is determined that in-water works need to occur, fish relocations may be required prior to construction activities. A Scientific License to Collect Fish Authorization, under the FWCA, should be submitted to the MNDMNRF in order to relocate any species within the in-water works area.
	During detailed design phase, in-water works restriction window should be incorporated into project's construction schedule. In-water works should be avoided from 1 March to 30 June and 1 September to 30 November of any given year to protect critical life stages of the resident fish species as identified by the MNDMNRF. This timing window will allow for resident fish communities to complete their spawning without construction disturbance.
Natural Environment (Continued)	It is recommended that the in-active Eastern Phoebe nest be removed prior to netting the structure, which must occur outside of the breeding bird window (April 1 st to August 31 st). This activity should be incorporated into project's construction schedule during detailed design.
	To avoid potential delays to construction (i.e., nesting under the bridge), it is recommended that the Niagara Region take a proactive approach and net the area over the stormwater management pipe under the east arch of the bridge in advance of the core breeding timing window – prior to 1 April. Netting should be half inch by half inch 19-gauge galvanized wire mesh (referred to as "hardware cloth" or "bird screen") because it is reliable and durable. It is readily available at hardware stores or from wire mesh suppliers. Nylon netting or mist netting should not be used for exclusion because birds can become entangled and be injured or die while trapped. Other materials such as plastic tarps, plastic mesh and geotextile fabrics require more maintenance because wind and inclement weather can cause the fabric to shift or tear, which will create gaps and may allow access. This activity should be incorporated into project's construction schedule during detailed design.
	To prevent harm to nesting birds, removal of woody vegetation (i.e., trees and shrubs) should be conducted outside of the typical bird nesting period in this area (April 1 st to August 31 st). These timing constraints should not be perceived as absolutes. This period represents the core breeding period, although some species may nest in March and September. Ultimately, the objective from a compliance perspective is to not circumvent the MBCA and its regulations. Due

Category	Commitment
	diligence measures should be implemented and documented for any nest searching efforts, including record control, to ensure compliance with the MBCA. This activity should be incorporated into project's construction schedule during detailed design.
Natural Environment (Continued)	All vegetation and tree removal must occur outside of the bat maternity roosting window (March 31- September 30) to avoid impacts to Species at Risk bats. This activity should be incorporated into project's construction schedule during detailed design.
	Due to the potential for turtle and snake habitat in the vicinity of the subject bridge, an Application for a Wildlife Scientific Collector's Authorization, under the FWCA, should be submitted to the MNDMNRF. This permit is required to relocate any wildlife (i.e., turtles, snakes, or amphibians) found in the vicinity of the subject bridge during the work activities. The contractor is responsible for the permitting and completion of the wildlife rescue and relocation work. All work must be completed by a qualified biologist.
	During detailed design phase, once the construction footprint is confirmed, an Information Gathering Form should be completed and submitted to the Ministry of the Environment, Conservation and Parks to receive advice on next steps related to potential for effects on the potential habitat for Species at Risk Bats and Butternut trees. A Butternut Health Assessment should also be prepared and submitted to the Ministry.
	During detailed design, the location of the two butternut trees should be identified on the design drawings to ensure that potential impacts to these trees are avoided during construction.
	During detailed design, all work zones must be clearly marked on detailed design drawings.
	During detailed design, staging, and access areas should be minimized as feasible to avoid disturbing the natural environment beyond the proposed disturbance limit;
	During detailed design, an Erosion and Sediment Control Plan should be developed for implementation during construction.
Natural Environment (Continued)	During detailed design, tree inventory should be completed, and a Tree Protection and Replacement Plan should be prepared to identify trees that may require removal and to protect the remaining trees. Mitigation for the loss of trees should occur in the form of replacement trees and shrubs. Replacement vegetation must be native species and suited to the local hydrology and soils of the area they are planted.
	During detailed design, a permit should be obtained from the Niagara Peninsula Conservation Authority for works within regulated areas and floodplain areas.
	During detailed design, if required, a CCTV Inspection should be completed to determine the condition of existing storm sewers. In addition, further assessment should be completed during detailed design to determine the capacity of storm sewers and the outfall to convey stormwater and the need for stormwater quality treatment. If the need for improvements to the stormwater quantity conveyance and/or stormwater quality treatments are identified, those improvements should be incorporated during detailed design.
	A preliminary hydrogeological investigation should be completed during detailed design to determine the requirement for an Environmental Activity and Sector Registry or a Permit to Take Water to support the bridge replacement. Should an EASR or PTTW be required, a detailed hydrogeological investigation should be completed to support the registration of an EASR or an application for a PTTW, and appropriate permit should be obtained. The hydrogeological assessment will also identify any impacts on groundwater and will propose mitigation measures. As part of the review of this draft report, the Ministry

Category	Commitment
	recommended that the proponent consult with the Permit to Take Water Unit of the Environmental Permissions Branch of the Ministry to determine any Permit to Take Water or Environmental Activity and Sector Registry requirements (enviopermissions@ontario.ca).
	The amount of excavated soil and/or imported soil should be determined during detailed design phase through the development of a Soil Management and Fille Management Plan. Management of excess soil (including excavation, transportation, temporary storage, and disposal) will be completed in accordance with O. Reg. 406/19 and the ministry’s current guidance document titled “Management of Excess Soil – A Guide for Best Management Practices” (2014).
Technical Environment	Utility impacts should be confirmed during detailed design. In case if utility relocation is required, the utility providers should be consulted, and utility relocation should be coordinated. If there are no/minor grading related effects on utilities, the utility providers should be contacted to inform them of these effects.

10.2 Commitments for Permits and Approvals

Table 10-2 outlines the permits and approvals that will be required to facilitate construction of this project.

Table 10-2: Permits and Approvals

Permit Authority	Permit / Approval
Fisheries and Oceans Canada	A request for review form should be submitted to Fisheries and Oceans Canada to receive advice on mitigation measures and to confirm that an authorization under Fisheries Act is not required.
Ministry of Heritage, Sport, Tourism and Culture Industries	A Stage 2 Archaeological Assessment, and any additional archaeological assessment that may be required (e.g., Stage 3 Archaeological Assessment) should be completed and approval should be obtained from the Ministry of Heritage, Sport, Tourism and Culture Industries.
Ministry of Northern Development, Mines, Natural Resources and Forestry	If it is determined that in-water works need to occur, fish relocations may be required prior to construction activities. An application for License to Collect Fish for Scientific Purposes, under the FWCA, should be submitted to the MNDMNRF and authorization should be obtained in order to relocate any species within the in-water works area.
	Wildlife Scientific Collectors Authorization should be obtained for intentional or anticipated incidental capture, handling and/or relocation of herpetofauna (e.g., snakes, frogs).
Ministry of the Environment, Conservation and Parks	An Environmental Activity and Sector Registry should be completed or a Permit to Take Water should be obtained, if the need is identified based on the results of hydrogeological/geotechnical investigation. As part of the review of this draft report, the Ministry recommended that the proponent consult with the Permit to Take Water Unit of the Environmental Permissions Branch of the Ministry to determine any Permit to Take Water or Environmental

Permit Authority	Permit / Approval
	Activity and Sector Registry requirements (enviopermissions@ontario.ca).
	An Information Gathering Form should be submitted to the Ministry of the Environment, Conservation and Parks to receive advice on next steps related to potential for effects on the potential habitat for Species at Risk Bats and Butternut trees.
Niagara Peninsula Conservation Authority	A permit under Ontario Regulation 155/06 should be obtained from the Niagara Peninsula Conservation Authority for works within regulated areas and floodplain areas.
Niagara Escarpment Commission	A Niagara Escarpment Development Permit under the Niagara Escarpment Planning and Development Act, RSO, 1990, should be obtained for works within the Escarpment Natural Area and Area of Development Control.

10.3 Monitoring Plan

The project construction should be subject to daily on-site inspection to ensure that mitigation measures and commitments identified in this report are adhered to by the Contractor. Monitoring should include following elements:

- A regular Environmental Monitoring/Inspection program during the course of the Project construction to confirm environmental protection measures and commitments identified in Section 9.0 and Section 10.0 of this report are being applied.
- Monitoring and maintenance of erosion and sediment control measures and addressing any failures.
- Maintenance of records of monitoring, maintenance and construction incidents

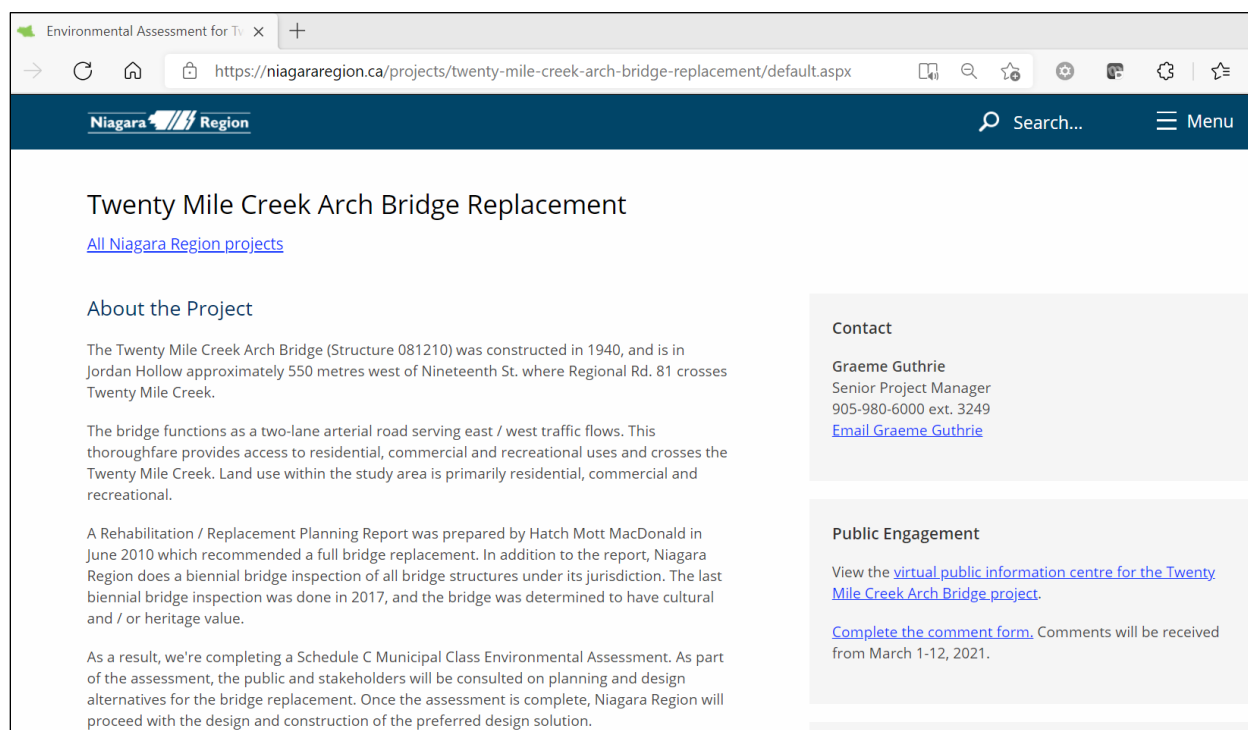
11.0 Consultation

11.1 Consultation Approach

11.1.1 Project Webpage

At the project commencement stage, a webpage was developed for this project on the Niagara Region's website. Information related to the Class EA study was posted on this webpage throughout the study, including study notices, Public Information Centre materials, and study reports. After completion of the Class EA Study, the Niagara Region will continue to post updates on the project webpage. The project webpage can be accessed by clicking at this hyperlink: [Twenty Mile Creek Arch Bridge Replacement](https://niagararegion.ca/projects/twenty-mile-creek-arch-bridge-replacement/default.aspx).

Figure 11-1: Screenshot of Project Webpage



11.1.2 Study Contact List

A Study Contact List was developed at the commencement of this Class EA study. This list included contacts from the federal and provincial government agencies, Niagara Peninsula Conservation Authority, Niagara Region, Town of Lincoln, Indigenous Nations, utility companies, and key stakeholders. The Contact List was updated throughout the study. Contact groups from the Study Contact List are listed on the following page.

Table 11-1: Contact Groups on the Study Contact List

Contact Group	Name
Indigenous Nations	Mississaugas of the Credit First Nation Haudenosaunee Confederacy Chiefs Council represented by Haudenosaunee Development Institute Six Nations of the Grand River
Federal Government Agencies	Environment and Climate Change Canada Fisheries and Oceans Canada
Provincial Government Agencies	Ministry of the Environment, Conservation and Parks Ministry of Northern Development, Mines, Natural Resources and Forestry Ministry of Heritage, Sport, Tourism and Culture Industries Infrastructure Ontario Ministry of Municipal Affairs and Housing Niagara Escarpment Commission Ontario Heritage Trust
Niagara Region	Public Health Water Wastewater Services Planning and Development Services Regional Clerk
Town of Lincoln	Public Works Department Town Clerk Planning and Development Department
Conservation Authority	Niagara Peninsula Conservation Authority
Emergency Service Provides	Town of Lincoln Fire Rescue & Emergency Services Niagara Region Niagara Emergency Medical Services Niagara Regional Police Service
School Boards	District School Board of Niagara Niagara Catholic District School Board
Active Transportation Committee	Regional Niagara Active Transportation Sub Committee
Chamber of Commerce	Lincoln Chamber of Commerce

Contact Group	Name
Utilities	Niagara Peninsula Energy Inc. Bell Canada Cogeco Cable Enbridge Gas Inc. Niagara Region Broadband Networks TransCanada Pipelines
Elected Officials	Regional Chair Regional Councillor for Lincoln Mayor of the Town of Lincoln Ward 3 Councillors of the Town of Lincoln
Special Interest Groups	Bruce Trail Conservancy

The final Study Contact List is provided in Appendix H.

11.1.3 Study Notices

11.1.3.1 Notice of Study Commencement

A Notice of Study Commencement was issued to introduce the Class EA Study and invite the public, Indigenous Nations, regulatory agencies and stakeholders to participate in the Study process. The notice was issued via following means:

Table 11-2: Distribution Method for the Notice of Study Commencement

Notice Distribution Method	Date
Posting on project webpage	August 11, 2020
Email circulation to Government Agencies, Emergency Services, Utility Companies and Special Interest Groups	October 30, 2020 & November 3, 2020
Publication in Niagara This Week	July 16, 2020

The Notice of Commencement is provided in Appendix I.

11.1.3.2 Notice of Public Information Centre #1

A Notice of Public Information Centre #1 was issued to invite the public, Indigenous Nations, regulatory agencies and stakeholders to participate in the Public Information

Centre #1. The following table lists the methods of distribution of the Notice of Public Information Centre #1.

Table 11-3: Distribution Methods for the Notice of Public Information Centre #1

Notice Distribution Method	Date
Posting on project webpage	February 3, 2021
Posting on Niagara Region's Facebook page	February 3, 2021
Grimsby Lincoln News	February 18, 2021
Posting on Niagara Region's Twitter page	February 19, 2021 & March 2, 2021
Posting on Town of Lincoln's Twitter page	March 5, 2021
Email circulation to the Indigenous Nations (Mississaugas of the Credit First Nation, Six Nations of the Grand River, and Haudenosaunee Confederacy Chiefs Council c/o Haudenosaunee Development Institute)	March 3, 2021
Issued for mailout to the area residents	February 18, 2021 & February 24, 2021
Email circulation to Government Agencies, Emergency Services, Active Transportation Committees, Utility Companies and Special Interest Groups	February 16, 2021 & February 24, 2021

The Notice of Public Information Centre #1 is provided in Appendix I.

11.1.3.3 Notice of Public Information Centre #2

A Notice of Public Information Centre #2 was issued to invite the public, Indigenous Nations, regulatory agencies and stakeholders to participate in the Public Information Centre #2. The following table lists the methods of distribution of the Notice of Public Information Centre #2.

Table 11-4: Distribution Methods for the Notice of Public Information Centre #2

Notice Distribution Method	Date
Issued for mailout to the area residents	October 6, 2021
Published in Grimsby Lincoln News	October 7, 2021 & October 14, 2021
Email circulation to Government Agencies, Emergency Services, Active Transportation Committees, Utility Companies and Special Interest Groups	October 7, 2021
Email circulation to the Indigenous Nations (Mississaugas of the Credit First Nation, Six Nations of the Grand River, and Haudenosaunee Confederacy Chiefs Council c/o Haudenosaunee Development Institute)	October 13, 2021

The Notice of Public Information Centre #2 is provided in Appendix I.

11.2 Agency Consultation

A summary of consultation with the agencies is provided below. Copies of correspondence are provided in Appendix J.

11.2.1 Ministry of the Environment, Conservation and Parks

On October 15, 2021, the Ministry of the Environment, Conservation and Parks shared a letter in response to the Notice of Study Commencement. The Ministry's response letter outlined Ministry's expectations and noted that these be considered in the identification of impacts and necessary mitigation, as applicable.

In addition, Ministry's response letter noted that the Crown has a legal duty to consult Aboriginal communities when it has knowledge, real or constructive, of the existence or potential existence of an Aboriginal or treaty right and contemplates conduct that may adversely impact that right. Before authorizing this project, the Crown must ensure that its duty to consult has been fulfilled, where such a duty is triggered. Although the duty to consult with Aboriginal peoples is a duty of the Crown, the Crown may delegate procedural aspects of this duty to project proponents while retaining oversight of the consultation process.

The Ministry's letter further added that the proposed project may have the potential to affect Aboriginal or treaty rights protected under Section 35 of Canada's Constitution Act 1982. Accordingly, the Ministry delegated the procedural aspects of rights-based consultation with the potentially effected Indigenous Nations to the Niagara Region. The Ministry recommended consulting with the following Indigenous Nations:

- Six Nations of the Grand River Territory
- Haudenosaunee Confederacy Chiefs Council
- Mississaugas of the Credit First Nation

Lastly, the Ministry requested the draft Environmental Study Report and requested that the Ministry be allowed a minimum of 30 days for review.

Table 11-5 below lists Ministry of Environment, Conservation and Parks' expectations for the Class EA Study and the sections of this report where they are addressed.

Table 11-5: Ministry of the Environment, Conservation and Parks' Expectations

Ministry's Expectations	Relevant Section of the Environmental Study Report
Climate Change Adaptation and Mitigation	Section 9.4.4
Species at Risk (including Effects and Mitigation Measures)	Section 5.4 and Section 9.4
Future Work Commitments and Required Permits/Approvals	Section 10.0
Effects on Source Water Protection-related Features in the Area	Section 5.4.5 and Section 9.4.5
Surface Water (including Effects and Mitigation Measures)	Section 5.4.3, Section 7.3.3 and Section 9.4.3
Indigenous Consultation	Section 11.4

11.2.2 Ministry of Northern Development, Mines, Natural Resources and Forestry

On December 3, 2020, the Ministry of Northern Development, Mines, Natural Resources and Forestry (MNDMNRF) (previously known as the Ministry of Natural Resources and Forestry (MNRF)) responded to the Notice of Study Commencement. The Ministry shared the Natural Heritage Information Request Guide and advised that it remains the proponent's responsibility to complete a preliminary screening for each project, to obtain available information from multiple sources, to conduct any necessary field studies, and to consider any potential environmental impacts that may result from an activity.

The Ministry requested the opportunity to review any draft reporting.

11.2.3 Ministry of Heritage, Sport, Tourism and Culture Industries

On October 1, 2020, the Study Team submitted the Stage 1 Archaeological Assessment to the Ministry of Heritage, Sport, Tourism and Culture Industries for review. An expedited review request was submitted to the Ministry on September 3, 2021.

On September 17, 2021, the Study Team submitted the Built Heritage & Cultural Landscape Assessment Report to the Ministry for review.

On September 21, 2021, the Study Team shared the evaluation of alternative design concepts document with the Ministry for review. This document was shared with the Ministry in advance of the Public Information Centre #2. The Study Team noted that there will be additional opportunity to review the materials and provide comments during the Public Information Centre #2 comment period.

On September 30, 2021, the Study Team sent a follow up email to the Ministry of Heritage, Sport, Tourism and Culture, inquiring if there were any comments on the evaluation of alternative design concepts and the preliminary preferred design. The Study Team also inquired if the Ministry staff would be available for a meeting before the Public Information Centre #2.

On October 4, 2021, the Ministry shared a letter noting that the Ministry was satisfied that the fieldwork and reporting for the archaeological assessment are consistent with the ministry's 2011 Standards and Guidelines for Consultant Archaeologists and the terms and conditions for archaeological licences. This report was entered into the Ontario Public Register of Archaeological Reports.

On October 15, 2021, a meeting was hosted by the Study Team to present the preliminary preferred design to the review agencies and obtain feedback in advance of the Public Information Centre #2. This meeting was attended by the Ministry of Heritage, Sport, Tourism and Culture.

On October 19, 2021, the Ministry shared comments on the evaluation of alternative design concepts document and the Built Heritage & Cultural Landscape Assessment Report. The Ministry also recommended that the Heritage Impact Assessment should be completed during the Class EA study period, so that it can inform the Class EA discussion of impacts and mitigation. The evaluation of alternative design concepts was updated based on the Ministry's comments and is included in this report. The updated Built Heritage & Cultural Landscape Assessment Report was submitted to the Ministry on November 18, 2021. The Ministry responded on December 16, 2021, that the updated report addressed Ministry's comments.

On February 11, 2022, draft Heritage Impact Assessment was submitted to the Ministry for review and comments. The Ministry reviewed the report and provided comments on March 10, 2022. Updated and final version of the Heritage Impact Assessment was submitted to the Ministry on March 18, 2022. MHSTCI staff confirmed that there are no further concerns.

11.2.4 Niagara Escarpment Commission

On July 31, 2019, the Study Team contacted Niagara Escarpment Commission to request guidance whether the proposed works will receive exemption under Ontario Regulation 828/90. On August 19, 2019, Niagara Escarpment Commission staff advised that the project location for the Twenty Mile Creek Bridge is within the area of Niagara Escarpment Development Control; therefore, any development requires advanced permission in the form of a Niagara Escarpment Development Permit, unless exempt under Ontario Regulation 828/90. In addition, the location of the Twenty Mile Creek Bridge replacement is designated as Escarpment Natural Area and abuts a Niagara Escarpment Parks and Open Space System, Balls Falls Conservation Area. Niagara Escarpment Commission staff also advised that the Commission would participate in the Municipal Class EA process if identified as a Schedule B projects.

On February 16, 2021, the Study Team shared the evaluation of alternative solutions documents and presentation for the Public Information Centre #1 with the Niagara Escarpment Commission for review and preliminary comments. The Commission staff provided a response that the subject bridge is located in the Escarpment Natural Area, the most protective designation in the Niagara Escarpment Plan and is also within the Niagara Escarpment Commission Area of Development Control. A development permit

would be required at the conclusion of the Class EA process. In addition, conformity with the Niagara Escarpment Plan is also required and should be mentioned in the consultation materials. Niagara Escarpment Plan Part 2.12, Infrastructure, among other policies, is of relevance, especially Part 2.12.5 which states: "infrastructure shall avoid Escarpment Natural Areas, unless the project has been deemed necessary to the public interest after all other alternatives have been considered".

On September 21, 2021, the Study Team shared the evaluation of alternative design concepts document with the Niagara Escarpment Commission for review and comment. This document was shared with the Niagara Escarpment Commission in advance of the Public Information Centre #2. The Study Team noted that there will be additional opportunity to review the materials and provide comments during the Public Information Centre #2 comment period.

On September 24, 2021, the Niagara Escarpment Commission staff completed a site visit to observe site conditions. The staff inquired whether the existing path under the bridge will be maintained. The Study Team confirmed that the bridge alternatives consider maintaining the pedestrian path under the bridge. The Niagara Escarpment Staff expressed interest in reviewing the details of pedestrian path during the detailed design phase of the project. The staff also noted that the evaluation of alternatives is adequate to explain the alternatives and the preferred option is the best in terms of minimizing the impact on natural heritage and the Escarpment Natural Area. The Niagara Escarpment Staff recommended referencing the policies of the Niagara Escarpment Plan in the Environmental Study Report. Specifically, Part 2.6.2 e) of the Niagara Escarpment Plan and confirm that the proposed works are necessary in the public interest and all alternatives have been considered. The staff also added that the Environmental Study Report should also address Part 2.12, subsections 2 and 5 to confirm that the construction approach will limit impact to the Escarpment Natural Area, it will minimize the negative impact on the Escarpment and that all other alternatives have been considered in justifying that the project is necessary to the public interest.

On November 16, 2021, the Study Team submitted the Niagara Escarpment Development Application for this project. This application and supporting drawings were provided to the Niagara Escarpment Commission for review and to determine whether the proposed works will require a permit or an exemption under the Niagara Escarpment Planning and Development Act.

On November 17, 2021, the Niagara Escarpment Commission staff confirmed that a permit would be required for this project.

The Niagara Region will continue to share project updates with the Niagara Escarpment Commission. Once the Class EA process is complete, the Niagara Region will share detailed design drawings with the Commission, when available. Niagara Region will obtain the required permit, prior to undertaking the project construction.

11.2.5 Ontario Heritage Trust

On September 3, 2021, the Ontario Heritage Trust contacted the Study Team, informing that the Trust owns hundreds of properties across the province, including one in Jordan Village. The Trust owns a property known as Ellis that has historically been managed on the Trust's behalf by the Niagara Peninsula Conservation Authority. The Trust is planning to undertake a feasibility study to formalize a section of the Twenty Valley Trail between Jordan Hollow Park and the Jordan Historical Museum. As part of these works, the Trust may also consider completing some creek restoration work. The Trust would like to coordinate timing of this work with the Niagara Region to prevent a potential conflict with the bridge replacement work. Lastly, the Trust expressed interest in maintaining the trail under the bridge, as it connects Balls Falls Conservation Area to Jordan Hollow Park to Ellis.

On September 8, 2021, the Study Team provided a response that the Niagara Region's current schedule for the project is to tender the project in late 2022 with construction in 2023. The existing underpass trail will be maintained and will become a safe crossing point for pedestrians that want to cross King Street.

On September 21, 2021, the Study Team shared the evaluation of alternative design concepts document with the Ontario Heritage Trust for review and comment. This document was shared with the Ontario Heritage Trust in advance of the Public Information Centre #2. The Study Team noted that there will be additional opportunity to review the materials and provide comments during the Public Information Centre #2 comment period.

On September 28, 2021, the Ontario Heritage Trust shared a letter expressing interest in maintaining the pedestrian path under the bridge as part of future bridge design to ensure unimpeded connectivity remains between Ball's Falls Conservation Area and the Trust's Ellis property. The letter also noted that the Trust is working in collaboration with the Town of Lincoln, the Niagara Peninsula Conservation Authority and the Bruce Trail Conservancy to undertake trail upgrades between Balls Falls and the Ellis property. The intention of the new trail upgrades is to utilize the existing underpass and follow the river northward through the Ellis property. The letter also noted that the Trust supports the preferred design as it will have the least impact on the Trust's property and those of

Trust's local partners. Lastly, the Trust's noted that there may be benefit to coordinating the bridge replacement work with the Trust's trail improvement work.

On October 15, 2021, a meeting was hosted by the Study Team to present the preliminary preferred design to the review agencies and obtain feedback in advance of the Public Information Centre #2. This meeting was attended by the Ontario Heritage Trust.

11.2.6 Niagara Peninsula Conservation Authority

On May 24, 2019, the Study Team contact the Niagara Peninsula Conservation Authority to submit an request for information related to regulation boundary, ecological land classification and fisheries information, including thermal regime, recommended timing windows, any available species at risk data. On June 10, 2019, Niagara Peninsula Conservation Authority staff responded that a copy of the 20 Mile Creek Floodplain Mapping Report and associated hydrologic and hydraulic models were sent to the Study Team via courier.

On February 16, 2021, the Study Team shared the evaluation of alternative solutions documents and presentation for the Public Information Centre #1 with the Niagara Peninsula Conservation Authority for review and preliminary comments. The Study Team noted that there will be additional opportunity to review the materials and provide comments during the Public Information Centre #1 comment period. No response was received from the Authority.

On September 21, 2021, the Study Team shared the evaluation of alternative design concepts document with the Niagara Peninsula Conservation Authority for review and comment. This document was shared with the Niagara Peninsula Conservation Authority in advance of the Public Information Centre #2. The Study Team noted that there will be additional opportunity to review the materials and provide comments during the Public Information Centre #2 comment period. The Study Team also invited the Niagara Peninsula Conservation Authority to a meeting to discuss the preliminary preferred design.

On September 30, 2021, the Study Team sent a follow up email to the Niagara Peninsula Conservation Authority, inquiring if there were any comments on the evaluation of alternative design concepts and the preliminary preferred design. The Study Team also inquired if the Conservation Authority staff would be available for a meeting before the Public Information Centre #2. No response was received from the Authority.

On October 15, 2021, a meeting was hosted by the Study Team to present the preliminary preferred design to the review agencies and obtain feedback in advance of the Public Information Centre #2. Staff from the Niagara Peninsula Conservation Authority were not able to attend this meeting.

11.2.7 Town of Lincoln

On March 9, 2021, the Study Team held a meeting with the Town of Lincoln staff from Public Works and Fire Departments. The purpose of this meeting was to discuss feasibility of access closure across Twenty Mile Creek during construction. The Town staff emphasized the need for maintaining the access across the bridge during construction. The Town staff noted that a number of fire vulnerable areas are in the Vineland area and the King Street through Jordan Hollow is crucial to avoid delays in response times. Operationally, there are alternative routes for getting the fire trucks there, but those routes will affect response timing. The Town staff also noted that the bridge be designed to accommodate emergency vehicles.

On April 22, 2021, the Study Team held a meeting with the Town of Lincoln staff from Public Works Department. The purpose of this meeting was to discuss potential options for the alternative design concepts. The Town of Lincoln staff noted that the MTO Book 18 encourages separated active transportation facilities. It was noted that the Class EA process has to identify and evaluate all reasonable alternatives (on-road bike lanes, sidewalk with separate bike path and multi-use path option, etc.). It was also noted that, from an operational perspective, the multi-use path is typically treated as sidewalk and the ownership is handed over to the municipality.

On August 13, 2021, the Study Team shared the evaluation of alternative design concepts document with the Town of Lincoln's Capital Projects staff for review and comment. The Town staff shared the document with the Town staff from Community Services Department and Planning Department. This document was shared with the Town of Lincoln in advance of the Public Information Centre #2. The Study Team noted that there will be additional opportunity to review the materials and provide comments during the Public Information Centre #2 comment period.

On August 25, 2021, the Town of Lincoln staff inquired whether the pedestrian path under the bridge will be maintained and suggested that the Niagara Peninsula Conservation Authority and Ontario Heritage Trust be consulted regarding this path.

On October 15, 2021, a meeting was hosted by the Study Team to present the preliminary preferred design to the review agencies and obtain feedback in advance of the Public Information Centre #2. This meeting was attended by the Town of Lincoln.

On October 28, 2021, Niagara Region staff delegated to the Town of Lincoln Active Transportation Committee. The purpose of this delegation was to inform the Active Transportation Committee of the active transportation elements within the preferred design.

On February 24, 2022, Niagara Region staff met with the Town of Lincoln to discuss the bridge replacement and other area projects including the Jordan Hollow Park revitalization.

On March 8, 2022, Niagara Region met with the Town of Lincoln to further discuss coordination between the Jordan Hollow Park revitalization project and the bridge replacement. The use of Jordan Hollow Park as the bridge project laydown area was discussed. The Town of Lincoln noted that this would have an impact on their schedule for the park revitalization. However, both parties agreed to work together since this approach would be for the greater good of the area to ensure both projects get completed with the least impact to residents and businesses.

On April 25, 2022, Niagara Region delegated at the Town of Lincoln Committee of the Whole meeting. The purpose of this delegation was to update the committee on the results of the environmental assessment prior to filing the ESR.

11.3 Utility Consultation

On May 31, 2019, Wood contacted a number of utility companies to confirm if they have any existing or planned utilities in the vicinity of Twenty Mile Creek Bridge. Responses received from the utility companies are documented in Table 11-6.

Table 11-6: Responses received from Utility Companies

Utility Company	Response
Niagara Peninsula Energy Inc.	No response received
Bell Canada	On May 31, 2021, Bell Canada responded that Bell Canada's plant is aerial in this location. If there is no conflict with the Hydro poles on the north side of the bridge then there are no concerns.
Cogeco Cable	On May 31, 2021, Cogeco responded that the company does not have any plant buried or aerial in this area.

Utility Company	Response
Enbridge Distribution Inc.	On May 31, 2021, Enbridge Gas Inc. provided area drawings, noting that there is no existing or proposed pipeline.
Niagara Region Broadband Networks	On May 31, 2021, Niagara Region Broadband Networks responded that the company does not any infrastructure in the area.
Horizon Utilities	No response received
Hydro One Networks	No response received

11.4 Indigenous Consultation

Indigenous engagement is a key component of the Class EA process. The Ministry of the Environment, Conservation and Parks delegated the procedural aspects of the duty to consult to Niagara Region in its response to the Notice of Commencement on October 15, 2020. In consultation with the MECP, Niagara Region sought direction on the identification of Indigenous Nations that may have an interest in the Study. MECP confirmed that engagement should proceed with the Mississaugas of the Credit First Nation (MCFN), Six Nations of the Grand River (SNGR) and Haudenosaunee Confederacy Chiefs Council, as represented by the Haudenosaunee Development Institute.

Following understood consultation protocols with these Indigenous Nations, Wood contacted the Nations at major points throughout the Study. The following sections provides an overview of the consultation with the three Nations.

A summary of consultation with the Indigenous Nations is provided below. Copies of correspondence are provided in Appendix K.

11.4.1 Mississaugas of the Credit First Nation

On March 3, 2021, Niagara Region provided MCFN with a community-specific EA Study engagement letter, a project summary and Notice of Public Information Centre #1. Subsequently, Wood spoke to Fawn Sault, the Consultation Coordinator at the Department of Consultation and Accommodation on April 6, 2021, to ask if the Nation had any comments or concerns regarding the project at this time. On April 15, 2021, Wood emailed MCFN to confirm that Niagara Region will be sharing a draft Environmental Study Report for review with MCFN in late 2021. Additionally, Wood also

provided MCFN with the completed Stage 1 Archaeological Assessment, noting that the assessment was also under review with MHSTCI. Wood stated to MCFN that Niagara Region will communicate with MCFN regarding participation in the Stage 2 Archaeological Assessment.

On April 16, 2021, MCFN sent an official response letter to Niagara Region, requesting additional details on the project timing. The following items were noted in the letter:

- Name of person or body undertaking the action or decision.
- Contact information for the person or body undertaking the action or decision.
- List of documents pertaining to the proposed action/decision that are available for MCFN to review.
- Description of what other information is expected to become available before the proposed action/decision is undertaken.
- Deadlines or filing dates pertaining to the action/decision.
- The Crown or Municipal review/approval that is required for the project.
- How the proposed action or decision may affect and/or benefit MCFN, its rights and territory.

Wood, on behalf of Niagara Region provided a response to MCFN on the topics in a letter dated June 1, 2021, which also included a summary of the overall EA Study, including an overview of all technical studies that will be completed as part of the EA Study.

On October 13, 2021, Niagara Region provided the Public Information Centre #2 notice with MCFN.

11.4.2 Six Nations of the Grand River

On March 3, 2021, Niagara Region provided SNGR with a community-specific EA Study engagement letter, a project summary and Notice of Public Information Centre #1. Subsequently, Wood spoke to Robbin Vanstone, the Consultation Supervisor of the Lands and Resources Department on April 1, 2021, to ask if the Nations had any comments or concerns regarding the Project at this time. On April 15, 2021, Wood provided an update to SNGR confirming that Niagara Region would provide a draft Environmental Study Report for review with SNGR in late 2021. Additionally, Wood also provided the completed Stage 1 Archaeological Assessment, noting that the assessment

was also under review with MHSTCI. Wood noted that the Region will follow-up with SNGR regarding participation in the Stage 2 Archaeological Assessment. On April 15, 2021, SNGR responded identifying interest in participating in the archaeological field work and asked for the timeline for conducting the fieldwork.

On April 23, 2021, Wood responded via email noting that the Stage 2 Archaeological Assessment fieldwork will be conducted during the detailed design stage of the Study and identified that they will inform SNGR prior to the scheduled field work to arrange for field participation. On the same day, SNGR responded to Wood and provided the 2021 Archaeological Monitoring Agreement.

On October 13, 2021, Niagara Region provided the Public Information Centre #2 notice to SNGR.

On October 21, 2021, Wood responded to SNGR's email from April 23, 2021, and explained that the Stage 2 Archaeological Assessment will not be commencing until detailed design phase of the Project and as such, the Region will sign the Archaeological Monitoring Agreement at that point. The Region will reach out to SNGR directly when this phase of the Project begins. SNGR responded on the same day thanking Wood for the update.

11.4.3 Haudenosaunee Confederacy Chiefs Council (Haudenosaunee Development Institute)

On March 3, 2021, Niagara Region provided Haudenosaunee Development Institute with a community-specific EA Study engagement letter, a project summary and Notice of Public Information Centre #1. On April 30, 2021, Wood provided the completed Stage 1 Archaeological Assessment, noting that the assessment was also under review with MHSTCI.

On October 13, 2021, Niagara Region provided the Public Information Centre #2 notice with Haudenosaunee Development Institute .

11.5 Public Consultation

11.5.1 Public Information Centre #1

As part of the Public Information Centre #1, information materials were posted on the Project website on March 1, 2021. Comments were invited for a two-week period (March 1 – March 12). The purpose of the PIC #1 was to:

- Provide a summary of study background and the Municipal Class EA process;
- Provide an overview of technical studies completed and planned;
- Present the Problem and Opportunity Statement;
- Present the alternative solutions;
- Outline the evaluation criteria to evaluate the alternative solutions;
- Summarize the evaluation of alternative solutions;
- Present the preliminary preferred solution;
- Allow the public to provide input;
- Enable the use of public feedback in the next stage of developing and evaluating potential alternative designs; and,
- Identifying the next stage of the process.

The PIC #1 slides are provided in Appendix M.

11.5.1.1 Public Comments

Comments received as a result of the Public Information Centre #1 identified support for the Preferred Solution (Bridge Replacement). Public Information Centre #1 comments are provided in the table below.

Table 11-7: Public Comments from PIC #1 and Study Team's Responses

Comment/Question	Summary of Comments	Study Team Response
Do you have any comments on the evaluation of alternative solutions process?	The evaluation seems very thorough and accurate.	Thank you for your feedback.
	Who are the key stakeholders in this Study and why weren't all stakeholders contacted directly?	The key stakeholders in this Study include government agencies, Niagara Peninsula Conservation Authority, emergencies services, Regional Niagara Active Transportation Committee, utilities and landowners directly adjacent to the bridge.
	What is the construction timeline?	At this time, it is anticipated that the construction may commence in Summer 2022. However, this is subject to acquisition of necessary permits/approvals, property acquisition, and approved budget to allow the construction.
	Will emergency services have access to the roadway during construction?	The Project Team recognizes the importance of King Street, especially for emergency vehicles. The Study Team has consulted with Lincoln Fire and Rescue Service, which has advised the importance of maintaining access to the emergency services during constructions. As such, the Study Team will be developing and evaluating alternative design option that with the objective to maintaining access during construction.
What do you think about the Preferred Solution (Bridge Replacement)?	Support for the bridge replacement to incorporate a wider platform for improved pedestrian and cyclist access and safety.	Safety is one of the key considerations in the design of the bridge. Further details regarding safety and provisions for pedestrian and cycling facilities will be presented PIC #2.
	All comment forms received identified support for the bridge replacement.	Thank you for your support.
	Safe access required for individuals and larger vehicles to cross the creek, during construction.	Design alternatives will be reviewed and assessed as part of the next phase of the Class EA. These alternatives will take into consideration with the proper design vehicles for the ultimate design as well as during construction. The construction staging design will take into consideration accommodation larger vehicle access, particularly fire trucks.
Do you have any comments that we should consider during the next steps of the Study?	Is there a long-term vision for generally widening King Street in the Twenty Mile Creek hollow area to improve pedestrian and bicycle safety?	There are ongoing consultation between the Region and Town of Lincoln to accommodate long term cycling facilities as part of the bridge replacement, and future projects. The cycling options and preferred design will be presented as part of PIC #2.

Comment/Question	Summary of Comments	Study Team Response
	Concern regarding wider lanes on the bridge causing increased speed by vehicles.	The vehicular lane width will be designed to meet current Niagara Region standards. Concern as per comment is noted and will be taken into consideration during design of alternatives. Exact lane width and configuration will be determined as part of the next phase of the Class EA and will be presented in PIC #2.
	Concern expressed regarding why the new bridge has shorter service life than the existing bridge.	The service life of the new bridge would be 75 years, which is the standard as per the bridge code. In comparison, the rehabilitation of the existing bridge would extend the service life by 30 years.
	Will the new bridge have the same three arch style?	The preferred design for the bridge replacement has not been determined yet. As part of the Phase 3 of the Municipal Class EA process, the Study Team will develop and evaluate various alternative design options for the bridge replacement. A preferred design will be identified that has minimal impact and/or offers greatest benefit. The preferred design of the new bridge will be presented at PIC #2.
	Will the walking trail under the east arch be maintained?	Yes. The trail will be maintained.
	What is the planned traffic diversion route?	The intent is to maintain through traffic on Regional Road 81 during construction. No traffic diversion is planned.
	Are there any sidewalks or walking paths planned between Jordan and Vineland?	The study area for this Study is limited to 20 Mile Creek Arch Bridge, which is approximately 550 m west of Nineteenth Street, where Regional Road 81 crosses Twenty Mile Creek. Any active transportation measures beyond this area are not part of the scope of the Study. However, the bridge will be designed in consultation with the Region and Town to accommodate any future active transportation requirements.
	Will the study consider widening of both approaches and to what distance?	The current study mainly focuses on the bridge replacement. The roadway approaches to the bridge will be reviewed to provide a proper tie-in to the new bridge design. The details of the work at the approaches will be confirmed during the next phase of the Class EA and will be presented in PIC #2.
Other	The virtual space is difficult to use on older computers. Various information is hidden from users or not easily accessible and provides the impression that feedback is discouraged.	Thank you for this feedback. The virtual consultation platform was launched in 2020 to provide a more engaging platform to communicate with the public. This feedback will be taken into consideration to continuously improve the platform.

11.5.2 Public Information Centre #2

As part of the Public Information Centre #2, information materials were posted on the Project website on October 18, 2021. Comments were invited for a two-week period (October 18 – October 29). The purpose of the PIC #2 was to:

- Provide project background and an overview of the Class EA Study
- Share the alternatives design concepts and their evaluation process
- Share preliminary preferred design and allow the public to provide input
- Outline next steps for the Class EA process

The PIC #1 slides are provided in Appendix N.

11.5.2.1 Public Comments

Comments were received from one member of public as a result of the Public Information Centre #2. Comments received and Study Team's responses are provided in table below.

Table 11-8: Public Comments from PIC #2 and Study Team's Responses

Comment	Study Team's Response
The cross-section raises the question of who the MUP is for. The way it is detailed without continuity, other than to a parking lot, limits its use. As a road biker through this area, I would be unlikely to use the MUP, so I see it more as creating a lookout for pedestrian who are parked in the lot. The termination of the separation barrier will be challenging, and end treatment will likely get hit regularly. I'm not sure the matrix evaluation is thinking of all users, likely only pedestrians. With Alternative 2, the MUP on the north side takes away space that could potentially be useful to cyclists traveling east, since they will certainly not cross the road to a use a MUP that is only 200 m long, and then cross the road again back to the other side. I believe alternative 3 is a more versatile cross-section for all users, except the south side should simple be a 2 m shoulder instead of the very odd combination of 1 m raised curb and 1 m shoulder.	We would like to add clarification that the Niagara Region's Transportation Master Plan identified a future cycling Facility for King Street (from Brookside Drive to Nineteenth Street) through the valley in Jordan. Given the deteriorating condition of the Twenty Mile Creek Bridge, the Niagara Region is undertaking a Class Environmental Assessment Study to identify a replacement structure. The Niagara Region is also taking the opportunity to provide a facility (i.e., multi-use path) for pedestrians and cyclists above the bridge and adjacent roadway approaches. Through a future undertakings, cycling facilities will be extended further to the Nineteenth Street to the east, and Brookside Drive to the west, in accordance with the recommendations of the Niagara Region's Transportation Master Plan. Timing of such an undertaking is not identified at this time. In keeping with the Ontario Traffic Manual Book 18 (Cycling Facilities) (MTO, 2021), and with consideration for the posted speed limit of 50km/h and an Annual Average Daily Traffic (AADT) in 2019 of 6,400 along this location of Regional Road 81 (King Street), Figure 5.6 – Desirable Cycling Facility Pre-selection Nomograph — Rural Context (Book 18 – MTO, 2021), indicates that a paved shoulder with buffer (or separate multi-use path) is the preferred desirable cycling facility. Therefore, in order to facilitate cyclist experience levels a multi-use path was selected as the preferred cycling facility. Further, the Niagara Region and the Town of Lincoln have opted for the north side of the bridge as the preferred location for the multi-use path, that is intended for a shared-use user preference. The MUP design minimizes grading impacts and property requirements. With the available right of way space on the north side of the roadway, this allows for the proposed widening for the multi-use path and minimize the need for existing roadway centreline realignment. In regards to the end treatment, the options for inclusion of a boulevard and safety barriers will be evaluated during the detailed design phase of this project. These options will provide further safety and delineation from roadside hazards.
It's unfortunate that the team is proposing to replace an old arch bridge with a boring steel girder bridge. Alternative 1, with steel girders trying to match the form of the concrete spandrel wall is however worse. I find it insulting to the heritage while being structurally illogical. We should be rebuilding a new, modern, concrete arch bridge (not earth filled). At this span, it is possible to build something simple of reinforced concrete - a modern tribute to the bridge it replaces, and something befitting with the character of the valley.	Though we understand that a concrete arch bridge structure matching the existing would be aesthetically more pleasing, however, the cost of such a structure is expected to be a minimum of 40% greater than the preferred bridge structure. In addition, as a result of provision of an arch structure, a small lower portion of the arch would be submerged under the 100-year flood level. This will require provision for protection of this area. While provision of this protection will have a minimal impact on the hydraulics, it would marginally increase the cost of the bridge replacement. In addition, construction of a concrete arch bridge structure would be more complex and take longer. Due to these reasons, a reinforced concrete arch structure was not considered for bridge replacement. In terms of the heritage assessment of the bridge, a Cultural Heritage Assessment was completed for the existing bridge. A Heritage Impact Assessment is currently underway. This assessment will recommend measures that will be considered in the bridge design during detailed design phase of the project. The Heritage Impact Assessment will be reviewed and approved by the Ministry of Heritage, Sport, Tourism and Culture Industries.

Comment	Study Team’s Response
Use open railings instead of concrete parapets to provide better views of the 20 Mile Ck upstream and downstream. This is a beautiful area and befitting of a beautiful bridge. What is proposed falls short. Build the bridge under a full closure. It will take half as long and cost 30% less. As a Niagara resident, I would prefer my tax dollars go to better use than maintaining a lane of traffic here during construction.	An open railing will be provided on the north side of the bridge to improve user experience of valley views. Concrete parapet barrier wall is being proposed between the multi-use path and the roadway due to its durability and greater safety. We agree that building the bridge under a full closure will substantially reduce cost and construction time. However, as per consultation and discussions held with local emergency services, full closure of the roadway for construction is not acceptable. The Town of Lincoln Fire services has indicated that this section of Regional Road 81 is a crucial route for fire services to respond to fire-vulnerable areas in the Vineland area and must avoid any delays in emergency response time. Fire services indicated that alternative routes are available, however these routes will affect emergency response times. Accordingly, a staged construction approach is being proposed to allow for vehicle access across the bridge during construction.

11.6 Review of Draft Environmental Study Report

The draft Environmental Study Report was circulated to the following groups on 10 May 2022 for review and comment: Indigenous Nations, government agencies, utility companies (see list below).

This opportunity for review of the draft report was provided before issuing the Notice of Study Completion. Comments were requested by 10 June 2022.

Comments received on the draft Environmental Study Report and Study Team's responses are provided in Table 11-9. Correspondence with agencies, stakeholders, and Indigenous Nations with regards to the review of the draft Environmental Study Report are provided in Appendix N.

The draft report was shared with the contacts from the following:

- Ministry of Northern Development, Mines, Natural Resources and Forestry
- Niagara Escarpment Commission
- Ministry of Heritage, Sport, Tourism and Culture Industries
- Ontario Heritage Trust
- Infrastructure Ontario
- Ministry of Municipal Affairs and Housing
- Town of Lincoln (staff from Public Works, Engineering Services, Recreation and Culture, Planning and Development, and Town Clerk)
- Niagara Peninsula Conservation Authority
- Emergency Medical Services - Niagara Region
- Lincoln Fire Rescue & Emergency Services
- District School Board of Niagara
- Director of Education of Niagara Catholic District School Board
- Regional Niagara Active Transportation Sub Committee
- Lincoln Chamber of Commerce
- Bruce Trail Conservancy
- Utility Companies

Table 11-9: Comments Received on Draft Environmental Study Report and Study Team’s Responses

Comment	Study Team’s Response
Ministry of Heritage, Sport, Tourism and Culture Industries (27 May 2022)	
Report Section: 9.3.1 Built Heritage Resources and Cultural Heritage Landscape (9.3.1.1 Potential Effects) - Pages 122-123 MHSTCI recommends some changes to the description of impacts to cultural heritage resources. The Heritage Impact Assessment (HIA) prepared for this project identified “moderate-high” impacts to the bridge structure, due to the plan to demolish the bridge. The HIA identified minor impacts to the Jordan Hollow CHL. We recommend the following changes to the report text (in bold and strikethrough): Destruction: The removal of the bridge is a direct impact on the structure itself. However, the bridge is proposed to be replaced with a new structure. Degree of impact would be moderate to high. Mitigation will be required. In terms of impacts on the Jordan Hollow CHL, the replaced bridge will maintain a crossing at the historic location. Degree of There will be minor impacts on the Jordan Hollow CHL would be none.	Section 9.3.1.1 (Pages 122-123) of the report has been updated to incorporate MHSTCI’s suggested edits.
Report Section: 9.3.2 Archaeological Resources (9.3.2.2 Mitigation Measures) - Pages 124-125 As the archaeological assessment process may involve further studies beyond the stage 2 assessment depending on the findings of the stage 2, the following revisions are recommended for this section: The areas of archaeological potential will require a Stage 2 Archaeological Assessment prior to any land disturbance activities. The areas of archaeological potential are shown on Figure 5-5. A Stage 2 Archaeological Assessment will be completed during detailed design phase of this project. Based on the results of the field investigation, the Stage 2 Archaeological Assessment will recommend next steps, which could include additional stages of Archaeological Assessment. Archaeological concerns are not considered addressed until all recommended archaeological assessment has been completed, and the reports have been entered onto the Ontario Public Registry of Archaeological Reports.	Section 9.3.2.2 (Pages 124-125) of the report has been updated to incorporate MHSTCI’s suggested edits.
Report Section: Table 10-1 Commitments for Additional Work - Pages 142-143 See comment above regarding archaeological assessment. It is recommended that the text in the last row on page 142 is divided into two items, the first to address the reporting commitments and timing, and the second to address Indigenous participation in archaeology. Each item would have its own row, as follows: <i>First row:</i> A Stage 2 Archaeological Assessment should be completed during detailed design phase of this project.	Table 10-1 Commitments for Additional Work (Pages 142-143) has been updated to incorporate MHSTCI’s suggested edits.

Comment	Study Team's Response
Additional stages of archaeological assessment may be required, based on the findings and recommendations of the Stage 2. Archaeological concerns are not considered addressed until all recommended archaeological assessment has been completed, and the reports have been entered onto the Ontario Public Registry of Archaeological Reports. Second row: The following Indigenous Nations should be invited to participate in the monitoring of the Stage 2 Archaeological Assessment fieldwork and report review: • Mississaugas of the Credit First Nation • Six Nations of the Grand River • Haudenosaunee Development Institute, on behalf of Haudenosaunee Confederacy During detailed design, the Project Team should review, refine (if required) and incorporate mitigation measures from Section 9.3 of this report into project planning and contract documents to avoid/minimize impacts on the cultural environment.	
Report Section: 11.2 Agency Consultation (11.2.3 Ministry of Heritage, Sport, Tourism and Culture Industries) - Page 157 We note the final version of the HIA was provided to MHSTCI on March 18, 2022.	Section 11.2.3 (Page 157) of the report has been updated to note that the final version of the HIA was provided to MHSTCI on March 18, 2022.
Ministry of the Environment, Conservation and Parks (08 June 2022)	
Notice of completion 1. Please ensure that the Notice of completion includes notification of the provision to request a section 16 Order (formerly known as a Part II Order) (Please refer to Section A.2.8 of the Municipal Class EA A.2.8 CHANGING THE PROJECT STATUS - APPEAL PROCESS (municipalclassea.ca)). 2. The Notice of completion and any follow- up correspondence should be included in the final Environmental Study Report.	1. The Study Team included the notification of the provision to request a section 16 Order in the Notice of Study Completion. 2. Notice of completion and any follow-up correspondence will be included in the Environmental Study Report following the completion of the formal 30-day review period.
Indigenous Consultation 3. Please ensure that the record of consultation is updated with any additional review comments that are received from potentially impacted communities regarding the draft ESR in advance of the issuance of the Notice of Completion.	3. The draft Environmental Study Report was circulated to the Indigenous Nations for review and comments, however, no comments were received. The record of consultation has been updated to reflect additional contact regarding the request of the review of this report.

Comment	Study Team's Response
4. Please ensure that the Notice of Completion is provided to potentially impacted communities, once finalized. The record of consultation should be updated with this circulation and with any follow-up correspondence. 5. Further to any follow-up during the review period for the EA, the proponent should continue reaching out to all communities previously engaged if there any substantial changes to the project/process or if they are applying for subsequent permits from the ministry that may be of interest or concern to communities.	4. Comment noted. The Notice of Study Completion will be provided to potentially impacted Indigenous Nations to provide additional opportunity to review this report. Record of consultation will be updated following the completion of the formal review period. 5. Comment noted.
Species at Risk 6. There is a new regulation for Butternut in Ontario. Please refer to Ontario Regulation 830/21 (https://www.ontario.ca/laws/regulation/210830). 7. The ESA does not apply to dead Butternut individuals. 8. MECP agrees with the following statement from the Draft ESR: "During detailed design phase, once the construction footprint is confirmed, an Information Gathering Form should be completed and submitted to the Ministry of the Environment, Conservation and Parks to receive advice on next steps."	6. Comment noted. Section 5.4.2.3.1 (Species at Risk Plants (Butternut)) has been updated to note this information. 7. Comment noted. Section 5.4.2.3.1 (Species at Risk Plants (Butternut)) has been updated to note this information. 8. Comment noted.
Groundwater 9. It is recommended that the proponent consult with the PTTW Unit of the Environmental Permissions Branch of the Ministry of the Environment, Conservation and Parks to determine any Permit to Take Water (PTTW) or Environmental Activity and Sector Registry (ESAR) requirements (enviropemissions@ontario.ca).	9. Comment noted. Table 10-1 Commitments for Additional Work has been updated to note this.
10. In December 2019, the ministry released a new regulation under the Environmental Protection Act, titled On-Site and Excess Soil Management (O. Reg. 406/19) to support improved management of excess construction soil. Construction-related activities associated with project implementation involving the management of excess soil should be completed in accordance with O. Reg. 406/19 and the ministry's current guidance document titled "Management of Excess Soil – A Guide for Best Management Practices" (2014).	10. Section 9.4.8 of the report has been updated to note the potential requirements for soil export and import. A commitment has also been included in Table 10-1.
Niagara Escarpment Commission (09 June 2022)	
NEC staff have reviewed the report for the above noted project, dated May 2022. We understand that the preferred design is to construct a new bridge which will incorporate vehicle travel lands (sic) and a multi-use path. This option was selected to improve public safety for auto users, cyclists, and pedestrians. The subject lands are within the NEC's Development Control Area. An NEC Development Permit will be required to authorize the work. The lands are designated as Escarpment Natural Area by the Niagara Escarpment Plan, 2017 (NEP). Infrastructure (reconstruction of a municipal bridge) is a permitted use, subject to meeting the Development Criteria in Part 2 of the NEP. Infrastructure within the Escarpment Natural Area must be deemed necessary to the public interest after all other alternatives have been considered. The ESR	The Project Team will contact Niagara Escarpment Commission during detailed design when additional information has become available (including detailed design and the studies noted in the NEC's comments).

Comment	Study Team's Response
notes that the project is necessary to the public interest and adequately explores alternative options. We understand that additional studies and plans will be completed during the detailed design phase, including a Stage 2 Archaeological Assessment (and any subsequent assessments), Geotechnical Study, preliminary Hydrogeological investigation, Erosion and Sediment Control Plan, Construction Storage and Staging Plan, Tree Protection and Replacement Plan, etc. The plans will need to demonstrate that the Infrastructure Development Criteria in Part 2.12 of the NEP and other relevant Development Criteria in Part 2 are satisfied. These studies and plans will be required to prior to issuance of a Development Permit. NEC staff have no objection in principle to the work proposed to reconstruct the Twenty Mile Creek bridge and look forward to continuing with the Development Permit Application. Please keep us informed during the detailed design phase.	
Town of Lincoln - Recreation and Culture (10 June 2022)	
No comments at this time.	No response required.
Town of Lincoln - Niagara West Fire & Emergency Services (10 June 2022)	
No concerns at this time. We are very interested in the pre-construction meetings and the workaround for emergency access throughout the project.	No response required.

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