Prepared By:

City of Brantford

Three Grand River Crossings Schedule 'C' Municipal Class Environmental Assessment

Environmental Study Report

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1. INTRODUCTION

In 2020 the City of Brantford (City), through their consultant GM BluePlan Engineering Limited (GMBP), initiated a Municipal Class Environmental Assessment to review alternatives for three bridges over the Grand River, collectively referred to as the Three Grand River Crossings, including the Lorne Bridge, Brant's Crossing Bridge and the TH&B Crossing Bridge. The City initiated this Municipal Class Environmental Assessment (MCEA) study with the following key objectives:

- Consider a reasonable range of appropriately planned potential solutions;
- Consider impacts to all aspects of the environment (social, natural, technical and economic);
- Select a preferred solution through a transparent decision-making process; and,
- Encourage public participation throughout the process.

The study encompasses an area along the Grand River approximately 175 metres wide, starting 200 metres north of Lorne Bridge to 200 metres south of the TH&B Crossing Bridge. Refer to **Figure 1-1** for a location plan of the Study Area.

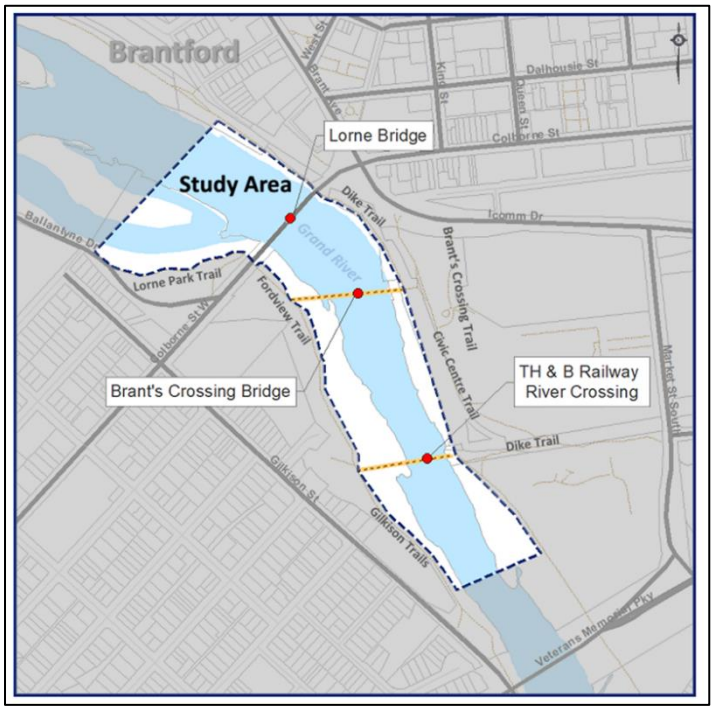


Figure 1-1: Study Area

The purpose of this Environmental Study Report (ESR) is to document the MCEA process, including public consultation, the evaluation and assessment of alternatives taking into consideration the social, natural, technical and economic environments, as well as the selection of a preferred solution in accordance with the MCEA process under the Environmental Assessment Act (EAA).

1.1 Lorne Bridge

Lorne Bridge carries five lanes of traffic on Colborne Street West across the Grand River. The roadway accommodates two lanes of traffic plus a left turn lane in the eastbound direction and two lanes in the westbound direction. There is a sidewalk on the north and south sides of the bridge.

There has been a crossing at the Lorne Bridge site since as early as 1841. The Lorne Bridge crossing has been reconstructed several times over the years, and has included a wood covered structure, a two-span, bowstring arch pony truss bridge and a through truss bridge.

In its current form, the Lorne Bridge consists of three unique structures defined below:

a) Lorne Arch Bridge – The Lorne Arch Bridge structure consists of three concrete spandrel arches spanning over the Grand River for an overall length of 130.5 metres (m). It currently has a 30-tonne load limit in the winter. Refer to **Figure 1-2** for a photograph of the existing structure.

b) Lorne Girder Bridge – The bridge is a single span precast, prestressed box girder bridge and is located immediately east of the Lorne Arch Bridge. The crossing was originally constructed alongside the Lorne Arch Bridge in 1924 and was replaced with the current girder bridge in 1980. The structure has an overall length of 19.8m and spans an abandoned railway corridor. There is a 160m long retaining wall beneath the eastern end of the span. Refer to **Figure 1-3** for a photograph of the existing structure.

c) Lorne Bridge Pedestrian Underpass – The structure is a precast concrete box culvert and is located immediately west of the Lorne Arch Bridge. The structure was built in 1980 and serves as an underpass for pedestrian and cyclist traffic under Colborne Street West. Refer to **Figure 1-4** below for a photograph of the existing structure.

Figure 1-2: Lorne Arch Bridge

Figure 1-3: Lorne Girder Bridge

Figure 1-4: Lorne Bridge Pedestrian Underpass

1.2 Brant's Crossing Bridge

The original crossing at the Brant's Crossing Bridge site was constructed in 1875 for the purpose of conveying railway traffic. The original crossing was replaced in 1913 with the current four-span steel truss and plate girder bridge design seen today. The bridge was converted to a pedestrian crossing in 1996. In February 2018 the bridge was closed following a flooding and ice jam event. A structural investigation took place following the flooding event and it was recommended that the City of Brantford keep the bridge closed until the necessary repairs can take place to ensure its safe use by the public. Refer to **Figure 1-5** to **Figure 1-7** below for photographs of the existing structure.

Figure 1-5: Brant's Crossing Bridge, Looking South

Figure 1-6: Brant's Crossing Bridge, Looking East

Figure 1-7: Brant's Crossing Bridge, Looking East

1.3 TH&B Crossing Bridge

The first permanent structure confirmed at the TH&B Crossing Bridge site was built in 1854. It is unknown when the original bridge was demolished prior to a new crossing being erected in approximately 1893. In 1921 the superstructure of the bridge was replaced with the current plate girder bridge design. The Toronto, Hamilton and Buffalo (TH&B) Railway line over the TH&B Crossing Bridge was officially abandoned in 1989. In 2006 the City of Brantford purchased approximately 4km of the abandoned rail beds within Brantford, which included the TH&B Crossing Bridge. Within two years the TH&B Crossing Bridge was refurbished for pedestrian use.

The bridge was temporarily closed following the February 2018 flooding and ice jam event. The bridge was reopened following structural investigations but was identified as requiring structural repairs in the near future to maintain the existing crossing. Refer to **Figure 1-8** to **Figure 1-10** below for photographs of the existing structure.

Figure 1-8: TH&B Crossing Bridge, Looking South

Figure 1-9: TH&B Crossing Bridge, Looking South

Figure 1-10: TH&B Crossing Bridge, Looking West

2. MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT PROCESS

Municipal infrastructure projects are subject to the Ontario Environmental Assessment Act (EA Act). The Municipal Class EA (MCEA) process was revised in 1993, 2000, 2007, 2011 and 2015 with proposed updates under review in 2020. The MCEA is an approved self-assessment process under the EA Act for a specific group or "class" of projects. The MCEA approach streamlines the planning and approvals process for municipal projects that are:

- Recurring;
- Similar in nature;
- Usually limited in scale;
- Predictable in the range of environmental impacts; and,
- Responsive to mitigation.

Projects are considered approved subject to compliance with an approved MCEA process. The MCEA applies to municipal infrastructure projects including roads, bridges, water and wastewater.

The MCEA outlines a comprehensive 5-Phase approach to project planning (illustrated in **Figure 2-1**) that provides a rational approach to consider the natural, social, cultural, built and economic environment including advantages and disadvantages of alternative solutions and their trade-offs to determine a preferred solution for addressing the problem or opportunity. This includes consultation with agencies, directly affected stakeholders and the public throughout the process. The key principles of successful environmental assessment planning include:

- Consultation;
- Consideration of a reasonable range of alternative solutions;
- Consideration of effects on natural, social, cultural, and economic environments and technical components;
- Systematic evaluation;
- Clear documentation; and
- Traceable decision making.

Projects subject to the MCEA process are classified into the following four “schedules” depending on the degree of the expected impacts.

Schedule A – Includes normal or emergency operational and maintenance activities, which are limited in scale and have minimal adverse environmental effects. These undertakings are pre-approved, and the proponent can proceed without further assessment and approval.

Schedule A+ – These minor projects are pre-approved. Although projects of this class do not usually have the potential for adverse environmental impacts, they tend to be broader in scale in comparison to Schedule A projects. The public is to be advised prior to the implementation of the project.

Schedule B – Includes projects which have the potential for some adverse environmental effects. This includes improvements to, and minor expansions of existing facilities. These projects must satisfy Phases 1 and 2 of the planning process as illustrated in **Figure 2-1** and are approved subject to screening including consultation with relevant agencies, members of the public, stakeholders and Indigenous Nations who may be directly affected

Schedule C – Includes the construction of new facilities and major expansions to existing facilities. These undertakings have the potential for greater environmental effects and must proceed under the planning and documentation procedures outlined in the MCEA manual satisfying phases 1 through 4 of the Class EA process. Phase 3 involves the assessment of alternative methods of carrying out the project, as well as public consultation on the preferred conceptual design. Phase 4 includes the preparation of an Environmental Study Report (ESR) that is filed for public review.

The components of the Three Grand River Crossings were reviewed to determine the appropriate schedule. Based on the project schedule definitions in Appendix 1 of the MCEA manual, it was determined that the project meets the requirements of a Schedule B or a Schedule C project, with the project being initiated as a Schedule B MCEA. At the end of Phase 2, the project team reviewed and reassessed that a Schedule C activity was applicable due to the alternative solutions being assessed and their associated costs (more than $2.4 million dollars).

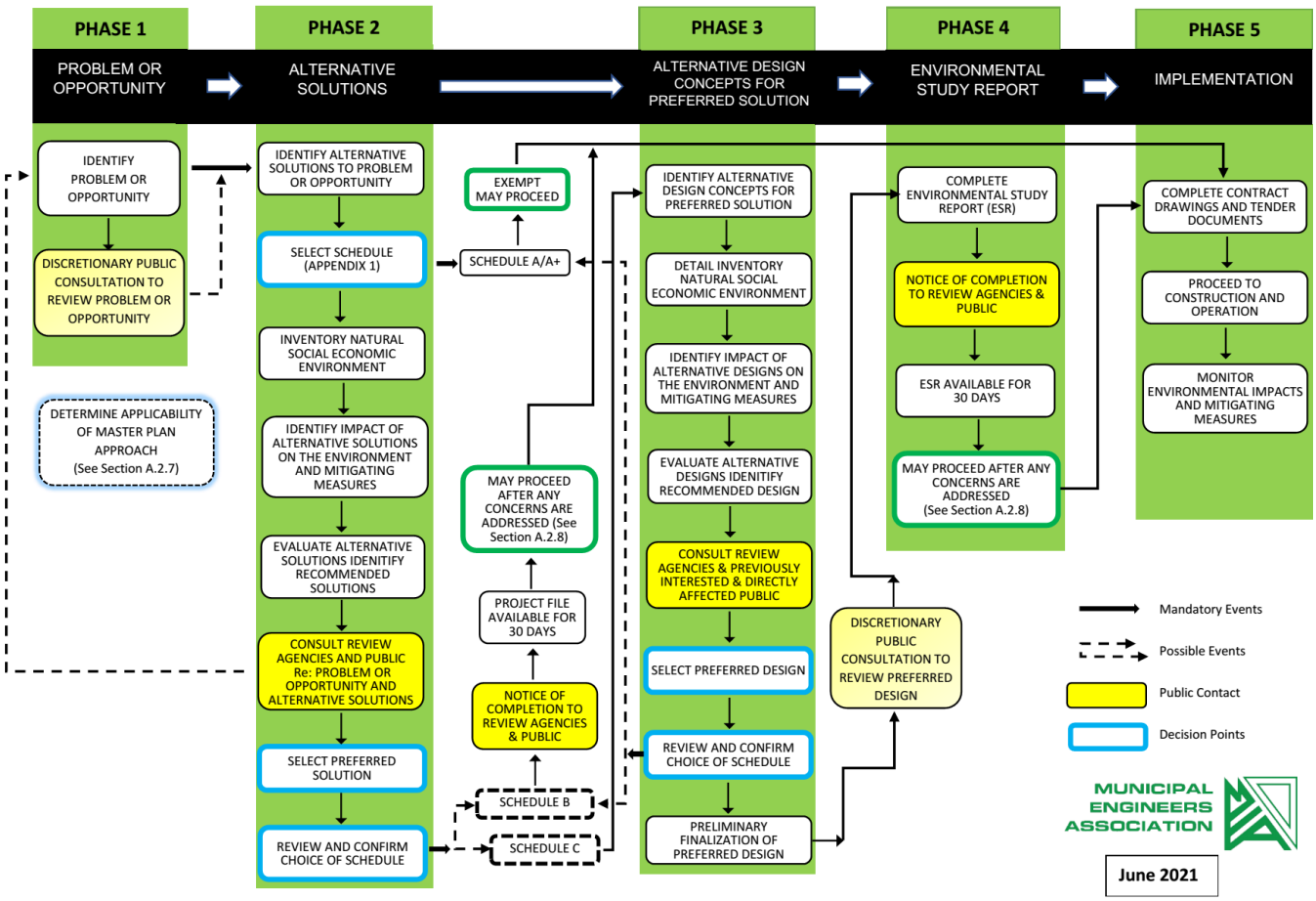


Figure 2-1: Municipal Class Environmental Assessment Process

3. PROBLEM / OPPORTUNITY STATEMENT

Phase 1 of the MCEA process requires the proponent to undertake a characterization of the project and the surrounding environment. The intent is to identify a clear statement of the problem or opportunity to be addressed leading to the conclusion that an improvement is needed, which then becomes the focus of the project. For this project, the Problem / Opportunity Statement is:

> The Three Grand River Crossings have been identified as requiring structural repairs or replacement to maintain each crossing. The purpose of this MCEA is to identify the short and long-term plans for the Three Grand River Crossings. The study will include determining the feasibility of removing the winter load limit on Lorne Bridge and the need for one or both of the Brant's Crossing Bridge and TH&B Crossing Bridge based on an assessment of the technical, social and environmental factors, including impacts to the active transportation network and the risks of further flooding events of the Grand River.

4. POLICY OVERVIEW

This section presents a summary of the Federal, Provincial, and Local legislation and policies affecting the Study Area and relevant to the Three Grand River Bridges Class EA.

4.1 Federal Legislation and Policy

4.1.1 Species at Risk Act

The Species at Risk Act (SARA) focuses on restoring and maintaining populations of species that are at risk of extinction or extirpation due to human activity such as habitat destruction, hunting, introduction of competing species, or other anthropogenic causes.

Species are designated at risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) by using biological information on a species deemed to be in danger. The COSEWIC reviews research information on population and habitat status, trends and threats and applies assessment criteria based on international standards. Once a species is added to Schedule 1 – List of Wildlife Species at Risk, it benefits from legal protection afforded and the mandatory recovery planning required under the Species at Risk Act.

4.1.2 Fisheries Act

The Fisheries Act is federal legislation for the protection of fish habitat from biological, physical, or chemical alterations that are harmful and/or destructive. Fisheries and Oceans Canada, in conjunction with various other agencies (Environment Canada, Ontario Ministry of Natural Resources and Forestry, Ontario Ministry of the Environment, Conservation and Parks (MECP)) are responsible for the enforcement and management of fisheries resources.

The following sections of the Fisheries Act relevant to this Class EA regarding fish, fish habitat protection, and pollution prevention are:

- Section 35(1): No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational, or aboriginal fishery, or to fish that support such a fishery.
- Section 36(3): No person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water.

4.1.3 Migratory Bird Convention Act

The Migratory Birds Convention Act (MBCA) was established in 1917 and amended in 1994 and 2005, to protect migratory birds, their eggs and their nests. The MBCA was created to implement the Migratory Birds Convention between Canada and the United States.

The MBCA lists protected families and subfamilies of migratory birds and lays out legislation surrounding activities that may impact migratory birds or nests, including when and where activities may occur.

4.2 Provincial Legislation and Policy

4.2.1 Planning Act

The Planning Act establishes the rules for land use planning in Ontario and describes how land uses may be controlled in communities. It also defines the respective roles and responsibilities of the province and municipalities, listed below:

Provincial Responsibility

- Issuance of Provincial Policy Statement
- Promotion of provincial interests
- Preparation of provincial plans, such as the Greenbelt Plan and Growth Plan for the Greater Golden Horseshoe
- Provision of advice to municipalities and the public on land use planning issues
- Administration of local planning controls and approvals where required

Municipal Responsibility

- Decision-making for future community planning
- Preparation of planning documents such as Official Plan and Zoning By-Laws
- Ensuring that planning decisions and documents are consistent with Provincial plans
- For Upper-Tier Municipalities (such as Peel Region), approval authority for lower-tier municipalities' Official Plans

4.2.2 Ontario Heritage Act

The *Ontario Heritage Act* provides the primary statutory framework for the conservation of cultural heritage resources in Ontario and includes their identification, protection and wise management. The conservation of cultural heritage resources is also a matter of provincial interest as reflected in provincial legislation such as the Planning Act and the Environmental Assessment Act (EAA), among others. The EAA, which defines "environment" to include cultural conditions that influence the life of humans or a community. Cultural heritage resources, which includes archaeological resources, built heritage resources and cultural heritage landscapes, are important components of those cultural conditions.

When determining the application of the MCEA as it relates to structural projects including water crossings, the intent of the project, the age and cultural heritage value of the structure must be taken into consideration. In accordance with the MCEA process, bridges constructed prior to 1956 always warrant a heritage assessment and a Cultural Heritage Evaluation Report (CHER) should be prepared by a qualified professional to determine if the bridge or the study area has cultural heritage value. A CHER is intended to identify areas of heritage interest as specified in the Provincial Policy Statement. If a significant built heritage resource is identified, a Heritage Impact Assessment (HIA) is undertaken to evaluate the proposed development or alteration to demonstrate how the significant built heritage resource will be conserved. Mitigation measures or alternative approaches may be identified. If the CHER determines that the bridge or study area does not have cultural heritage value, then the cultural heritage criteria has been satisfied. This project must consider and address impacts to built heritage/cultural heritage resources and undertake the necessary assessments to determine conservation and mitigation measures.

4.2.3 Endangered Species Act

The *Endangered Species Act* (ESA) was originally written in 1971 and amended in 2008. Similar to the Federal *Species at Risk Act* (SARA), the ESA aims to provide protection to plant and animal species that are at risk of extinction or extirpation from Ontario.

Species thought to be at risk in Ontario are initially determined by the Committee on the Status of Species at Risk in Ontario (COSSARO), and if approved by the provincial Ministry of Natural Resources and Forestry (MNRF), species will be added to the provincial list of endangered and threatened species in compliance with the ESA. The ESA immediately provides habitat protection to all species listed as threatened, endangered or extirpated.

The ESA provides guidance on determining whether anthropogenic activities, such as construction, could impact regulated species and considers biology and behaviour of the species, details of the activity, and how the activity may affect the species' ability to carry out its life processes.

4.3 Municipal Legislation and Policy

4.3.1 The Official Plan of the City of Brantford

The Official Plan of the City of Brantford is a comprehensive framework of goals and objectives statements, land use designations and policies which will guide the future development of the City of Brantford. The following sections summarize a review of the Official Plan of the City of Brantford (Amendment No. 211).

Land Uses

The Study Area is set within an urban landscape on the edge of the City of Brantford's downtown core. Lands within the City are designated in accordance with Schedule 1-1 of the Official Plan. Immediately east of the Grand River, the Official Plan designates the land as community parks and open space which then transitions to core commercial. The Official Plan also designates "Low Density Residential" and "Mixed Commercial-Residential" areas northeast of the Study Area. Lands to the east of the Grand River in the vicinity of the Study Area are also designated as an "Urban Growth Centre". Lands west of the Grand River are primarily designated as "Low Density Residential" with a pocket of "High Density Residential". Additionally, to the west of the Grand River an "Intensification Corridor" is designated on Colborne Street West. An "Intensification Corridor" is defined as being located along major roads and arterials that have potential to provide a focus for increased residential and employment densities and mixed use development and redevelopment.

Cultural Heritage

The Official Plan lists its goal and objective for cultural heritage and archaeology; respectively, these are to "sustain, conserve and enhance significant built environments:, and "identify, inventory and conserve lands, cultural heritage landscapes, buildings, structures and sites of historic, architectural and archaeological values."

The Official Plan also defines the following criteria for determining cultural heritage significance:

- Section 9.3.2.1 – the resource and associated features date from an important period in Brantford's historical development;
- Section 9.3.2.6 – it is a good, representative example of outstanding interior design; and,
- Section 9.3.2.7 – it makes an important contribution to the urban composition or streetscape which it forms a part.

Natural Heritage

The three bridges included in this MCEA cross the Grand River, which is a prominent watercourse through the City of Brantford, and within the Grand River Conservation Authority's (GRCA) watershed. Lands adjacent to the Study Area are within the Floodplain and are identified as "Special Policy Area 1". There is also a "Category 2" abandoned landfill site to the east of the Study Area.

Transportation

Colborne Street West is designated as a "Major Arterial Road" on Schedule 5-1 of the Official Plan. A Major Arterial Road is defined in the Official Plan as carrying large volumes of intra-municipal and inter-regional traffic through the City in association with other types of roads.

Brant's Crossing Bridge and TH&B Railway River Crossing are both designated as a "Multi-Use Trail" on Schedule 5-3 of the Official Plan.

4.3.2 Transportation Master Plan

The most recent update to the City of Brantford's Transportation Master Plan Update (TMP) was adopted by City Council in 2014. The following summarizes a review of the TMP as it pertains to this MCEA:

- It is the intention of the TMP that walking and cycling is encouraged as the preferred option for short trips. A target is set for 10% of trips in the peak period are made by walking/cycling by 2031.
- The Lorne Bridge, along with the Veteran's Memorial Parkway Bridge, provide the main connections into the City from the southwest.

- Colborne Street West at Lorne Bridge currently shows fair to poor level of service. Through strategic road widenings and extensions, plus roadway operation improvements at key intersections, the level of service could be improved on Colborne Street West at the Lorne bridge.

4.3.3 Downtown Master Plan

The City of Brantford's Downtown Master Plan (DMP) was completed in 2008 and guides development and improvements as well as providing a vision of how the Downtown can continue to evolve into the future. The following summarizes a review of the DMP as it pertains to this MCEA:

- A bicycle connection under the Lorne Bridge and further westward is identified for the long term.
- The DMP offers an opportunity to create a stronger open space network. Brant's Crossing Bridge was identified as a space that contributes to the open space network of Brantford, as well as contributing to the natural heritage of the Grand River and its vicinity.

4.3.4 Parks and Recreation Master Plan

The City of Brantford's Parks and Recreation Master Plan (PRMP) was completed in 2018 and is a municipal guidance document, designed to further effective planning, budgeting and implementation of stated goals and objectives for parks and recreation in the City of Brantford. The following summarizes a review of the PRMP as it pertains to this MCEA:

- The mission of the Parks and Recreation Department is as follows: "Connecting and enriching our community through innovative, inclusive and sustainable parks, facilities, programs, services and natural environments".
- Goal 1 of the PRMP is: "To invest in sustainable infrastructure for resident and business retention, attraction and community quality of life".
- Goal 4 of the PRMP is: "To connect the system of parks, open space and trails that maximizes the city's natural heritage assets and the Grand River as a central feature".

None of the Three Grand River Crossings are mentioned explicitly in the plan; however, the bridges provide connectivity to the City's recreation network.

4.3.5 Waterfront Master Plan

The City of Brantford's Parks and Recreation Master Plan (WMP) was completed in 2010 and was developed to set forth a framework to protect the Grand River and its Tributaries as a fundamental public resource for the residents of Brantford. The following summarizes a review of the PRMP as it pertains to this MCEA:

- The plan intends for trails to be easily identified and accessed, and to have the network become a widely recognized destination.
- The WMP outlines six Waterfront Components which guided the inventory, analysis and recommendations of the WMP: Environment, Parks, Access, Heritage and Culture, Destinations, and Neighbourhoods and Districts.
- The Three Grand River Crossings are mentioned as providing links from one side of the Grand River to the other. A trail loop on both sides of the River is easy to achieve in the vicinity of these crossings, however, may be less appealing elsewhere due to the long distances to the bridge crossings.
- Lorne Bridge is noted as a historic and prominent bridging point in Brantford.
- The plan addresses cultural heritage within the waterfront areas and outlines three key principles to be considered within the planning area:
    - Protect and interpret the pre-contact history and role of the Grand River corridor.
    - Enhance connections between the Grand River and areas of cultural heritage significance in Brantford.
    - Conserve and interpret areas of cultural heritage significance.
- Brant's Crossing Bridge is described as a critical link in the trail system connecting both sides of the River.
- The Study Area is set within what the WMP refers to as "Lower Downtown". Through long term redevelopment of this area, the WMP notes there is an opportunity to create a major destination.

4.4 City of Brantford Age Friendly Strategy

Healthy Aging: The City of Brantford's Age-Friendly Plan outlines a roadmap to build an age-friendly community. The following summarizes a review of the plan as it pertains to this MCEA:

- The plan details considerations for age-friendly outdoor spaces, including improving the walkability of sidewalks and trails by installing appropriate signage, providing appropriate lighting and providing areas to rest.
- The plan details strategies to allow older adults to continue to contribute to civic participation and planning.
- The plan also details strategies on providing age-friendly communication for older adults.

5. EXISTING CONDITIONS

This section summarizes existing conditions including the social, cultural, natural, technical and economic environments as well as policy requirements relevant to the study area. This information is used to support development and evaluation of alternative solutions and identification of potential impacts and mitigating measures.

5.1 Social Environment

5.1.1 Neighbouring Land Use

As detailed in **Section 4.3.1**, lands adjacent to the Study Area include low density residential, mixed commercial-residential and high density residential. To the east of the Study Area, notable infrastructure from north to south along the river includes the Brantford Armoury, several businesses adjacent to the downtown, Brant's Crossing Park, Elements Casino Brantford, Brantford & District Civic Centre and Earl Haig Family Fun Park. To the west of the Study Area, notable infrastructure from north to south along the river includes Lorne Park, Fordview Park, two apartment buildings (also known as Brant Towers) and a mixed commercial-residential area.

5.1.2 Recreational Use

Access to numerous outdoor recreational opportunities are provided within the Study Area. Lorne Bridge, Brant's Crossing Bridge and the TH&B Crossing Bridge, all have connections into the Brantford trail system, which flank the Grand River on each side within the Study Area. The trails within the Study Area are paved or have a stone surface and provide active transportation opportunities such as running, biking or hiking. The Grand River also provides outdoor recreational opportunities, including bird watching, boating and paddling, fishing and geocaching.

Several recreational groups operate within the City of Brantford to promote recreational activities, including Active Grand, Boys and Girls Club Brantford, Brant Cycling Club, Brant Waterways Foundation, Grand Valley Trails Association, and Seniors and Kids Intergenerational Programming.

5.1.3 Aesthetic/Visual Considerations

The Study Area provides several views and vistas of the surrounding natural environment and local infrastructure. Views from each bridge in the Study Area provide wide vistas of the full span of the other bridges. Despite the height of vegetation along the banks of the Grand River, the Brantford Armoury, Boer War Monument and War Memorial are prominent in views to the north or northeast from each bridge. Views to the north from Lorne Bridge are the most expansive, and include the Brantford Armoury, the course of the river, and Grand Island. Views within the study area convey a historical industrial character through a rusted metal and weathered concrete fabric of the bridges.

Views to the east occur when travelling along the SC Johnson Trail between Brant's Crossing and the Lorne Bridge, and views west and east are possible when travelling by vehicle or on foot across the Lorne Bridge. Views when crossing Brant's Crossing Bridge and TH&B Crossing Bridge are more limited and tend to be channeled either east or west along the former rail lines.

5.1.4 Cultural Heritage

At the onset of the project the "Municipal Heritage Bridges Cultural Heritage and Archaeological Resources Assessment Checklist" was completed to document the review and conclusions specific to the need for further heritage evaluation. Refer to **Appendix A** for the "Municipal Heritage Bridges Cultural, Heritage and Archaeological Resources Assessment Checklist" for the three bridges within the study area.

A Cultural Heritage Evaluation was completed by Golder Associates Ltd. (Golder) to establish the cultural heritage significance of each bridge and the study area as a whole and assess impacts of the proposed undertaking in consideration of its determined heritage value. The complete report is provided in **Appendix B.**

Study Area

The study area, including areas of the surrounding landscape, referred to in the CHER as the "Brantford Crossings", were evaluated to determine if they met the definition of a cultural heritage landscape (CHL). The Brantford Crossings area is defined as being centrally located in the City of Brantford and is an approximately 1 km section of the Grand River that extends from immediately north of the Veterans Memorial Parkway Bridge Bridge in the south to north of the Lorne Bridge in the north. It is widest in the north (approximately 400 m) where it includes Lorne Park and the Armoury on the west and east sides of the river, respectively, and narrows to 160 m wide on the south and bound by Fordview Trail on the west and the Dike Trail on the east.

The study area is associated with the historic crossing of the Grand River by Indigenous leader Thayendanegea (Joseph Brant) and includes remnants of crossings, rail lines, dams and recreational and institutional land-use dating from the late 19th century to the 20th century. The CHER describes the Brantford Crossings area as an evolved heritage landscape with design or physical value, historical or associative value, and contextual value. The Brantford Crossings was found to meet six of the nine criteria of O. Reg. 9/06 and therefore has cultural heritage value or interest as a cultural heritage landscape.

Figure 5-1 below shows the proposed boundaries of the potential cultural heritage landscape, referred to as "Brantford Crossings", in relation to the study area of this Environmental Assessment.

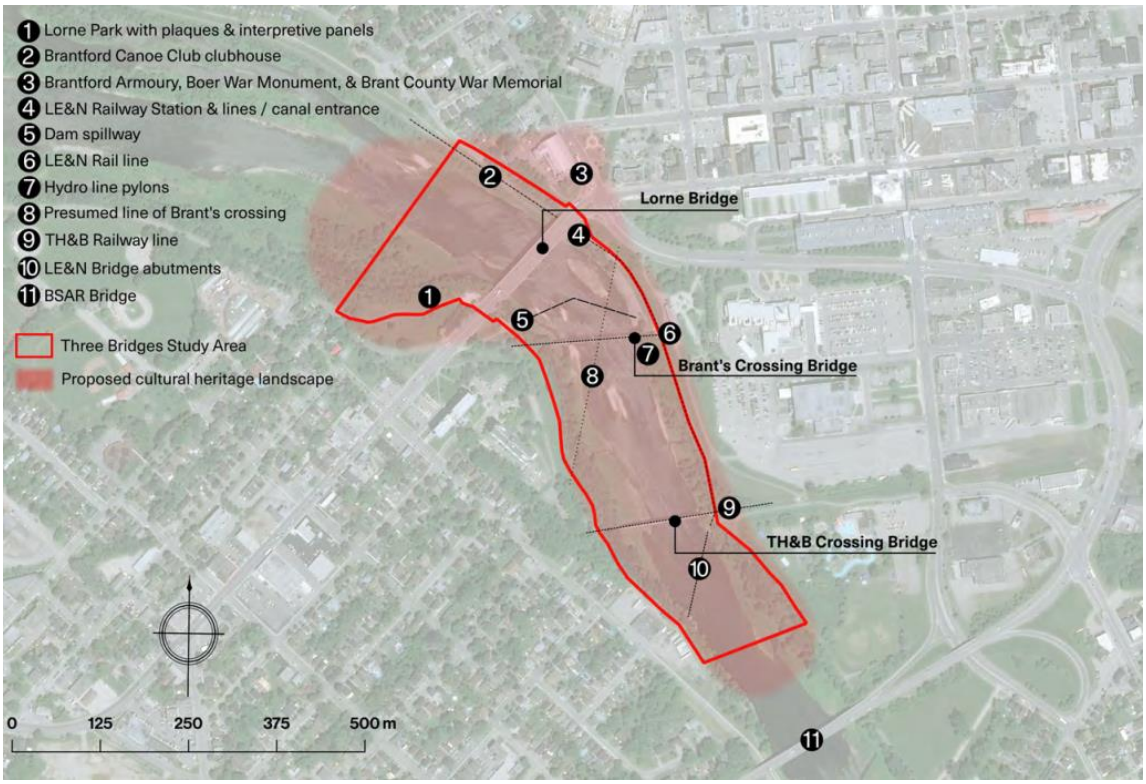


Figure 5-1: Proposed Brantford Crossings cultural heritage landscape

Lorne Bridge

The Lorne Bridge is not currently designated under Part IV of the Ontario Heritage Act. As evaluated in the CHER, the Lorne Bridge was found to meet eight of the nine criteria of O. Reg. 9/06 and therefore has cultural heritage value or interest as a built heritage resource. The Lorne Bridge was found to have cultural heritage significance due in part to the following:

- It is the last in a long line of crossings in this location that date as early as the 1830s.
- It has historical value for its direct association with the long history of bridge building in the community.
- Its association as a prominent landmark with strong visual appeal and relationship to the Grand River National Heritage River and nearby Brant's Crossing and TH&B bridges.

Heritage attributes identified for the Lorne Bridge include:

- Three arch spans combined with a simply supported beam approach span;
- Construction in reinforced concrete in three different grades that have been smoothed and do not mimic masonry;
- Flattened arches with open spandrel arches;
- Concrete piers and abutments scaled to the form of the bridge;
- Bifurcated staircase on the west approach featuring a denticulated cornice, thick square newels and a balustrade low chamfered and molded handrail with "Renaissance" balusters; and,
- Clear wide vistas of the Grand River and Brant's Crossing Bridge and TH&B Crossing Bridge.

Brant's Crossing Bridge

Brant's Crossing Bridge is not currently designated under Part IV of the Ontario Heritage Act. As evaluated in the CHER, Brant's Crossing Bridge was found to meet seven of the nine criteria of O. Reg. 9/06 and therefore has cultural heritage value or interest as a built heritage resource. The Brant's Crossing Bridge was found to have cultural heritage significance due in part to the following:

- It is one of only three surviving examples in the province that combines girder and Pratt truss spans.
- Its concrete substructure represents a relatively early adoption of concrete for bridge construction in Ontario, and the survival of the bridge virtually intact over 100 years of heavy water and ice flow suggests it was built to a high degree of craftmanship.
- The bridge's prominence, relationship to the Grand River Canadian Heritage River, and nearby Lorne and TH&B bridges, and its industrial aesthetic of rivetted steel and concrete, all contribute to its contextual value, and it is considered to be a local landmark.
- Its association with Brantford's development as a prosperous industrial centre from the late 19th century to late 20th century.

Heritage attributes identified for the Brant's Crossing Bridge include:

- Substructure with three curved end concrete piers and concrete abutments with wingwalls;
- Superstructure composed of two pony plate girder approach spans and two 6-panel through Pratt truss frame centre spans, with some members exhibiting bulb angles;
- Pedimented portal bracing on the west span;
- Deck with closely spaced wood ties with surviving sections of rail track; and,
- Clear, wide vistas of the Grand River, Lorne Bridge and TH&B Crossing Bridge.

TH&B Crossing Bridge

TH&B Crossing Bridge is not currently designated under Part IV of the Ontario Heritage Act. As evaluated in the CHER, TH&B Crossing Bridge was found to meet seven of the nine criteria of O. Reg. 9/06 and therefore has cultural heritage value or interest as a built heritage resource. The TH&B Crossing Bridge was found to have cultural heritage significance due in part to the following:

- This girder construction is representative of rail bridges of the time, yet the number of surviving examples with four or more spans is increasingly rare in Ontario, especially in the municipality and surrounding area.

- The bridge has historical value for its direct association with the TH&B Railway, who played a significant role in Brantford's development from the late 19th century to the mid-20th century, and with the Dominion Bridge Works Company, who were nationally renowned for their bridge construction and for their highly skilled Mohawk riveters.
- The bridge's prominence, relationship to the Grand River Canadian Heritage River and nearby Lorne and Brant's Crossing bridges, as well as its industrial aesthetic of rivetted steel, ashlar masonry and concrete all contribute to its contextual value, and it is considered to be a local landmark.

Heritage attributes identified for the TH&B Crossing Bridge include:

- Substructure with rivetted metal caisson pier bents and east stone masonry abutment;
- Superstructure composed of four identical pony plate girder spans;
- Deck with closely spaced wood ties; and,
- Clear, wide vistas of the Grand River, Lorne Bridge and Brant's Crossing Bridge.

5.1.5 Archaeology

Archaeological Assessments determine the archaeological potential of properties or areas and are required for all land development projects under the Planning Act and public development projects under the Environmental Assessment Act. The Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) reviews archaeological assessments to determine if they meet the requirements of the Ministry's Standards and Guidelines for Consultant Archaeologists (Government of Ontario 2011) in accordance with the Ontario Heritage Act, R.S.O. 1990, c. 0.18 (Ontario Government 1990). The primary focus of the Ministry is to determine if all fieldwork and reporting for an assessment has been undertaken according to the terms and conditions of a licensed archaeologist and if potential archaeological sites have been properly conserved. Should the alternative solution identified as part of Phase 2 of this MCEA process require excavation in an area that has not previously been disturbed, an archaeological investigation maybe required.

Following the Standards and Guidelines for Consultant Archaeologists, administered by the The Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI), a Stage 1 Archeological Assessment was completed by Golder. This assessment included background research into the Study Area and was used to determine the archaeological site potential. The complete report is provided in **Appendix C**. The assessment generally identified the following:

- Parts of the Study Area exhibits archeological potential and would require Stage 2 archaeological assessment if they are anticipated to be impacted. The Stage 2 assessment should be conducted by a licensed archaeologist following the test pit survey method at five metre intervals as per Section 2.1.2 of the Standards and Guidelines for Consultant Archaeologists. Refer to the green shaded areas as shown in **Figure 5-2** below.
- The Grand River Watershed passes through the Study Area, and the recognition of this waterway as a Canadian Heritage River System, a marine archaeological assessment should be completed prior to any proposed impact to the marine landscape which includes property up to the high-water mark along the shoreline. Refer to the brown shaded areas as shown in **Figure 5-2** below.
- The remainder of the Study Area does not possess archaeological potential due to disturbance from previous construction or did not exist due to permanently wet conditions until the late 19th century. These areas do not require further assessment. Refer to the blue and pink shaded area as shown in **Figure 5-2** below.

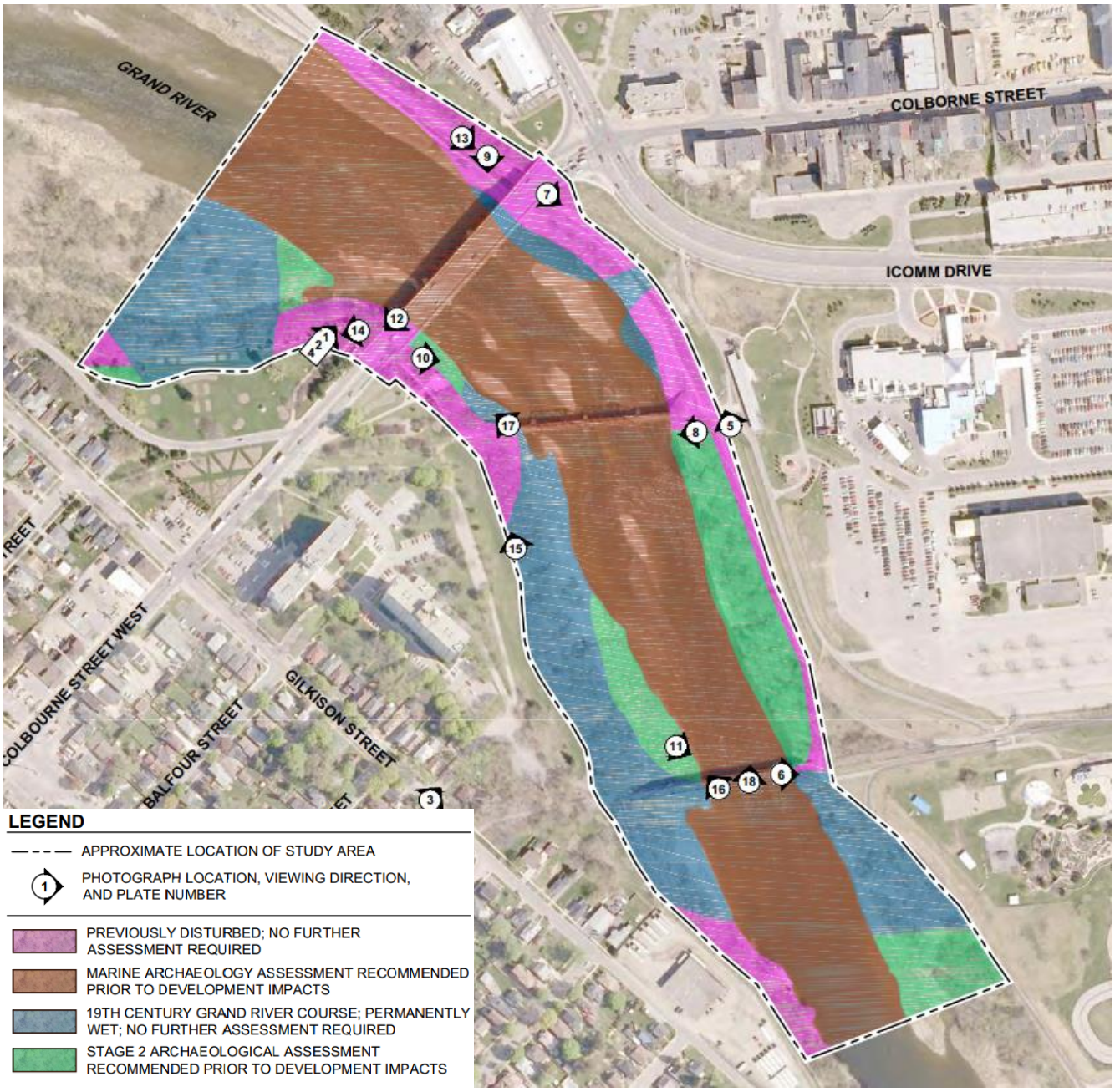


Figure 5-2: Results of Property Inspection (Source: Golder Associated Ltd., Stage 1 Archeological Assessment, Map 18)

Recommendations from the Stage 1 Archaeological Assessment report include the requirement for a Stage 2 Archaeological Assessment for any part of the Study Area exhibiting archaeological potential that could be impacted by the selected preferred solution.

5.1.6 Indigenous Nations Considerations

Indigenous Nations have unique understanding of the natural environment given their relationship with traditional lands, practices and way of life. As such they provide valuable information to help identify solutions and measures to mitigate impacts to natural and cultural resources. The City of Brantford is working with the Mississaugas of the Credit First Nation

(MCFN) to ensure that this project is planned, reviewed and developed in a manner which meets MCFN and Six Nations of the Grand River requirements.

This Study Area also falls within the boundaries of the Haldimand Treaty, which includes lands within six miles of each side of the Grand River. The Study Area is approximately 7km north of the existing Six Nations of the Grand River reserve.

This Study Area also falls within the boundaries of the Head of the Lake Treaty 14, the Crown and the MCFN entered into in 1806. As such, the MCFN are recognized as the traditional stewards of the land, waters and resources within these Treaty Lands and Territory. Confirmed under Treaty, this stewardship role extends to cultural and archaeological resources. As outlined in the MCFN *Standard and Guidelines for Archaeology* (February 2020), "respect for the traditional stewardship role should embrace two precepts:

- MCFN have the right to be consulted on archaeological practice that affects our cultural patrimony, including the interpretation of archaeological resources and recommendations for the disposition of archaeological artifacts and sites within the Treaty area, and;
- Archaeological practice must include thoughtful and respectful consideration of how archaeological techniques can be used to reveal not only the data traditionally surfaced by archaeologists, but also cultural important data valued by the MCFN."

5.2 Natural Environment

5.2.1 Natural Environment Report

Golder completed a review of the natural heritage features in the Study Area as part of their Natural Environment Report. The full report is provided in **Appendix D** and is summarized below.

Terrestrial Features and Wildlife

The following is a summary of the terrestrial features and wildlife review completed as part of the Natural Environment Report:

- Five unique ecological communities were identified within the Study Area.
- There is one wetland within the study area, located northwest of Lorne Bridge, that is approximately 3 hectares in size. According to the City of Brantford's Official Plan, an impact assessment is required to be completed for development proposed within 120m of a wetland 2 hectares or greater in size. The impact assessment must evaluate the ecological function of the adjacent lands, identify a vegetative buffer and demonstrate there will be no adverse impacts on the wetland or its ecological function.
- The Grand River valleyland is considered to be significant based on the Natural Heritage Reference Manual. Development and site alteration is permitted within significant valleylands where it is demonstrated that there will be no adverse impacts to the features or its ecological function.
- All of the plant species identified through the botanical, or other, surveys are secure and common, widespread and abundant in Ontario and globally or are unranked alien species. No butternut, or other plant species at risk identified to have potential to occur in the study area were observed during the field surveys.
- A botanical field inventory was completed, during which 47 vascular plant species were identified (45% native and 45% exotic or cultivar species and 10% non-identifiable due to plant condition or seasonal timing).
- All vegetation clearing should occur outside of the breeding bird season (April 15 – August 15). If this is not possible, a nesting survey would be required.
- Refer to Section 6.1 and 6.2 of the Natural Environment Report for additional operational constraints, mitigation measures and protection recommendations to protect terrestrial features and wildlife.

Threatened and Endangered Species

The following is a summary of the threatened and endangered species that are occurring, or have the potential to occur in the study area as identified within the Natural Environment Report:

- One of the bird species observed during the field surveys, the chimney swift, is designated threatened under the Endangered Species Act (ESA). According to background records, chimney swift is commonly observed along the Grand River throughout Brantford and likely uses the area for foraging. Buildings within the terrestrial study area may contain chimney structures suitable for nesting or roosting.
- The following species were assessed to have moderate potential to occur within the study area: barn swallow, bank swallow, eastern small-footed myotis, little brown myotis, tri-colored bat and queensnake. Refer to Section 4.5.1 of the Natural Environment Report for details regarding possible habitat within the study area. Additionally, refer to Section 6.3 of the Natural Environment Report for details regarding operational constraints and protection recommendations that should be considered during project activities.
- Aquatic species at risk that have the potential to occur include black redhorse, eastern sand darter, silver shiner, wavy-rayed lamp mussel and rainbow mussel.
- Four species of conservation concern were assessed to have moderate potential to occur within the study area: monarch, common nighthawk, eastern wood-pewee and snapping turtle.
- Refer to Section 6.3 of the Natural Environment Report for additional operational constraints and protection recommendations to protect species designated threatened or endangered and their habitat.

Fisheries and Aquatic Resources

The following is a summary of the fisheries and aquatic resources review completed as part of the Natural Environment Report:

- Long term changes in land use practices and fisheries management planning has led to productive spawning and breading grounds for bass, walleye and pike as well as sucker species and carp.
- The water temperatures were supportive of the warmwater thermal regime designation.
- All construction should take place outside of the MNRF restricted fisheries timing window (March 15 to July 15). Additionally, in-water work should be avoided during the winter waterfowl concentration season (January 1 to March 31).
- A Department of Fisheries and Oceans (DFO) Request for Review shall be submitted if work is to be completed within a fish bearing watercourse. Additionally, if work is to be completed within the Gran River, a GRCA permit application shall be completed.
- Refer to Section 6.4 of the Natural Environment Report for additional operational constraints, mitigation measures and protection recommendations to protect fish and fish habitats.

5.3 Technical Environment

5.3.1 Phase One Environmental Site Assessment

Refer **Appendix E** for the Phase One Environmental Site Assessment (ESA) completed by GMBP to identify potential an/or actual environmental concerns or risks associated with the study area resulting from current and historical land uses in the study area and on adjacent lands. The ESA is summarized as follows.

- The potential for environmental risk to the study area is low with respect to the presence of certain hazardous construction materials (e.g. asbestos-containing materials, urea formaldehyde foam insulation and PCBs).
- Based on the age of the structures, there is the potential for leaded paint on painted bridges and surfaces.
- No records or evidence were found in the available records (including TSSA records and databases search provided through the Environmental Risk Information Services report) and no information was reported by the City of Brantford indicating the historical or current presence of fuel storage tanks on-site.
- Three historic waste disposal sites were reported east and west of the Grand River in the Study Area vicinity. At some of these historic sites, groundwater impacts were previously reported.
- Due to the nature and distribution of Areas of Potential Environmental Concern related to on-site sources (i.e. fill) and off-site sources related to activities at multiple upgradient properties (i.e. fuel storage, landfills, industrial activities), there is significant potential to encounter potentially contaminated soil and/or groundwater throughout the study area. Should the preferred solution require excavation of soils within the Study Area, or should it be of interest to gain greater certainty regarding the environmental condition of the soil and groundwater in the Study Area, it is recommended that a Phase Two ESA be undertaken. The Phase Two ESA would include the

advancement of boreholes and/or test pits as well as the sampling and analyses of environmental media (i.e. soil and groundwater) to provide greater certainty with respect to the subsurface conditions in the Study.

5.3.2 Structural Condition

The Lorne Bridge, Brant's Crossing Bridge and TH&B Crossing Bridge have all been recommended for repair or replacement through the Ontario Inspection Manual (OSIM) Inspection Program, which are routine inspections that occur every two years. These recommendations are also supported by various background studies which were completed prior to this MCEA. As part of this study, a Structural Evaluation Report was prepared for each crossing, which included the completion of structural modelling and calculations to determine the adequacy of the structure to support specified loading conditions outlined in the Canadian Highway Bridge Design Code (S6-19). The sections below provide a summary of the structural condition of each structure based on the previous background studies, as well as the Structural Evaluation Reports completed as part of this MCEA. Refer to **Appendix F** for the complete Structural Evaluation Reports.

Lorne Bridge

Components throughout the Lorne Bridge, including the arch bridge, girder bridge, pedestrian underpass and retaining walls have been identified as requiring capital works to maintain the crossing. The Lorne Arch Bridge is the most prominent structure and is also in the greatest need of remedial action. As identified in previous inspection reports, rehabilitation works would include significant concrete repairs throughout the structure, asphalt resurfacing and expansion joints replacements. Concrete repairs are also required for the Lorne Girder Bridge and retaining walls. The Lorne Bridge Pedestrian Underpass has been known to have issues with water leaking through the joints of the precast units and requires proper waterproofing. The Structural Evaluation Report noted that the Lorne Girder Bridge and Lorne Bridge Pedestrian Underpass do not require a load posting.

A key consideration of this MCEA is the removal of the Lorne Arch Bridge's 30 tonne winter load limit. Based on the research and analysis completed as part of the Structural Evaluation Report, the 30 tonne winter load limit may be able to be removed without structural strengthening. Research into arch bridges has shown that the engineering profession has differing opinions on the behaviour of arch bridges; and therefore, additional structural monitoring is recommended to calibrate the structural models of the bridge and confirm if structural strengthening is necessary to remove the 30 tonne winter load limit. Alternatively, the City could choose to proceed with structurally strengthening the Lorne Arch Bridge to remove the 30 tonne winter load limit.

Brant's Crossing Bridge

The Brant's Crossing Bridge has been closed since a flooding and ice jam event in the Grand River in February 2018. Following the flooding event, the structure was subject to a detailed structural inspection in accordance with the Ontario Structural Inspection Manual, during which the geometry of the structure and any associated structural deficiencies were documented and later used for the structural evaluation completed as part of this MCEA. Major deficiencies noted for Brant's Crossing Bridge include severe corrosion and section loss to steel members throughout the structure, concrete abutments and piers in poor condition and bearings that have shifted and are not functioning as intended.

The structural evaluation determined that although the bridge does not require a load posting, minor structural repairs are required to reopen the crossing in the short term and a major rehabilitation is required to maintain the crossing for the longer term. The repairs recommended for the short term include installing a confinement system at all bearings to resist and monitor future lateral shifting and other miscellaneous works to repair damage to the pedestrian walkway.

TH&B Crossing Bridge

Similar to the Brant's Crossing Bridge, the TH&B Crossing Bridge was also subject to a detailed structural inspection following the flooding and ice jam even in February 2018. Major deficiencies noted for the TH&B Crossing Bridge include severe corrosion and section loss to steel members throughout the structure and severe weathering of the wood deck.

Based on the structural evaluation, the TH&B Crossing Bridge does not require a load posting for pedestrian loading; however, a load posting would be required for maintenance vehicle loading in excess of 2.8kN (285kg) per axle. If the bridge was to be used by a maintenance vehicle with an axle load in excess of that stated above, or the CSA S6-19 80kN maintenance vehicle, the existing wood deck would need to be modified or replaced.

In addition to the wood deck, there are several other deficiencies identified as part of the 2018 detailed structural investigation that are recommended to be addressed as part of the next capital project. These repairs include minor steel repairs, concrete and masonry repairs to the abutments and minor repairs to the bearings.

5.3.3 Geotechnical

Golder completed a Geotechnical Assessment within the study area to review the existing geotechnical conditions based on site reconnaissance and a review of existing geotechnical data. The full study is provided in **Appendix G.** The following is a summary of the Geotechnical Assessment:

- Based on the review of existing geotechnical data, it was determined that the each of the three bridges are founded on limestone bedrock between elevations 194.0 m and 196.0 m.
- Based on the anticipated foundation levels on/within limestone bedrock, the site may be classified as Site Class C (very dense soil and soft rock) in accordance with the Canadian Highway Bridge Design Code (S6-19).
- The overburden soils are not considered suitable to support new foundation structures at the bridge sites. Spread/strip footings or caissons bearing on the limestone bedrock underlying the overburden materials are feasible for support of abutments and piers.

5.3.4 Hydrogeological

A desktop hydrogeological review was completed by GMBP to provide a high-level overview of the hydrogeology of the study area, with the results presented in a technical memo. The technical memo is provided **Appendix H.** The following is a summary of the Geotechnical Assessment:

- The study area is located in the physiographic region known as the Norfolk Sand Plain.
- It is interpreted that typical annual groundwater levels are in the range of approximately 197.3 m to potentially as high as 199.9 m. Generally, the groundwater levels at Brant's Crossing Bridge and TH&B Crossing Bridge are higher relative to the Lorne Bridge as there are more well-drained sand and gravel materials encountered at the two former bridges.
- In terms of Source Protection, the lands within the Study Area are within an Intake Protection Zone IPZ-3; although the works associated with this project are not likely to trigger a "Significant" drinking water threat in these IPZ-3 areas.
- Due to the historical activities in the Site area, there is potential for impacted groundwater to be encountered during excavation and/or dewatering activities conducted on-Site
- Should the preferred solution require excavations, especially where excavation depths extend below the groundwater table (inferred to be in the range of elevations 197.3 m to 199.9 m), the project would benefit from additional investigation to confirm dewatering requirements as well as to support the obtainment of necessary approvals and the development of dewatering plans, including monitoring and mitigation activities
- Where dewatering in excess of 50,000 L/day be required, Environmental Activity and Sector Registry approval is required to ensure regulatory compliance for construction dewatering. However, should dewatering in excess of 400,000 L/day be required, a Permit to Take Water will need to be obtained.

5.3.5 Hydraulics

As part of this MCEA, a Hydraulic Assessment Report was completed by Ecosystem Recovery Inc. to confirm flood elevations within the study area and to evaluate the bridges against the Ministry of Transportation (MTO) and City Standards. Opportunities to enhance the function of each crossing were also discussed. A brief summary of this study is provided in this section and the complete assessment is provided in **Appendix I**.

The hydraulic model that was developed for this assessment was based on an existing model provided by the Grand River Conservation Authority (GRCA) and supplemented by terrestrial LiDAR (light detection and ranging) data and bathymetric data that was collected as part of this MCEA. During the evaluation of the existing bridge hydraulics, both open water and ice jam flood events were considered. The City of Brantford engineering guidelines do not specify their own standards for assessing hydraulic crossing structure, thus design standards from the Ministry of Transportation (MTO) Drainage manual were adopted for this assignment and are explained in detail in the Hydraulic Assessment Report.

The hydraulic modelling results indicate that the Lorne Bridge soffit elevation is sufficient under existing conditions, while the soffit elevations of the two pedestrian bridges would require an increase in order to meet the MTO Design Criteria. Based on the evaluation, the soffits of the Brant's Crossing Bridge and TH&B Crossing Bridge should be raised by a minimum of 0.83 and 0.81m, respectively, which raises the soffits above the 10-year ice jam event and the open water Regulatory event. It should be noted that raising the bridges does not eliminate the chance of flood damage to the structures, but it does significantly reduce the likelihood.

5.3.6 Transportation and Traffic

Paradigm Transportation Solutions Limited (PTSL) completed a traffic analysis within and adjacent to the Study Area to review existing and future, vehicular and active transportation considerations on the bridges and adjacent parallel routes. The full study is provided in **Appendix J** and is summarized as follows.

- Under existing conditions, the study intersections operate with acceptable levels of service and within capacity during the weekday AM and PM peak hours.
- There are five transit routes that utilize roadway adjacent to the Study Area.
- There is a need for a separated cycling facility crossing the Grand River, based on the operating characteristics on Colborne Street West, which are not conducive to a shared roadway environment or a signed cycling route without separated facilities. If separated facilities cannot be provided, consideration should be given to providing cyclists with alternate routes across the Grand River.
- The existing structures provide strong connectivity across the Grand River, without introducing conflict points with motor vehicle traffic.

5.3.7 Utilities

The utilities in the Study Area were considered for their potential to impact construction methods. Based on our investigation there is exiting Bell infrastructure which runs beneath the deck of the Lorne Bridge, between the spandrel arch ribs. At the Brant's Crossing Bridge there is an existing Rogers Fibre cable that runs beneath the wood deck. There are overhead hydro lines located approximately 20m north of the TH&B Crossing Bridge at its east approach. There are also electrical services housed within all three bridges, which provide power to the streetlights on each bridge.

A Stormwater Management Report was completed to review stormwater runoff at each bridge location, and it included in **Appendix K**. Currently, Lorne Bridge drains water from the deck using a series of deck drains, with a stormwater outfall adjacent to the northeast abutment. Brant's Crossing Bridge and TH&B Crossing Bridge do not have a formal drainage system, with water draining through the wooden deck into the river.

While utility locates for design purposes were acquired during this EA study, the detailed design team should confirm all utilities in the area prior to construction.

5.4 Climate Change

In accordance with the MCEA Process, impacts associated with climate change must be considered. The approach that climate change has on existing infrastructure design can be assessed in two ways 1) reducing a projects effect on climate change through mitigation including greenhouse gas emissions and 2) assessing how vulnerable the project may be to changing climate. These risks could be grouped by:

- durability – material degradation, UV resistance;
- serviceability – temperature induced damage;
- geotechnical – scour problems, soil stresses;
- increased demand – wind, waves, snow load, ice induced loads;
- accidental loads – vehicular accidents;
- extreme natural events – flooding;
- operational risks – snow removal.

Through the evaluation process a consideration for each of the approaches and risks will be completed where applicable to determine the preferred approach.

6. IDENTIFICATION AND EVALUATION OF ALTERNATIVE SOLUTIONS

As part of Phase 2 of the MCEA Process all reasonable and feasible solutions are identified. These alternative solutions represent different approaches or strategies to address the needs of the project, taking into consideration all the aspects of the environment. Under the provisions of the Municipal MCEA process, all reasonable alternative solutions require consideration to ensure that there is adequate justification to proceed with the improvements and that the need for the project is clearly demonstrated. The alternative solutions are assessed against their ability to reasonably address the identified problems and opportunities.

6.1 Individual Crossing Alternative Solutions

This section presents alternative solutions for each of the Lorne Bridge, Brant's Crossing Bridge and TH&B Crossing Bridge. Ultimately, the individual crossing alternative solutions will be combined into a list of "Overall Crossing Strategies" for the Study Area, which is presented in **Section 6.4.1**.

An extensive list of all alternative solutions for each of the Lorne Bridge, Brant's Crossing Bridge and TH&B Crossing Bridge was developed. Alternative solutions for each crossing were screened to ensure they were technically and economically viable and met the needs of the Problem and Opportunity Statement. The viable alternative solutions were then evaluated to determine if they were feasible and if they should be shortlisted to be evaluated as part of the Overall Crossing Strategy. The subsections below identify individual crossing alternative solutions, as well as if they were carried forward to the evaluation.

6.1.1 Lorne Bridge Alternative Solutions

Brief descriptions of the Lorne Bridge alternative solutions are described in the sections below.

Lorne Bridge Alternative A: Do Nothing

As part of the MCEA process, the "do-nothing" alternative involves no change to the existing environment or resources. It is included for comparison purposes and a base line for the evaluation of other alternatives. The "do-nothing" approach has been screened out at an early stage because of the existing structural and functional deficiencies. Structural inspections and evaluations indicated that the bridge requires structural repairs given the age of the bridge, existing conditions, and load limit related issues. This alternative would see the status quo maintained in the short term; however, the bridge requires capital infusion to repair deteriorated elements or replacement. Therefore, selection of this alternative would postpone any action until further into the future but would eventually lead to the selection of one of the alternatives described in the subsequent sections. Therefore, this alternative has not been considered for evaluation.

Lorne Bridge Alternative B: Close Bridge Permanently

This alternative would involve permanently closing the crossing for all users. The Lorne Bridge is a critical transportation link in the City and Colborne Street West is identified as a major arterial road in the Transportation Master Plan. Therefore, closing the bridge is not a viable alternative and was not considered for evaluation.

Lorne Bridge Alternative C: Rehabilitate

This alternative would rehabilitate the existing structure to maintain its function as a vehicular crossing with sidewalks on each side. The rehabilitation would allow for the 30 tonne winter load limit to be removed. Rehabilitation works would include concrete repairs throughout the structure, asphalt resurfacing, and expansion joints replacements. All repairs would be sympathetic in nature, with the outward appearance of the structure remaining unchanged.

During construction temporary working platforms to provide access to the abutments, arches, and piers would be required. The bridge would remain open to traffic during construction, with staged lane closures and one lane of traffic provided in each direction.

This alternative was carried forward for evaluation.

Lorne Bridge Alternative D: Replace

This alternative would see a completely new structure be installed to provide the crossing of Colborne Street West over the Grand River. The new bridge could be of conventional construction, such as a girder bridge similar to other vehicular bridges in the City of Brantford. Similar bridges include the Veteran's Memorial Parkway Bridge or the Cockshutt Bridge on Erie Avenue over the Grand River. Alternatively, a gateway structure, similar to the existing Lorne Arch Bridge could be constructed. A new gateway structure would carry a significantly higher initial capital cost than a new bridge built of conventional construction.

The replacement structure would require new foundations for the abutments and piers, which could consist of spread footings on bedrock similar to the existing structure.

The replacement of Lorne Bridge would require a temporary bridge adjacent to the existing bridge during construction to provide vehicular access. The temporary structure could be incorporated into the new bridge, allowing for a larger bridge width compared to the existing crossing. This would allow for delineated or expanded active transportation facilities over the new crossing.

This alternative was carried forward for evaluation.

6.1.2 Brant's Crossing Bridge Alternative Solutions

Brief descriptions of the Brant's Crossing Bridge alternative solutions are described in the sections below.

Brant's Crossing Bridge Alternative A: Do Nothing

Similar to Lorne Bridge, this alternative would see the status quo maintained in the short term; however, the bridge requires capital infusion to repair deteriorated elements or replacement. Therefore, selection of this alternative would postpone any action until further into the future but would eventually lead to the selection of one of the alternatives described in the subsequent sections. Therefore, this alternative was not considered for evaluation.

Brant's Crossing Bridge Alternative Bi: Close Permanently with Retention of Existing Structure as a Monument

This alternative would involve permanently closing the bridge but retaining and maintaining the structure as a heritage resource. Permanent barricades would need to be installed to prevent the use of the bridge. The wood decking of the bridge could also be removed to deter the crossing of the bridge. The structure would need to be periodically inspected and maintained to ensure the structural integrity of the structure to support its own weight.

The closing of Brant's Crossing Bridge would result in significant negative impacts to the active transportation connectivity within the Study Area. Additionally, the structure does not meet the MTO Design Criteria for the evaluated ice jam events.

This alternative was carried forward for evaluation.

Brant's Crossing Bridge Alternative Bii: Close Permanently with Structure Removal

This alternative would involve closing the bridge and removing it permanently. A crane would be required at each approach of the structure, resulting in temporary disturbances to the surrounding environment. The opportunity to salvage pieces of the existing bridge, or the entire superstructure, for display at another location could be considered. The existing piers and abutments could be left in place to minimize disturbance to the natural environment and to serve as a representation of the former crossing. Permanent barricades would need to be installed at each abutment.

The closing and removal of Brant's Crossing Bridge would result in significant negative impacts to the active transportation connectivity and the cultural heritage environment.

This alternative was carried forward for evaluation.

Brant's Crossing Bridge Alternative Ci: Rehabilitate

Under this alternative, the Brant's Crossing Bridge would undergo structural repairs to reopen as a pedestrian crossing. Repairs would include concrete patches to the abutments and piers and reinforcement of various steel members throughout the structure. All repairs to the structure would be sympathetic in nature, with the outward appearance of the

bridge being maintained. This alternative would not include raising the bridge to reduce the risk of damage from flooding and ice jam events.

This alternative was carried forward for evaluation.

Brant's Crossing Bridge Alternative Cii: Rehabilitate and Raise Bridge

Under this alternative the structure would be rehabilitated similar to Alternative Ci, while also including raising the superstructure of the bridge to reduce the risk of damage from flooding and ice jam events. Raising the bridge would involve jacking the bridge and installing new caps on the abutments and piers to raise the bridge a minimum of 0.83m.

This alternative was carried forward for evaluation.

Brant's Crossing Bridge Alternative D: Replace and Raise Bridge

This alternative would see the Brant's Crossing Bridge replaced with a completely new superstructure capable of conveying pedestrian and cyclist traffic over the Grand River. A crane would be required at each approach to remove the existing superstructure and then crane the new superstructure into place. Modifications to the existing abutments and piers would be required to raise the new soffit of the bridge a minimum of 0.83m to reduce the risk of damage from flooding and ice jam events.

This alternative was carried forward for evaluation.

6.1.3 TH&B Crossing Bridge Alternative Solutions

Brief descriptions of the TH&B Crossing Bridge alternative solutions are described in the sections below.

TH&B Crossing Bridge Alternative A: Do Nothing

Similar to Lorne Bridge, this alternative would see the status quo maintained in the short term; however, the bridge requires capital infusion to repair deteriorated elements or replacement. Therefore, selection of this alternative would postpone any action until further into the future but would eventually lead to the selection of one of the alternatives described in the subsequent sections. Therefore, this alternative was not considered for evaluation.

TH&B Crossing Bridge Alternative Bi: Close Permanently with Retention of Existing Structure as a Monument

This alternative would involve permanently closing the bridge but retaining and maintaining the structure as a heritage resource. Permanent barricades would need to be installed to prevent the use of the bridge. The wood decking of the bridge could also be removed to deter the crossing of the bridge. It is noted that the existing structure does not meet the MTO Design Criteria for the evaluated ice jam events.

This alternative was carried forward for evaluation.

TH&B Crossing Bridge Alternative Bii: Close Permanently with Structure Removal

This alternative would involve closing the bridge and removing it permanently. Construction of temporary access paths and staging areas along the western banks of the Grand River would be required to accommodate the removal of the structure. The existing piers and abutments could be left in place to minimize disturbance to the natural environment and to serve as a representation of the former crossing. Permanent barricades would need to be installed at each abutment.

This alternative was carried forward for evaluation.

TH&B Crossing Bridge Alternative Ci: Minor Rehabilitation and Eventual Removal

The minor rehabilitation under this alternative would involve replacing the existing wood deck as well as some other minor repairs. The estimated service life following the rehabilitation would be 10 to 15 years. At the end of its service life the TH&B Crossing Bridge would be closed and removed. The existing foundations, which include the steel piers and concrete abutments, would remain in place to minimize disturbances to the natural environment and provide recognition of the current structure.

This alternative was carried forward for evaluation.

TH&B Crossing Bridge Alternative Cii: Rehabilitate

Under this alternative, the TH&B Crossing Bridge would undergo structural repairs to maintain the crossing as an active transportation crossing. Repairs would include concrete patches to the abutments and piers, repairs to the bearings, replacement of the existing wood deck and minor steel repairs throughout the structure. All repairs to the structure would be sympathetic in nature, with the outward appearance of the bridge being maintained. This alternative would not include raising the bridge to reduce the risk of damage from flooding and ice jam events.

This alternative was carried forward for evaluation.

TH&B Crossing Bridge Alternative Ciii: Rehabilitate and Raise

Under this alternative the structure would be rehabilitated similar to Alternative Ci, while also raising the superstructure of the bridge to reduce the risk of damage from flooding and ice jam events. Raising the bridge would involve jacking the bridge and installing new caps on the abutments and piers to raise the soffit of the bridge a minimum of 0.81m.

This alternative was carried forward for evaluation.

TH&B Crossing Bridge Alternative D: Replace and Raise

This alternative would see the TH&B Crossing Bridge replaced with a completely new superstructure capable of conveying pedestrian and cyclist traffic over the Grand River. Modifications to the existing abutments and piers would be required to raise the new superstructure a minimum of 0.81m to reduce the risk of damage from flooding and ice jam events.

This alternative was carried forward for evaluation.

6.1.4 New Pedestrian River Crossing Alternative Solutions

The following alternative solutions for a new pedestrian river crossing were considered to address the problem statement. Brief descriptions of each alternative are described in the sections below.

Construct New Pedestrian River Crossing Alternative A: Do Nothing

Under this alternative a new pedestrian river crossing would not be constructed at a new location within the Study Area.

This alternative was carried forward for evaluation.

Construct New Pedestrian River Crossing Alternative B: Construct New Crossing

This alternative would involve the construction of a new pedestrian river crossing at a new location within the Study Area. This alternative would have high potential impacts to the natural environment and would pose a larger economic impact. Additionally, the shortlisted alternatives for Brant's Crossing Bridge and TH&B Crossing Bridge will maintain at least one pedestrian river crossing within the Study Area, reducing the need for a new crossing to be constructed.

This alternative was carried forward for evaluation.

6.2 Individual Crossing Alternative Solutions Cost Estimates

Preliminary cost estimates were prepared for the capital works associated with each alternative solution. The capital costs in **Table 6-1** represent the estimated initial cost to implement the alternative solution. The lifecycle cost represents the estimated total cost of implementing each alternative, forecasted over 75 years, and includes the capital as well as future maintenance and repair costs. These costs account for engineering and a 20% contingency allowance. Itemized cost estimates for each alternative solution are provided in **Appendix L**.

Table 6-1: Individual Crossing Preliminary Cost Estimates

Bridge	Alternative Solution	Capital Cost (2021 Dollars)	Lifecycle Cost (2021 Dollars)
Lorne Bridge	Rehabilitate	$8,300,000	$33,000,000
	Replace (Conventional Structure)	$19,000,000	$45,000,000
	Replace (Gateway Structure)	$37,000,000	$87,000,000
Brant's Crossing Bridge	Close Bridge Permanently with Retention of Existing Structure as a Monument	$300,000	$1,000,000
	Close Permanently with Structure Removal	$700,000	$700,000
	Rehabilitate	$1,000,000	$6,400,000
	Rehabilitate and Raise Bridge	$2,300,000	$7,700,000
	Replace and Raise Bridge	$3,700,000[1]	$5,500,000[1]
TH&B Crossing Bridge	Close Bridge Permanently with Retention of Existing Structure as a Monument	$300,000	$1,000,000
	Close Permanently with Structure Removal	$700,000	$700,000
	Minor Rehabilitation with Eventual Removal	$300,000	$1,000,000
	Rehabilitate	$600,000	$6,400,000
	Rehabilitate and Raise Bridge	$1,900,000	$7,800,000
	Replace and Raise Bridge	$3,200,000	$8,100,000

[1] Cost estimate revised during Phase 3 of MCEA

6.3 Noise and Vibration Impacts

RWDI conducted a noise and vibration study to predict potential sound and vibration levels as it relates to the alternative solutions carried forward. The report included a review of municipal noise control by-laws, as well as providing mitigation measures to minimize the potential for any impacts. Overall, the primary noise and vibration impact will be from construction activities which has the potential to be an annoyance to noise sensitive areas with the study limits. The alternative solutions being considered are expected to cause no change in operational sound and vibration levels. Refer to **Appendix M** for the complete Environmental Noise Assessment.

6.4 Evaluation of Individual Crossing Alternative Solutions

6.4.1 Evaluation Methodology

In accordance with the MCEA process the alternative solutions are evaluated to determine their suitability and identify how each solution addresses the problem and opportunity statement. The framework for the evaluation process for this project takes into consideration the broad definition of the environmental and the environmental components as identified in the EA Act and is outlined in **Table 6-2**.

Table 6-2: Environmental Components

Environmental Component	Environmental Considerations/Descriptions
Social	This component considers the potential effects on the neighbourhoods, businesses, community character, historical/archaeological and built heritage resources and social cohesion of the project.
Natural	This component considers the potential effects on the natural and physical aspects of the environment (air, land, water) including terrestrial and aquatic species.
Technical	This component considers the technical suitability and engineering aspects of the project.
Economic	This component considers the short and longer-term cost of the project.

Based on the environmental components listed above, a list of criteria was established to measure the suitability of each alternative taking into consideration the trade-offs, advantages and disadvantages to address the problem/ opportunity statement. The assessment is based on the existing environmental conditions compiled through field visits and secondary source information, as summarized in **Section 5**. Criteria used to assess each alternative and its ability to address the problem/opportunity statement are summarized below in **Table 6-3**. The intent is to have a preferred solution with the lowest negative and most beneficial impact.

Table 6-3: Criteria for Assessment of Alternatives

Environment	Criteria
Social	• Permanent impacts to public and private land including acquisition, access and/or displacement of facilities • Permanent impacts to pedestrian, cyclist and vehicular connectivity • Temporary issues / impacts during construction • Overall safety of all users (vehicles, pedestrians and cyclists) • Change in the appearance of the structures and views to the surrounding landscape • Changes to appearance or character of cultural heritage resource • Threatened viability of heritage or archaeological resource • Impacts to Indigenous Nations
Natural	• Impacts on terrestrial species, including Species at Risk • Impacts on aquatic species at risk
Technical / Engineering	• Service life of structure, including meeting existing and future needs • Structural integrity and compliance with design standards • Hydraulic considerations • Geometry • Impacts on pedestrian and cyclist traffic flow • Ease of construction • Utility conflicts • Approval requirements
Economic	• Initial and future capital investments • Maintenance requirements

To assess the suitability of each alternative solution, a qualitative evaluation was used to identify significant advantages and disadvantages with respect to the specific evaluation criteria developed in **Table 6-3** for each environmental component (social, natural environment, technical and economic). After the various evaluation criteria were developed,

they were then applied to each of the alternative solutions to identify their potential impacts on the environment with the significance of the potential impact anticipated based on the following:

- the direct change occurring at the time of project completion
- indirect effects following project completion
- changes brought on because of the project.

To provide an impartial, traceable and consistent evaluation, as required by the MCEA process, the method and rational identified in **Table 6-4** was used to illustrate the highest and lowest impact of each alternative relative to the evaluation criteria for each category considered (e.g. economic, social, cultural, natural environment, and technical). The evaluation was carried out using the Reasoned Argument method, comparing differences in impacts and providing a clear rationale for the selection of the preferred alternative.

Table 6-4: Level of Effect

Level of Effect		Rational
High (Least Beneficial / Highest Negative Impact)	↓	Implementation could threaten the sustainability of the feature and should be considered a concern. Significant remediation, monitoring and additional work is required to reduce the potential impact.
Moderate (Neutral / Moderate Benefit)	↔	Implementation could result in the decline of the feature but should stabilize after project completion. Additional work may be required for mitigation and compensation purposes.
Low (Most Beneficial / Lowest Negative Impact)	↑	Implementation could have limited impact on the resource during the construction stage of the project and the life span of the project but would have negligible impact on the resource.

6.4.2 Evaluation Summary

The evaluation of individual crossing alternatives has been captured in a matrix format to allow for direct comparison between the alternative solutions. The matrix also identifies which individual crossing alternatives were shortlisted to be included in the evaluation of the Overall Crossing Strategy. The evaluation matrices are provided in the tables below.

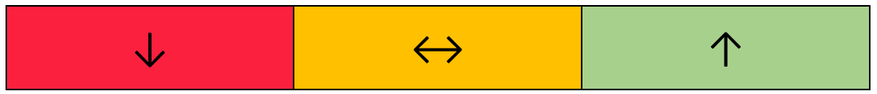
Criteria	Measure		Alternative C – Rehabilitate		Alternative D – Replace
Social Environment					
Property Impacts	Permanent impacts to public and private land, including property acquisition, access and/or displacement of facilities	↑	• No permanent impacts to property anticipated.	↓	• Footprint of bridge would be increased to accommodate temporary bypass bridge during construction and additional lanes / separated active transportation facilities following construction.
Impacts to Connectivity	Permanent impacts to pedestrian, cyclist and vehicular connectivity	↔	• 30 tonne winter load limit would be removed. • No increase or decrease in active transportation connectively (no new bike lanes).	↑	• New structure would include separated active transportation facilities. • New structure could include additional vehicular traffic capacity.
Impacts During Construction	Temporary issues (noise, dust, air, vibration)	↔	• Temporary noise, dust, vibration nuisances during construction. • Anticipated duration for rehabilitation would be approximately 8 months.	↓	• Major construction with large equipment resulting in nuisances throughout construction. • Anticipated duration for replacement would be approximately 1 year.
	Connectivity and travel time during construction		• Staged lane closures on bridge will be required throughout construction.		• One lane of traffic provided in each direction on adjacent temporary bypass bridge throughout construction.
Public Health & Safety	Overall safety of all users (vehicles, pedestrians, cyclists)	↔	• No dedicated cycling lanes. Cyclist traffic would continue to share roadway with vehicles. • 30 tonne winter load limit would be removed.	↑	• Separated active transportation facilities, including dedicated bike lanes could be added.
Aesthetics	Change in appearance of the structure	↑	• Will maintain outward appearance of the bridge due to sympathetic rehabilitation.	↓	• Removal of the concrete arch bridge will have a direct impact on the aesthetics. • New structure could be designed to be aesthetically pleasing.
	Change in views to the surrounding landscape		• Views of the surrounding landscape from the existing bridge would be maintained.		• Potential for view of the surrounding landscape to be improved through lookouts on new bridge.
Cultural Heritage Resources	Changes to appearance or character of heritage resource	↑	• Will maintain the heritage attributes of existing bridge through sympathetic rehabilitation. • No change to the appearance or character of the neighbourhood is anticipated.	↓	• Loss of heritage attributes of existing bridge. • Significant change to appearance and character of the neighbourhood.
	Threatened viability of heritage or archaeological resource		• No anticipated impact to areas that require a Stage 2 Archaeological Assessment.		• In coordination with the expanded bridge footprint, areas with archaeological potential would need to be assessed in a Stage 2 Archaeological Assessment.
	Impacts to Indigenous Nations		• No known impacts to Indigenous Nations.		• Impacts to Indigenous Nations would need to be assessed in coordination with the expanded bridge footprint.

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

Criteria	Measure	Alternative C – Rehabilitate		Alternative D – Replace	
Natural Environment					
Terrestrial Wildlife & Vegetation	Impacts on terrestrial species (flora and fauna), including Species at Risk	↑	• Area within isolated work areas should be surveyed prior to the start of construction for relocation of wildlife (nesting birds) • Minor potential for displacement, disturbance or harm of wildlife. Considerations for impacts to Species at Risk required. • All disturbances can be reasonably mitigated. • Minimal disturbance to potential habitat for Species at Risk, both temporarily and permanently.	↓	• Expected to result in significant temporary disturbance of the embankments for staging and equipment access, and the permanent footprint of the bridge would be expanded resulting in permanent loss of vegetation. • Potential to cause disturbance to cliff swallows nesting on Lorne Bridge. • Expanded footprint of Lorne Bridge would result in permanent removal of potential habitat for small-footed myotis and may result in permanent removal of habitat for queensnake.
Aquatic Wildlife & Vegetation	Impacts on aquatic species, including Species at Risk	↑	• The temporary and limited period of disturbance for near and in-water works required for rehabilitation is favorable compared to replacement.	↓	• Significant in-water work and disturbance of embankments and riverbed that may permanently alter the riparian vegetation, substrates, cover and habitat types available, and adversely affect sensitive fish habitat.
Technical Environment					
Design	Service life of structure	↔	• Estimated service life of structure following rehabilitation would be 15-30 years before the next major capital expenditure.	↑	• Estimated service life of a new structure would be 75 years.
	Structural Integrity - compliance with design standards		• 30 tonne winter load limit would be removed.		• New structure would be designed to be compliant with current design standards.
	Hydraulic Considerations		• No change to hydraulics (existing structure meets MTO flow criteria).		• No change to hydraulics (replacement structure would be designed to pass MTO flow criteria).
	Geometry		• No changes to existing geometry.		• Geometry of structure could be designed as required to accommodate additional vehicular capacity and delineated active transportation facilities.
Transportation	Impacts on vehicular, pedestrian and cyclist traffic flow (e.g. increase congestions)	↔	• Delineated cycling facilities cannot be accommodated. Cyclists would continue to share the road with vehicles.	↑	• New structure can accommodate expanded active transportation facilities that would be delineated from vehicular traffic.
Constructability	Ease of construction	↔	• Large scale construction.	↓	• Large scale construction undertaking requiring significantly more effort than rehabilitation.
	Utility conflicts		• No impacts to utilities are anticipated.		• Relocation of Bell conduit that runs above the spandrel arches would be required.
	Approval requirements		• A GRCA permit application shall be submitted for the Project. • A DFO Request for Review shall be submitted for the Project. • A permit or registration under the Endangered Species Act may be required if individuals or habitat of Species at Risk are impacted.		• A GRCA permit application shall be submitted for the Project. • A DFO Request for Review shall be submitted for the Project. • A permit or registration under the Endangered Species Act may be required if individuals or habitat of Species at Risk are impacted.

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

Criteria	Measure	Alternative C – Rehabilitate		Alternative D – Replace	
Economic Environment					
Lifecycle Costs	Initial and future capital investment requirements	↔	• Anticipated initial capital cost of $8.3M • Estimated that another rehabilitation would be required in approximately 25 years with replacement in approximately 50 years. Estimated 75-year lifecycle cost of $33M	↓	• Anticipated initial capital cost of between $19M for replacement structure of conventional construction ($37M for heritage structure) • Estimated that a minor rehabilitation would be required in approximately 25 years with a major rehabilitation in approximately 50 years. Estimated 75-year lifecycle cost of $45M.
	Maintenance requirements		• Ongoing maintenance and inspection of structure.		• Ongoing maintenance and inspection of structure.
EVALUATION SUMMARY		**SHORTLISTED** Based on the evaluated criteria, this alternative was shortlisted to be included in the evaluation of the Overall Crossing Strategy.		**NOT SHORTLISTED** Based on the evaluated criteria, this alternative was not shortlisted to be included in the evaluation of the Overall Crossing Strategy.	



Criteria	Measure	Alternative B.i – Close Permanently with Retention of Existing Structure as a Monument		Alternative B.ii – Close Permanently with Structure Removal	
SOCIAL ENVIRONMENT					
Property Impacts	Permanent impacts to public and private land, including property acquisition, access and/or displacement of facilities	↔	• No permanent impacts to property anticipated.	↔	• No permanent impacts to property anticipated.
Impacts to Connectivity	Permanent impacts to pedestrian and cyclist connectivity	↓	• Direct impact to connectivity of pedestrians and cyclists due to closure of crossing.	↓	• Direct impact to connectivity of pedestrians and cyclists due to closure of crossing.
Impacts During Construction	Temporary issues (noise, dust, air, vibration)	↔	• Temporary noise nuisances during construction to close bridge. • Anticipated construction duration of approximately 1 to 2 months.	↔	• Temporary noise and dust nuisances during construction to close and remove bridge. • Anticipated construction duration of approximately 1 to 2 months.
	Connectivity and travel time during construction		• Minor impacts to trails at the approaches of the bridge during construction of barricades.		• Minor impacts to trails at the approaches of the bridge during removal of bridge.
Public Health & Safety	Overall safety of all users	↓	• Public safety improved by not crossing bridge, although there is a risk that public may still attempt to access bridge by going over or around barriers.	↑	• Public safety improved by not crossing bridge.
Aesthetics	Change in appearance of the structure	↔	• Existing bridge appearance would be maintained with alteration due to permanent barriers to prohibit access to the bridge and potential removal of pedestrian walkway.	↓	• Removal of the bridge will have a direct impact on aesthetics.
	Change in views to the surrounding landscape		• Views to the surrounding landscape from the bridge would be eliminated following closure of the bridge.		• Views to the surrounding landscape from the bridge would be eliminated following closure of the bridge. • Surrounding landscape can be viewed more clearly from the embankments following removal of the bridge.
Cultural Heritage Resources	Changes to appearance or character of heritage resource	↔	• The structure has been identified as a cultural heritage resource and will be maintained as a monument. • Wide vistas of the Grand River, Lorne Bridge and TH&B Crossing Bridge eliminated due to closure of bridge.	↓	• The structure has been identified as a cultural heritage resource; therefore, removal of the bridge will impact the heritage value. Opportunities to salvage the bridge for display at another location or a commemorative plaque should be considered as a mitigation measure. • Wide vistas of the Grand River, Lorne Bridge and TH&B Crossing Bridge eliminated due to removal of the bridge.
	Threatened viability of heritage or archaeological resource		• No anticipated impact to areas that require a Stage 2 Archaeological Assessment.		• No anticipated impact to areas that require a Stage 2 Archaeological Assessment.
	Impacts to Indigenous Nations		• No known impacts to Indigenous Nations.		• No known impacts to Indigenous Nations.

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

Criteria	Measure	Alternative B.i – Close Bridge Permanently with Retention of Existing Structure as a Monument		Alternative B.ii – Close Bridge Permanently with Structure Removal	
NATURAL ENVIRONMENT					
Terrestrial Wildlife & Vegetation	Impacts on terrestrial species (flora and fauna), including Species at Risk	↑	• Limited potential for negative impact to terrestrial wildlife and vegetation.	↔	• Limited vegetation removal and ground disturbance required to facilitate removal of the bridge.
Aquatic Wildlife & Vegetation	Impacts on aquatic species, including Species at Risk	↑	• Limited potential for negative impact to aquatic wildlife and vegetation.	↓	• Potential for negative impact to aquatic wildlife and vegetation with removal of piers.
TECHNICAL ENVIRONMENT					
Design	Service life of structure	↓	• Ongoing minor repairs would be required to maintain the structure.	↑	• Structure longevity not a concern once bridge is removed.
	Structural Integrity - compliance with design standards		• There will not be an immediate impact to the structural integrity; however, the bridge will continue to deteriorate over time.		• Structural integrity of the bridge is not a concern once bridge is removed.
	Hydraulic Considerations		• No change to hydraulics. The existing structure does not meet the MTO Design Criteria for the evaluated ice jam events.		• Barrier to water and ice flow is removed.
	Geometry		• No anticipated impacts to geometry.		• Existing structure would be removed.
Transportation	Impacts on pedestrian and cyclist traffic flow	↓	• Trail system connection from Fordview Park Trail to Dike and Brant's Crossing Trails across river would be eliminated in this location.	↓	• Trail system connection from Fordview Park Trail to Dike and Brant's Crossing Trails across river would be eliminated in this location.
Constructability	Ease of construction	↑	• Minor construction works.	↔	• Would involve dismantling and removing existing superstructure.
	Utility conflicts		• No utility impacts anticipated. Potential to remove decommissioned utility pipe.		• Relocation would be required for the existing Rogers Fibre cable that runs in a conduit beneath the wood decking.
	Approval requirements		• Limited approvals anticipated.		• Minor environmental approvals anticipated.
ECONOMIC ENVIRONMENT					
Lifecycle Costs	Initial and future capital investment requirements	↑	• Anticipated initial capital cost of $0.3M • 75-year life cycle cost of $1M (assuming removal in 30 years).	↑	• Anticipated initial capital cost of $0.7M • 75-year life cycle cost of $0.7M.
	Maintenance requirements		• Minor maintenance requirements to maintain existing structure and barricades.		• No maintenance requirements following removal.
EVALUATION SUMMARY		**NOT SHORTLISTED** Based on the evaluated criteria, this alternative was not shortlisted to be included in the evaluation of the Overall Crossing Strategy.		**NOT SHORTLISTED** Based on the evaluated criteria, this alternative was not shortlisted to be included in the evaluation of the Overall Crossing Strategy.	

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

Criteria	Measure	Alternative C.i – Rehabilitate		Alternative C.ii – Rehabilitate and Raise Bridge		Alternative D – Replace and Raise Bridge	
SOCIAL ENVIRONMENT							
Property Impacts	Permanent impacts to public and private land, including property acquisition, access and/or displacement of facilities	↔	• No permanent impacts to property anticipated.	↔	• No permanent impacts to property anticipated.	↔	• No permanent impacts to property anticipated.
Impacts to Connectivity	Permanent impacts to pedestrian, cyclist and vehicular connectivity	↔	• Maintains connectivity between western residential area and downtown area to the east.	↔	• Maintains connectivity between western residential area and downtown area to the east.	↑	• Maintains connectivity between western residential area and downtown area to the east. • Potential for improved active transportation facilities over bridge.
Impacts During Construction	Temporary issues (noise, dust, air, vibration)	↓	• Construction with large equipment resulting in nuisances throughout construction. • Anticipated duration for rehabilitation would be approximately 3 months.	↓	• Major construction with large equipment resulting in nuisances throughout construction. • Anticipated duration for rehabilitation would be approximately 5 months.	↓	• Major construction with large equipment resulting in nuisances throughout construction. • Anticipated duration for replacement would be approximately 6 months.
	Connectivity and travel time during construction		• Users would be directed to detour to adjacent TH&B Crossing Bridge and Lorne Bridge during construction.		• Users would be directed to detour to adjacent TH&B Crossing Bridge and Lorne Bridge during construction.		• Users would be directed to detour to adjacent TH&B Crossing Bridge and Lorne Bridge during construction.
Public Health & Safety	Overall safety of all users	↑	• Structural repairs would improve safety across bridge.	↑	• Structural repairs would improve safety across bridge.	↑	• Public safety would be improved across the bridge.
Aesthetics	Change in appearance of the structure	↑	• Will maintain the outward appearance of the bridge due to sympathetic rehabilitation.	↑	• Will maintain the outward appearance of the bridge due to sympathetic rehabilitation.	↔	• Removal of the bridge will have a direct impact on aesthetics; however, the new bridge could be designed to be aesthetically pleasing and maintain the truss bridge aesthetic.
	Change in views to the surrounding landscape		• Views of the surrounding landscape from the existing bridge would be maintained.		• Views of the surrounding landscape from the existing bridge would be maintained.		• Views of the surrounding landscape from the existing bridge would be maintained.

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

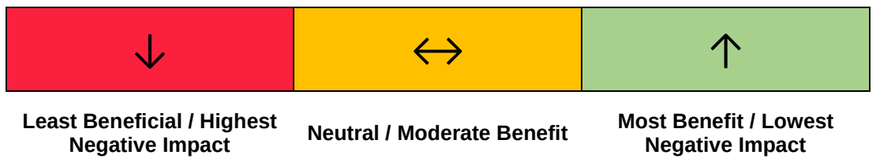
Criteria	Measure	Alternative C.i – Rehabilitate		Alternative C.ii – Rehabilitate and Raise		Alternative D – Replace and Raise	
SOCIAL ENVIRONMENT							
Cultural Heritage Resources	Changes to appearance or character of heritage resource	↑	• The structure has been identified as a cultural heritage resource and rehabilitation would maintain the heritage value through sympathetic design. • Wide vistas of the Grand River, Lorne bridge and TH&B Crossing Bridge from the Brant's Crossing Bridge would be maintained.	↑	• The structure has been identified as a cultural heritage resource and rehabilitation would maintain the heritage value through sympathetic design. • Wide vistas of the Grand River, Lorne bridge and TH&B Crossing Bridge from the Brant's Crossing Bridge would be maintained.	↔	• The existing structure has been identified as a cultural heritage resource; therefore, removal of the bridge will impact the heritage value. Opportunities to salvage the bridge for display at another location or a commemorative plaque should be considered as a mitigation measure. • Wide vistas of the Grand River, Lorne bridge and TH&B Crossing Bridge from the Brant's Crossing Bridge would be maintained.
	Threatened viability of heritage or archaeological resource		• No anticipated impact to areas that require a Stage 2 Archaeological Assessment.		• No anticipated impact to areas that require a Stage 2 Archaeological Assessment.		• No anticipated impact to areas that require a Stage 2 Archaeological Assessment.
	Impacts to Indigenous Nations		• No known impacts to Indigenous Nations.		• No known impacts to Indigenous Nations.		• No known impacts to Indigenous Nations.
NATURAL ENVIRONMENT							
Terrestrial Wildlife & Vegetation	Impacts on terrestrial species (flora and fauna), including Species at Risk	↔	• Area within isolated work areas should be surveyed prior to the start of construction for relocation of wildlife (nesting birds). • Minor potential for displacement, disturbance or harm of wildlife. • Considerations for impacts to Species at Risk required. • All disturbances can be reasonably mitigated.	↔	• Area within isolated work areas should be surveyed prior to the start of construction for relocation of wildlife (nesting birds). • Minor potential for displacement, disturbance or harm of wildlife. • Considerations for impacts to Species at Risk required. • All disturbances can be reasonably mitigated.	↔	• Temporary impacts arising from limited grading and removal of vegetation. Potential for bank instability and sediment laden runoff during construction, unless properly managed. • Area within isolated work areas should be surveyed prior to the start of construction for relocation of wildlife. • Potential for temporary displacement, disturbance or harm of wildlife. • Considerations for impacts to Species at Risk required. • All disturbances can be reasonably mitigated.
Aquatic Wildlife & Vegetation	Impacts on aquatic species, including Species at Risk	↔	• Temporary impacts due to underpinning of west pier and platforms for patching at piers. • No long-term impacts are anticipated.	↔	• Temporary impacts due to underpinning of west pier and platforms for patching/jacking at piers. • No long-term impacts are anticipated.	↔	• Temporary impacts due to underpinning of west pier and platforms for patching at piers. • No long-term impacts are anticipated.

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

Criteria	Measure	Alternative C.i – Rehabilitate		Alternative C.ii – Rehabilitate and Raise		Alternative D – Replace and Raise	
TECHNICAL ENVIRONMENT							
Design	Service life of structure	↓	• Estimated service life of structure is 15-30 years before the next major capital expenditure.	↑	• Estimated service life of structure is 15-30 years before the next major capital expenditure.	↑	• Estimated service life of a new bridge would be 75 years.
	Structural Integrity - compliance with design standards		• Structural repairs would be designed to current design standards.		• Structural repairs would be designed to current design standards.		• New bridge would be designed to be compliant with current design standards.
	Hydraulic Considerations		• Existing structure would not meet MTO Design Criteria for the evaluated ice jam events.		• Structure would be raised to meet MTO Design Criteria for the evaluated ice jam events.		• Modifications to the existing piers and abutments would be required to allow for the new structure to be installed at the proper elevation to convey the Regulatory event.
	Geometry		• Structural repairs would need to be designed to match existing geometry.		• Elevation of existing structure would be increased. • Structural repairs would need to be designed to match existing geometry.		• Flexibility in geometry of new trusses. • New bridge span lengths would need to be designed to suit existing pier locations.
Transportation	Impacts on pedestrian and cyclist traffic flow	↑	• Trail system connection from Fordview Park Trail to Dike and Brant's Crossing Trails across river would be maintained.	↑	• Trail system connection from Fordview Park Trail to Dike and Brant's Crossing Trails across river would be maintained.	↑	• Trail system connection from Fordview Park Trail to Dike and Brant's Crossing Trails across river would be maintained. • Potential to widen existing active transportation facilities to improve flow across bridge.
Constructability	Ease of construction	↓	• Moderate scale construction undertaking.	↑	• Moderate scale construction undertaking requiring unique construction practices for raising the existing bridge.	↓	• Large scale construction undertaking including the need for a crane.
	Utility conflicts		• No utility impacts anticipated. Potential to remove decommissioned utility pipe.		• No utility impacts anticipated. Potential to remove decommissioned utility pipe.		• Relocation/support would be required for the existing Rogers Fibre cable that runs in a conduit beneath the wood decking.
	Approval requirements		• A GRCA permit application shall be submitted for the Project. • A DFO Request for Review shall be submitted for the Project. • A permit or registration under the Endangered Species Act may be required if individuals or habitat of Species at Risk are impacted.		• A GRCA permit application shall be submitted for the Project. • A DFO Request for Review shall be submitted for the Project. • A permit or registration under the Endangered Species Act may be required if individuals or habitat of Species at Risk are impacted.		• A GRCA permit application shall be submitted for the Project. • A DFO Request for Review shall be submitted for the Project. • A permit or registration under the Endangered Species Act may be required if individuals or habitat of Species at Risk are impacted.

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

Criteria	Measure	Alternative C.i – Rehabilitate		Alternative C.ii – Rehabilitate and Raise		Alternative D – Replace and Raise	
ECONOMIC ENVIRONMENT							
Lifecycle Costs	Initial and future capital investment requirements	↔	• Anticipated initial capital cost of $1.0M • 75-year life cycle cost, assuming replacement in 30 years, of $6.4M. • Future capital investments could be anticipated in approximately 15 years. • More frequent capital investments required due to advanced age of existing structure. • Structural replacement likely required within 30 to 40 years.	↔	• Anticipated initial capital cost of $2.3M • 75-year life cycle cost, assuming replacement in 30 years, of $7.7M. • Future capital investments could be anticipated in approximately 15 years. • More frequent capital investments required due to advanced age of existing structure. • Structural replacement likely required within 30 to 40 years.	↔	• Anticipated initial capital cost of $3.1M • 75-year life cycle cost, assuming replacement in 50 years, of $8.5M. • Future capital investments could be anticipated in approximately 25 years.
	Maintenance requirements		• Ongoing maintenance of structure.		• Ongoing maintenance of structure.		• Ongoing maintenance of structure.
EVALUATION SUMMARY		**SHORTLISTED** Based on the evaluated criteria, this alternative was shortlisted to be included in the evaluation of the Overall Crossing Strategy.		**SHORTLISTED** Based on the evaluated criteria, this alternative was shortlisted to be included in the evaluation of the Overall Crossing Strategy.		**SHORTLISTED** Based on the evaluated criteria, this alternative was shortlisted to be included in the evaluation of the Overall Crossing Strategy.	



Criteria	Measure	Alternative B.i – Decommission and Close Bridge		Alternative B.ii – Decommission and Remove Bridge	
Social Environment					
Property Impacts	Permanent impacts to public and private land, including property acquisition, access and/or displacement of facilities	↔	• No permanent impacts to property anticipated.	↔	• No permanent impacts to property anticipated.
Impacts to Connectivity	Permanent impacts to pedestrian and cyclist connectivity	↓	• Direct impact to connectivity for pedestrians and cyclists due to closure of crossing.	↓	• Direct impact to connectivity for pedestrians and cyclists due to closure of crossing.
Impacts During Construction	Temporary issues (noise, dust, air, vibration)	↔	• Temporary noise nuisances during construction. • Anticipated construction duration of approximately 1 to 2 months.	↔	• Temporary noise and dust nuisances due to construction. • Anticipated construction duration of approximately 1 to 2 months.
	Connectivity and travel time during construction		• Minor impacts to trails at the approaches of the bridge during construction of barricades.		• Minor impacts to trails at the approaches of the bridge during removal of bridge.
Public Health & Safety	Overall safety of all users	↓	• Public safety improved by not crossing bridge, although there is a risk that public may still attempt to access bridge by going over or around barriers.	↑	• Public safety improved by not crossing bridge.
Aesthetics	Change in appearance of the structure	↔	• Existing bridge appearance would be maintained with alteration due to permanent barriers to prohibit access to the bridge and potential removal of pedestrian pathway.	↓	• Removal of the bridge will have a direct impact on aesthetics.
	Change in views to the surrounding landscape		• Views to the surrounding landscape from the bridge would be eliminated following closure of the bridge.		• Views to the surrounding landscape from the bridge would be eliminated following closure of the bridge. • Surrounding landscape can be viewed more clearly from the embankments following removal of the bridge.
Cultural Heritage Resources	Changes to appearance or character of heritage resource	↔	• The structure has been identified as a cultural heritage resource and will be maintained as a monument. • Wide vistas of the Grand River, Lorne Bridge and Brant's Crossing Bridge eliminated due to closure of bridge.	↓	• The structure has been identified as a cultural heritage resource; therefore, removal of the bridge will impact the heritage value. Opportunities to salvage the bridge for display at another location or a commemorative plaque should be considered as a mitigation measure. • Wide vistas of the Grand River, Lorne Bridge and Brant's Crossing Bridge eliminated due to removal of the bridge.
	Threatened viability of heritage or archaeological resource		• No anticipated impact to areas that require a Stage 2 Archaeological Assessment.		• No anticipated impact to areas that require a Stage 2 Archaeological Assessment.
	Impacts to Indigenous Nations		• No known impacts to Indigenous Nations.		• No known impacts to Indigenous Nations.

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

Criteria	Measure	Alternative B.i – Close Bridge Permanently with Retention of Existing Structure as a Monument		Alternative B.ii – Close Bridge Permanently with Structure Removal	
Natural Environment					
Terrestrial Wildlife & Vegetation	Impacts on terrestrial species (flora and fauna), including Species at Risk	↑	• Limited potential for negative impact to terrestrial wildlife and vegetation.	↔	• Limited vegetation removal and ground disturbance required to facilitate removal of the bridge.
Aquatic Wildlife & Vegetation	Impacts on aquatic species, including Species at Risk	↑	• Limited potential for negative impact to aquatic wildlife and vegetation.	↓	• Potential for negative impact to aquatic and wildlife and vegetation with removal of piers.
Technical Environment					
Design	Service life of structure	↓	• Ongoing minor repairs would be required to maintain the structure.	↑	• Structure longevity not a concern once bridge is removed.
	Structural Integrity - compliance with design standards		• There will not be an immediate impact to the structural integrity; however, the bridge will continue to deteriorate over time.		• Structural integrity of the bridge is not a concern once bridge is removed.
	Hydraulic Considerations		• No change to hydraulics. The existing structure does not meet the MTO Design Criteria for the evaluated ice jam events.		• Barrier to water and ice flow is removed.
	Geometry		• No anticipated impacts to geometry.		• Existing structure would be removed.
Transportation	Impacts on pedestrian and cyclist traffic flow	↓	• Trail system connection from Fordview Park Trail to Dike Trail across river would be eliminated in this location.	↓	• Trail system connection from Fordview Park Trail to Dike Trail across river would be eliminated in this location.
Constructability	Ease of construction	↑	• Minor construction works.	↔	• Would involve dismantling and removing existing superstructure.
	Utility conflicts		• No utility impacts anticipated.		• No utility impacts anticipated. • Overhead hydro located approximately 20m north of bridge to be considered when removing bridge.
	Approval requirements		• Limited approvals anticipated.		• Minor environmental approvals anticipated.
Economic Environment					
Lifecycle Costs	Initial and future capital investment requirements	↑	• Anticipated initial capital cost of $0.3M • 75-year life cycle cost of $1M.	↔	• Anticipated initial capital cost of $0.7M • 75-year life cycle cost of $0.7M.
	Maintenance requirements		• Minor maintenance requirements to maintain existing structure and barricades.		• No maintenance requirements following removal.
EVALUATION SUMMARY		**NOT SHORTLISTED** Based on the evaluated criteria, this alternative was not shortlisted to be included in the evaluation of the Overall Crossing Strategy.		**NOT SHORTLISTED** Based on the evaluated criteria, this alternative was not shortlisted to be included in the evaluation of the Overall Crossing Strategy.	

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

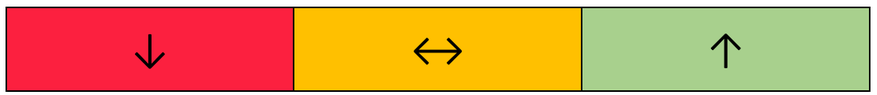
Criteria	Measure	Alternative C.i – Minor Rehabilitation and Eventual Removal		Alternative C.ii – Rehabilitate	
Social Environment					
Property Impacts	Permanent impacts to public and private land, including property acquisition, access and/or displacement of facilities	↔	• No permanent impacts to property anticipated.	↔	• No permanent impacts to property anticipated.
Impacts to Connectivity	Permanent impacts to pedestrian, cyclist and vehicular connectivity	↔	• Maintains connectivity between western residential area and downtown area to the east in the short term. • Connectivity eliminated following eventual removal in the long term.	↑	• Maintains connectivity between western residential area and downtown area to the east.
Impacts During Construction	Temporary issues (noise, dust, air, vibration)	↔	• Minor construction with equipment resulting in nuisances throughout construction. • Anticipated duration for rehabilitation would be approximately 1 month.	↓	• Construction with large equipment resulting in nuisances throughout construction. • Anticipated duration for rehabilitation would be approximately 3 months.
	Connectivity and travel time during construction		• Users would be directed to detour to adjacent Brant's Crossing Bridge and Lorne Bridge during construction.		• Users would be directed to detour to adjacent Brant's Crossing Bridge and Lorne Bridge during construction.
Public Health & Safety	Overall safety of all users	↑	• Structural repairs would improve safety across bridge.	↑	• Structural repairs would improve safety across bridge.
Aesthetics	Change in appearance of the structure	↔	• Will maintain the outward appearance of the bridge due to sympathetic rehabilitation in the short term. • Removal of the bridge will have a direct impact on aesthetics in the long term.	↑	• Will maintain the outward appearance of the bridge due to sympathetic rehabilitation.
	Change in views to the surrounding landscape		• Views of the surrounding landscape from the existing bridge would be maintained in the short term. • Views to the surrounding landscape from the bridge would be eliminated following removal of the bridge in the long term.		• Views of the surrounding landscape from the existing bridge would be maintained.
Cultural Heritage Resources	Changes to appearance or character of heritage resource	↔	• The structure has been identified as a cultural heritage resource and rehabilitation would maintain the heritage value through sympathetic design. Removal of the structure will have an impact on heritage resources. • Wide vistas of the Grand River, Lorne bridge and Brant's Crossing Bridge from the TH&B Crossing Bridge would be maintained in the short term.	↑	• The structure has been identified as a cultural heritage resource and rehabilitation would maintain the heritage value through sympathetic design. • Wide vistas of the Grand River, Lorne bridge and Brant's Crossing Bridge from the TH&B Crossing Bridge would be maintained.
	Threatened viability of heritage or archaeological resource		• No anticipated impact to areas that require a Stage 2 Archaeological Assessment.		• No anticipated impact to areas that require a Stage 2 Archaeological Assessment.
	Impacts to Indigenous Nations		• No known impacts to Indigenous Nations.		• No known impacts to Indigenous Nations.

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

Criteria	Measure	Alternative C.i – Minor Rehabilitation and Eventual Removal		Alternative C.ii – Rehabilitate	
Natural Environment					
Terrestrial Wildlife & Vegetation	Impacts on terrestrial species (flora and fauna), including Species at Risk	↔	• Area within isolated work areas should be surveyed prior to the start of construction for relocation of wildlife (nesting birds). • Minor potential for temporary displacement, disturbance or harm of wildlife. • All disturbances can be reasonably mitigated.	↔	• Area within isolated work areas should be surveyed prior to the start of construction for relocation of wildlife. • Potential for temporary displacement, disturbance or harm of wildlife. • Considerations for impacts to Species at Risk required. • All disturbances can be reasonably mitigated.
Aquatic Wildlife & Vegetation	Impacts on aquatic species, including Species at Risk	↔	• No long-term impacts are anticipated.	↔	• Temporary impacts due to underpinning of west pier and platforms for patching/jacking at piers. • No long-term impacts are anticipated.
Technical Environment					
Design	Service life of structure	↑	• Estimated service life of structure is 10-15 years prior to eventual removal.	↓	• Estimated service life of structure is 15-30 years before the next major capital expenditure.
	Structural Integrity - compliance with design standards		• Structural repairs would be designed to current design standards.		• Structural repairs would be designed to current design standards.
	Hydraulic Considerations		• In short term existing structure would not meet MTO Design Criteria for the evaluated ice jam events. • In the long term, following the removal the bridge would not block water and ice flow.		• Existing structure would not meet MTO Design Criteria for the evaluated ice jam events.
	Geometry		• Structural repairs would need to be designed to match existing geometry.		• Structural repairs would need to be designed to match existing geometry.
Transportation	Impacts on pedestrian and cyclist traffic flow	↔	• In short term the trail system connection from Fordview Park Trail to Dike Trail across river would be maintained. • In long term the trail system connection would be eliminated in this location.	↑	• Trail system connection from Fordview Park Trail to Dike Trail across river would be maintained. • Potential to formalize connection to Civic Centre Trail to the northeast.
Constructability	Ease of construction	↑	• Minor scale of construction undertaking.	↔	• Moderate scale construction undertaking.
	Utility conflicts		• No utility impacts anticipated. • Overhead hydro located approximately 20m north of bridge to be considered when removing bridge.		• No utility impacts anticipated.
	Approval requirements		• Limited approvals anticipated.		• A GRCA permit application shall be submitted for the Project. • A DFO Request for Review shall be submitted for the Project. • A permit or registration under the Endangered Species Act may be required if individuals or habitat of Species at Risk are impacted.

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

Criteria	Measure	Alternative C.i – Rehabilitate (Do Not Raise Bridge)		Alternative C.ii – Rehabilitate	
Economic Environment					
Lifecycle Costs	Initial and future capital investment requirements	↑	• Anticipated initial capital cost of $0.3M • 75-year life cycle cost of $1.0M	↔	• Anticipated initial capital cost of $1.9M • 75-year life cycle cost of $7.8M
	Maintenance requirements		• No maintenance requirements following removal.		• Ongoing maintenance of structure.
EVALUATION SUMMARY		**SHORTLISTED** Based on the evaluated criteria, this alternative was shortlisted to be included in the evaluation of the Overall Crossing Strategy.		**SHORTLISTED** Based on the evaluated criteria, this alternative was shortlisted to be included in the evaluation of the Overall Crossing Strategy.	



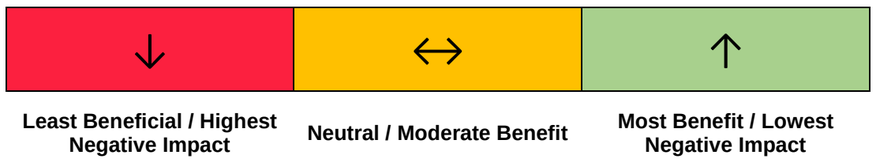
Criteria	Measure	Alternative C.iii – Rehabilitate and Raise		Alternative D – Replace and Raise	
Social Environment					
Property Impacts	Permanent impacts to public and private land, including property acquisition, access and/or displacement of facilities	↔	• No permanent impacts to property anticipated.	↔	• No permanent impacts to property anticipated.
Impacts to Connectivity	Permanent impacts to pedestrian, cyclist and vehicular connectivity	↑	• Maintains connectivity between western residential area and downtown area to the east. • Potential for connectivity to be improved by formalizing trail connection to the northeast.	↑	• Maintains connectivity between western residential area and downtown area to the east. • Potential for improved active transportation facilities over bridge. • Potential for connectivity to be improved by formalizing trail connection to the northeast.
Impacts During Construction	Temporary issues (noise, dust, air, vibration)	↓	• Major construction with large equipment resulting in nuisances throughout construction. • Anticipated duration for replacement would be approximately 5 months.	↓	• Major construction with large equipment resulting in nuisances throughout construction. • Anticipated duration for replacement would be approximately 6 months.
	Connectivity and travel time during construction		• Users would be directed to detour to adjacent Brant's Crossing Bridge and Lorne Bridge during construction.		• Users would be directed to detour to adjacent Brant's Crossing Bridge and Lorne Bridge during construction.
Public Health & Safety	Overall safety of all users	↑	• Structural repairs would improve safety across bridge.	↑	• New bridge would be designed to meet current safety standards.
Aesthetics	Change in appearance of the structure	↑	• Will maintain the outward appearance of the bridge due to sympathetic rehabilitation.	↑	• Removal of the bridge will have a direct impact on aesthetics; however, the new bridge could be designed to be aesthetically pleasing.
	Change in views to the surrounding landscape		• Views of the surrounding landscape from the existing bridge would be maintained.		• Views of the surrounding landscape from the existing bridge would be maintained.
Cultural Heritage Resources	Changes to appearance or character of heritage resource	↓	• The structure has been identified as a cultural heritage resource and rehabilitation would maintain the heritage value through sympathetic design. • Wide vistas of the Grand River, Lorne bridge and Brant's Crossing Bridge from the TH&B Crossing Bridge would be maintained.	↓	• The structure has been identified as a cultural heritage resource; therefore, removal of the bridge will impact the heritage value. Opportunities to salvage the bridge for display at another location or a commemorative plaque should be considered as a mitigation measure. • Wide vistas of the Grand River, Lorne bridge and Brant's Crossing Bridge from the TH&B Crossing Bridge would be maintained.
	Threatened viability of heritage or archaeological resource		• No anticipated impact to areas that require a Stage 2 Archaeological Assessment.		• No anticipated impact to areas that require a Stage 2 Archaeological Assessment.
	Impacts to Indigenous Nations		• No known impacts to Indigenous Nations.		• No known impacts to Indigenous Nations.

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

Criteria	Measure	Alternative C.iii – Rehabilitate and Raise		Alternative D – Replace and Raise	
Natural Environment					
Terrestrial Wildlife & Vegetation	Impacts on terrestrial species (flora and fauna), including Species at Risk	↔	• Area within isolated work areas should be surveyed prior to the start of construction for relocation of wildlife (nesting birds). • Minor potential for displacement, disturbance or harm of wildlife. • Considerations for impacts to Species at Risk required. • All disturbances can be reasonably mitigated.	↔	• Temporary impacts arising from limited grading and removal of vegetation. Potential for bank instability and sediment laden runoff during construction, unless properly managed. • Area within isolated work areas should be surveyed prior to the start of construction for relocation of wildlife. • Potential for temporary displacement, disturbance or harm of wildlife. • Considerations for impacts to Species at Risk required.
Aquatic Wildlife & Vegetation	Impacts on aquatic species, including Species at Risk	↔	• Temporary impacts due to underpinning of west pier and platforms for patching/jacking at piers. • No long-term impacts are anticipated.	↔	• Temporary impacts due to underpinning of west pier and platforms for patching at piers. • No long-term impacts are anticipated.
Technical Environment					
Design	Service life of structure	↑	• Estimated service life of structure is 15-30 years before the next major capital expenditure.	↑	• Estimated service life of a new bridge would be 50 years due to the planned replacement of the substructure.
	Structural Integrity - compliance with design standards		• Structural repairs would be designed to current design standards.		• New bridge would be designed to be compliant with current design standards.
	Hydraulic Considerations		• Structure would be raised to meet MTO Design Criteria for the evaluated ice jam events.		• Modifications to the existing piers and abutments would be required to allow for the new structure to be installed at the proper elevation to convey the Regulatory event.
	Geometry		• Elevation of existing structure would be increased. • Structural repairs would need to be designed to match existing geometry.		• New bridge span lengths would need to be designed to suit existing pier locations.
Transportation	Impacts on pedestrian and cyclist traffic flow	↑	• Trail system connection from Fordview Park Trail to Dike Trail across river would be maintained. • Potential to formalize connection to Civic Centre Trail to the northeast.	↑	• Trail system connection from Fordview Park Trail to Dike Trail across river would be maintained. • Potential to formalize connection to Civic Centre Trail to the northeast.
Constructability	Ease of construction	↓	• Moderate scale construction undertaking requiring unique construction practices for raising the existing bridge.	↓	• Large scale construction undertaking including the need for a crane.
	Utility conflicts		• No utility impacts anticipated.		• No utility impacts anticipated. • Overhead hydro located approximately 20m north of bridge to be considered when removing existing bridge.
	Approval requirements		• A GRCA permit application shall be submitted for the Project. • A DFO Request for Review shall be submitted for the Project. • A permit or registration under the Endangered Species Act may be required if individuals or habitat of Species at Risk are impacted.		• A GRCA permit application shall be submitted for the Project. • A DFO Request for Review shall be submitted for the Project. • A permit or registration under the Endangered Species Act may be required if individuals or habitat of Species at Risk are impacted.

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

Criteria	Measure	Alternative C.iii – Rehabilitate and Raise		Alternative D – Replace and Raise	
Economic Environment					
Lifecycle Costs	Initial and future capital investment requirements	↔	• Anticipated initial capital cost of $1.9M • 75-year life cycle cost of $7.8M	↓	• Anticipated initial capital cost of $3.2M • 75-year life cycle cost of $8.1M
	Maintenance requirements		• Ongoing maintenance of structure.		• Ongoing maintenance of structure.
EVALUATION SUMMARY		**SHORTLISTED** Based on the evaluated criteria, this alternative was shortlisted to be included in the evaluation of the Overall Crossing Strategy.		**NOT SHORTLISTED** Based on the evaluated criteria, this alternative was not shortlisted to be included in the evaluation of the Overall Crossing Strategy.	



6.5 Overall Crossing Strategy Alternative Solutions

Refer to **Figure 6-1** below for a summary of an overview of individual crossing alternatives, including which alternatives were shortlisted to be evaluated as part of the Overall Crossing Strategy.

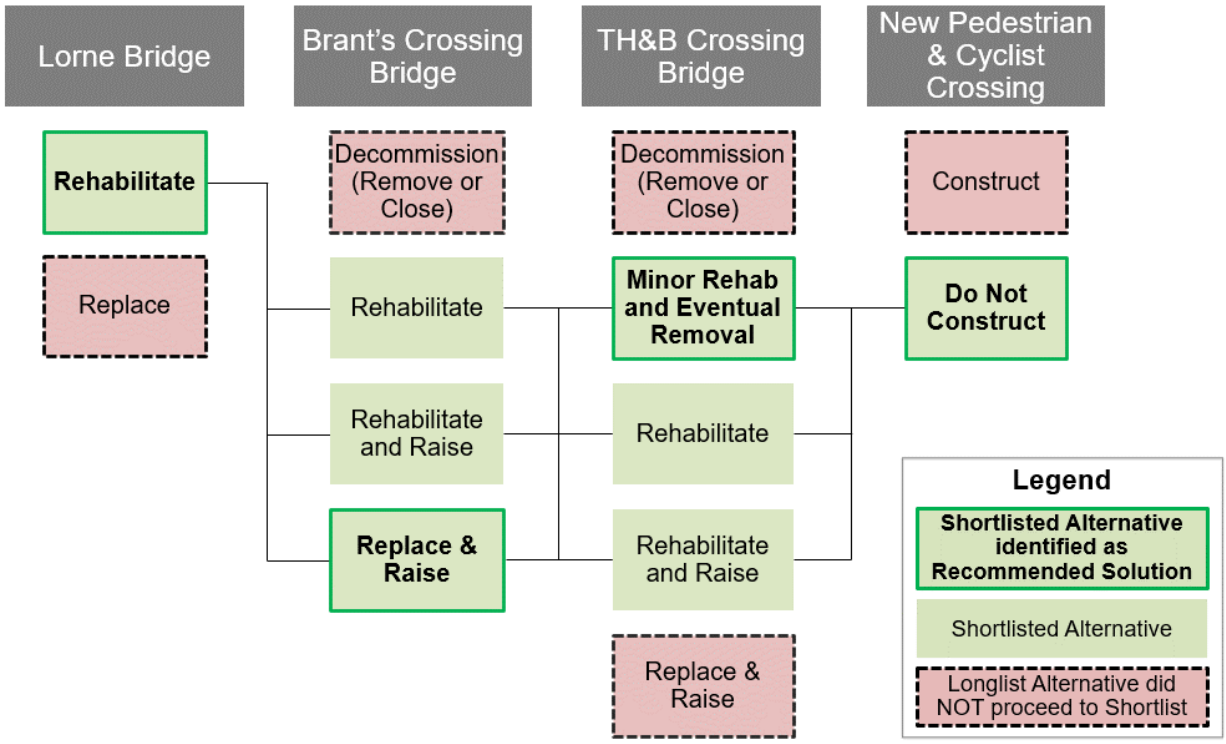


Figure 6-1: Summary of Shortlisted Individual Crossing Alternatives

The shortlisted alternatives were combined into a list of Overall Crossing Strategies for the Study Area. Each Overall Crossing Strategy consists of an alternative solution for the Lorne Bridge, Brant's Crossing Bridge and TH&B Crossing Bridge. Prior to the evaluation of the Overall Crossing Strategies, each strategy was screened to determine if it was feasible.

Refer to **Table 6-5** below for a summary of the screening for the Overall Crossing Strategy alternatives.

Table 6-5: Summary of Overall Crossing Strategy Screening

Overall Crossing Strategy	Lorne Bridge	Brant's Crossing Bridge	TH&B Crossing Bridge	New Bridge Crossing	Is the Overall Crossing Strategy Alternative Feasible
1	Rehabilitate	Rehabilitate	Minor Rehab and Eventual Removal	Do Nothing	YES
2	Rehabilitate	Rehabilitate	Rehabilitate	Do Nothing	YES
3	Rehabilitate	Rehabilitate	Rehabilitate and Raise	Do Nothing	NO

Overall Crossing Strategy	Lorne Bridge	Brant's Crossing Bridge	TH&B Crossing Bridge	New Bridge Crossing	Is the Overall Crossing Strategy Alternative Feasible
4	Rehabilitate	Rehabilitate and Raise	Minor Rehab and Eventual Removal	Do Nothing	YES
5	Rehabilitate	Rehabilitate and Raise	Rehabilitate	Do Nothing	NO
6	Rehabilitate	Rehabilitate and Raise	Rehabilitate and Raise	Do Nothing	YES
7	Rehabilitate	Replace & Raise	Minor Rehab and Eventual Removal	Do Nothing	YES
8	Rehabilitate	Replace & Raise	Rehabilitate	Do Nothing	NO
9	Rehabilitate	Replace & Raise	Rehabilitate and Raise	Do Nothing	NO

Note that if one of the pedestrian bridges were to be raised, and the other pedestrian bridge was to stay at its current height, the benefit to improving ice jamming and river flows is not achieved since one of the bridges would continue to limit the flow of the river. Therefore, Strategy 3, Strategy 5 and Strategy 8 were determined to not be feasible Overall Crossing Strategy Alternatives. Additionally, Strategy 9 was not carried forward as the intent behind replacing Brant's Crossing Bridge would be to consolidate the investment in active transportation infrastructure in the Study Area into one pedestrian and cyclist crossing.

6.6 Overall Crossing Strategy Cost Estimates

Preliminary cost estimates for Overall Crossing Strategies are based the applicable combination of individual crossing alternative solutions cost estimates presented in **Table 6-1**. The capital costs in **Table 6-6** represent the estimated initial cost to implement the alternative solution at each bridge within the Overall Crossing Strategy. The lifecycle cost represents the estimated total cost of implementing the alternative solution, forecasted over 75 years, and includes the capital as well as future maintenance and repair costs.

Table 6-6: Overall Crossing Strategy Preliminary Cost Estimates

Overall Crossing Strategy	Lorne Bridge Alternative	Brant's Crossing Bridge Alternative	TH&B Crossing Bridge Alternative	Capital Cost (2021 Dollars)	Lifecycle Cost (2021 Dollars)
1	Rehabilitate	Rehabilitate	Minor Rehab and Eventual Removal	$9,600,000	$40,200,000
2	Rehabilitate	Rehabilitate	Rehabilitate	$9,900,000	$45,800,000
4	Rehabilitate	Rehabilitate and Raise	Minor Rehab and Eventual Removal	$10,800,000	$41,400,000
6	Rehabilitate	Rehabilitate and Raise	Rehabilitate and Raise	$12,400,000	$48,500,000
7	Rehabilitate	Replace & Raise	Minor Rehab and Eventual Removal	$12,630,000	$39,300,000

6.7 Evaluation of Overall Crossing Strategy Alternative Solutions

6.7.1 Evaluation Methodology

Overall Crossing Strategy Alternative Solutions were evaluated using the same methodology presented in **Section 6.4.1**.

6.7.2 Evaluation Summary

The evaluation of the Overall Crossing Strategies has been captured in a matrix format to allow for direct comparison between the alternative solutions. The evaluation matrices are provided in the tables below.

Criteria	Measure	Strategy 1: Lorne Bridge: Rehabilitate; Brant's Crossing Bridge: Rehabilitate; TH&B Crossing Bridge: Rehabilitate with Eventual Removal		Strategy 2: Lorne Bridge: Rehabilitate; Brant's Crossing Bridge: Rehabilitate; TH&B Crossing Bridge: Rehabilitate		Strategy 4: Lorne Bridge: Rehabilitate; Brant's Crossing Bridge: Rehabilitate and Raise; TH&B Crossing Bridge: Rehabilitate with Eventual Removal	
SOCIAL ENVIRONMENT							
Property Impacts	Permanent impacts to public and private land, including property acquisition, access and/or displacement of facilities	↔	• No permanent impacts to property anticipated.	↔	• No permanent impacts to property anticipated.	↔	• No permanent impacts to property anticipated.
Impacts to Connectivity	Permanent impacts to pedestrian, cyclist and vehicular connectivity	↓	• In short term the trail system connection from Fordview Park Trail to Dike Trail across river would be maintained. In long term the trail system connection would be eliminated.	↔	• Maintains two active transportation bridges within the Study Area. • Ongoing issues with simultaneous cyclist and pedestrian use at Brant's Crossing Bridge.	↓	• In short term the trail system connection from Fordview Park Trail to Dike Trail across river would be maintained. In long term the trail system connection would be eliminated.
Impacts During Construction	Temporary issues (noise, dust, air, vibration)	↔	• Temporary nuisances during construction.	↔	• Temporary nuisances during construction.	↔	• Temporary nuisances during construction.
	Connectivity and travel time during construction		• Temporary detours at each bridge would be provided during construction.		• Temporary detours at each bridge would be provided during construction.		• Temporary detours at each bridge would be provided during construction.
Public Health & Safety	Overall safety of all users	↑	• Structural repairs would improve safety across each bridge.	↑	• Structural repairs would improve safety across each bridge.	↑	• Structural repairs would improve safety across each bridge.
Aesthetics	Change in appearance of the structure	↔	• Will maintain the outward appearance of all bridges due to sympathetic rehabilitation. • TH&B Crossing Bridge will eventually be removed which would have a direct impact on the appearance of the area.	↔	• Will maintain the outward appearance of all bridges due to sympathetic rehabilitation.	↔	• Will maintain the outward appearance of all bridges due to sympathetic rehabilitation. • TH&B Crossing Bridge will eventually be removed which would have a direct impact on the appearance of the area.
	Change in views to the surrounding landscape		• Views of the surrounding landscape from the existing bridges would be maintained at all bridges in the short term. • Views to the surrounding landscape from the TH&B Crossing Bridge would be eliminated following closure of the bridge. • Surrounding landscape can be viewed more clearly from the embankments following removal of the TH&B Crossing Bridge.		• Views of the surrounding landscape from the existing bridges would be maintained.		• Views of the surrounding landscape from the existing bridges would be maintained at all bridges in the short term. • Views to the surrounding landscape from the TH&B Crossing Bridge would be eliminated following closure of the bridge. • Surrounding landscape can be viewed more clearly from the embankments following removal of the TH&B Crossing Bridge.

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

Criteria	Measure	Strategy 1:		Strategy 2:		Strategy 4:	
SOCIAL ENVIRONMENT							
Cultural Heritage Resources	Changes to appearance or character of heritage resource	↓	• The eventual removal of TH&B Crossing Bridge would have a direct impact on cultural heritage resources.	↑	• Cultural heritage resources to be maintained through sympathetic rehabilitations at each bridge.	↓	• The eventual removal of TH&B Crossing Bridge would have a direct impact on cultural heritage resources.
	Threatened viability of heritage or archaeological resource		• No anticipated impact to areas that require a Stage 2 Archaeological Assessment.		• No anticipated impact to areas that require a Stage 2 Archaeological Assessment.		• No anticipated impact to areas that require a Stage 2 Archaeological Assessment.
	Impacts to Indigenous Communities		• No known impacts to Indigenous Communities.		• No known impacts to Indigenous Communities.		• No known impacts to Indigenous Communities.
NATURAL ENVIRONMENT							
Terrestrial Wildlife & Vegetation	Impacts on terrestrial species (flora and fauna), including Species at Risk	↔	• Temporary impacts from construction can be appropriately mitigated at all bridges.	↔	• Temporary impacts from construction can be appropriately mitigated at all bridges.	↔	• Temporary impacts from construction can be appropriately mitigated at all bridges.
Aquatic Wildlife & Vegetation	Impacts on aquatic species, including Species at Risk	↔	• Temporary impacts from construction can be appropriately mitigated at all bridges.	↔	• Temporary impacts from construction can be appropriately mitigated at all bridges.	↔	• Temporary impacts from construction can be appropriately mitigated at all bridges.
TECHNICAL ENVIRONMENT							
Design	Service life of structure	↓	• Rehabilitations at Brant's Crossing Bridge and Lorne Bridge would extend the service life by 15-30 years. • TH&B Crossing Bridge would be removed in 10-15 years at the end of its service life.	↓	• Rehabilitations at the bridges would extend their service life by 15-30 years before the next major capital expenditure.	↑	• Rehabilitations at Brant's Crossing Bridge and Lorne Bridge would extend the service life by 15-30 years. • TH&B Crossing Bridge would be removed in 10-15 years at the end of its service life.
	Structural Integrity - compliance with design standards		• Structural repairs would be designed to current design standards.		• Structural repairs would be designed to current design standards.		• Structural repairs would be designed to current design standards.
	Hydraulic Considerations		• Increased risk as Brant's Crossing Bridge and TH&B Crossing Bridge would not be raised to meet MTO Design Criteria for the evaluated ice jam events.		• Increased risk as Brant's Crossing Bridge and TH&B Crossing Bridge would not be raised to meet MTO Design Criteria for the evaluated ice jam events.		• Reduces risk as Brant's Crossing Bridge would be raised to meet MTO Design Criteria for the evaluated ice jam events. Short term risk due to TH&B Crossing Bridge not being raised.
	Geometry		• Structural repairs would need to be designed to match existing geometry.		• Structural repairs would need to be designed to match existing geometry.		• Structural repairs would need to be designed to match existing geometry.

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

Evaluation of Overall Crossing Strategy Alternative Solutions

Criteria	Measure	Strategy 1:		Strategy 2:		Strategy 4:	
TECHNICAL ENVIRONMENT							
Transportation	Impacts on pedestrian and cyclist traffic flow	↓	• Maintains two active transportation bridges within the Study Area in the short term. • Ongoing issues with simultaneous cyclist and pedestrian use at Brant's Crossing Bridge.	↔	• Maintains two active transportation bridges within the Study Area. • Ongoing issues with simultaneous cyclist and pedestrian use at Brant's Crossing Bridge.	↓	• Maintains two active transportation bridges within the Study Area in the short term. • Ongoing issues with simultaneous cyclist and pedestrian use at Brant's Crossing Bridge.
Constructability	Ease of construction	↑	• Moderate scale construction undertaking for Brant's Crossing Bridge. • Less intensive rehabilitation required for TH&B Crossing Bridge.	↔	• Moderate scale construction undertaking for Brant's Crossing Bridge and TH&B Crossing Bridge.	↔	• Increased constructability challenges with raising Brant's Crossing Bridge. • Less intensive rehabilitation required for TH&B Crossing Bridge.
	Utility conflicts		• No utility impacts anticipated.		• No utility impacts anticipated.		• No utility impacts anticipated.
	Approval requirements		• Approvals required.		• Approvals required.		• Approvals required.
ECONOMIC ENVIRONMENT							
Lifecycle Costs	Initial and future capital investment requirements	↑	• Initial capital cost of $1.3M • Lifecycle cost of $7.1M	↔	• Initial capital cost of $1.6M • Lifecycle cost of $13M	↔	• Initial capital cost of $2.6M • Lifecycle cost of $8.4M
	Maintenance requirements		• Ongoing maintenance at each bridge. • No maintenance requirements at TH&B Crossing Bridge following removal.		• Ongoing maintenance at each bridge.		• Ongoing maintenance at each bridge. • No maintenance requirements at TH&B Crossing Bridge following removal.
EVALUATION SUMMARY		↔		↔		↔	

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

Criteria	Measure	Strategy 6: Lorne Bridge: Rehabilitate; Brant's Crossing Bridge: Rehabilitate and Raise; TH&B Crossing Bridge: Rehabilitate and Raise		Strategy 7: Lorne Bridge: Rehabilitate; Brant's Crossing Bridge: Replace and Raise; TH&B Crossing Bridge: Rehabilitate with Eventual Removal	
SOCIAL ENVIRONMENT					
Property Impacts	Permanent impacts to public and private land, including property acquisition, access and/or displacement of facilities	↔	• No permanent impacts to property anticipated.	↔	• No permanent impacts to property anticipated.
Impacts to Connectivity	Permanent impacts to pedestrian and cyclist connectivity	↔	• Maintains two active transportation bridges within the Study Area. • Ongoing issues with simultaneous cyclist and pedestrian use at Brant's Crossing Bridge.	↔	• In short term the trail system connection from Fordview Park Trail to Dike Trail across river would be maintained. In long term the trail system connection would be eliminated. • Opportunity to improve issues with simultaneous cyclist and pedestrian use at Brant's Crossing Bridge, improving connectivity across the bridge.
Impacts During Construction	Temporary issues (noise, dust, air, vibration)	↔	• Temporary nuisances during construction.	↔	• Temporary nuisances during construction.
	Connectivity and travel time during construction		• Temporary detours at each bridge would be provided during construction.		• Temporary detours at each bridge would be provided during construction.
Public Health & Safety	Overall safety of all users	↑	• Structural repairs would improve safety across each bridge.	↑	• Structural repairs would improve safety across each bridge.
Aesthetics	Change in appearance of the structure	↔	• Will maintain the outward appearance of all bridges due to sympathetic rehabilitation.	↔	• Will maintain the outward appearance of TH&B and Lorne due to sympathetic rehabilitation. • The new Brant's Crossing Bridge could be designed to be aesthetically pleasing and be sympathetic to the existing structure. • TH&B Crossing Bridge will eventually be removed which would have a direct impact on the appearance of the area.
	Change in views to the surrounding landscape		• Views of the surrounding landscape from the existing bridges would be maintained.		• Views of the surrounding landscape from the existing bridges would be maintained in the short term. • Views to the surrounding landscape from the TH&B Crossing Bridge would be eliminated following closure of the bridge. • Surrounding landscape can be viewed more clearly from the embankments following removal of the bridge.

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

Criteria	Measure	Strategy 6:		Strategy 7:	
SOCIAL ENVIRONMENT					
Cultural Heritage Resources	Changes to appearance or character of heritage resource	↑	• Cultural heritage resources to be maintained through sympathetic rehabilitations at each bridge.	↓	• The eventual removal of TH&B Crossing Bridge would have a direct impact on cultural heritage resources. • The replacement of Brant's Crossing Bridge would have a direct impact on cultural heritage resources.
	Threatened viability of heritage or archaeological resource		• No anticipated impact to areas that require a Stage 2 Archaeological Assessment.		• No anticipated impact to areas that require a Stage 2 Archaeological Assessment.
	Impacts to Indigenous Communities		• No known impacts to Indigenous Communities.		• No known impacts to Indigenous Communities.
NATURAL ENVIRONMENT					
Terrestrial Wildlife & Vegetation	Impacts on terrestrial species (flora and fauna), including Species at Risk	↔	• Temporary impacts from construction can be appropriately mitigated at all bridges.	↔	• Temporary impacts from construction can be appropriately mitigated at all bridges.
Aquatic Wildlife & Vegetation	Impacts on aquatic species, including Species at Risk	↔	• Temporary impacts from construction can be appropriately mitigated at all bridges.	↔	• Temporary impacts from construction can be appropriately mitigated at all bridges.
TECHNICAL ENVIRONMENT					
Design	Service life of structure	↑	• Rehabilitations at the bridges would extend their service life by 15-30 years before the next major capital expenditure.	↑	• Rehabilitations at Brant's Crossing Bridge and Lorne Bridge would extend the service life by 15-30 years. • TH&B Crossing Bridge would be removed in 10-15 years at the end of its service life.
	Structural Integrity - compliance with design standards		• Structural repairs would be designed to current design standards.		• Structural repairs would be designed to current design standards.
	Hydraulic Considerations		• Reduces risk as Brant's Crossing Bridge and TH&B Crossing Bridge would be raised to meet MTO Design Criteria for the evaluated ice jam events.		• Reduces risk as Brant's Crossing Bridge would be raised to meet MTO Design Criteria for the evaluated ice jam events. Short term risk due to TH&B Crossing Bridge not being raised.
	Geometry		• Structural repairs would need to be designed to match existing geometry.		• Flexibility in geometry of new trusses at Brant's Crossing Bridge. New bridge span lengths would need to be designed to suit existing pier locations.

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

Criteria	Measure	Strategy 6:		Strategy 7:	
TECHNICAL ENVIRONMENT					
Transportation	Impacts on pedestrian and cyclist traffic flow	↔	• Maintains two active transportation bridges within the Study Area. • Ongoing issues with simultaneous cyclist and pedestrian use at Brant's Crossing Bridge.	↔	• Maintains two active transportation bridges within the Study Area in the short term. • Opportunity to improve active transportation flow across Brant's Crossing Bridge through replacement of the structure.
Constructability	Ease of construction	↓	• Increased constructability challenges with raising Brant's Crossing Bridge and TH&B Crossing Bridge.	↑	• Less intensive rehabilitation required for TH&B Crossing Bridge.
	Utility conflicts		• No utility impacts anticipated.		• Relocation/support would be required for the existing Rogers Fibre cable that runs in a conduit beneath the wood decking.
	Approval requirements		• Approvals required.		• Approvals required.
ECONOMIC ENVIRONMENT					
Lifecycle Costs	Initial and future capital investment requirements	↓	• Initial capital cost of $4.1M • Lifecycle cost of $15M	↔	• Initial capital cost of $4.0M • Lifecycle cost of $6.3M
	Maintenance requirements		• Ongoing maintenance at each bridge.		• Ongoing maintenance at each bridge. • No maintenance requirements at TH&B Crossing Bridge following removal. • Potential for improvements to maintenance operations at Brant's Crossing Bridge following replacement.
EVALUATION SUMMARY		↓		↑	

↓	↔	↑
Least Beneficial / Highest Negative Impact	**Neutral / Moderate Benefit**	**Most Benefit / Lowest Negative Impact**

6.8 Recommended Overall Crossing Strategy

The primary considerations between the various strategies included impacts to the cultural heritage environment, maintaining or improving active transportation connectivity, reducing risk of flooding and ice jamming, constructability challenges, and initial and lifecycle costs.

From a cultural heritage perspective, maintaining the crossings in their existing location is the most beneficial or has the least negative impact. However, based on age and condition, the rehabilitation alternatives will eventually lead to replacement in the long run. If Brant's Crossing Bridge or TH&B Crossing Bridge were to be replaced or removed, effects to the cultural heritage environment could be mitigated through documentation of the existing heritage features, installing a descriptive plaque commemorating the heritage features, or relocating or reusing parts of the existing structures as an aesthetic feature or art piece.

From a connectivity and active transportation perspective, the more crossings over the Grand River the better. Feedback from the first Public Information Centre noted that the Brant's Crossing Bridge is the more desired location for a crossing in comparison to the TH&B Crossing Bridge. There are opportunities to improve the active transportation at Brant's Crossing Bridge if it were replaced. Currently, the geometry of the Brant's Crossing Bridge is not ideal for accommodating simultaneous cyclist and pedestrian traffic. Replacement of Brant's Crossing Bridge could allow for a wider platform over the bridge to support cyclist and pedestrian traffic.

From a hydraulics perspective and based on risk of flooding and ice jamming impacts, the key difference across alternatives is whether the Brant's Crossing Bridge and TH&B Crossing Bridge are raised or removed in the near future to improve river flows and reduce risk of structure damage. Rehabilitating and raising the structures is considered to be the most challenging from a constructability perspective.

Finally, the last key difference to note between the Overall Crossing Strategies was the initial and lifecycle costs for each strategy, as outlined in **Table 6-6**.

Based on the evaluation of the Overall Crossing Strategies, **Strategy 7 (Rehabilitate Lorne Bridge, Replace and Raise Brant's Crossing Bridge and Minor Rehabilitation and Eventual Removal of TH&B Crossing Bridge)** was identified as the recommended Overall Crossing Strategy. The sections below provide additional information regarding the Overall Crossing Strategy for each crossing.

6.8.1 Lorne Bridge – Rehabilitate

The Lorne Bridge is recommended to be rehabilitated to address the structural deficiencies that have been identified in recent structural investigations to maintain its function as a vehicular crossing with sidewalks on each side. As detailed in the Structural Evaluation Report completed as part of this MCEA, there is some uncertainty in estimating the behaviour of arch bridges. If the City wishes to remove the existing 30 tonne winter load limit, without structural strengthening, it is recommended that an 18-month monitoring program be completed to calibrate the structural models of the bridge and accurately inform the structural strengthening required, if any. The monitoring program could determine that strengthening of the bridge is ultimately not required. It is estimated that the monitoring program would cost approximately $150,000 and last 18 months. Alternatively, the City could proceed with completing the structural strengthening, which is estimated to cost $2 million and is included in the $8.3 million rehabilitation estimate.

In addition to the possible strengthening of the arch bridge to remove the 30 tonne winter load limit, rehabilitation works would include concrete repairs throughout the structure, asphalt resurfacing and expansion joint replacements. All repairs would be sympathetic in nature, with the outward appearance of the structure remaining largely unchanged. Temporary working platforms to provide access to the abutments, arches and piers would be required. Staged lane closures of Colborne Street West over the structure would be required during the rehabilitation works while maintaining one lane of traffic in each direction over the bridge.

It is understood that the City is exploring options to improve the trail alignment on the east embankment of the Grand River under Lorne Bridge. The rehabilitation works to Lorne Bridge that are recommended as part of this MCEA would include concrete repairs to the substructure and superstructure adjacent to and above the trail. It is possible that heavy construction equipment will require access to this area. Based on this information, it is recommended that the City

consider reconstructing this section of trail concurrently or following the completion of the rehabilitation works at Lorne Bridge. Additionally, the trail underneath the Lorne Bridge may need to be periodically closed during construction.

It is also understood that the City is investigating alternatives to eliminate the Lorne Girder Bridge span since the former railway corridor under the bridge is no longer in use. One alternative that was highlighted to the Project Team was to replace the girder span with a pedestrian underpass, similar to the structure on the west side of the Lorne Bridge. We note that this option would require the installation of a significant retaining wall structure. The City asked the Project Team to confirm if there would be any negative hydraulic impacts associated with this alternative. This scenario was modelled as part of the Hydraulic Impact Study, confirming that there is not anticipated to be any detrimental impacts to the hydraulics at the Lorne Bridge or downstream.

6.8.2 Brant's Crossing Bridge – Replace and Raise

This alternative would see a completely new superstructure be installed at the Brant's Crossing Bridge location. For the purposes of this study, the new superstructure has been considered to have prefabricated steel trusses that would be somewhat similar to the existing trusses. The width of the deck could also be increased to allow for improved flow of cyclist and pedestrian traffic. The new superstructure would be designed for a 75-year service life.

The concrete substructure would receive major repairs, including adding 0.83m of additional height to raise the bridge to meet the MTO Design Criteria for the evaluate ice jam events. Raising the bridge reduces the probability of an ice jam event occurring at the bridges to less than 1% in any given year and would substantially reduce the risk of damage to the bridge in comparison to the current configuration. It should be noted that raising the bridges does not reduce the impacts of flooding to the area as a whole.

This alternative removes features that have been identified as retaining heritage value. A Heritage Impact Assessment report was completed as part of this study and provides recommendations to partially mitigate the heritage value lost when the original structure is removed.

6.8.3 TH&B Crossing Bridge – Minor Rehabilitation with Eventual Removal

The rehabilitation of the TH&B Crossing Bridge would include replacing the existing wood deck as well as some minor concrete and steel repairs. The estimated service life for the TH&B Crossing Bridge following the rehabilitation would be 10 to 15 years. At the end of its useful life, the TH&B Crossing Bridge would be closed and removed. The existing foundations, which include the steel piers and concrete abutments, would remain in place to minimize disturbances to the natural environment and provide recognition of the current structure.

In the long term, following the removal of the TH&B Crossing Bridge, the risk of flooding and ice jamming events impacting the structure will be eliminated. This alternative does include a short-term risk associated with flooding while the superstructure remains in place at its current elevation.

The eventual removal of the superstructure will impact features that have been identified as retaining heritage value. A Heritage Impact Assessment report provided recommendations to partially mitigate the heritage value lost when the original structure is removed.

The removal of the TH&B Crossing Bridge will eliminate an active transportation crossing over the Grand River, thereby impacting the connectivity in the area. Based on feedback from the first Public Information Centre, Brant's Crossing Bridge was identified as the more desired location for a crossing, in comparison to the TH&B Crossing Bridge. It should be noted that the loss of connectivity at the TH&B Crossing Bridge will be partially mitigated by widening the Brant's Crossing Bridge deck to provide dedicated cycling and pedestrian lanes.

6.9 Heritage Impact Assessment

As recommended by the Cultural Heritage Evaluation Report, a Heritage Impact Assessment (HIA) was completed for the Three Grand River Crossings and their Study Area to identify the impacts the recommended solutions for each bridge may have on the cultural heritage value or interest and heritage attributes of the bridges and their associated cultural heritage landscape. Using guidance developed by the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI), policies of the City's Official Plan, Canada's Historic Places Standards and Guidelines for the Conservation

of Historic Places in Canada (2010), and other sources, the HIA describes heritage policies applicable to new development. The HIA assesses the potential impacts of the preferred alternatives and recommends conservation or mitigation strategies to avoid or reduce adverse effects.

The assessment concluded that without mitigation, the recommended solutions could result in minor to moderate negative impact through risk of alteration or damage and removal of heritage attributes. Based on these results, the HIA recommends that the City consider mitigation measures to avoid or substantially reduce the identified negative impacts. For the complete Heritage Impact Assessment completed by Golder, please refer to **Appendix N.**

6.9.1 Lorne Bridge

Recommendations for the rehabilitation of the Lorne Bridge include:

- Prepare a Heritage Conservation Plan that outlines the measures required to sensitively repair and rehabilitate the Lorne Bridge and how the heritage attributes of the structure will be protected, conserved and enhanced.
- Photo-document the work areas prior to any intervention and keep a centralized record of all work performed during the construction phase.
- Create temporary buffers to protect heritage attributes not included in the rehabilitation, such as the bifurcated stairs to the northwest of the structure.
- Monitor for vibration impact during construction.
- Add the bridge's heritage attributes into annual inspection and maintenance planning.
- Limit use of de-icing salts in the vicinity of the bifurcated stairs to the northwest of the structure.

6.9.2 Brant's Crossing Bridge

Recommendations for the replacement of the Brant's Crossing Bridge include:

- Compile a thorough as-built record of the existing structure with photo-documentation and measured drawings following guidelines such as those developed by the Historic American Engineering Record.
- Salvage one of the two through trusses and conserve as an interpretive feature in the adjacent parkland.
- Prepare a Heritage Conservation Plan (HCP) that outlines how the cultural heritage attributes of the Brant's Crossing Bridge substructure will be protected conserved and enhanced.
    - If one truss will be salvaged as an interpretive feature in the adjacent parkland, the HCP should include measures to guide lifting, relocating, sitting, installing and conserving the truss as well as how it will be interpreted.
- Photo document the superstructure dismantling, as well as the truss relocation and installation process, if pursued.
- Photo document the substructure work areas prior to intervention and keep a centralized record of all work performed during the construction phase.
- Salvage and re-use as many components of the superstructure as possible.
- Add the bridge's heritage attributes into annual inspection and maintenance planning.
- If a truss is relocated to the adjacent parkland, develop a maintenance plan to ensure the truss is conserved over the long-term.

6.9.3 TH&B Crossing Bridge

Recommendations for the minor rehabilitation of the TH&B Crossing Bridge include:

- Compile a thorough as-built record of the structure with photo-documentation and measured drawings following guidelines such as those developed by the Historic American Engineering Record.
- Photo document the work areas prior to intervention and keep a centralized record of all work performed during the construction phase.
- Add the bridge's heritage attributes into annual inspection and maintenance planning.

7. PHASE 2 CONSULTATION

Consultation and communication with members of the public, property owners, Indigenous Nations, and relevant agencies is an integral part of the MCEA process. The consultation strategy has the sole purpose of generating awareness of the project and provide opportunities for those interested to get involved in the planning process and to facilitate constructive input at key points throughout the process, prior to the final recommendations. All correspondence from the public, agencies and other stakeholders related to this study can be found in **Appendix O**.

After consultation with the MECP regarding Indigenous nations consultation, local Indigenous nations were contacted at the onset and at key points throughout the project.

Through the course of the study, the Project Team met with representatives from Six Nations of the Grand River to provide updates on the study process. The City welcomes discussions with these nations should they indicate further interest in the MCEA, or in future implementation of the recommended alternatives. A full list of correspondence with Indigenous nations is provided in **Appendix O**.

The sections below summarize the actions that were taken to notify and communicate with stakeholders.

7.1 Notice of Study Commencement

At the initial stages of the project a mailing list was established which included relevant federal and provincial agencies, municipal government officials, key stakeholders, Indigenous Nations, special interest groups and members of the public. The mailing list was updated throughout the study to include those who expressed interest in the project or those who wished to be removed from the mailing list.

A Notice of Study Commencement was sent to the established mailing list on March 5, 2020. The Notice was also published on the City's project webpage and in the local newspapers. A total of 225 notices were distributed, including 77 to members of the public. The purpose of the Notice was to introduce the study and problem statement to the public.

7.2 Project Webpage

Throughout the duration of the project, a project webpage was hosted by the City at www.brantford.ca/threegrandrivercrossings. The project webpage included access to background information, materials presented during the PICs, as well as an online comment form.

7.3 Public Information Centre #1

The first Public Information Centre (PIC) was held from May to July 2020. Due to the ongoing COVID-19 pandemic, the PIC was completed virtually. A total of 209 notices were distributed, including 87 to members of the public. PIC #1 provided an overview of the project, including the EA process, alternative solutions being considered and criteria that would be used to evaluate the alternatives. The process for PIC #1 is shown below:

- **May 20, 2020:** First Notice of Public Information Centre #1
- **May 27, 2020:** Second Notice of Public Information Centre #1
- **May 27, 2020:** PIC Presentation Video posted to the project webpage
- **May 27 – June 10, 2020:** Question and Comment Period
- **June 17, 2020:** Question and Answer Video posted to the project webpage
- **June 17 – July 8, 2020:** Question and Comment Period
- **July 15, 2020:** Frequently Asked Questions List with answers posted to the project webpage

In addition to the PIC materials listed above, an online survey was posted throughout PIC process on the City's project webpage. In total there were 162 responses to the survey. There were also another 13 comments received by the Project Team by email. The PIC presentation video received a total of 275 views and the Q&A video received a total of 183 views. A key takeaway from the comments received from the public during PIC #1 was the Brant's Crossing Bridge was the preferred crossing for active transportation.

Documents from the PIC #1 process have been included in **Appendix P**.

7.4 Public Information Centre #2

The second Public Information Centre (PIC) was held from March to April 2021. Due to the ongoing COVID-19 pandemic, the PIC was completed virtually. A total of 219 notices were distributed, including 97 to members of the public. The presentation for PIC #2 was streamed live on YouTube. PIC #2 presented the existing conditions, evaluation of alternative solutions and the recommended Overall Crossing Strategy recommended within this report. The process for PIC #2 is shown below:

- **March 18, 2021:** Notice of Public Information Centre #2 and PIC Presentation posted to the project webpage
- **April 1, 2021:** Live Public Information Centre #2 Presentation
- **April 1 – April 15, 2021:** Question and Comment Period
- **April 22, 2021:** Frequently Asked Questions List with answers posted to the project webpage

A total of 10 comments were received by the Project Team throughout the PIC #2 process and the recording of the live PIC presentation had a total of 146 views as of April 15, 2021.

Documents from the PIC #2 process have been included in **Appendix Q**

7.5 Council Acceptance of Recommended Overall Crossing Strategy

On June 22, 2021 the Council of the City of Brantford accepted the recommendation of Overall Crossing Strategy 7 as the Preferred Solution. Due to the anticipated costs associated with implementing the recommended solutions detailed in the Preferred Solution, Council also approved the completion of the study as a Schedule “C” activity.

8. PHASE 3 ALTERNATIVE DESIGN CONCEPTS

Phase 3 of the EA process considers Alternative Design Concepts for the Preferred Solution. In this case, there are multiple alternative design concepts for each bridge within the Overall Crossing Strategy, as outlined below:

Lorne Bridge

- Keep or Modify Existing Cross Section

Brant's Crossing Bridge

- Style of New Truss
- Width of Pathway over the Bridge
- Material of Bridge Deck
- Incorporation of a Lookout
- Incorporation of Lighting

TH&B Crossing Bridge

- Style of New Truss
- Width of Pathway over the Bridge
- Material of Bridge Deck
- Incorporation of a Lookout
- Incorporation of Lighting

The following sections will discuss the alternative design concepts listed above in more detail.

8.1 Lorne Bridge – Rehabilitation Design Concepts

As discussed in **Section 6**, the *Preferred Solution* for the Lorne Bridge is rehabilitation. During this study, public feedback indicated that the existing sidewalks on Lorne Bridge are too narrow, particularly when a pedestrian and cyclist are on the sidewalk simultaneously. The design concept that was explored for the Lorne Bridge was if modification to existing cross section could improve active transportation over the structure, as detailed in the section below.

8.1.1 Keep or Modifying Existing Cross Section

The existing cross section of the Lorne Bridge consists of five vehicular lanes that are each approximately 3.5m wide, with a 2m wide sidewalk on each side. It should be noted that the Accessibility for Ontarians with Disabilities Act (AODA) requires exterior paths to provide a minimum clear width of 1.5 metres and that the minimum width for a multi-use trail within the City of Branford is 3.0m with a 0.5m buffer on either side.

Note that the bridge deck was widened in the 1980's and cannot be widened further without full structure replacement. Therefore, any widening of the existing sidewalk, or addition of cycling lanes would need to come from the width allocated to the existing vehicular lanes. The existing vehicular lane widths (3.5m) are the minimum width recommended by the City's Transportation Mater Plan for an arterial road and are therefore not recommended to be narrowed. Additionally, due to the traffic volumes on Colborne Street over the bridge, the elimination of a vehicular lane to accommodate expanded active transportation facilities is not recommended.

The Transportation Study completed as part of this project noted that the existing traffic volumes crossing the Lorne Bridge signify the need for separated cycling facilities, rather than a shared roadway facility. Additionally, Colborne Street West is not designated as a cycling route in the City's Transportation Master Plan, whereas the Brant's Crossing Bridge and TH&B Crossing Bridge are included. The replacement of the Brant's Crossing Bridge will provide the opportunity to improve accessibility for active transportation traffic in the study area, without introducing conflict points with motor vehicle traffic.

Therefore, it is recommended that the Lorne Bridge maintains the existing sidewalks and lane widths following its rehabilitation. The expansion of the active transportation facilities over the Lorne Bridge is recommended to be explored during the eventual replacement of the crossing.

8.2 Brant's Crossing Bridge – Replace and Raise Design Concepts

As discussed in **Section 6**, the *Preferred Solution* for Brant's Crossing Bridge is to replace and raise the superstructure. Since the structure is being replaced, there are several design concepts to consider, as detailed in the subsections below.

8.2.1 Style of New Truss

The recommended solution for the Brant's Crossing Bridge accounts for replacing the existing steel superstructure and rehabilitating the concrete substructure. To mitigate the negative impact of removing the heritage superstructure, the existing through truss spans will be replaced with new prefabricated through trusses. The existing girder spans adjacent to the embankments could also be replaced with a through truss, or a pony truss. The main difference between through trusses and pony trusses is that a through truss has steel components overhead, where as a pony truss does not.

Through trusses for all four spans would have a similar appearance to the version of the structure that was present prior to 1913, which consisted of three through truss spans. Refer to **Figure 8-1** for an elevation view representation of a through truss for all four spans, as well as a section of a typical through truss, and a photograph of Craig's Crossing Bridge in Cambridge which is an example of a through truss. With pony trusses at the end spans the new superstructure would have a similar profile to the existing superstructure, with shorter end spans and taller spans in the middle. Pony truss spans also provide the opportunity to view above the sides of the trusses, similar to the existing girder spans. Refer to **Figure 8-2** for an elevation view representation of pony truss spans at the end spans, as well as a section of a typical pony truss, and a photograph of the Homer Watson Boulevard Bridge in Waterloo, which is an example of a pony truss.

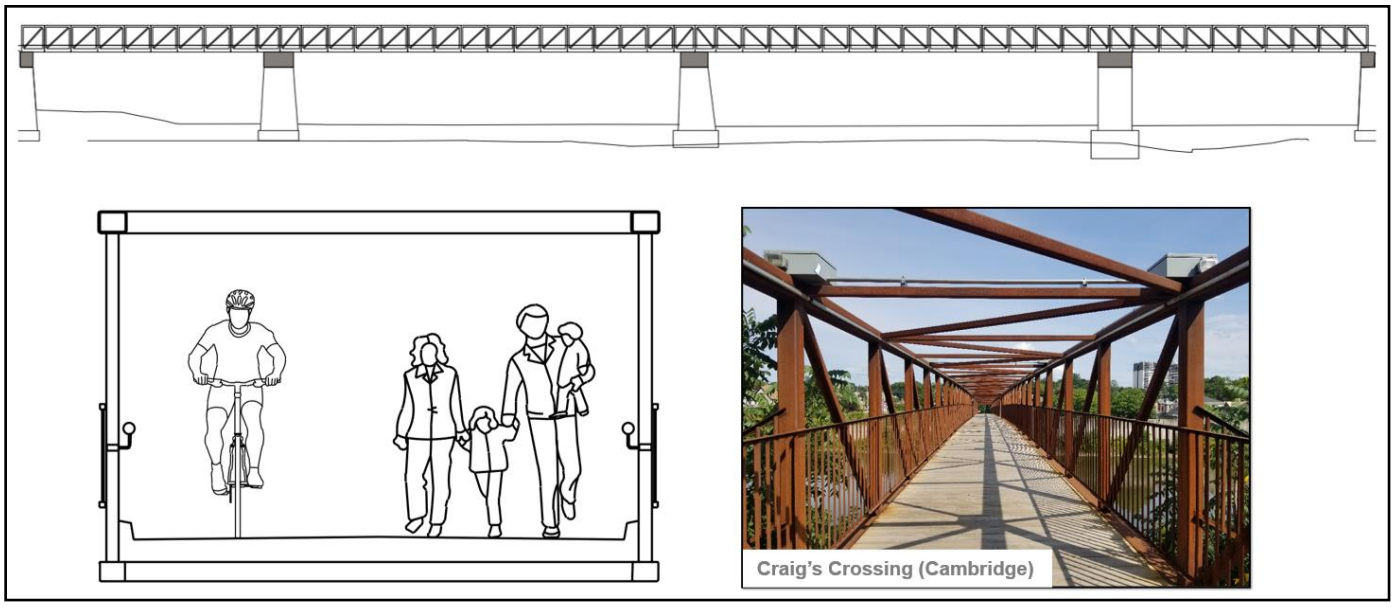


Figure 8-1: Representation of Through Truss Spans for all Spans

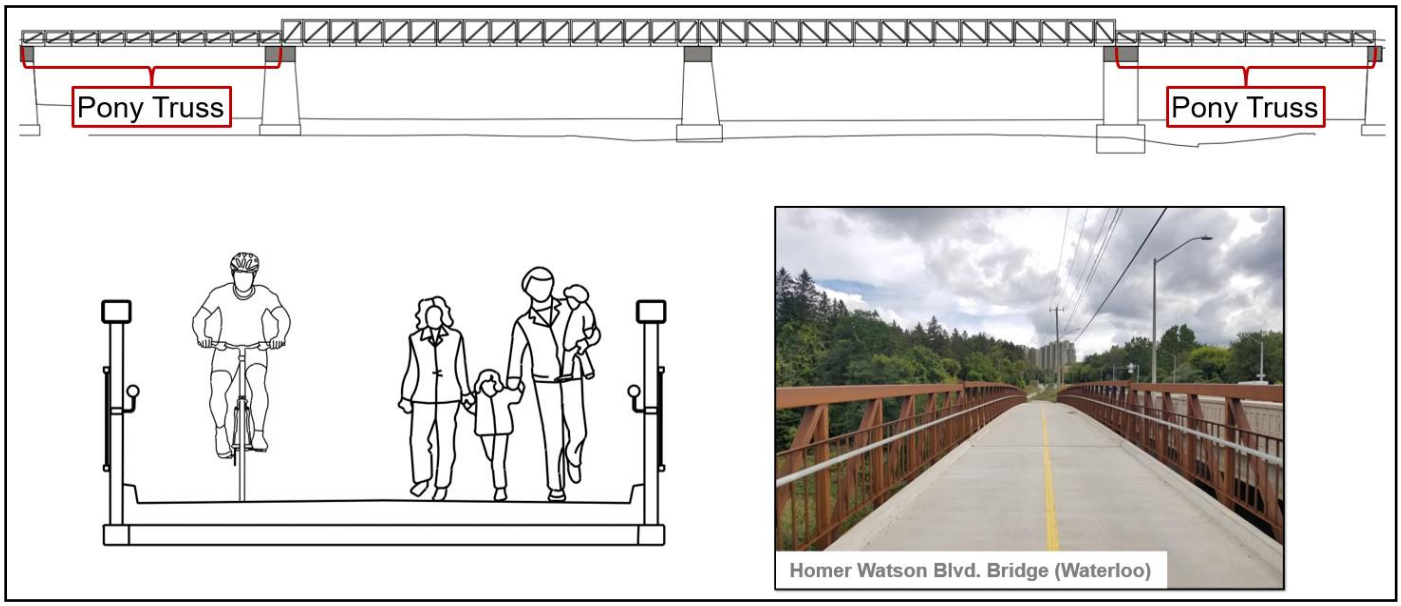


Figure 8-2: Representation of Pony Truss Spans at Each End

Refer to **Table 8-1** for a summary of the assessment of styles for the new trusses.

Table 8-1: Assessment of Style of New Truss

Criterion	Through Trusses for All Spans		Through Trusses for Middle Spans and Pony Truss Spans for End Spans	
Aesthetics / Appearance	↔	Similar in appearance to version of the structure that was present prior to 1913. Less similar in appearance to existing structure.	↑	Similar profile to the existing superstructure, with shorter end spans and taller spans in the middle.
Views from the Bridge	↓	View partially obstructed by truss members for all spans.	↑	Opportunity to view above sides of the pony trusses, similar to existing girder spans.
Capital Costs	↔	Approximately equivalent	↔	Approximately equivalent

Based on the assessment above, the recommended design solution for the style of the new truss is for through trusses for the middle spans and pony trusses for the end spans.

8.2.2 Width of Pathway over the Bridge

The next design concept that was considered for Brant's Crossing Bridge was the width of the new pathway over the bridge. The existing pathway over the bridge is 2.4m wide which is prohibitive to simultaneous pedestrian and cyclist use. The existing superstructure has a width of 5.5m, meaning there is sufficient room on the existing concrete substructure below to accommodate a wider pathway over the bridge.

For a multi-use trail in the City of Brantford, the recommended minimum width is 3m with a 0.5m buffer on each side, for an overall width of 4m.

It was noted by City Operational Services that widths beyond 4m are not preferred since it would take more than two passes to clear the bridge during winter maintenance. Additionally, superstructure widths beyond 4m could result in increased cost and construction complexity.

Therefore, the recommended design solution for the width of the pathway over the bridge is 4m. A dedicated cycling lane and a dedicated pedestrian lane across the bridge was not accounted for as part of the recommended design solution. City Staff expressed concerns with delineated cycling and pedestrian lanes since conflicts could arise when users cross the lane to enjoy views from either side of the bridge. Additionally, other structure on multi-use trails within the City of Brantford are similar and do not provide separated cyclist and pedestrian facilities. It is recommended that the inclusion of a painted line down the center of the new pathway on the new Brant's Crossing Bridge be reviewed further as part of the detailed design phase.

8.2.3 Material of Bridge Deck

The material of the new bridge deck for the Brant's Crossing Bridge was another design concept that was considered. The following materials were considered for the new bridge deck:

- Wood Deck Boards;
- Steel Deck Panels;
- Concrete Deck; and,
- Fiberglass Reinforce Polymer (FRP) Deck Panels.

Refer to **Table 8-2** for a summary of the assessment of material of the bridge deck. Based on the assessment, a concrete deck is the recommended design solution due to its long service life, its minimal maintenance requirements, including being the most preferred for winter maintenance, and it offers the smoothest rising surface. Note that the original design concept considered in Phase 2 of this EA for the replacement of Brant's Crossing Bridge was a steel deck panels. The additional cost for a concrete deck is estimated to be approximately $250,000.

Table 8-2: Assessment of Material of New Bridge Deck

Criterion	Wood Deck Boards		Steel Deck Panels		Concrete Deck		Fibreglass Reinforced Polymer Deck Panels	
Riding Surface	↓	Uneven due to joints between wood planks	↓	Uneven due to joints between steel deck panels	↑	Smooth, homogenous material, with joints only at the ends of each span	↔	Slightly uneven due to joints between deck panels
East of Winter Maintenance	↓	Potential issues with snowplow blades hitting joints between wood planks	↓	Potential issues with snowplow blades hitting joints between steel deck panels	↑	Most preferred for winter maintenance due to limited joints in deck surface	↔	Small potential for issues with snowplows hitting joints between deck panels
Maintenance Requirements	↓	Routine maintenance to replace deck boards as required	↔	Isolated replacement of deck boards may be required as steel rusts	↑	Resilient material, with isolated patch repairs potentially being required	↑	Very resilient material, with small potential for replacement of deck panels
Service Life	↓	10-15 years	↔	10-25 years	↑	25-40 years	↑	50-75 years
Capital Cost	↑	Approximately $150,000	↑	Approximately $250,000	↔	Approximately $500,000	↓	Approximately $750,000

8.2.4 Incorporation of a Lookout

The existing superstructure has a lookout incorporated at the center concrete pier of the bridge. The incorporation of a lookout into the new bridge was a design concept that was considered for the Brant's Crossing Bridge. The lookout could face upstream towards the Lorne Bridge, downstream towards the TH&B Crossing Bridge, or potentially small lookouts on both the upstream and downstream sides of the bridge.

Figure 8-3: Existing Lookout

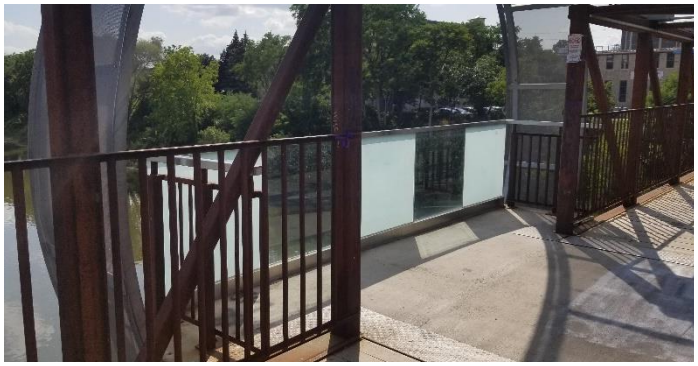


Figure 8-4: Example of Lookout on Craig's Crossing Bridge in Cambridge

The additional cost for incorporating a lookout could range from $200,000 to $400,000. Incorporating a lookout into the new bridge would improve the marketability of the bridge as a tourism destination for photography, bird watching and connecting to the natural environment. A lookout would also provide an area for users to stop and rest without impeding the flow of traffic on the bridge. Feedback received from stakeholders and the public during the third Public Information Centre was very supportive of a lookout being incorporated into the new superstructure.

The recommended design solution is to incorporate a lookout as part of the replacement of Brant's Crossing Bridge. Details of the lookout, including but not limited to the number, size, orientation, and style of the lookout should be confirmed during detailed design. The additional cost for incorporating a lookout could range from $200,000 to $400,000 depending on its size and complexity.

8.2.5 Incorporation of a Lighting

The final design concept that was considered for the replacement of Brant's Crossing Bridge was the incorporation of lighting on the new structure. It is noted that the existing bridge does have street light style lighting mounted along the top of the trusses and the trails at either end also have streetlights illuminating the approaches to the bridge. City staff have noted that up until the closure of the bridge there had been ongoing issues with vandalism to the existing lighting system, resulting in the lights infrequently operating.

Figure 8-5: Example of Existing Lighting Mounted on Brant's Crossing Bridge

Figure 8-6: Example of Aesthetic Lighting Mounted on a Pedestrian Bridge in Guelph

Aesthetic lighting, such as lighting that changes colours or accents features of the bridge, could also be incorporated into the new bridge. The addition of aesthetic lighting could improve the marketability of the bridge as a tourism destination. The addition of aesthetic lighting could increase the cost of the project by $150,000 to $500,000 depending on its complexity.

It is recommended that at a minimum basic lighting be incorporated into the new superstructure to match existing conditions. The incorporation of aesthetic lighting should be considered at the detailed design stage. Protection of the lighting system from vandalism should also be a key consideration during detailed design.

8.3 TH&B Crossing Bridge – Minor Rehabilitation and Eventual Removal

As discussed in **Section 6**, the *Preferred Solution* for TH&B Crossing Bridge is to complete a minor rehabilitation with the intent of eventually remove the structure at the end of its useful life in approximately 10-15 years. The design concepts considered for the TH&B Crossing Bridge focused on the existing pathway over the bridge, as detailed in the sections below.

8.3.1 Material of Bridge Deck

The first design concept that was considered for the TH&B Crossing Bridge was if the existing pathway over the bridge could be replaced to improve the riding surface. The existing deck is in poor condition with several plywood patches present.

The minor rehabilitation of the TH&B Crossing Bridge will include installing a new deck and deck support system that will be designed to minimize damage from maintenance equipment and enable replacement of worn-out deck boards without creating uneven surfaces. Other deck materials such as concrete or FRP are not recommended as their service life ranges from 25 to 75 years, while the intent is to eventually remove the structure in 10-15 years.

Therefore, it is recommended to replace the existing deck with a new wood deck system. Note that the new wood deck will be designed to make it easier to replace deck boards if they are damaged or decay.

8.3.2 Raising of Bridge Deck

Comments received during this study noted that the sides of the TH&B Crossing Bridge were high and difficult to see over. The final design concept that was considered for the TH&B Crossing Bridge was if the existing deck could be raised to make it easier to see over the sides of the bridge.

The existing sides of the bridge are 1.5m above the bridge deck and are load carrying structural elements. The Canadian Highway Design Bridge Code specifies a minimum barrier/railing height of 1.37m to protect cyclists. Therefore, to reduce the height of the sides of the TH&B Crossing Bridge, the bridge deck could be raised approximately 130mm. It is estimated that raising the deck at TH&B Crossing Bridge would be approximately double the cost of a replacement the deck at its current height.

As the intent is to eventually remove the structure in 10-15 years, it is not recommended to invest additional funds into raising the deck.

8.4 New Pedestrian River Crossing – Do Nothing

The recommended solution for the construction of a new pedestrian river crossing was “Do Nothing”; therefore, further design concepts were not explored.

9. SUMMARY OF RECOMMENDED DESIGN SOLUTIONS

The recommended design solutions for the three bridges are summarized as follows:

- **Rehabilitate Lorne Bridge ($8.3 million initial capital cost and $33 million lifecycle cost):**
  - Maintain existing sidewalks and lane widths
- **Replace and Raise Brant's Crossing Bridge ($4.4 million initial capital cost and $6.2 million lifecycle cost):**
  - Pony trusses at the two end spans and through trusses for the two middle spans
  - 4 metre wide pathway over bridge
  - Concrete deck surface
  - Incorporation of a lookout
  - Incorporate basic lighting and consider aesthetic lighting during detailed design
- **Minor Rehabilitation and Eventual Removal of TH&B Crossing Bridge ($0.3 million initial capital cost and $1.0 million lifecycle cost):**
  - Wood deck system designed to minimize damage from maintenance equipment
  - Replace existing deck in the same configuration (do not raise deck)

Preliminary design drawings based on the recommended design solutions are provided in **Appendix R**. A Wayfinding Strategy Report was also prepared to inventory the existing wayfinding signage within the Study Area and identify opportunities for improvements based on the Preferred Overall Crossing Strategy. Refer to **Appendix S** for the full report.

10. PHASE 3 CONSULTATION

10.1 Public Information Centre #3

The third Public Information Centre (PIC) was held from October to November 2021. Due to the ongoing COVID-19 pandemic, the PIC was completed virtually. A total of 204 notices were distributed, including 99 to members of the public. The presentation for PIC #3 was streamed live on YouTube. PIC #3 reviewed design alternatives for the recommended solutions presented in PIC #2 and reviewed the alternative design concepts. The process for PIC #3 is shown below:

- **October 7, 2021:** Notice of Public Information Centre #3 and PIC Presentation posted to the project webpage
- **October 14, 2021:** Live Public Information Centre #3 Presentation
- **October 21 – November 4, 2021:** Question and Comment Period
- **November 11, 2021:** Frequently Asked Questions List with answers posted to the project webpage

A total of 8 comments were received by the Project Team throughout the PIC #3 process and the recording of the live PIC presentation had a total of 72 views as of November 4, 2021. Documents from the PIC #2 process have been included in **Appendix U**.

10.2 Notice of Study Completion

This MCEA was approved by Brantford City Council on December 21, 2021. The issuance of the Notice of Study Completion initiates a 30-calendar day public review period. During this period, the public may submit any concerns they may have to the Project Team. Additionally, if there are concerns that have an impact on constitutionally protected Aboriginal and treaty rights, a request may be made to the Ministry of Environment Conservation and Parks for an order requiring a higher level of study or that conditions be imposed.

11. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

11.1 Social Environment Impacts and Mitigation

11.1.1 Property Impacts

Permanent impacts to property are not anticipated for the recommended design solutions.

11.1.2 Impacts to Connectivity

Following the rehabilitation of Lorne Bridge the 30-tonne winter load limit would be removed, improving vehicular connectivity over the bridge. In the short term, connectivity at TH&B Crossing Bridge would be maintained, with connectivity eliminated following the eventual removal of the bridge. The eventual removal of the TH&B Crossing Bridge can be partially mitigated by improving active transportation facilities across the new superstructure at Brant's Crossing Bridge.

11.1.3 Impacts During Construction

For all structures construction noise and vibration impacts are anticipated during construction but are expected to be minimal and temporary. The municipal by-law for hours of construction will be adhered to by the contractor.

The rehabilitation of Lorne Bridge will require partial lane closures over the bridge for approximately eight months during construction. Refer to the Transportation Study in **Appendix J** for recommended traffic operations during the lane closures. The replacement of Brant's Crossing Bridge and the rehabilitation of TH&B Crossing Bridge will require each bridge to be closed throughout construction. To mitigate the impacts to the trail network during construction, it is recommended that the construction on Brant's Crossing Bridge and TH&B Crossing Bridge be staggered so that each bridge can be used as a detour route while the other is closed for construction.

11.1.4 Public Health and Safety

Following the rehabilitation of the Lorne Bridge, the 30-tonne winter load limit would be removed and will improve public safety across the bridge. The replacement of Brant's Crossing Bridge would allow for the new superstructure to be designed to current safety standards. The rehabilitation of TH&B Crossing Bridge will also improve safety across the bridge through repairs to deteriorated components.

11.1.5 Aesthetics

The rehabilitation of the Lorne Bridge will maintain the outward appearance of the structure through sympathetic rehabilitation. The removal and replacement of the Brant's Crossing Bridge will have a direct impact on aesthetics; however, the new bridge should be designed to be aesthetically pleasing and as sympathetic to the existing structure as possible. In the short term there will be no impact to aesthetics of the TH&B Crossing Bridge; however, the eventual removal of the crossing would have a direct impact on aesthetics.

11.1.6 Cultural Heritage Resources

A Heritage Impact Assessment was prepared to assess potential impacts of the preferred alternatives and recommends conservation or mitigation strategies to avoid or reduce adverse effects. Refer to **Section 6.9** for recommendations from the HIA for each bridge.

11.2 Natural Environment Impacts and Mitigation

11.2.1 Terrestrial Wildlife and Vegetation

The following recommendations are taken from the Natural Environment Report:

- Vegetated and wetland areas are to be maintained to the extent possible. The development area should be clearly marked.

- If it is deemed necessary to carry out project works with industrial equipment in wetland areas or to ford industrial equipment across wetland areas, swamp mats/pads should be used to protect the wetland ecosystem and prevent rutting.
- If drilling or digging occurs in wetland areas the organic layer should be stockpiled and reinstated upon construction completion to salvage seed source.
- Tree/shrub planting should be considered for planning purposes and limited to native species that exist currently within the site and region, and that are suitable for the microhabitat conditions (e.g., floodplain, slopes).
- All machinery should be cleaned prior to arrival in the study area to mitigate for the transfer of non-native and/or invasive species.
- All disturbed areas should be restored to their original contour and gradient, re-stabilized with appropriate erosion and sediment control measures, and revegetated with native seed mix and/or planted with native species.
- All vegetation clearing should occur outside of the breeding bird season (April 15 – August 15). If this is not possible, a nesting survey should be completed by a qualified biologist in all areas to be cleared prior to clearing activities. If any active nests are found during the nesting survey, a buffer should be installed around the nest to protect against disturbance. Vegetation within the protection buffer should not be removed until the young have fledged the nest.
- Avoid in-water work in the Grand River, particularly in the middle sections, during the winter waterfowl concentration season (Jan 1 – March 31).
- Fencing should be installed around active work areas to prevent movement of wildlife into these areas where they may be harmed.
- Any wildlife encountered within the active work area should be given the opportunity to leave the area on its own without harassment. Gaps in construction boundary fencing should be maintained until vegetation clearing is complete to provide wildlife with a route of escape.
- The area within all isolated work areas (i.e., areas where fencing creates a complete closed barrier) should be surveyed prior to the start of construction and any herpetofauna and other wildlife found must be removed from the area. Relocation of turtles, frogs, and other wildlife should be undertaken by qualified personnel possessing a valid Scientific Collectors Permit obtained from the MNRF.
- In the event that a wildlife individual is injured or does not leave the area on its own within a reasonable time frame (i.e., 24 hours), the contractor should contact the City of Brantford Project manager for advice.
- Avoid removal of Lowland Deciduous Forest (FOD7) which may provide suitable habitat for tri-colored bat. If clearing of vegetation is required in this area, it is recommended that additional field surveys be completed to confirm if the habitat is being used by tri-colored bat. If habitat is confirmed, a permit under the ESA may be required to remove habitat and vegetation removal, specifically trees, should be avoided during the maternity roosting season for tri-colored bat (April 30 to July 31).
- Avoid removal of rocks, boulders and blocks along the armoured banks of the Grand River which may provide suitable habitat for eastern small-footed myotis. If alteration or removal of the habitat is required, it is recommended that additional field surveys be completed to confirm if the habitat is being used by eastern small-footed myotis. If habitat is confirmed, a permit under the ESA may be required to remove habitat and removal of habitat should avoided during the maternity roosting season for eastern small-footed myotis (April 30 to July 31).
- Regulated habitat for queensnake includes all continuous areas of a watercourse/waterbody up to the high water mark within 250 m of an area being used by queensnake, as well as the area up to 30 m inland from the high water mark. Although no individuals were observed during field surveys, the Grand River is known habitat for this species. It is recommended additional effort to survey for queensnake be conducted. If presence is confirmed, a permit under the ESA may be required to remove habitat and removal of habitat should avoided during the active season for queensnake (April 15 to October 15).

11.2.2 Terrestrial Wildlife and Vegetation

The following recommendations are taken from the Natural Environment Report:

- As work is being completed within a fish bearing watercourse a DFO Request for Review shall be submitted for the Project. Dependant upon the type of work being undertaken, residual effects of the project that may result in the harmful alternation, disruption or destruction to fish habitats and/or as a result of the DFO review process, a DFO *Fisheries Act* Authorization for the project may be required.
- A GRCA permit application for the alteration of the watercourse shall be completed for the Project.

- The extent and duration of near or in-work should be minimized to the extent possible.
- All construction will take place outside of the MNRF restricted fisheries timing window, which restricts in or near water work from **March 15 to July 15 (i.e., in-water work can occur from July 16 to March 14)**
- Construction activities shall be scheduled to avoid wet and rainy periods and in-water works shall be conducted during low flow conditions.
- Existing trails and roads shall be used wherever possible as access routes to avoid disturbance to waterbody banks and riparian vegetation areas.
- The contractor should develop and implement an Erosion and Sediment Control Plan for the site that minimizes risk of sedimentation of the watercourse and wetland during all phases of the Project. A response plan should also be developed that is to be implemented immediately in the event of a sediment release. Effective erosion and sediment control measures shall be installed before starting work to prevent the entry of sediment into the watercourse. Inspect them regularly during the course of construction and conduct regular maintenance and repairs as necessary.
- Construction should take place in isolation (i.e., silt curtains/coffer dams and pumps should be used).
- Temporary water control structures (i.e., silt curtains, coffer dams and sandbags) and materials placed in water will consist of clean, washed sheet material that is adequately embedded to withstand the anticipated flows during construction.
- Flow control methodology should be verified during construction and may change due to site specific requirements. Dewatering methods, if required, should be developed for the Project.
- Water discharges should be appropriately filtered to remove suspended sediments. The water pump used to dewater the work area should pump water to a sediment control device or allow for natural attenuation, so that suspended sediments can settle out before re-entry into the watercourse.
- Water withdrawal and by-pass pumps should be appropriately screened using the DFO Freshwater Intake End of Pipe Fish Screen Guidelines (DFO 2020b).
- Fish must be removed from all isolated work areas, prior to construction. Relocation of fish should be undertaken by qualified personnel possessing a valid Licence to Collect Fish for Scientific Purposes obtained from the MNRF.
- The contractor will develop and implement a Spill Prevention and Response Plan that minimizes risk of accidental spills or releases from entering the watercourse during all phases of the Project. Equipment should be in clean condition (free of excess or leaking fuel, lubricants, or any other deleterious substances) and should be operated to minimize disturbance to waterbody banks and riparian vegetation. Perform as many construction activities as possible well away from the watercourse (i.e., staging, preparation, construction of parts). The washing, refuelling, and servicing of machinery and storage of fuel and other materials should be conducted at least 30 m away from the watercourse and wetland to prevent any deleterious substances from entering the water.
- Equipment shall be operated above the high-water mark/from top of bank/from a floating barge unless specified in the contract documents and/or debris removal shall be completed by hand within the watercourse, wherever possible.
- Barges or shrouding should be used to trap and prevent concrete and other bridge materials from entering the waterbody.
- Limit tree removal to the extent possible. Only the vegetation required to accommodate operational and safety concerns for the Project should be removed. The area over which vegetation in riparian vegetation areas is removed shall affect no more than one third (1/3) of the total woody vegetation in the right-of-way within 30 metres of the ordinary high-water level of a waterbody. Vegetative root masses found within the waterbody banks shall remain undisturbed unless otherwise specified.
- All disturbed areas should be restored to their original contour and gradient, re-stabilized with appropriate erosion and sediment control measures, and revegetated with native seed mix and/or planted with native species.
- The removal of natural woody debris, rocks, sand, or other material from the banks, the shoreline, or the bed of the watercourse or waterbody will be minimized below the high-water mark. If material is removed from the waterbody, set it aside and return it to the original location once construction activities are completed.
- All stockpiled and water materials (i.e., dredging spoils, construction waste and materials, uprooted or cut aquatic plants, accumulated debris) should be contained and stabilized above the high-water mark of the watercourse to prevent re-entry.

- Best management practices, including lighting, noise, sediment and erosion controls, spill prevention, etc., should be implemented during the construction phase of the Project.
- All requirements, not described above, but identified as part of advice, permits, approvals or authorizations for the Project from relevant agencies are to be adhered to.

11.3 Technical Environment Impacts and Mitigation

11.3.1 Design

The estimated service life of each bridge following construction would be 15-30 years for Lorne Bridge, 75 years for Brant's Crossing Bridge and 10-15 years for TH&B Crossing Bridge.

In regard to hydraulic considerations, Brant's Crossing Bridge will be raised to convey the Regulatory flooding event. In the short term the TH&B Crossing Bridge will not meet the MTO Design Criteria for the evaluated ice jam events; however, in the long term the bridge will be removed and would not block water and ice.

The span lengths of the new superstructures at Brant's Crossing Bridge will need to be designed to suit the existing pier locations. A key consideration in the design of the pony truss spans will be vibration due to the shallow depth of trusses and the relatively long span. Note that the recommended design solution for Brant's Crossing Bridge includes a concrete deck which should assist in the design of dampening vibrations.

11.3.2 Transportation

As detailed in **Section 8.1.1**, delineated cycling lanes cannot be accommodated as part of the recommended design solution for the Lorne Bridge. To mitigate the lack of delineated cycling lanes on Lorne Bridge, the replacement of Brant's Crossing Bridge will improve the flow of simultaneous pedestrian and cyclist use across the bridge through a wider bridge deck.

11.3.3 Constructability

The rehabilitation of Lorne Bridge will involve large scale construction, with work occurring throughout the superstructure and the substructure. There are utility conduits that run beneath the bridge deck that will need to be worked around during construction; however, they will likely not conflict with the proposed works and will not require relocation.

The replacement of Brant's Crossing Bridge will involve large scale construction, including the need for a crane on the banks of the Grand River to lift out the existing superstructures and lift in the new superstructure. The existing Rogers fibre optic cable that runs beneath the existing bridge deck will require relocation or support during construction.

The rehabilitation of the TH&B Bridge will be a minor scale construction undertaking with no utility conflicts anticipated. The eventual removal of the superstructure will require a crane to lift the existing superstructure.

11.4 Economic Environment Impacts and Mitigation

The estimated costs of the recommended design solutions are summarized in **Table 11-1**. The costs presented in this MCEA have been presented to Brantford City Council with the intent to finance the projects through the City's capital works budget.

Table 11-1: Individual Crossing Preliminary Cost Estimates

Bridge	Recommended Design Solution	Capital Cost (2021 Dollars)	Lifecycle Cost (2021 Dollars)
Lorne Bridge	Rehabilitate	$8,300,000	$33,000,000
Brant's Crossing Bridge	Replace and Raise Bridge	$4,400,000	$6,200,000
TH&B Crossing Bridge	Minor Rehabilitation with Eventual Removal	$300,000	$1,000,000

11.5 Climate Change

The risk associated with extreme natural events such as flooding and ice jams has been considered during this MCEA. The Brant's Crossing Bridge will be raised to convey the Regional Storm that is based on Hurricane Hazel to mitigate the risks associated with flooding and ice jams. Prior to its eventual removal the TH&B Crossing Bridge will not be able to convey the Regional Storm; however, in the long term the bridge will be removed and would not block water and ice.

The risks of climate change associated with the recommended design solutions will be reduced through appropriate mitigation measures during the detailed design phase.

12. NEXT STEPS

The following steps are recommended following completion of the Class EA study:

1. **Completion of Phase 4**
    i. Address 30-day public review period
2. **Phase 5: Implementation**
    i. Implementation of detailed design, agency approvals and tendering of the projects for construction
    ii. Construction

Appendix ‘A’ – Municipal Heritage Bridges Cultural, Heritage and Archaeological Resources Assessment Checklist

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA

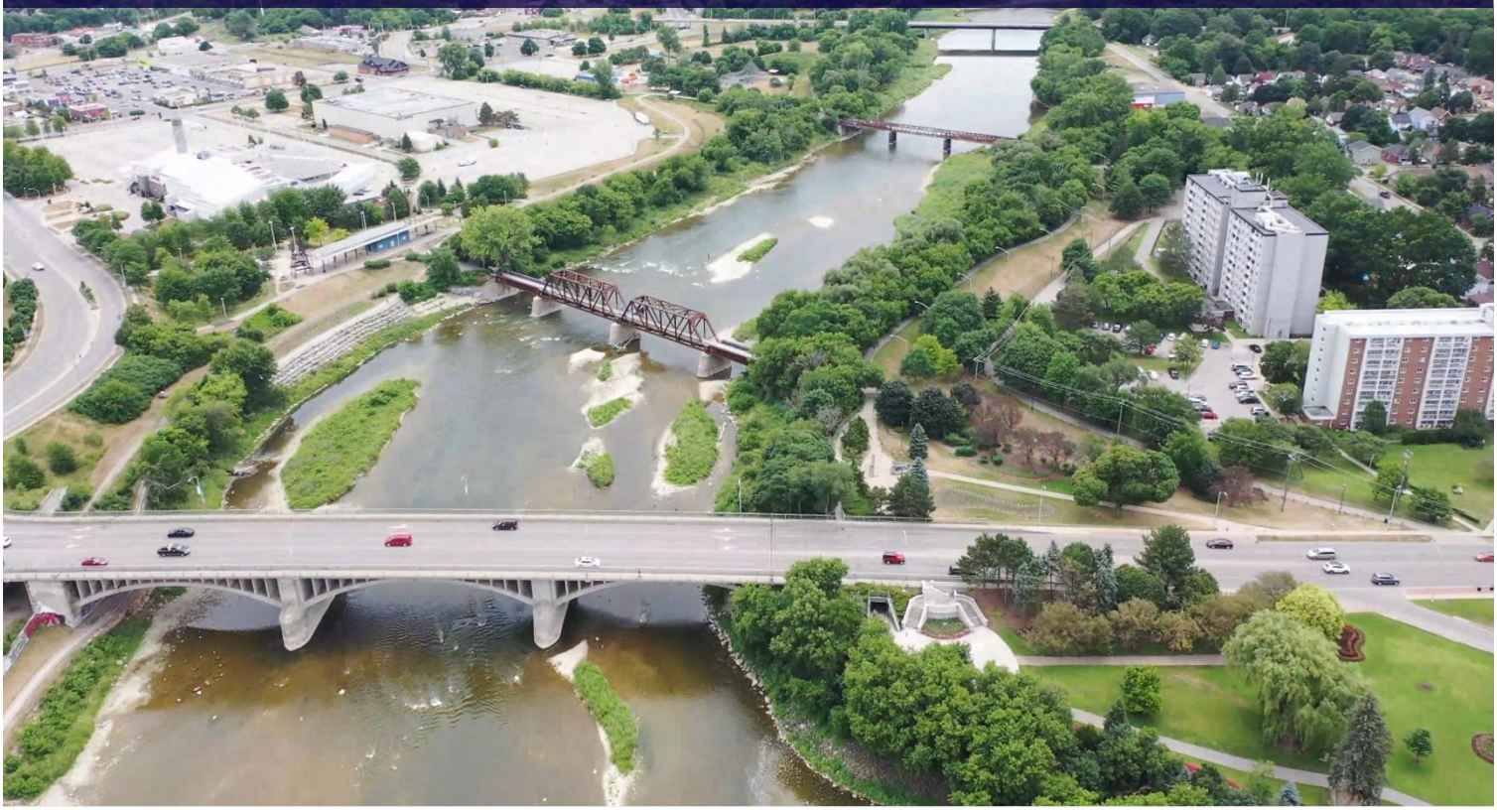
Appendix ‘B’ – Cultural Heritage Evaluation Report

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA

Appendix ‘C’ – Stage 1 Archaeological Assessment

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA

Appendix ‘D’ – Natural Environment Report



GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA

Appendix ‘E’ – Phase 1 Environmental Site Assessment

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA

Appendix ‘F’ – Structural Evaluation Reports

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA

Appendix ‘G’ – Geotechnical Assessment

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA

Appendix ‘H’ – Hydrogeological Technical Memo

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA

Appendix ‘I’ – Hydraulic Assessment

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
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Appendix ‘J’ – Transportation Study

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA

Appendix ‘K’ – Stormwater Management Report

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA

Appendix ‘L’ – Cost Estimates

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA

Appendix ‘M’ – Environmental Noise Assessment

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA

Appendix ‘N’ – Heritage Impact Assessment

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA

Appendix ‘O’ – Public Comments

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA

Appendix ‘P’ – PIC #1 Materials

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA

Appendix ‘Q’ – PIC #2 Materials

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA

Appendix ‘R’ – Preliminary Design Drawings

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA

Appendix S' – Wayfinding Strategy Report

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA

Appendix ‘T’ – PIC #3 Materials

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
650 WOODLAWN RD. W., BLOCK C, UNIT 2, GUELPH ON N1K 1B8 P: 519-824-8150 F: 519-824-8089 WWW.GMBLUEPLAN.CA