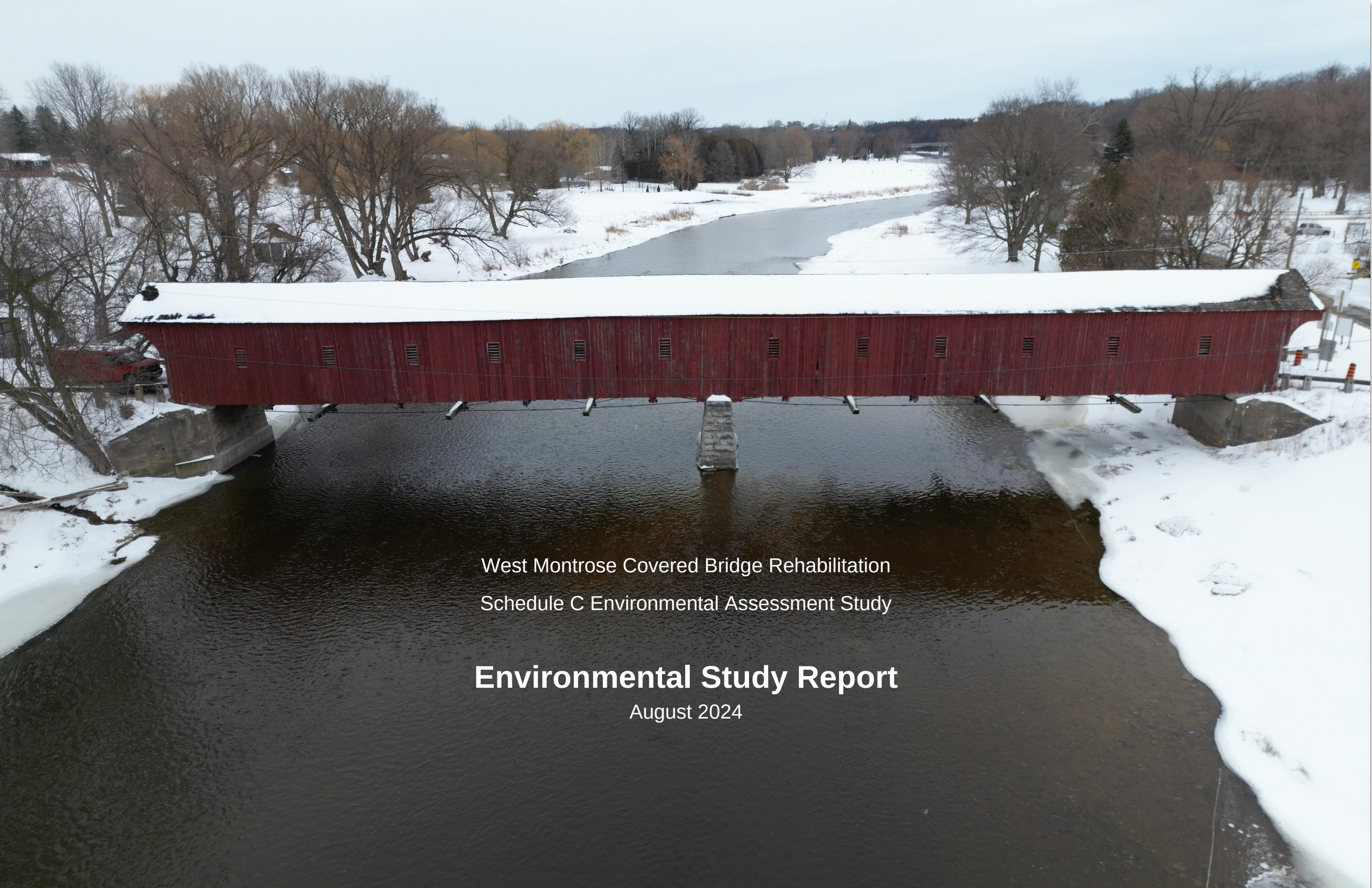


West Montrose Covered Bridge Rehabilitation

Schedule C Environmental Assessment Study

Environmental Study Report

August 2024

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Environmental Study Report

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EXECUTIVE SUMMARY

E1 EA STUDY

The Regional Municipality of Waterloo (The Region) is undertaking a Schedule C Environmental Assessment (EA) for the West Montrose Covered Bridge rehabilitation located in the village of West Montrose, in the Township of Woolwich, Ontario. The study commenced in March 2021. Construction is planned to begin in Spring 2025.

The bridge connects Hill Street, Covered Bridge Drive and Rivers Edge Drive and spans the Grand River. The bridge was constructed in 1881, measuring approximately 200 feet (61 m) in length and is the only remaining Covered Bridge in Ontario with significant historical and heritage value. Following years of detailed monitoring and structural assessments, it has been determined that rehabilitation is required to extend the bridge's service life. The EA has considered alternative improvements to rehabilitate the structure. Solutions were developed that focus on repairing defects in the least intrusive, reversible means possible. Preservation of the appearance of the bridge is an important design objective.

This study followed the Municipal Class EA process for a Schedule C project based on the scope and complexity of the project as well as the estimated capital cost of the project. Following the 30-day review period, the project will be approved for design and construction if no Section 16 Orders are received.

E2 CONSULTATION

The study was carried out in consultation with Township staff, external agencies, property owners, and the public. The consultation included the following:

- Three (3) rounds of Public Consultation, including one in-person Open House.
- Value Engineering (VE) workshop (including community participation).
- Liaison with external agencies.
- Meetings with the Township of Woolwich and Region of Waterloo's Heritage Committees.
- Meetings with the property owners living adjacent to the bridge.
- Meetings with the West Montrose Residents' Association/BridgeKeepers.
- Consultation with the Mennonite Community, and
- Consultation with Indigenous Peoples.

Proactive feedback was received on the Recommended Plan through this collaborative consultation.

The EA report is available to the public, stakeholders and agencies for a 30-day review period from August 21 2024 to September 20, 2024.

E3 ANALYSIS AND EVALUATION

E3.1 Alternative Planning Solutions

The analysis and evaluation process involves a 2-step decision-making process. Initially the study documents the analysis and evaluation of Alternative Planning Solutions (alternative project types or alternative strategies to address the problem) followed by the subsequent evaluation of preliminary design alternatives. The Alternative Planning Solutions included: Do Nothing, Transportation Demand Management, Rehabilitation or Replacement.

E3.2 Preliminary Design Alternatives

Several alternatives were generated as bridge rehabilitation techniques that could strengthen the bridge over the long-term, accommodate the travel demand, as well as retain the heritage attributes of the bridge and original material as much as possible.

In developing Preliminary Design Alternatives, several general principles and objectives were considered for West Montrose Covered Bridge rehabilitation. These included:

- Retention of heritage attributes and respecting the heritage designation of the bridge; and
- Consideration of the appropriate design live load while maintaining the posted load limit of 3 tonnes.

The development of the Preliminary Design Alternatives was completed in multiple stages:

1. One alternative was considered and presented at Public Consultation No. 1. This alternative included removal of the existing steel Bailey trusses and replacement with a new steel girder (Alternative A – Steel Girder Reinforcement).
2. Two (2) Preliminary Design Alternatives were considered and presented at Public Consultation No. 2:
    - Alternative A: Steel Girder Reinforcement.
    - Alternative B: Timber Truss Reinforcement with Fiber Reinforced Polymers (FRP)
3. A VE Workshop was held to define the function of the bridge and develop a long list of potential alternatives and strategies to be developed for the rehabilitation alternatives.
4. A detailed evaluation of the timber truss was undertaken
5. Six (6) Preliminary Design Alternatives were considered, evaluated, and presented at Public Consultation No. 3:
    - Alternative A: Steel Girder Reinforcement.
    - Alternative B: Timber Truss Reinforcement with FRP
    - Alternative C: Repairs to wooden truss members to achieve a design vehicular live load limit of:
        - Alternative C1: 12 tonnes
        - Alternative C2: 10 tonnes

- Alternative C3: 8 tonnes
- Alternative C4: 6 tonnes

Numerous inspections, analyses, and studies were completed, all of which influenced the rehabilitation alternatives that were ultimately evaluated by the Evaluation Team. The following sections describe the evaluation and selection of the Technically Preferred Alternative (TPA) carried forward in this EA Study.

E3.3 Evaluation of Alternatives

The evaluation of the Preliminary Design Alternatives was completed using a quantitative methodology. The evaluation considered input from the public, agencies and stakeholders.

This methodology compares the relative differences of the alternatives being considered using the evaluation criteria as descriptors.

The initial task in the evaluation is to develop evaluation criteria from which alternatives will be assessed. This process includes the identification of "global" groups of factors followed by the selection of several "local" sub-factors under the global groups.

As an initial step, the evaluation criteria were grouped into broad categories, or factors, established to describe the study specific engineering and environmental concerns. Four factors were selected which were used for each evaluation.

These global factors were:

- Heritage.
- Structural.
- Social Environment.
- Cost.

Within each of these categories (factor groups) are sub-factors which define the measure and the relative differences of magnitude of impact.

An Evaluation Team was created with subject matter experts including: heritage specialists; structural engineers; timber structure specialists; Region and Township staff; and transportation engineers. The sub-factors address the goals of the study, are comprehensive enough to describe all aspects of the effects of the project, and do not double-count sub-factors.

The Evaluation Team members were responsible for completing separate weighting exercises which provided independent perspectives of the relative importance of factor groups and sub-factors for each specific evaluation. The results of the weighting exercise are illustrated in **Figure** E1. The Technically Preferred Alternative (TPA) is **Alternative C2 Wood Repairs (10 tonnes).**

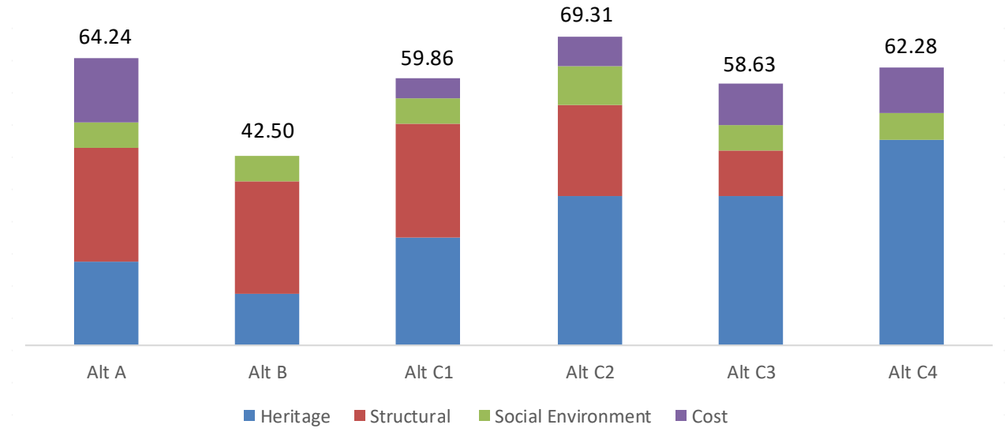


Figure E1: Scores (Average Weights of Evaluation Team)

E4 RECOMMENDED PLAN

The Recommended Plan is a combination of the TPA and refinements based on public, agency and stakeholder input from Public Consultation No. 3. It includes overall strengthening of the bridge by repairs or replacement of specific wooden truss members. The existing steel Bailey truss will be removed, and the wooden trusses will be the primary structural system carrying 100% of the vehicular live load and the entire weight of the bridge. The preferred design vehicular live load is 10 tonnes, while the posted load limit will remain at 3 tonnes.

The recommended design concept proposes the following:

1. Reducing the existing sag on the bridge
2. Replacing the roof with new cedar shingles.
3. Replacing the red exterior wooden cladding, matching the existing paint colour.
4. Replacing the window louvres
5. Removing the existing steel Bailey truss
6. Reinstating the tar and chip wearing surface after replacement of the nail-laminated deck.
7. Hanger Rods: replace with new steel rods.
8. Replacing the roof rafters as necessary
9. Replacing the tie beams, as necessary
10. Replacing the wooden curbs
11. Replacing the interior light bulbs as necessary
12. Needle Beams: Replacing the needle beams with new 16" x 16" Douglas fir beams
13. Floor Beams: Replacing the floor beams with new 16" x 16" Douglas fir beams
14. Stone mortar repairs and placement of scour protection at the bridge pier

15. Replacing the external sway bracing
16. Stringers: replace in kind (i.e. sawn wood stringers).
17. Replacing the existing nail-laminated wooden deck
18. Removing the Bailey truss hanger system
19. Removing the non-functioning tension rods (1959)
20. Bottom Lateral Bracing: Replace in kind (i.e., steel threaded rods with turnbuckles).
21. Bottom Chords: Replace with new Douglas Fir chords. This will involve adapting the ends of all diagonals and lower diagonals at the bottom chords to receive the replacement bottom chord members.
22. Repairing the concrete at the bridge abutments and placing scour protection at the abutments
23. Keeping the same bridge deck elevation and approach grades
24. Adding a height restriction bar to prevent heavy vehicles from using the bridge
25. Using fire retardant materials on the timber truss elements and exterior cladding
26. Replacing the end diagonals at the pier and strengthening the end diagonals at the abutments
27. Adding new overhead wood lateral bracing.
28. Adding a new timber guiderail
29. Reinforcing the top chord with the lower top chord
30. Removing the interior cladding and reinstatement in short sections at each end of the bridge

Items No. 1 to No. 25 are common to all of the alternatives that were considered. Items No. 26 to No. 30 are specific to the Preferred Alternative C2 – Wooden Truss repairs to a 10 tonne design live load limit.

Additionally, the following will be performed:

- All new cladding and roof elements will be incised and pressure-treated with permissible wood preservative (likely water-borne preservative).
- Bolster beams will be replaced with elastomeric bearings on concrete pedestals
- Checks and splits in existing wood members will be repaired by injecting with epoxy resin and reinforcing with screws.
- Eliminate racking by means of replumbing trusses. Additional means of rack prevention will be investigated including replacement of tie beams at top chord level and/or installation of ship's knees. Some ship's knees already exist.
- Locally replace the upper end of lower diagonal member LD10 due to decay

Replacement wooden truss members will be comprised entirely of sawn wood elements. Glulam and other engineered wood products will not be used.

A key consideration of the EA was a request from the Township of Woolwich Heritage Committee to consider changing the operation of the bridge to restrict vehicular traffic. Closing the bridge to vehicular traffic would not result in a significant delay to vehicular traffic, however, horse and buggies would still need to be permitted to cross the bridge. While signage can be posted that restricts motorized vehicles from using the bridge, it would be difficult to physically prevent all vehicles from accessing the bridge while maintaining adequate passage for horse and buggies. After further public consultation on this topic, the design is proceeding as originally intended, with the Covered Bridge being rehabilitated to remain open to vehicles not exceeding 3 tonnes. This recommendation was presented to, and supported by, Regional Council.

Table E1 summarizes the Effects and Impacts of the Preferred Alternative and proposed mitigation measures.

E4.1 Height Restriction Bars

The use of height restrictors is recommended to protect the bridge from being damaged by large vehicles because over height (and oversized) vehicles will strike the restrictor in advance of the bridge. Community comments from Public Consultation No. 3 suggested locating these measures away from the bridge to not obstruct the views of the bridge for photos by visitors. Comments were also received to implement height restrictors that had designs sympathetic to the cultural heritage bridge. Alternatives were considered in the EA and public input was obtained.

Following Public Consultation No. 3, the Project Team revised the recommended design to include narrowing the road on the south approach of the bridge by moving the wooden guiderails closer to each other to eliminate the need for the height restriction bar on the south approach. The height restriction bar on the north approach will be between 2.8 to 3.3 m and the details will be confirmed during detailed design.

E4.2 Project Schedule and Construction Process

Construction is planned to begin in Spring 2025 and be complete by Spring 2026. It is important that this work begin in 2025 to prevent further deterioration of the bridge and any historic timber truss materials.

The general order of work is anticipated as follows:

- Mobilization and site set-up.
- Close Covered Bridge Drive.
- Install erosion and sediment control measures
- Install the temporary works and temporarily support the existing bridge.

- Complete removals
- Complete wood truss repairs
- Construct the new wood floor system
- Construct the new roof
- Install the new exterior cladding.
- Construct the new interior cladding at ends of bridge only.
- Lower the existing bridge from its temporary supports and transfer loads to permanent structure.
- Remove the temporary works.
- Pave the deck with a new tar and chip wearing surface
- Construct any improvements to bridge approaches, including an overhead height restrictor on the north approach and narrowing of the road on the south approach.
- Restoration and grading.
- Demobilize.

No in-water work is permitted between March 15 – July 15, therefore, the placement of scour protection at the pier and abutments is planned to take place in August 2025. The in-water work will take place in two stages. Stage 1 will be for the south span of the bridge, including the installation of a cofferdam and placement of scour protection around the pier and south abutment. Stage 2 will be for the installation of a cofferdam and placement of the scour protection around the north bridge abutment.

The anticipated hours of work are between 7a.m. – 7p.m. to comply with local noise by-laws. Water and dust suppressants (non-chloride) will be applied during construction to protect air quality due to dust.

Disposal of waste materials and excess soil generated during construction will comply with all applicable By-Laws and Regulations, including the Excess Soil Management Regulation (O.Reg. 406/19). The local community has expressed interest in reusing some of the materials from the bridge rehabilitation such as the exterior siding and the historic timber truss members that will be replaced. This will be co-ordinated with the Contractor during construction.

E5 NEXT STEPS

At the end of the 30-day review period, should there be no objections to the project or Section 16 Orders received, the Region may proceed with design and construction of the Recommended Plan. Construction is planned to begin in Spring 2025 until Spring 2026.

Table E1: Effects and Impacts of the Preferred Alternative and Proposed Mitigation		
Effects/Impact/Comment	**Interested Party**	**Mitigation**
Potential environmental impact of the proposed fire protection and wood preservative treatment for Species at Risk (SAR) in the river. Fire protection and wood preservative treatment is recommended for the wood elements of the bridge.	MECP, DFO, GRCA	The specific wood preservative and fire retardant products to be used will be determined during design, and will be selected based on having a low aquatic toxicity and environmental impact, in consultation with any relevant stakeholders. Bridge elements will be treated prior to arriving on site as much as possible. For wooden truss members to be treated in-situ, a covering may be used if required to mitigate impacts to the River.
Potential environmental impacts of proposed scour protection placement at the bridge pier and abutments. Cofferdams, dewatering and a causeway will be required to place the scour protection at the bridge pier and abutments which may result in displacement of SAR using the area as well as the loss of specific habitat features and components.	MECP, DFO, GRCA	Should the level of scour protection outlined in the Hydraulic report be provided, the following requirements shall be met and approvals shall be obtained: - No in-water work is permitted between March 15 – July 15 of any year, as this is the critical spawning and rearing periods - Work should be conducted in the dry - All fish and freshwater mussels are to be removed from within the coffer dam enclosure - Due to the potential presence of mussel and fish SAR within the project limits, an Information Gathering Form (IGF) will be submitted to the MECP to confirm any permit requirements under the ESA - An updated Request for Review will be sent to DFO during design - A hydrogeological investigation will be undertaken to determine the estimated groundwater dewatering rates and a Permit to Take Water (PTTW) will be obtained if necessary - Ongoing engagement and consultation with First Nations - Application for a Transport Canada Navigable Waterways permit - GRCA permit outlining construction staging, erosion and sediment controls, and temporary works (e.g. isolation / dewatering)
The West Montrose Covered Bridge is a significant historical and heritage bridge structure. The recommendations must protect and retain the heritage elements of the bridge recognizing this is an evolving structure that has had changes overtime.	MCM, Public, Township of Woolwich	The design preserves as much as the original material as possible, with the replacement of various elements that are in a deteriorated condition to provide the necessary strengthening. Where material must be removed and replaced due to condition, the material is replaced in kind to the extent possible. Sawn wood is to be used for all replacement truss members.
Noise from construction equipment and vehicles during construction.	Township of Woolwich	Restrict idling of equipment to the minimum necessary to perform the work. Contractor will be required to abide by noise control by-laws for day-to-day operations.
Property impacts.	Private property owners on four corners of the bridge	Consultation and co-ordination with impacted property owners, with necessary agreements to be established prior to construction for construction staging and access to the bridge. Restoration of private property following construction completion to the satisfaction of the private property owners.

Table E1: Effects and Impacts of the Preferred Alternative and Proposed Mitigation		
Effects/Impact/Comment	**Interested Party**	**Mitigation**
Height restriction bar restricts oversized vehicles from accessing the bridge.	Public	Engaging with a specialist to refine the design of the overhead height restriction bar on the north approach. The height restriction bar was removed on the south approach, where many photos of the bridge are taken. Instead, the road will be narrowed on the south approach by moving the wooden guiderails closer to each other to eliminate the need for the height restriction bar on the south approach.
Bridge closure during construction restricting pedestrians, cyclists and buggies.	Residents and Mennonite community	Consideration of access through construction will be given during stages of the work, if possible. However, during construction, the site will be the responsibility of the contractor and closure of access will be necessary during certain periods. Advance communication of closure and potential periods to be open will be given to the community and signs will be posted on adjacent roads. Potential options for traffic calming on Line 86 will be investigated to accommodate the increased usage by horse and buggies, pedestrians and cyclists.
Sediment and erosion control for potential impacts to the Grand River.	MECP, GRCA	A Sediment and Erosion Control plan will be prepared to prevent the entry of sediment into the Grand River. • Any construction activities at the pier and abutments will be isolated from the river with a cofferdam and conducted “in the dry”. The cofferdam will allow the bridge pier, as well as north and south abutment work areas, to be adequately dewatered and prevent the release of sediment downstream. • To mitigate the transport of sediment, environmental protection measures (such as straw bale- and rock- flow checks and silt fence barriers) must be incorporated into the final design and installed during construction. Ontario Provincial Standard Specification (OPSS) 805 Construction Specification for Temporary Erosion and Sediment Control Measures must be followed by the Contractor. • Double-row silt fencing will be installed along the perimeter of the construction site prior to commencing any construction activities, straw bales must be placed between the rows of silt fencing to provide additional treatment capacity and improve stability of the silt fencing. Silt fencing shall remain in place throughout the construction process and will only be decommissioned once vegetation has been established and soil is stabilized. Silt fencing shall be inspected weekly or after significant rainfall by the contractor. • Following the decommissioning of all erosion and sediment control measures, all accumulated sediments shall be removed from site and disposed of appropriately. • All construction debris must be disposed of off-site in an appropriate manner. • Where dewatering is required, effluent will be discharged a minimum distance of 30 m from the river and outlet into a filter bag to prevent entry of sediment to the river. • All stockpiled materials must be placed 15 meters away from the river and away from the top of any slope. • All earth material stockpiles will be surrounded with double-row silt fence barrier until such time that they are removed from site or blended into the existing site grading. • Following the completion of final site grading and topsoil application, a suitable seed mixture will be applied to all exposed soil. • Exposed slopes will be protected by requiring the Contractor to limit the time that such areas are exposed prior to final application of topsoil and seed.
Surface Water Contamination and Debris Accumulation	MECP, GRCA	To prevent surface water contamination during construction, precautions will be taken to avoid accidental spillage or discharge of chemical contaminates (e.g., gasoline, oils and lubricants). These precautions will include the following: • All mobile equipment refueling will take place no closer than 30 m from the river to prevent water contamination due to accidental fuel spills. For non-mobile equipment, refueling will be carried out in a controlled manner to prevent fuel spillage. In addition, a drip pan should be installed under any non-mobile equipment working within the construction zone. • All equipment operating near the river shall be properly maintained to avoid contaminant leakage and will be free of excess oil/grease. • The contract package should provide contact information for the Spills Action Centre (1-800-268-6060). An emergency spill response kit should be on site at all times and in the event that a spill occurs, proper containment, clean up and reporting, in accordance with provincial requirements, is required.

Table E1: Effects and Impacts of the Preferred Alternative and Proposed Mitigation		
Effects/Impact/Comment	**Interested Party**	**Mitigation**
		The Contractor should take all necessary precautions to prevent the accumulation of litter and construction debris within any natural areas and the Grand River. This should include the following: • Use of scaffolding to prevent wood and construction debris from falling in the river during bridge re-construction activities. The scaffolding will have kick plates installed around the perimeter to prevent debris from accidentally falling into the river. • Daily cleanup of working platforms over the river and disposal of material in a container located on shore away from the river. • The establishment of garbage bins within the work limits for depositing construction debris and lunch litter.
Loss of components of various vegetation communities found within the project study limits.	MECP	It is recommended that the permanent displacement of vegetation communities within the bridge rehabilitation work area be minimized, where possible, and appropriate restrictions and mitigation measures be implemented to reduce the potential for negative impacts. These measures should include the following: • Vegetation clearing shall be minimized, where possible; • Following completion of grading and topsoil application, disturbed areas shall be reseeded with a seed mixture that will promote suitable native vegetation regeneration; • Tree barrier protection should be in accordance with OPSS 801 Construction Specification for the Protection of Trees to demarcate and protect existing trees along cut lines from equipment damage; • Delineation of vegetation clearing zones and vegetation retention zones shall be made clear on construction specifications and in the field; • Specifications for appropriate tree felling and grubbing procedures shall be implemented to minimize impacts on surrounding vegetation; • No equipment shall enter woodlands outside of the grading limits; • Construction activities adjacent to woodlands shall occur from within the grading limits; and • No long-term stockpiling of excavated material shall occur within 30 m of a woodland.
Removal of vegetation during construction activities may result in displacement of wildlife using the area. Clearing of vegetation within the proposed grading limits will result in the loss of habitat for species requiring terrestrial habitat. Construction activities may also increase exposure of wildlife to predation by domestic animals as well as unwarranted persecution from the public.	MECP	To minimize the temporary displacement of birds and wildlife species potentially utilizing the study area, it is recommended that efforts be made to minimize vegetation removal within the project limits. It is also recommended that any removal of shrubs and trees take place outside the bird nesting season of April 1st - August 30th. If clearing work must be conducted during the breeding bird season, a breeding/nesting bird survey should be conducted by an avian specialist prior to the beginning of clearing activities to verify potential nesting activity. Furthermore, if nesting activities are observed during clearing/construction, works in that area should cease and the MNRF should be contacted immediately. If evidence of bird nesting activity is noted on the bridge structure in 2024, it is recommended that bird exclusion netting be installed on the bridge prior to spring 2025 nesting activities in order to exclude birds during 2025 construction.
Fisheries and Aquatic Habitat	MECP/DFO	In order to protect fisheries and aquatic habitat resources within the project limits, the Contractor's operations must be controlled to prevent the entry of deleterious materials to the river. Where the contract requires work in the river and/or on its banks, operation of equipment within such areas will be kept to the minimum necessary to perform work and comply with operational constraints that may be specified elsewhere in the contract. OPSS 182 provides construction specifications for these measures. In-water timing windows will be employed to ensure in-water work does not occur during critical spawning and rearing periods. No in-water work is permitted between March 15th and July 15th of any year. Natural flows downstream of any work will be maintained at all times during construction.

Table E1: Effects and Impacts of the Preferred Alternative and Proposed Mitigation

Effects/Impact/Comment	Interested Party	Mitigation
		All pumps for dewatering shall have fine screening placed over the intake to prevent entrainment of fish and other aquatic species during operation. Screening to be implemented as per the Department of Fisheries and Oceans (DFO) guidelines (Freshwater Intake End-of-Pipe Fish Screen Guideline (1995). All fish will be removed from the work area before works are undertaken. This work is to be completed under a Licence to Collect Fish for Scientific Purposes from the MNRF. It is recommended that a qualified Fisheries Biologist be retained for this work. Removal or disturbance of riparian vegetation will be minimized during construction operations to prevent unnecessary loss of river shading, overhead cover, or bank stability. Any streambed disturbed because of proposed works should be covered with suitable-sized rock protection, rounded river stone gravel, cobble material, or replaced with the original bed material. Prior to application of the rock protection around the in-water pier and work at the abutments, a cofferdam will be installed around the pier and abutment work areas and all fish and freshwater mussels will be removed from within the coffer dam enclosure. The Region of Waterloo should retain a Fisheries Specialist to carry out the fish and mussel relocation under an MNRF License to Collect Fish. Any fish or mussel species at risk encountered during the removal should be reported to the MECP and DFO.
Seven SAR and their associated habitat (rainbow mussel, wavyrayed lampmussel, silver shiner, black redhorse, barn swallow, western chorus frog, and snapping turtle) may be found within the project construction limits. Removal of vegetation, existing bridge components planned for replacement, and in-water construction activities may result in displacement of the SAR using the area and as well as the permanent loss of specific habitat features and components	MECP	Given the nature of the proposed bridge rehabilitation works and the habitat requirements noted above for species at risk in the area, there is potential for disturbance to sensitive species and their habitat. Mitigation measures should be included in the contract to protect these species and their habitat. • The Contractor shall be aware of the requirements and prohibitions of the federal Species at Risk Act (2002) and the provincial Endangered Species Act (2007). Section 9 (1) of the Endangered Species Act (2002) states that “no person shall kill, harm, harass, capture or take living member of a species that is listed on the Species at Risk in Ontario List as an extirpated, endangered, or threatened species”. • Prior to application of the rock protection around the in-water pier and bridge abutments, a cofferdam should be installed around the work area and all fish and freshwater mussels should be removed from within the coffer dam enclosure. Any fish or mussel species at risk encountered during the removal should be reported to the MECP and DFO. • Silt fence barrier should be installed adjacent to the river to deter turtle species at risk from entering the work area. • Caution should be taken during the turtle nesting season in June and early July as turtles use embankments and other terrestrial sites for nesting. During the active season (April 1 – December 30), it is recommended that a thorough sweep of the area before works begin to encourage any turtles using the site to move away. • All clearing and grubbing, as well as the installation of bird exclusion netting on the bridge, should take place outside the bird nesting season of April 1st - August 30th to avoid nesting impacts to avian SAR within the study area. • On-site personnel should receive training on all potential species at risk to be found within the project limits. Information and orientation should be provided to the Contractor so that those working on-site are familiar with the identification and biology of all potential SAR as well as liabilities associated with interaction with these species. • If during construction activities any species at risk are observed, the MECP must be contacted within two (2) business days. Injury to a SAR must be reported to MECP immediately; • Avoid creating habitat for SAR inadvertently (e.g. un-protected [i.e. with silt fence barrier] stock piles, exposed substrates, brush piles) inside active construction areas by ensuring silt fence barrier or temporary exclusion fencing is installed and maintained appropriately. Due to the potential presence of mussel and fish SAR within the project limits, an Information Gathering Form (IGF) will be submitted to the MECP in order to outline proposed mitigation measures as well as to verify if permits will be required for this project. As well, DFO has been sent a revised Request for Review to update this agency as to the additional project logistics of causeway construction.

Table E1: Effects and Impacts of the Preferred Alternative and Proposed Mitigation		
Effects/Impact/Comment	**Interested Party**	**Mitigation**
Heritage Attributes and Potential Impacts	MECP/MCM	• Any repair work to the original wood trusses should be compatible physically and visually with the structure and its distinctive materials, features and construction techniques or craftsmanship and any repairs should match the original material in composition, design, colour and texture of the original wood element if possible while meeting code requirements. Reinforcing the original wood trusses with new 4” (89mm) thick, fastened wood plank preserves the original wood trusses in place and service. • The removal of the Bailey steel truss should be documented photographically and existing condition notes should form part of the Region’s bridge record. Reuse of the Bailey bridge in part or whole can be considered for light pedestrian and cycle use if found structurally adequate. • Any general repairs to the pier stone masonry above the water line should be compatible physically and visually with the structure and match the exiting stonework and mortar in mortar mix composition, design, and colour. • The new exterior wood siding should replicate as much as possible the construction dimensions and materials stated in the 1880 specifications. This will restore the original design intent and ensure the bridge is compatible physically and visually with the distinctive materials, features and craftsmanship of the original structure. The selected wood species used should match the original in design and texture as much as possible even if it is to be repainted red. (Original tongue and groove board with raised batten siding has been located in certain siding sections. It has been replaced over time in most areas with a raised batten fixed between two vertical boards). • If structurally feasible, the portal ends should be reconstructed using the original 1880 design intent. Consider restoring the exterior structure to its earliest documented appearance when all siding is replaced. • Existing interior wood splash panelling to be replaced in kind in the four corners at both ends of the bridge is considered to be a satisfactory rehabilitation design solution. • Replacement of the entire roof structure with new cedar shingles should be in keeping with the original materials and be compatible physically and visually with the structure and its distinctive materials, features and construction techniques or craftsmanship. The new roof structure and wood shingles should use the same wood species as the original specifications, if possible, and should match the original specified roof material in composition, design, colour and texture. • Re-installment of the conserved light fixtures should be in the approximate location of the existing fixtures. • Views to and into the bridge from the north and south banks of the Grand River should be maintained as detailed in the new restored portal design. Expert advice should be retained to prepare the final design of the height restriction bar and the preferred location.
Utilities	Enova, GRCA	• Overhead hydro lines on the south approach of the bridge and on the west side of the bridge may limit the size of equipment that has the ability to access the bridge. The Contractor must confirm that any equipment has adequate clearance from overhead utility lines. • There is a GRCA monitoring station near the south abutment of the bridge. Care must be taken during construction to ensure protection of this infrastructure.

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1.0 INTRODUCTION

The Regional Municipality of Waterloo (The Region) is undertaking a Schedule C Environmental Assessment (EA) for the West Montrose Covered Bridge rehabilitation in the Township of Woolwich, Ontario. The study commenced in March 2021 and construction is planned to begin in Spring 2025.

The West Montrose Covered Bridge is in the Township of Woolwich, spanning the Grand River in the community of West Montrose. The bridge connects Hill Street, Covered Bridge Drive and Rivers Edge Drive. The Covered Bridge was constructed in 1881, measuring approximately 200 feet (61 m) in length and is the only remaining covered bridge in Ontario with significant historical and heritage value. The bridge has reached a point where rehabilitation is required to extend the bridge's service life. The EA has considered improvements to rehabilitate the structure. Solutions were developed that focus on repairing defects in the least intrusive, reversible means possible. Preservation of the appearance of the bridge and the bridge's heritage attributes is a very important design objective.

1.1 Study Team

The Project Team for this EA study is identified in **Table 1**.

Table 1: EA Study Participants

Study Team Member Name	Company/Affiliation	Involvement in Study
Steve Taylor	BTE	Project Manager
Wasim Aldabbagh	BTE	Road Design and Assistant Project Manager
Darcie Dillon	BTE	Consultation and Heritage Planner
Gord Bell	BTE	EA Process Lead
Stephen Brook	BTE	Traffic Lead
Stephen Holmes	BTE	Quality Control
Stephen Brown	Entuitive	Structural Engineer
Andrew Lehan	Entuitive	Structural Engineer
Wendy Shearer	Independent Consultant	Heritage Consultant
Michelle Pinto	Region of Waterloo	Region Project Manager
Skylar Van Kruistum	Region of Waterloo	Head of Design and Construction
Shawn Buckley	Region of Waterloo	Manager, Transportation Program Development
Darryl Schwartzentruber	Township of Woolwich (Township)	Township representative
Leo Sanchez	Sanchez Engineering Inc.	Hydraulic Study
Sandy Shantz	Mayor	Township

Table 1: EA Study Participants

Study Team Member Name	Company/Affiliation	Involvement in Study
Bonne Bryant	Woolwich Ward 3 Councillor	Township
Kayla Grant	Woolwich Ward 3 Councillor	Township
Richard Unterman	Heritage	Unterman McPhail Associates
Kevin Li	Doug Dixon & Associates	Bridge Engineering (Substructure)
Doug Dixon	Doug Dixon & Associates	Bridge Engineering (Substructure)
Ted Brumfitt	Arcadis	Bridge Engineering Peer Review
John Stephenson	Cambrium Infrastructure	Bridge Engineering Peer Review
David Moses	Moses Structural Engineers	Bridge Engineering – Timber Inspection
Doug Clark	EcoTec	Natural Heritage Study
Caitlin Lacy	ASI	Stage 1 Archeological Assessment
William Loghrin, Andrew Cooke	Peto MacCallum	Geotechnical and Hydrogeological Investigations

1.2 Study Area

The Study Area is in the Township of Woolwich and the Region of Waterloo, as illustrated in **Figure 1.**

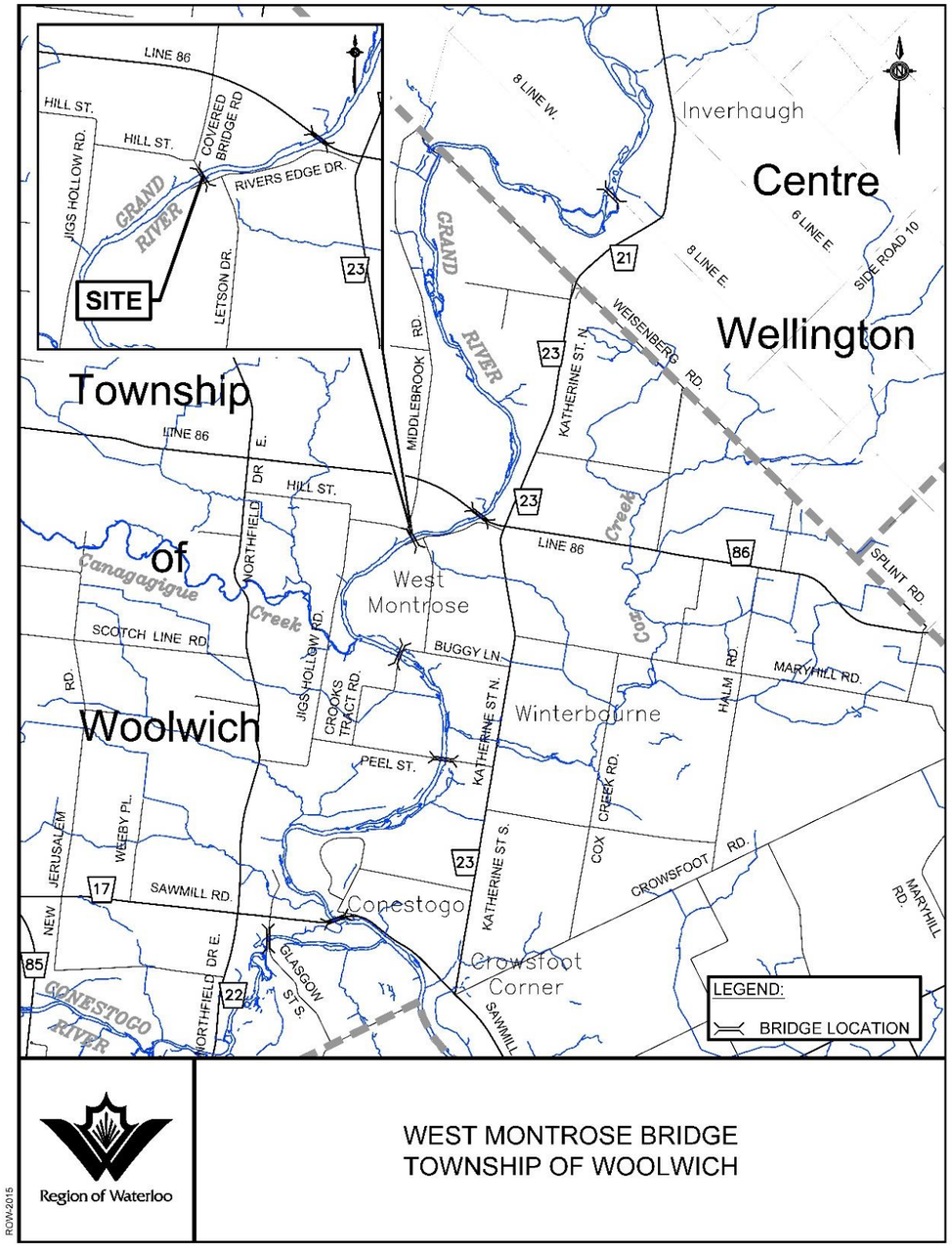


Figure 1: Study Area

2.0 EA PROCESS

This study followed the Municipal Class Environmental Assessment (MCEA) process for a Schedule C project based on the scope and complexity of the project as well as the estimated capital cost of the project.

This document specifies the procedures required to plan specific transportation projects according to an approved planning process.

The study approach included the Ministry of the Environment, Conservation and Parks (MECP) five guiding principles for EA studies, namely:

- Consider all reasonable alternatives.
- Provide a comprehensive assessment of the environment.
- Utilize a systematic and traceable evaluation of net effects.
- Undertake a comprehensive public consultation program.
- Provide clear and concise documentation of the decision-making process and public consultation program.

The Class EA Process was undertaken in a series of phases commencing with problem identification and culminating in the filing of an Environmental Study Report. The Planning and Design Process for the Municipal Class EA is illustrated in **Figure 2**.

The Class EA process includes an evaluation of all reasonable alternatives and the selection of a preferred alternative(s) with acceptable effects (including avoidance and mitigation of any residual effects) on the natural and social/cultural environments. A key component of this process is engagement of stakeholders and rights holders. This EA Study involved four of the five Schedule C EA phases:

Phase 1: Identify the Problem
Phase 2: Alternative Solutions
Phase 3: Alternative Design Concepts for Preferred Solution
Phase 4: Environmental Study Report
Phase 5: Implementation (future phase)

The West Montrose Covered Bridge ESR Report will be available for review on the Region of Waterloo's EngageWR.ca website for a 30-day public comment period, between August 21, 2024 and September 20, 2024. The ESR is also available for review in person during regular business hours at the Regional Municipality of Waterloo Clerk's Office, 150 Frederick Street, 2nd Floor Kitchener, ON and at the Township of Woolwich Administration Office, 24 Church Street West, Elmira, ON. Interested persons may provide comments to the Study Team anytime during this review period, but no later than September 20, 2024, by contacting either one of the following Project Team members:

Ms. Michelle Pinto, P.Eng., MBA, Project Manager
Regional Municipality of Waterloo
150 Frederick Street, 6th Floor
Kitchener, ON, N2G 4J3
E-mail: mipinto@regionofwaterloo.ca
Phone: 519-575-4603

Mr. Steve Taylor, P.Eng., Consultant Project Manger
BT Engineering
Email: stevenj.taylor@bteng.ca
Phone: 519-672-2222

2.1 Section 16 Order

All public concerns are to be directed to the above-noted Project Team members. However, where outstanding concerns may relate to potential adverse impacts on constitutionally protected Aboriginal and treaty rights, then a Section 16 Order request on these matters may be addressed in writing, or by e-mail, to the following provincial government contacts, and copied to the Project Team members listed above, no later than September 20, 2024.

Minister
Ministry of the Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto ON M7A 2J3
Minister.mecp@ontario.ca

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

If there are no Section 16 Orders on the project, or the Minister denies any/all Section 16 Order request(s) with or without conditions, then the proponent (Region of Waterloo) will have complied with the appropriate conditions and sections of the Environmental Assessment Act and will have the right to proceed to final design and construction of the recommended design concept (Phase 5 of the Class EA Process)

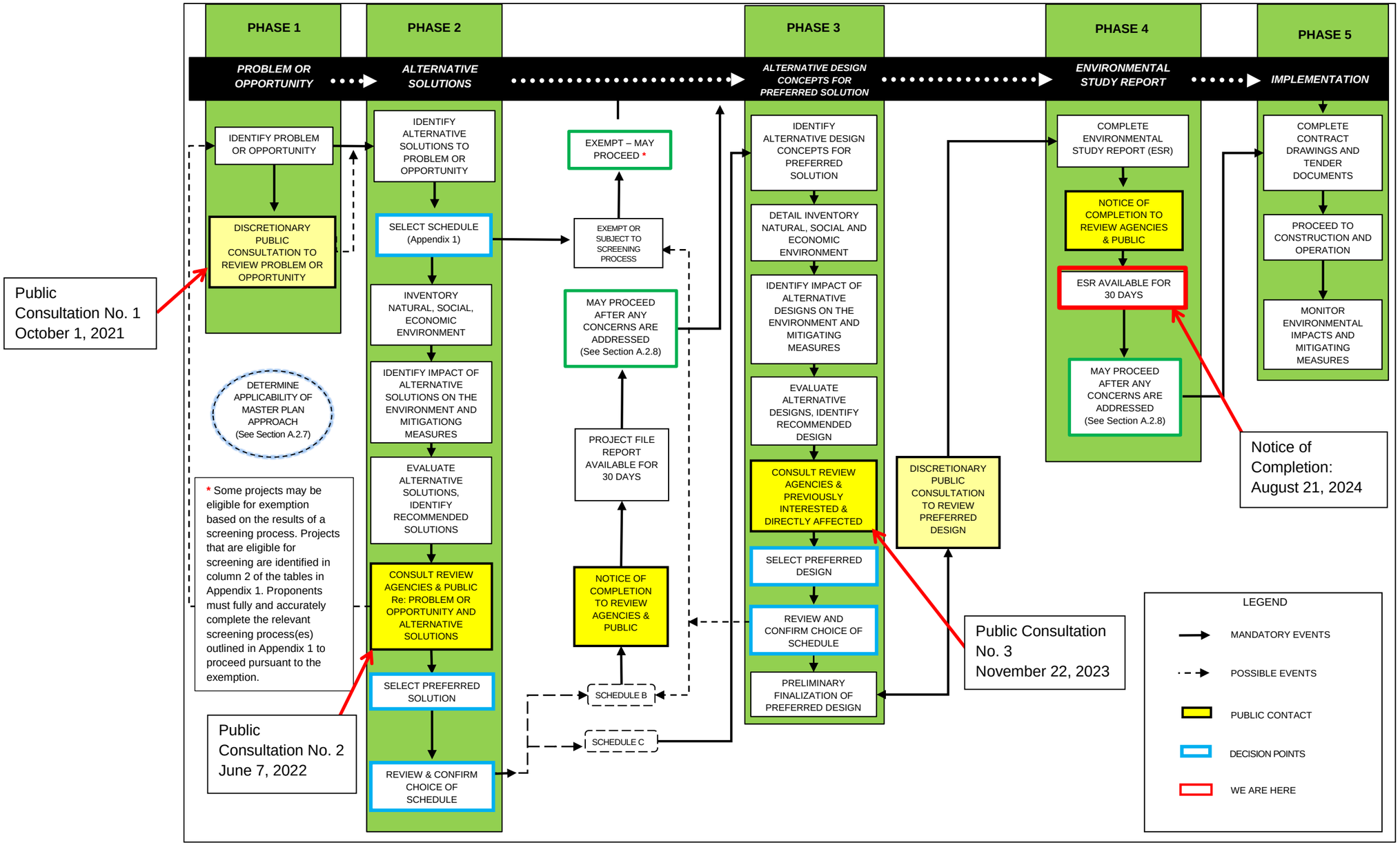


Figure 2: Municipal Class EA Planning and Design Process

3.0 CONSULTATION PROGRAM

The following sections provide a summary of the consultation activities held during the study.

3.1 Notices

Notices for the Study Commencement, Public Consultations, and the Notice of Filing Study Completion were posted on the Region's website, local newspapers, and the project EngageWR page, and emailed, and mailed to the contact list. Public Consultation No. 1 was held virtually during the pandemic and included an online survey between October 1 and November 5, 2021. Public Consultation No. 2 was also held virtually with an online survey between June 7 and July 7, 2022. Notice of Public Consultation No. 3 was advertised on the Region's website, in the Woolwich Observer on Thursday November 16, 2023 and Waterloo Region Record on Tuesday, November 14, 2023. The Notice of Study Completion was published on the Region's website, in the Waterloo Region Record on August 21, 2024 and August 23, 2024 and in the Woolwich Observer on August 22, 2024 and August 29, 2024.

See **Appendix A** for the Notice of Study Commencement, Public Consultation No. 1 Summary Report, Public Consultation No. 2 Summary Report, Public Consultation No. 3 Summary Report, and Notice of Study Completion.

3.2 Contact List

A mailing list was created at the start of the study, which included property owners in West Montrose, agencies, stakeholders, and Indigenous Peoples. The mailing list was updated throughout the duration of the study and was used to identify the recipients of the notices. See **Section 3.6.2** Agencies and Stakeholders for the list of agencies and contact persons.

3.3 Public Consultation No. 1

Public Consultation No. 1 was held as a virtual public consultation, with an online survey open between Friday, October 1, 2021 until Friday, November 5, 2021 on the Region's EngageWR Website. Participants were encouraged to complete a survey, submit questions via the Question-and-Answer page, and contact the project team.

Notices were issued on the Region's website. The notice was also sent by email and hard copy letters to members of the mailing list (public, agencies, stakeholders, utility companies and Indigenous Peoples).

Public Consultation No. 1 presented the following:

1. The needs for major rehabilitation of the bridge.
2. The project environment (natural, social, cultural/heritage, and economic).
3. The alternative solution for the bridge rehabilitation being considered by the Project Team.

A total of thirty-six (36) people participated in the survey during the public consultation comment period. Refer to **Appendix A** for the Public Consultation No. 1 Summary Report.

3.4 Public Consultation No. 2

Public Consultation No. 2 was virtual with an online survey open between Tuesday, June 7, 2022 until Thursday, July 7, 2022 on the Region's EngageWR Website. Participants were encouraged to complete a survey, submit questions via the Question-and-Answer page, and contact the project team.

Notices were issued on the Region's website. The notice was also sent by email and hard copy letters to members of the mailing list (public, agencies, stakeholders, and Indigenous Peoples). Signs were posted at the bridge approaches to advise the public of the public consultation and posts were put out on social media channels including Facebook and Twitter.

Public Consultation No. 2 presented the following:

1. Alternatives that were considered by the project team for the major rehabilitation of the bridge.
2. Criteria used to evaluate the alternatives.
3. Project team preferred alternative rehabilitation strategy.

A total of fifty-one (51) engaged visitors participated in the survey or provided feedback during the Public Consultation comment period. Refer to **Appendix A** for the Public Consultation No. 2 summary report, including a summary of comments.

3.5 Public Consultation No. 3

An in-person Public Open House was held on Wednesday, November 22, 2023 at the West Montrose United Church. A survey was posted on the Region's EngageWR Website between November 22, 2023 until December 21, 2023. Participants were encouraged to complete the survey, submit questions via the Question-and-Answer page, submit comment forms, and contact the project team.

Notices were issued on the Region's website and in the Woolwich Observer on Thursday November 16, 2023 and Waterloo Region Record on Tuesday, November 14, 2023. The notice was also sent by email to agencies, stakeholders and Indigenous Peoples, and hard copy letters were mailed out to residents in West Montrose. Posts were put out on social media channels including Facebook and Twitter.

Two road signs were also posted in advance of Public Consultation No. 3, to advertise the public event to users of the bridge, see **Photo 1** and **Photo 2**.



Photo 1: North Approach Public Consultation No. 3 Posted Sign



Photo 2: South Approach Public Consultation No. 3 Posted Sign

Public Consultation No. 3 presented the following:

1. An introduction to the Study.
2. Overview of the MCEA Process.
3. Proposed Rehabilitation Alternatives and Evaluation.
4. Recommended Rehabilitation Strategy.
5. Next Steps.

A total of 140 comment sheets/survey responses were received during the public consultation comment period. Refer to **Appendix A** for the Public Consultation No. 3 summary report, including comment sheets.

3.6 Public and Stakeholder Consultation

3.6.1 Property Owners

The mailing list included adjacent property owners and members of the public who requested to be notified of the Study. Notices were sent to the members of the mailing list to notify them of the various public consultation opportunities and of the filing of this report for the 30-day review period.

3.6.2 Agencies and Stakeholders

The Study Team met with the West Montrose Residents' Association (Bridge Keepers) and representatives from the National Society for the Preservation of Covered Bridges (NSPCB) on October 19, 2023 to discuss the results of the evaluation and present Alternative C2 as the preferred rehabilitation alternative. The meeting was held in the Township of Woolwich's Council Chambers in Elmira, Ontario.

The BridgeKeepers and NSPCB are important stakeholders and provided critical feedback that glue-laminated timber (glulam), and other engineered wood products would not be a welcome addition to the bridge. At that time, the proposed design included using glulam to replace the bottom chords, floor beams, and needle beams. After receiving this feedback, the preliminary design was adjusted to make use of sawn wood elements only. This feedback demonstrates the importance of community collaboration.

The Study Team met with the Region's Heritage Committee in June 2022 to present the project to the Committee. The Region does not currently have a Heritage Committee, therefore, no meetings were held for Public Consultation 3.

The Study Team also met with the Township of Woolwich's Heritage Committee on July 26, 2022 and on November 8, 2023. The Committee was generally in support of Alternative C2, however, they requested that the Project Team consider permanently closing the bridge to vehicular traffic to prolong the life of the structure. A question about this possibility was included in the public consultation survey for Public Consultation No. 3 in November 2023. The Recommended Plan

includes keeping the bridge open to all traffic (with a posted 3 tonne weight limit), based on the public feedback received.

The following agencies and stakeholders were contacted as part of the project including:

- Ministry of Environment, Conservation and Parks - West Central Region
- Ministry of Environment, Conservation and Parks – Species at Risk Branch
- Ministry of Citizenship and Multiculturalism (MCM)
- Grand River Conservation Authority
- Mississaugas of the Credit First Nations
- Six Nations of the Grand River (both Elected Council and Traditional Council-Haudenosaunee Confederacy Chiefs Council)
- Infrastructure Canada - Indigenous Consultation
- Township of Woolwich
- Bridge Keepers/West Montrose Residents Association
- Mennonite Community
- National Society for the Preservation of Covered Bridges
- Fisheries and Oceans Canada
- Transport Canada

Appendix N contains select correspondence received from interested agencies and stakeholders.

3.6.3 Mennonite Community

Contact with the Mennonite community used direct verbal contact at key study stages. Community input was achieved through specific contact made with representative Mennonite community members living in West Montrose, as well as engagement through the Lost Acre Variety Store that is owned by Mennonites and close to the bridge.

3.7 Indigenous Peoples Engagement

The following First Nations groups were contacted at various milestones during the project, including EA Commencement, Public Consultation opportunities and Study Completion.

- Haudenosaunee Development Institute (HDI)
- Mississaugas of the Credit First Nation (MCFN)
- Six Nations of the Grand River (SNGR).

MCFN and SNGR noted that they did not have any comments on the Stage 1 Archeological Assessment and Natural Environment Report. SNGR requested that trees be replaced at a 10:1 ratio. During design, a restoration plan will be prepared outlining the areas for tree replacement. **Appendix B** includes a summary of the correspondence with First Nations. The Project Team will continue to engage HDI, MCFN and SNGR as the project proceeds.

4.0 NEED AND JUSTIFICATION

The West Montrose Covered Bridge requires a complete structural rehabilitation if the structure is to be preserved and continue to safely service users through this century. Field studies and engineering analyses determined that the bridge life could be extended and safety of bridge users could be assured through a major rehabilitation. The bridge currently serves a variety of users including motorists, horse-drawn buggies, pedestrians, and cyclists.

The bridge is a designated structure under Section 27, Part IV of the *Ontario Heritage Act,* is a RSCHR in the Region, is ranked as one of the top ten most significant bridges in the Region and is the last remaining historic covered bridge in Ontario to carry vehicular traffic. See **Appendix C** for the *Ontario Heritage Act* West Montrose By-law 60-2007. The historical and heritage significance of the bridge requires alternatives and solutions that respect its significance. Preservation of the appearance of the bridge, and heritage attributes, is an important design consideration. See **Photo 3** and **Photo 4** for existing conditions of the pier and soffit.

The need and justification for this project is to define rehabilitation strategies for the covered bridge for improved operation, safety, and longevity. A Design Criteria Sheet was prepared to address the design elements required for the study, see **Appendix D**.



Photo 3: Existing Pier Condition



Photo 4: Existing Soffit Condition

5.0 EXISTING CONDITIONS

The Study Area is the area of the bridge, roadway approaches and the Grand River. The following sections describe the existing conditions which define the baseline of environmental and structural conditions of the bridge and Study Area.

5.1 Natural Environment

A desktop review of secondary resources was completed to identify aquatic and terrestrial constraints in the Study Area. The following sources of information (databases, online mapping, satellite imagery) were used:

- Natural Heritage Information Centre (NHIC).
- Toporama mapping.
- Grand River Conservation Authority (GRCA) mapping.
- Department of Fisheries and Oceans (DFO).
- Species at Risk (SAR) mapping.
- Land Information Ontario (LIO).
- Aquatic Resource Area (ARA) mapping.

Adjacent to the Study Area is a non-provincially significant wetland. Data retrieved from NHIC indicated SAR such as Eastern Wood-pewee (Contopus virens), Greater Redhorse (Moxostoma valenciennesi), Wavy-rayed Lampussel (Lampsilis fasciola), and Silver Shiner (Notropis photogenis).

The proposed in-water work to place the level of scour protection outlined in the hydraulic report at the bridge pier and abutments will require the installation of coffer dams, dewatering and a causeway to access the pier. A detailed assessment of any impacts to the SAR or potential SAR habitat within the project study area will be required. A Request for Review was submitted to DFO at project initiation in 2021 and the response from DFO is provided in **Appendix N**. An updated Request for Review will need to be submitted during detailed design. An Information Gathering Form (IGF) will also be required to be submitted to the MECP to determine whether the proposed in-water work activities will require authorization under the Endangered Species Act (ESA). Further investigation on the level of scour protection, and associated impacts of placing the scour protection, should be assessed during detailed design.

See **Appendix E** for the Natural Environment Report.

5.2 Social and Cultural Environmental

5.2.1 Heritage/Cultural

The West Montrose Covered Bridge has a storied history. Like many covered bridges, it is referred to as the “Kissing Bridge” due to the privacy afforded by the exterior cladding and roof.

Designed by John Bear and built in 1881 by John and his brother Benjamin, the West Montrose Covered Bridge is a timber truss with a hybrid Howe truss configuration. Measuring approximately 200-ft. (61 m) in length, this single lane, two span bridge is covered with a gable roof and red-painted exterior wood board with batten-like wood strips covering the joints.

The Township of Woolwich enacted Designation By-Law No. 60-2007, designating the West Montrose Covered Bridge under Section 27, Part IV of the *Ontario Heritage Act* on August 14, 2007. Furthermore, the Regional Municipality of Waterloo recognizes the subject bridge as a Regionally Significant Cultural Heritage Resource (RSCHR); the bridge is ranked as one of the top ten most historically significant bridges in the Waterloo Region; and it is the last remaining covered bridge in Ontario that carries vehicular traffic. The West Montrose Covered Bridge has been identified as the only vehicular covered bridge in Ontario, the 8th oldest covered bridge in Canada, and possibly, the longest Queen Post variant bridge in North America. It is located within the Grand River watershed, which is recognized as a Canadian Heritage River.

The Township of Woolwich By-law 60-2007 will require amendments for this bridge rehabilitation. The process to amend the By-Law was outlined by the Township of Woolwich and is provided in **Appendix M**.

The existing bridge reflects the materials, innovative Howe truss engineering design, and construction techniques from the 19th century. It is a unique structure in that the design has floor beams below the bottom chord of the truss. The primary purpose of the project is to protect and retain the heritage elements of the bridge recognizing this is an evolving structure that has had changes overtime. See **Photo 5** for the Ontario Heritage Foundation plaque, describing the historical significance and history of the bridge.

The Heritage Impact Assessment (HIA) report, completed by Unterman McPhail & Associates, is provided in **Appendix F**. The Standards and Guidelines for the Conservation of Historic Places in Canada and the Ontario Heritage Bridge Guidelines were used as a guiding document for the preparation of the HIA. A meeting was held with staff from the MCM on October 19, 2023 to discuss requirements for the HIA.

5.2.2 Archaeology

A Stage 1 Archaeological Assessment (AA) was completed by ASI Heritage in 2022 (PIF P1066-0213-2021). The Stage 1 background study determined no previously registered archaeological sites are located within 1 km of the Study Area. The property inspection determined that the Study Area has been subject to deep and extensive disturbance. The following recommendations were made in the Stage 1 Archaeological Assessment Report:

- The Study Area does not retain archaeological potential on account of deep and extensive land disturbance. These lands do not require further archaeological assessment; and

- Should the proposed work extend beyond the current Study Area, further Stage 1 archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

The Stage 1 AA is in **Appendix G**. The Stage 1 AA was circulated to the Mississaugas of the Credit First Nations, Six Nations of the Grand River and HDI First Nations groups.

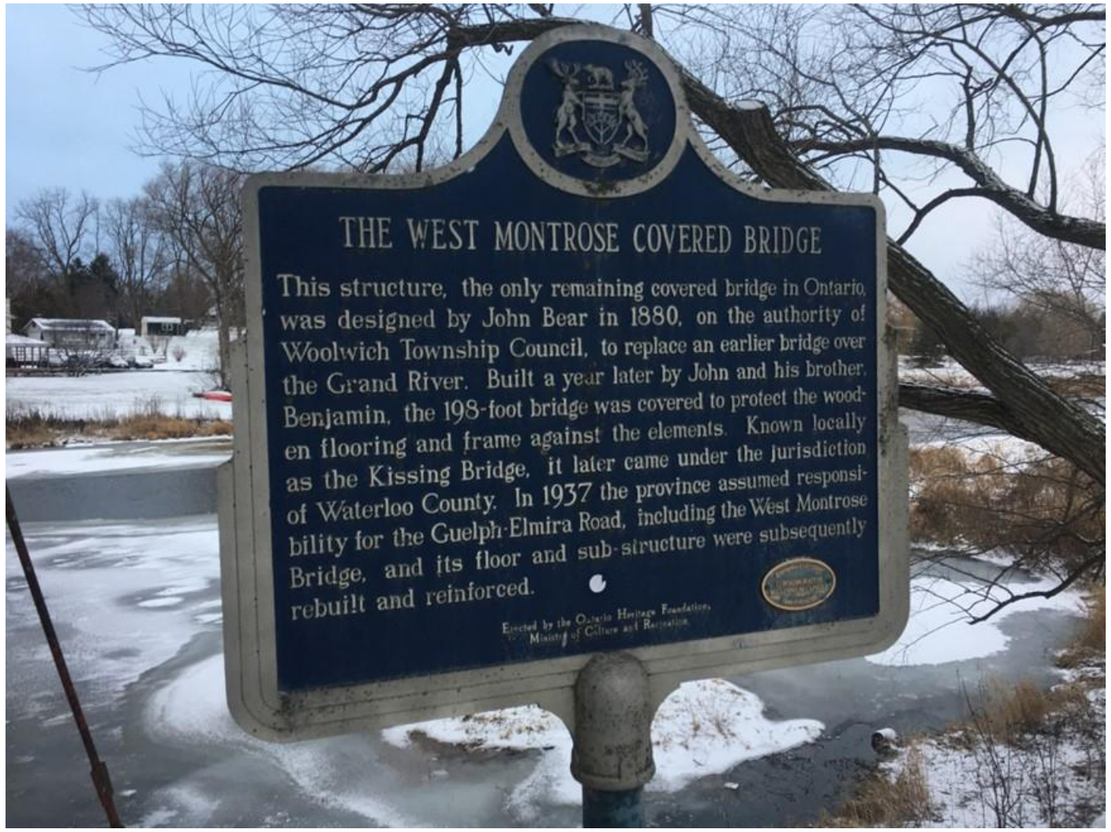


Photo 5: Ontario Heritage Foundation Plaque

5.2.3 Noise

The study recommendations do not change the vehicular patterns or volumes and therefore sound levels are not anticipated to change.

5.3 Petroleum Wells

A review of the Study Area using Ontario GeoHub Petroleum Well Dataset was completed and no petroleum wells are located near or within the Study Area. The closest petroleum well is located 4 km away, and the study recommendations will not affect the well. No impact or mitigation is anticipated for this project.

5.4 Structural

The bridge was designed and built on the authority of the Woolwich Township Council in 1880-1881. The Ontario Department of Highways (predecessor to the present-day Ontario Ministry of Transportation) assumed ownership of the bridge in 1937. The Region of Waterloo assumed ownership of the bridge in 1998 from the province.

Major rehabilitation was done by MTO between 1950 and 1965 which included the addition of a steel Bailey truss. As the original wooden trusses age and experience creep deformations, they are shedding more load to the Bailey trusses which cannot carry the entire load of the bridge. Additionally, the deteriorated condition of the existing wood structure is such that rehabilitation is required to preserve the longevity of the structure.

The Region of Waterloo undertook additional major rehabilitations to upgrade the Bailey trusses, replace various wood components, reconstruct the northwest bearing seats, and replace cracked timber floor beams. The 2017 timber condition assessment report noted numerous locations with high moisture content, many over the fibre saturation point of wood, creating conditions suitable for decay. At that time, defects in the timber components such as splits, checks, decay, mold, decayed internal pockets, cavities, and decay in pressure treated components were present. Leaks in the roof and walls break the first line of defense for the covered bridge while high flood levels jeopardize the deck structure. In the 7 years since the assessment report, it is expected that the decay and deterioration have progressed, and a new assessment was completed as part of this study. Remediation of the structure will be required to limit the ingress of moisture, provide detailing to prevent the accumulation of moisture, and repair timber components and connectors in part or in whole.

The West Montrose Covered Bridge is a two-span wood through truss structure carrying a single lane of traffic over the Grand River along Covered Bridge Drive (see **Photo 6**). The bridge is in the centre of West Montrose, connecting the northern and southern parts of the community. The bridge has two equal spans of approximately 28.9 m. The spans are simply supported, except that the bottom chord members are continuous over the pier. The total bridge length is approximately 200 ft (61 m), including wood portal framing that extends beyond the truss supports. The traveled width inside the bridge is 4648 mm (15’-3”). The existing wood trusses have been structurally augmented by installation of steel Bailey trusses circa 1965. The Bailey trusses are concealed behind white-coloured interior wood cladding.



Photo 6: West Elevation View of Bridge

The bridge is currently posted for a 3-tonne live load limit. The bridge is generally subject to local and tourist traffic only. Commercial and through traffic make use of the nearby bridge carrying Regional Road 86 (Line 86) over the Grand River. This bridge is approximately 950 m upstream from the covered bridge.

The bridge has undergone numerous documented and undocumented repairs. Major repairs and modifications include:

- Replacement of the wood pier with a masonry pier circa 1900.
- Replacement of the wood crib abutments with concrete abutments (believed to have occurred sometime after the pier replacement).
- Original transverse plank deck replaced with nail-laminated deck circa 1954.
- Major rehabilitation in 1959 including replacement of floor beams and needle beams, replacement of localized sections of the bottom chords, strengthening of the bottom chords by installation of longitudinal reinforcing rods, and repainting of the bridge.
- Semi-retirement of the bridge in 1959 by construction of a new highway bridge to carry modern truck loading on the nearby Regional Road 86 (Line 86).
- Installation of steel Bailey trusses to supplement the wood trusses circa 1965.
- Repainting of bridge in 1971.
- Replacement of the roof in 1987.
- Major rehabilitation in 1999 consisting of strengthening of the steel Bailey trusses, localized replacement of decayed segments of wood truss members, and replacement of the nail-laminated deck.
- Repainting of bridge in 2004.

The above-noted repairs and modifications to the bridge resulted in the full or partial replacement of many of the original wood members. **Table 2** summarizes the historical known replacements.

Table 2: Known Replacement of Original Wood Members

Wood Member	Status as Original or Replacement Member
Truss Top Chords and Lower Top Chords	Believed to be original
Truss Bottom Chords	Local segments have been replaced in 1933, 1959, and 1999.
Truss Diagonals and Lower Diagonals	Believed to be original except for local segments that were replaced to accommodate local bottom chord replacement
Wood Deck	Original transverse plank deck replaced with nail-laminated deck circa 1954. Deck replaced again in kind in 1999.
Stringers	Many original stringers are believed to remain. Additional lines of stringers have been added, likely when the new deck was installed circa 1954
Floor Beams and Needle Beams	No original members remain. Complete replacement occurred in 1959 with numerous individual members replaced since then
Tie Beams	Some original members remain
Vertical Posts	Believed to be original
Rafters and Roof Decking	No records available, but decking unlikely to be original given the structure's age
Exterior Cladding	Some original cladding remains
Interior Cladding	Photographic evidence suggests the present cladding is not original to the bridge. We believe the interior cladding was initially installed some time in the 1930s.

The bridge has a history of live load posting ranging from 2 tonnes to 5 tonnes. A structural evaluation of the Bailey trusses in 1997 by Giffels Associates Limited (subsequently IBI Group; now part of Arcadis) and subsequent major rehabilitation in 1999 resulted in a documented live load capacity of 8 tonnes with simultaneous snow loading on the roof and 11 tonnes in the absence of snow loads. In recent years the bridge has remained posted for a 3 tonnes live load limit to discourage heavier vehicles from crossing the bridge.

The local community has played a significant role in the continued preservation and celebration of the bridge. For instance, the Bridge Keepers act as advocates for preserving the bridge. They hold annual events that celebrate the bridge, such as an annual Christmas caroling event inside the bridge. Also, the local Mennonite community contributed the labour to rebuild the nail-laminated deck during the last major rehabilitation in 1999. The bridge is very much a destination for the local community and tourists, in addition to its initial function as a river crossing.

A 2017 inspection was completed by Moses Structural Engineers. These findings served as a benchmark against which the findings from the current study's field inspections could be compared against. Elements of the covered bridge, such as points of connection between

members, required a moisture content inspection to indicate whether moisture was being trapped and possibly contributing to decay. See the Structural Design Summary Report in **Appendix H**.

The field inspections of the existing bridge as part of this study, were conducted in two phases. The first phase of inspections occurred from Tuesday, February 21, 2023 to Monday, February 27, 2023, excluding the weekend days.

The bridge was fully closed to traffic for the first inspection phase. The interior cladding was removed in advance of the inspection to improve inspection access to the existing wood trusses and steel Bailey trusses (see **Photo 7**). It was restored upon completion of the inspection phase before the road was reopened to traffic.

The second phase of inspection occurred from Tuesday, June 13th, 2023 to Thursday, June 15th, 2023. The inspection was conducted from a floating work platform positioned beneath the bridge in the Grand River (see **Photo 8**). The bridge remained open to traffic during the second inspection phase. The interior cladding was not removed.



Photo 7: Interior Cladding Removed for First Inspection



Photo 8: Floating Work Platform Used for On-Water Inspection

The scope of the inspection work consisted of the following:

- Arm's length visual inspection of the wood members, connections, and steel rods.
- Resistance drilling measurements of the wood members using a 400 mm long drilling rod to assess the likelihood of decay within a member.
- Moisture content measurements of the wood members to assess the likelihood of decay within a member.
- Removing small samples of the wood elements for species identification under microscope in a laboratory.
- Visual grading of the in-situ wood members per the National Lumber Grades Authority's (NLGA) National Grading Rules for Canadian Lumber.

Physical measurements of the existing bridge geometry were also taken during the inspections. The available drawings for the bridge show very few dimensions. A topographic survey and light detection and ranging (LiDAR) survey were also undertaken to further collect this geometric information. The surveying was completed by Callon Dietz Incorporated.

The key inspection findings are in **Appendix H, Sub-appendix A** and were used in the generation and evaluation of alternatives.

The Structural Design Summary Report is in **Appendix H**.

5.5 Geotechnical Investigations

A geotechnical investigation was undertaken by Peto MacCallum Ltd. The fieldwork for the geotechnical investigation was conducted between July 18 and August 18, 2023. The purpose of this investigation was to explore the subsurface soil and ground water conditions at the site. The general subsurface stratigraphy encountered at the site comprised of surficial pavement structure and fill soils, over non-cohesive sand and gravel / sandy silt / sand, over silt till, over non-cohesive gravelly sand, over bedrock. The presence of an artesian well was encountered during the drilling, as outlined in the report. Geotechnical recommendations for micro-pile installations for foundation retrofit were provided with recommendations for excavations, backfilling, and pavement restoration.

A Permit to Take Water (PTTW) may be required if coffer dams and dewatering is necessary during construction. A hydrogeological investigation should be conducted during detailed design to determine the extent of dewatering required.

The Geotechnical Investigation Report is in **Appendix I**.

5.6 Bridge Hydraulics

The purpose of the Bridge Hydraulics Report is to summarize the hydraulic considerations and calculations made in support of the assessment of the bridge rehabilitation alternatives and the detailed design of the recommended bridge rehabilitation measures.

The GRCA provided the HEC-RAS model of the Grand River between the Elora Gorge (upstream limit) to below Sawmill Road at the downstream end. The results of the model were set as the existing conditions.

The existing waterway consists of two 30 m± long spans. The abutments have a vertical face from the riverbed to the bearing level and have wingwalls on all bridge quadrants. The stone-faced pier is 1.3 m± wide at the bridge bearing level and 2.2 m± wide at its base.

The GRCA HEC-RAS model provides the peak flow data for the reach of the Grand River that includes the bridge. The underside of the floor/needle beams on the upstream side of the bridge can pass a storm with an annual exceedance probability (AEP) of 2% (50-year flood) with no vertical clearance. The 50% AEP (2-year flood) will overtop River's Edge Drive and floodwaters will flow around the south bridge approach.

5.6.1 Bridge Hydraulic Design Criteria

Given the overall site and bridge configuration and the resulting limitations, it was agreed that the design will be based on the following criteria:

a. The bridge rehabilitation must result in no increase in water levels upstream of the crossing.
b. The bridge waterway dimensions must not be reduced (clear spans, soffit elevations).
c. Any proposed scour protection added to the bridge must not significantly reduce the available waterway opening area.
d. The bridge rehabilitation will be designed for the hydrostatic and hydrodynamic loads imposed by the Regional Storm.
e. The assessment of the potential vulnerability of the bridge to scour and any mitigation measures will be based on the Design Flood 2% AEP or 50-year flood.

At this site, flooding will commence at flows that are more frequent than the 50 % AEP flood event. There is a significant discharge in the south overbank of the river. For the design flood 2% AEP, the water level will be 6 cm± above the elevation of the floor beams but below the elevation of the truss low chord. The 4% AEP (25-year flood) headwater level will be 22 cm± lower than the bottom of the floor beams.

Raising the structure to provide the required vertical clearance to the soffit elevation was considered during the study process, but it was concluded that the potential effects of raising the bridge on the approaches are severe, such as impact on properties near the approaches and the risk to the structure when raising it.

5.6.2 Recommended Soffit Elevation

As a result, it was recommended that the soffit elevation be maintained at its existing elevation; or raised nominally to eliminate the existing sagging of the bridge lower chord. The final minimum soffit elevation (measured at the bottom of the floor beams) is 323.187 m, which is 2 cm± higher than the existing soffit elevation (323.165 m). Removal of the steel hardware and cables will reduce the possibility of debris or ice floes snagging the underside of the bridge. The bottom chord lowest elevation will be 323.662 m, which is higher than the 50-year flood headwater level. The vertical clearance during the design flood, measured to the minimum low chord elevation, will be 0.24 m.

5.6.3 Scour Protection

There is potential for scour of the streambed at the bridge abutments and the pier. It is necessary to provide scour protection to the abutments and the pier. The recommended scour protection is presented **Figure 3**.

A layer of rock protection at the abutment should be provided extending 3.5 m into the watercourse, to act as a launching apron. The design flow velocity through the opening is 3.1 m/s, which requires stone with D50 diameter of 300 mm, placed in a layer 600 mm thick. The rock protection should be placed on Type 2 non-woven geotextile.

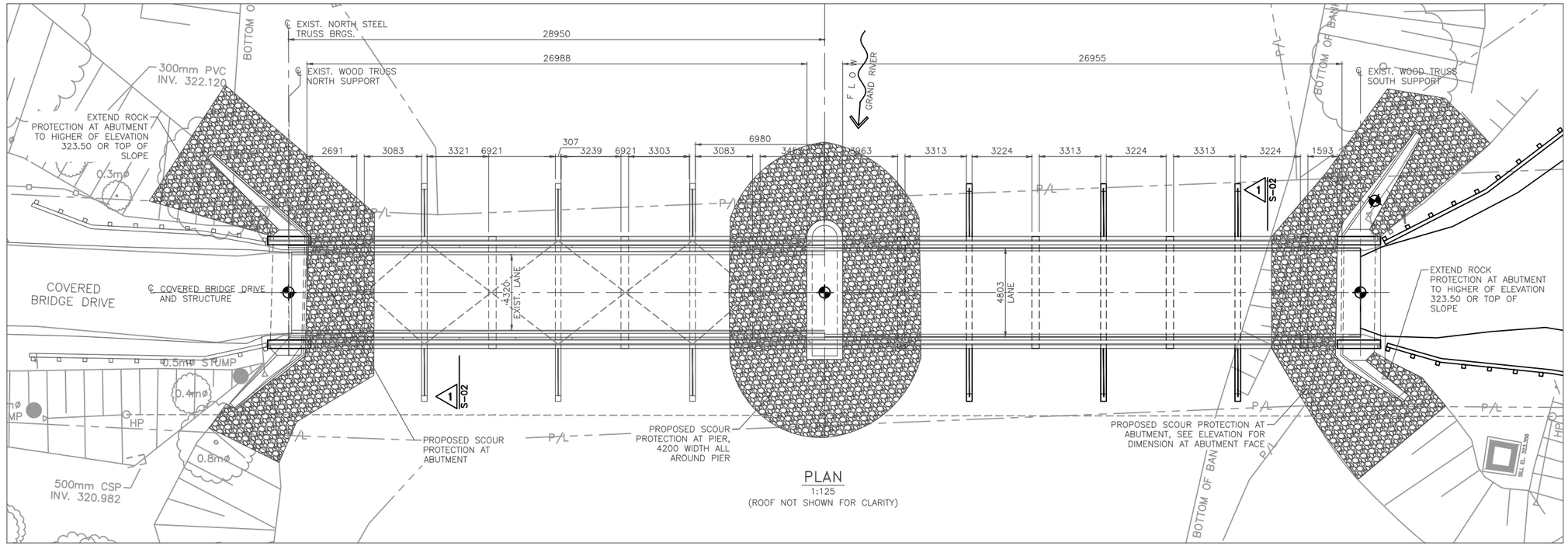
A layer of rock protection at the pier should be provided extending 4.2 m into the watercourse from the edges of the pier. The design flow velocity at the pier is 4.7 m/s, which requires stone with D_{50}

diameter of 450 mm, placed in a layer 1000 mm thick. The rock protection should be placed on Type 2 non-woven geotextile, extending to the top of the rock.

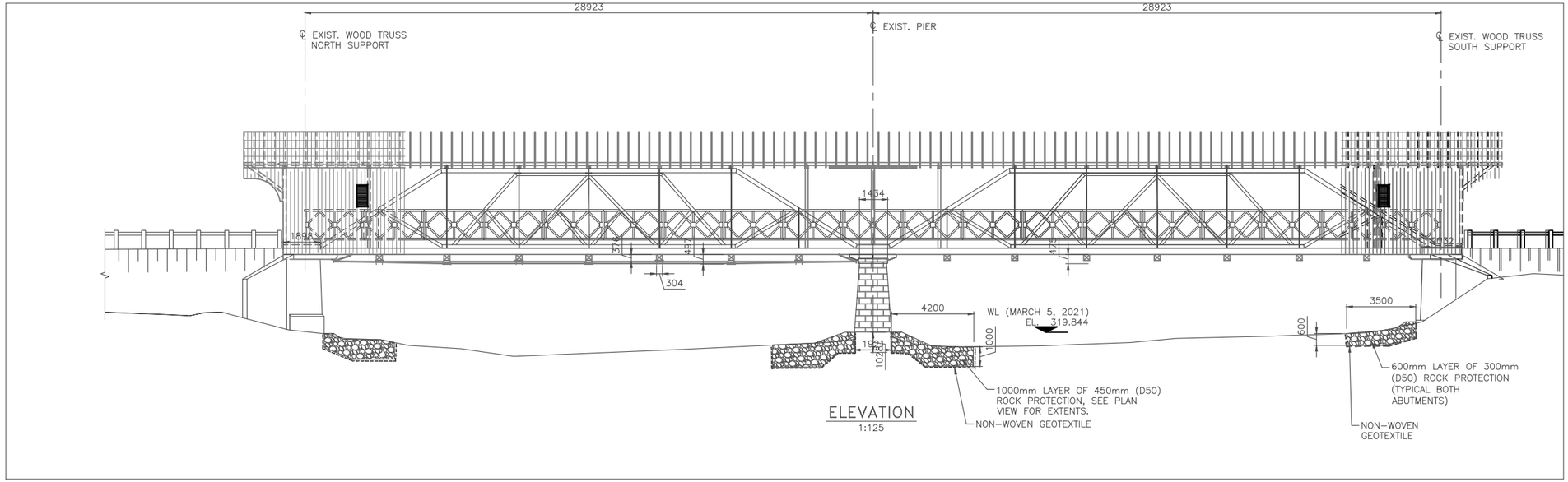
To avoid a change in upstream water levels by reducing the available waterway opening, the rock protection should be placed below the existing streambed.

Provided that the top of the recommended rock protection is installed at the pier and the abutments as shown on **Figure 3**, the scour protection will not cause increases to the flood water levels upstream of the bridge due to constriction of the flow.

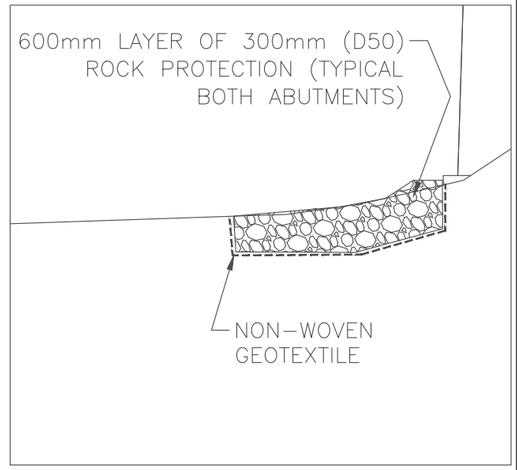
The Bridge Hydraulic Report, see **Appendix J**, describes the design criteria, soffit recommendations, hydraulic calculations and scour protection.



PLAN
1:125
(ROOF NOT SHOWN FOR CLARITY)



ELEVATION
1:125



DETAIL OF ROCK PROTECTION AT ABUTMENT, SIMILAR AT PIER. SEE ELEVATION FOR ROCK PROTECTION SIZES AND DIMENSIONS.

SANCHEZ ENGINEERING INC.

DRAWN BY:	LSC
PROJECT No:	SN0468
DATE:	2024 08 07
SCALE:	AS SHOWN

REGION OF WATERLOO
WEST MONTROSE COVERED BRIDGE
SCOUR PROTECTION

FIGURE
3

5.7 Source Water Protection

The West Montrose Covered Bridge is within the Grand River Source Protection Plan Area. The Region of Waterloo Official Plan Map 6B illustrates the Township of Woolwich Source Water Protection Areas, which identifies a Municipal Wellhead at the bridge location. The rehabilitation alternatives are all contained within the footprint of the bridge; however, dewatering is recommended to place the scour protection. It is anticipated that this work will have no impact on the Municipal Wellhead. Industry best practices will be used to prevent spills and / or the release of contaminated material during construction. The Municipal Wellhead will be protected during construction. See **Figure 4** for a map of the Township of Woolwich wellhead protected areas.

5.8 Traffic Signage

Traffic signage on both ends leading up to the West Montrose Covered Bridge indicates the bridge is a single lane with a maximum weight limit of 3 tonnes. There is a warning sign diverting traffic of trucks, tractors, buses, or motor homes from the covered bridge to an alternate route, as seen in **Photo 9.**

5.9 Navigable Protection Program – Canadian Navigable Waterways Act

Since the Grand River under the bridge is currently being used by the public for recreational purposes, the body of water is considered Navigable for the purposes of the Canadian Navigable Waters Act (CNWA). An application will be made to Transport Canada's Navigation Protection Program (NPP) to obtain approval to undertake the in-water works. Initial correspondence with Transport Canada is provided in **Appendix N**.

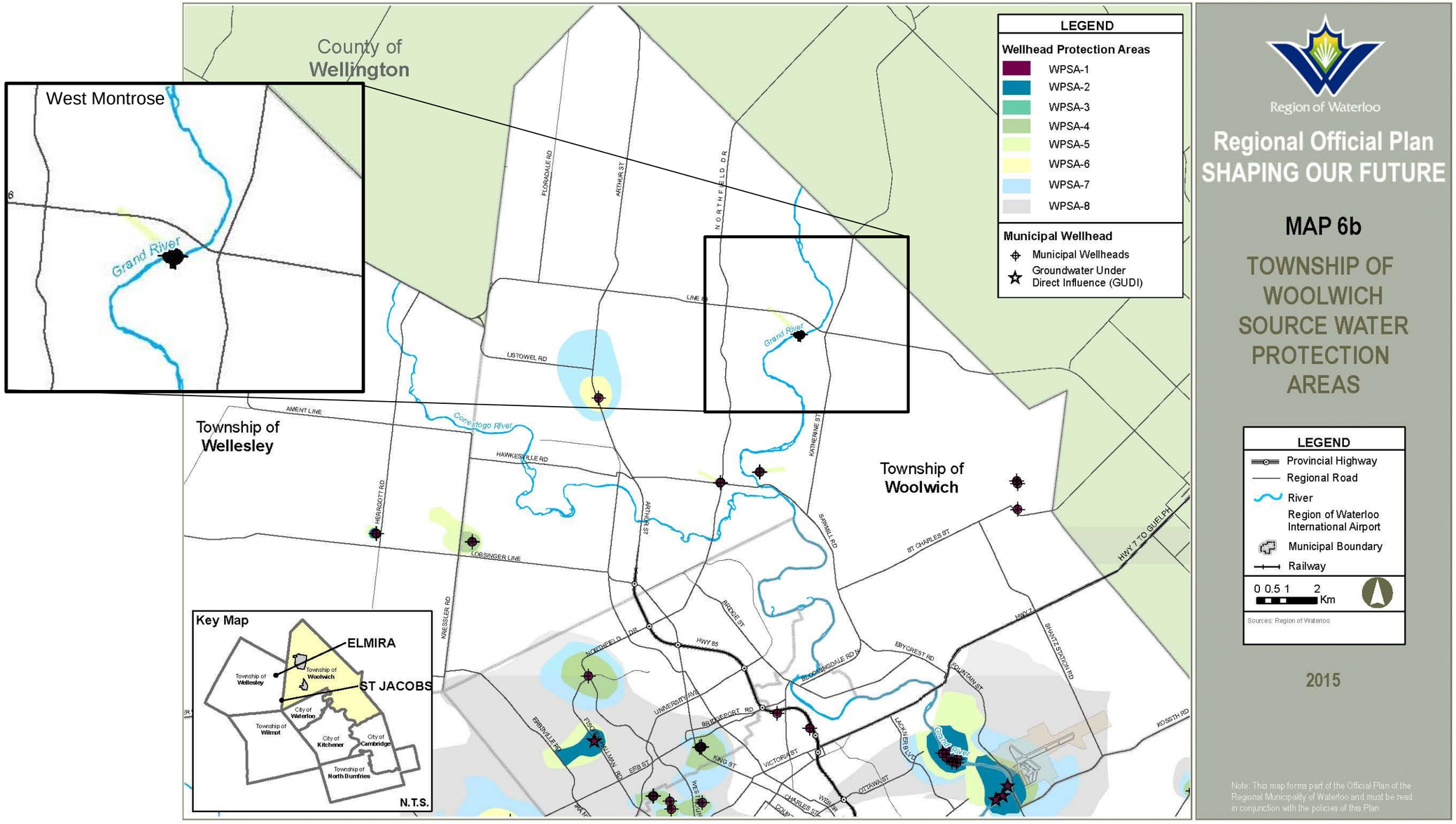


Figure 4: Region of Waterloo Wellhead Protection Sensitivity Areas



Photo 9: West Montrose Covered Bridge Traffic Signage

5.10 Land Use

The Covered Bridge is located within a Prime Agricultural Area (Regional Official Plan Map 7) crossing over the Grand River. West Montrose is defined as a Cultural Heritage Landscape (CHL) in the Township of Woolwich Official Plan, with specific Character Defining Attributes. The Township has prepared a Conservation Plan for the West Montrose CHL, which contains a more detailed description of character defining elements and has detailed methods of protection of these character defining elements.

The Provincial Policy Statement (PPS) (2020) is a consolidated statement of the government's policies on land use planning. It gives provincial policy direction on key land use planning issues that affect communities, such as:

- Efficient use and management of land and infrastructure
- The provision of sufficient housing to meet changing needs, including affordable housing
- The protection of the Province's natural heritage resources, water resources, agricultural resources, mineral resources, and cultural heritage and archaeological resources
- Opportunities for economic development and job creation
- The appropriate transportation, water, sewer and other infrastructure needed to accommodate current and future needs
- The protection of people, property and community resources by directing development away from natural or human-made hazards, such as flood prone areas

In accordance with the Ontario PPS (2020), the rehabilitation of the West Montrose Covered Bridge underscores the commitment to the protection of the heritage resource, long term preservation and appropriate transportation infrastructure needed to accommodate current and future needs.

5.11 Climate Change

The effects of changing climate conditions were considered in the study.

Firstly, the use of timber to rehabilitate the bridge is generally more sustainable than using steel, providing an overall carbon benefit. This high-visibility project will help promote the use of mass timber in bridges across Canada. If possible, new materials will be sourced locally, reducing emissions for materials getting to the site. The advantages of timber as a building material are well-known: plentiful in supply, cost-effective and able to absorb CO2 from the atmosphere. When correctly designed, new timbers can last for 100 years and be swapped out at the end of its useful life in a bridge to be reused in another context. The Project Team will continue discussions with the community about options for reuse of the timber members being replaced and/or the steel Bailey truss.

Changes to the frequency, intensity and duration of precipitation were considered in the rehabilitation design through flood loading acting on the bridge due to large storm events and/or improvements to the river hydraulics at the bridge to preclude or minimize such loading. The Design Flood Load for the Bridge is the Regional Storm Event. While it is not possible to raise the soffit of the bridge due to impacts on the adjacent roadway, the bridge will be designed to resist lateral loads should the water rise to the soffit of the bridge. Scour protection will be installed to mitigate the effects of any potential scour to the bridge pier and abutments caused by a heavy storm. The plan includes avoiding a change in upstream water levels by placing the rock protection below the existing streambed.

Interference with the local landscape, plant cover and other natural features will be minimized to the greatest extent possible. Erosion and sediment control measures will be implemented and any disturbed areas will be restored after construction.

The VE component of the project investigated alternative modifications to consider the effects of climate change, including raising the bridge to provide additional vertical clearance, adding spans to reduce the headwater levels, and others. However, these alternatives were determined to have significant negative effects or were not feasible to implement. The bridge span and its soffit are fixed, for practical purposes, so the vertical clearance requirement cannot be met. Consequently, the bridge will be rehabilitated while maintaining its existing approaches and structure elevations.

6.0 GENERATION OF ALTERNATIVES

The analysis and evaluation of alternatives is a central requirement of the Municipal Class EA process. Alternative Planning Solutions were generated to define alternatives to the project. Following the selection of the preferred Planning Solution, Preliminary Design Alternatives were developed. Alternatives that were not viable, had significant impacts, or had substantially poorer performance compared with other alternatives, were not considered reasonable alternatives.

6.1 Alternative Planning Solutions

The following Alternative Planning Solutions were generated and assessed for the West Montrose Covered Bridge:

- **Do Nothing** - The Do Nothing Alterative must be considered, as mandated by the Class EA. It represents a baseline from which other approaches can be compared. It does not address the structural deficiencies and was not carried forward.
    - The magnitude of this alternative is substantial as it risks loss of the heritage asset.
    - No mitigation measures are possible for this approach.
    - This solution was not considered a reasonable alternative to carry forward.
- **Transportation Demand Management** - This strategy would eliminate vehicular demand on the bridge and encourage alternative travel routes. Pedestrians, cyclists and horse and buggies would still be permitted. This does not address the structural deficiencies and was not carried forward.
    - The impact of this alternative is substantial as it requires out-of-way travel for the local community.
    - No mitigation measures are possible for this approach. Strengthening of the bridge would still be required to accommodate pedestrians, cyclists and horse and buggies.
    - This solution was not considered a reasonable alternative to carry forward and was not preferred by the public.
- **Rehabilitation** - This strategy would rehabilitate the existing bridge, which aligns with heritage conservation practices and addresses the structural deficiencies. This alternative was carried forward as the **Preferred Alternative Solution**.
    - The impact of this alternative is net positive as it retains the heritage asset.
    - Mitigation measures to be investigated with respect to limiting vehicle size and environmental effects of the scour protection for the centre pier.
- **Replacement** - This strategy would replace the existing bridge. This alternative addresses the structural deficiencies of the bridge; however, it does not align with heritage conservation practices and does not maintain the historic and heritage structure. This alternative was not carried forward.
    - The impact of this alternative is substantial as it results in the loss of the heritage asset and does not align with heritage conservation practices.
    - The only mitigation measure possible for this approach is documentation.
    - This solution was not considered a reasonable alternative to carry forward.

6.2 Bridge Rehabilitation Alternatives

The development of the Preliminary Design Alternatives was completed in multiple stages:

1. DDA undertook structural evaluations in 2019 and 2020, following which a Schedule A+ Municipal Class EA was initiated. One Preferred Alternative was considered and presented at Public Consultation No. 1 (October 2021). The alternative included removal of the existing steel Bailey trusses and replacement with new steel girders (Alternative A – Steel Girder Reinforcement). The interior view of the bridge would remain consistent with the way it looks today.
2. The public comments in response to Public Consultation No. 1 resulted in the development of a second rehabilitation alternative. Two (2) Preliminary Design Alternatives were considered and presented at Public Consultation No. 2 (June 2022):
    - Alternative A: Steel Girder Reinforcement.
    - Alternative B: Timber Truss Reinforcement.
3. After Public Consultation No. 2, the Region retained a detailed design engineering team experienced with wood heritage structures to complete the EA and the detailed design. The team performed a detailed inspection of the timber truss in 2023. A Value Engineering (VE) Workshop was held to define the function of the bridge and develop a long list of potential alternatives and strategies to be developed for the rehabilitation alternatives.
4. Following the VE Workshop, six (6) Preliminary Design Alternatives were considered, evaluated, and presented at Public Consultation No. 3 (November 2023):
    - Alternative A: Steel Girder Reinforcement.
    - Alternative B: Timber Truss Reinforcement.
    - Alternative C: Repairs to wooden truss members to achieve a design vehicular live load limit of:
        - Alternative C1: 12 tonnes.
        - Alternative C2: 10 tonnes.
        - Alternative C3: 8 tonnes.
        - Alternative C4: 6 tonnes.

Numerous inspections, analyses, and studies were completed all of which influenced the rehabilitation alternatives that were ultimately evaluated by the Evaluation team. The following sections describe the evaluation and selection of the Technically Preferred Alternative (TPA) carried forward in this EA Study. The full background of investigations is in the Structural Design Summary Report in **Appendix H.**

6.2.1 Public Consultation No. 1 Alternatives and Evaluation

DDA undertook a structural evaluation of the bridge in 2019, with a specific aim to evaluate the ability of the steel Bailey trusses to carry all gravity loads should the existing wood trusses

deteriorate to the point where they are on longer functioning structurally. The Bailey trusses were found to not have sufficient capacity to resist all loads acting on the bridge should the wood trusses no longer have any structural capacity. DDA's 2019 report recommended an assessment of all existing wood elements to identify rehabilitation needs. A visual inspection of the existing timber and steel elements was undertaken. The inspection was limited to inspection of the bridge from deck level with no roof inspection and limited inspection of the floor system and underside of the bridge from the south abutment.

The "West Montrose Covered Bridge Detailed Inspection Report" (2019) features detailed findings for the steel Bailey trusses, including the reporting of cross-section measurements for all elements, which is believed to be the first time in the bridge's history that that information had been officially documented. DDA made the following recommendations of note:

- Replace the existing shingles and roof sheathing boards.
- Replace or repair the existing squash blocks.
- Replace the exterior wood sheathing.
- Repair splits and check in the top chord and lower top chord members.
- Locally repair the diagonal and lower diagonal members that had deteriorated.
- Replace interior cladding (i.e. "splash panels") to accommodate new steel box girders (assuming the steel box girder alternative were to be carried forward).
- Replace the wood deck and stringers.
- Replace all floor beams and needle beams that were older than seven years (i.e. from before 2013).
- Further inspect the bottom chord and lower portions of the diagonal and lower diagonal members when better access is available.
- Repair the concrete abutments and pier.

In addition to their inspection, DDA retained Complete Survey Solutions to perform a geodetic survey of the bridge. The survey recorded both the vertical and lateral deflections of the bridge. DDA made the following observations from the survey results:

- The top of the pier is higher than the tops of the abutments.
- The west wood truss is sitting lower than the east wood truss.
- The bridge was found to be laterally deflected (i.e. "sweeping") to the east.
- The pier appears to be settling to the east.

Following the 2019 and 2020 assessments of the bridge, DDA subsequently worked with the Region to initiate a Schedule A+ MCEA for the purpose of rehabilitating the bridge. The steel box girder concept (Alternative A) was introduced to the public as the preferred rehabilitation alternative at Public Consultation No. 1 in October 2021.

6.2.2 Public Consultation No. 2 Alternatives and Evaluation

The public comments in response to Public Consultation No. 1 resulted in the development of a second rehabilitation alternative. There were two rehabilitation alternatives that were under consideration at Public Consultation No. 2:

- **Alternative A - Steel Girder Reinforcement.** This alternative was presented to the public at Public Consultation No. 1 and involves removal of the existing Bailey trusses and replacement with new steel box girders. The interior white cladding would be replaced, and the new steel girders would be hidden from view, similar to the look of the bridge interior today.
- **Alternative B - Timber Truss Reinforcement**. This alternative involves strengthening of the existing wooden truss with high strength fiber reinforcement. The height of the bridge would increase by approximately 300 mm to facilitate reinforcing the bottom chords of the existing wooden truss. The interior cladding and Bailey trusses would be removed under this Alternative, and the addition of a timber guiderail would be required to protect the wooden truss from damage.

The evaluation of alternatives was completed qualitatively. The evaluation is provided in **Appendix A** within the Public Consultation #2 Summary Report. The factors considered included:

- **Structural Performance:** The ability of the alternative to meet structural design requirements, and its structural reliability and durability.
- **Constructability:** Consideration for ease of construction and impact to the public and environment.
- **Cultural Heritage:** Does the alternative preserve the cultural heritage of the bridge?
- **Aesthetics:** How visually appealing is the alternative?
- **Sustainability:** Which Alternative requires less energy to construct and produces the least amount of greenhouse gas emissions?
- **Life-cycle Cost:** What is the cost of the alternative over the design life, including construction costs and the costs for future maintenance requirements?

Alternative B – Timber Truss Reinforcement was recommended and presented as the Preferred Alternative at Public Consultation No. 2.

6.2.3 Value Engineering Workshop

After Public Consultation No. 2, the Region retained a detailed design engineering team experienced with wood heritage structures to complete the EA and the detailed design. The team performed a detailed inspection of the timber truss in 2023. The team then held a VE workshop on March 21, 2023 at the Region's Operations Centre in Cambridge, Ontario. The workshop focus was to review the previous recommendations of the Schedule A+ MCEA (Alternative B presented

at Public Consultation No. 2), and the initial project review by the detailed design (BTE/Entuitive) team (2023).

The VE team was comprised of participants from the Region of Waterloo, Township of Woolwich, BTE, Entuitive, Wendy Shearer Landscape Architect, Sanchez Engineering Inc, Bridge Keepers, DDA, Arcadis, Unterman McPhail Associates, Cambrium Infrastructure, and Moses Structural Engineers. The Township of Woolwich Mayor and local Councillors were also in attendance.

The purpose of the workshop was to identify design objectives for the rehabilitation of the bridge and ideas to be considered in selecting rehabilitation improvements to the bridge.

The study utilized the initial phases of the 6-phase job plan of SAVE International to define the necessary project requirements and prioritize elements. This was achieved through the three VE primary stages: pre-workshop, workshop, and post-workshop activities. The workshop focus was on the function analysis and creativity phases.

The pre-workshop activities included data collection and analyzing and reviewing study materials supplied by the Region and Design Team.

A 1-day workshop was held on March 21, 2023 to analyze functional requirements of the project, as well as generate, evaluate and develop ideas for alternative value enhancements to move forward with this project. The exercise was for the VE workshop to review the project definition and to then question all previous decisions before carrying forward a short list of preliminary design approaches to consider in greater detail i.e., value proposals (either related to cost or performance) to improve the project within affordability constraints.

The VE methodology is an interactive team approach that focuses on the functions that the project must deliver to achieve the needed balance between competing objectives and perspectives. For this project, the Workshop participants developed a common understanding of the problem, priorities of the community and defined their expectations. With this knowledge, they were able to identify feasible ideas for consideration by the owner and design team.

A long list of value proposals (82 ideas) were generated that had the opportunity to improve value (i.e., improve performance, constructability or reduce life cycle costs) while meeting the required performance. Through an evaluation exercise, this long list was then short-listed to 55 ideas.

The workshop team achieved consensus for the following conclusions and recommendations. The design team considered the previously presented Alternative A and B, as well as various value proposals aimed at improving the structure and surrounding landscape. The key recommendations for each alternative bridge type included:

- Set the posted load limit of the bridge to 3 tonnes (to maintain service to existing traffic and not attract larger vehicles to the bridge) and design for a minimum live load of 5 tonnes.
- Improve signage to restrict vehicles that are not permitted (weight and height).
- Improvements to hydraulic capacity and or designing for hydraulic loading caused by large storm events (preservation of the heritage asset from severe weather events which are increasing in frequency and intensity because of global warming).
- The exterior cladding will be removed and replaced if a substantial amount of deterioration has occurred (the exterior cladding is the protective component to preserve the heritage wooden structure).

The VE Workshop results were then reviewed by the design team to further develop rehabilitation alternatives that addressed the function of the project. The Value Engineering Workshop Report is in **Appendix K**.

6.2.4 Public Consultation No. 3 Alternatives and Evaluation

Following the VE Workshop, several alternatives were generated as bridge rehabilitation techniques that could accommodate the travel demand within the Study Area, as well as retain the heritage attributes of the bridge. In developing Preliminary Design Alternatives, several general principles and objectives were considered, including:

- Retention of heritage attributes and respecting the heritage designation of the bridge.
- Consideration of the design live load while maintaining the posted load limit of 3 tonnes.

Preliminary Design Alternatives carried forward are described as follows:

Alternative A New Steel Girders:

Strengthen bridge by addition of two new steel box girders to replace the Bailey trusses (15 tonnes).

- Disengage the existing Bailey trusses from supporting timber trusses and replace with 2 new steel girders and new steel floor beams.
- New steel members will carry all loads acting on bridge even as wood trusses deteriorate.
- Wood trusses remain as secondary structure and ornamentation instead of acting as primary structure.
- Aesthetically similar to the existing bridge with the exception of the bridge soffit.
- Presented as Alternative A at Public Consultation No. 1 and 2.

Alternative B – Timber Truss Reinforcement with FRP:

- Reinforce existing wood members using FRP strips bonded to the bottom chord and remove Bailey trusses.
- Not reversible and results in 80 mm to 300 mm increase in bridge height; and
- Presented as Alternative B at Public Consultation No. 2.

Alternative C Wood Repairs:

The distinguishing factor for all C alternatives is the design vehicular live load and corresponding strengthening needs for repairing specific wood truss members.

- Alternative C1 Wood Repairs (12 tonnes).
- Alternative C2 Wood Repairs (10 tonnes).
- Alternative C3 Wood Repairs (8 tonnes).
- Alternative C4 Wood Repairs (6 tonnes).

Alternatives A, B and C were then evaluated using the Multi-Attribute Trade-off System (MATS) quantitative evaluation process, as described in **Section 7.0**.

6.3 Height Restriction Bar

To prevent oversized vehicles from accessing the bridge, a height restriction bar is recommended. Initially, a height restriction bar was proposed on both the north and south approaches. After hearing the feedback at Public Consultation #3, the south approach was revised to remove the height restriction bar and instead narrow the approach by bringing in the guiderails on each side as shown in Figure 8.

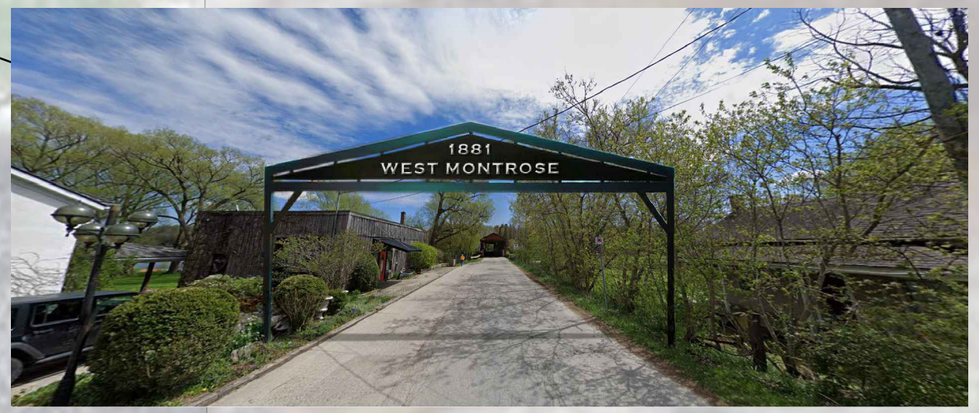
The height restriction bar on the north approach will be between 2.8 to 3.3 m, to be confirmed during detailed design.

COVERED BRIDGE DRIVE

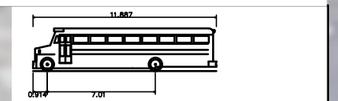
LETSON DRIVE

RIVERS EDGE DRIVE

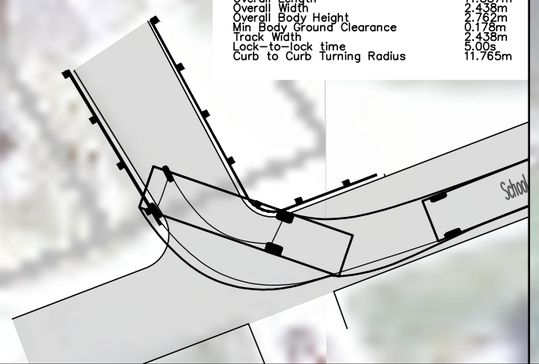
NO HEAVY VEHICLES
CARS ONLY BEYOND THIS POINT

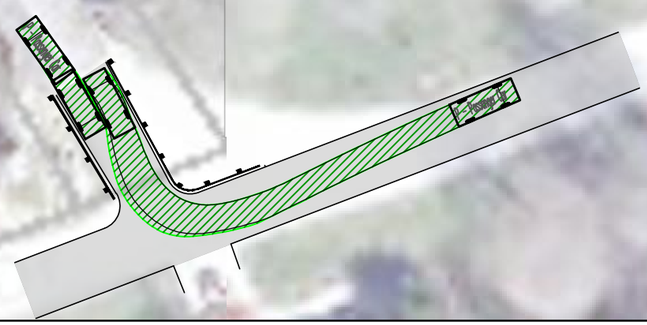


School Bus is Unable to Make a Turn onto the Bridge



School Bus	
Overall Length	11.887m
Overall Width	2.438m
Overall Body Height	2.762m
Min Body Ground Clearance	0.178m
Track Width	2.438m
Lock-to-lock time	5.00s
Curb to Curb Turning Radius	11.765m





BTE 22-058
2024-01-12

West Montrose Covered Bridge
Appendix B - South Approach – Oversized Vehicle Restriction Concept

BT ENGINEERING
BTE

7.0 EVALUATION OF ALTERNATIVES

The evaluation approach is based on a "Weighted Additive Method" which focuses on the differences between the alternatives, addresses the complexity of the base data collected, and provides a traceable decision-making process. The method allows sensitivity tests to be performed because of the matrix configuration of the assessment and the use of numerical scores to measure the impact of the alternatives. The sensitivity tests are also documented in this report. This approach is consistent with MECP practices for the evaluation of numerous and complex alternatives, or for contentious projects. Using the "Weighted Additive Method", overall scores are assigned to each alternative and the alternative with the highest score is selected as the preferred alternative to complete the evaluation.

The initial task in the evaluation is to develop evaluation criteria from which alternatives will be assessed. This process includes the identification of "global" groups of factors followed by the selection of several "local" sub-factors under the global groups.

As an initial step, the evaluation criteria were grouped into broad categories, or factors, established to describe the study specific engineering and environmental concerns. Four factors were selected which were used for each evaluation.

These global factors were:

- Heritage.
- Structural.
- Social Environment.
- Cost.

Within each of these categories (factor groups) are sub-factors which define the measure and the relative differences of the alternatives. The sub-factors were developed from a long list created by the Study Team with input from the public, agencies, stakeholders and interest groups. Where there were no measurable or meaningful differences between alternatives, and it is agreed that the alternatives are generally equal with respect to this criterion, then the sub-factor is not carried forward.

An Evaluation Team was created with subject matter experts including: heritage specialists; structural engineers; timber structure specialists; Region and Township staff; and transportation engineers. If more than one sub-factor generated by the Study Team measured the same thing, then only one criterion was selected to be carried forward.

7.1 Evaluation of Alternatives

The Evaluation Team members were responsible for completing separate weighting exercises which provided independent perspectives of the relative importance of factor groups and sub-factors for each specific evaluation. The results of the weighting exercise are illustrated below in **Figure 6** and **Figure 7**. The Preferred Alternative from the evaluation is **Alternative C2 Wood Repairs (10 tonnes).**

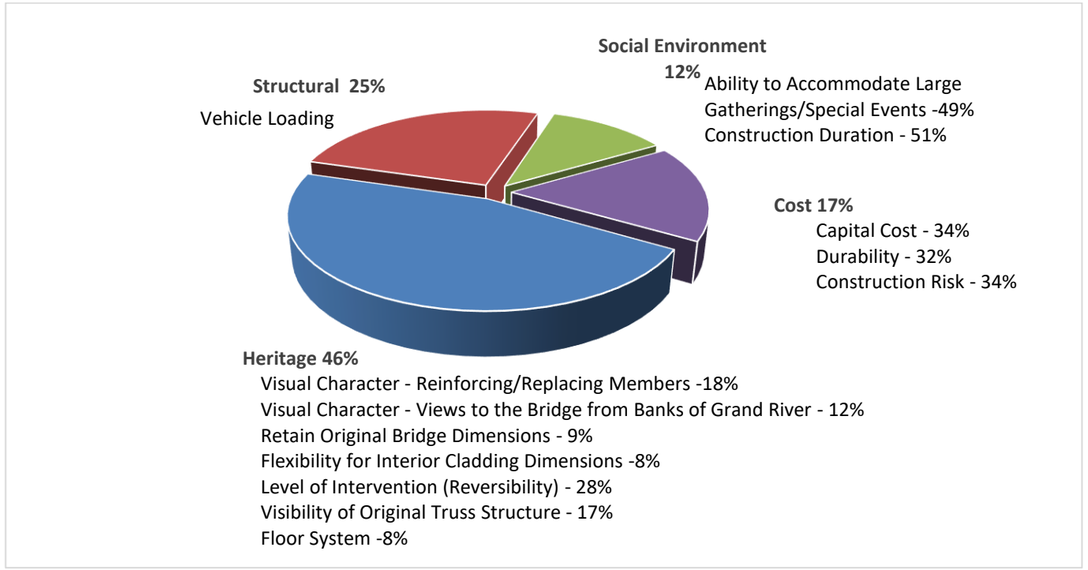


Figure 6: Global Factors and Sub-factor Average Weights

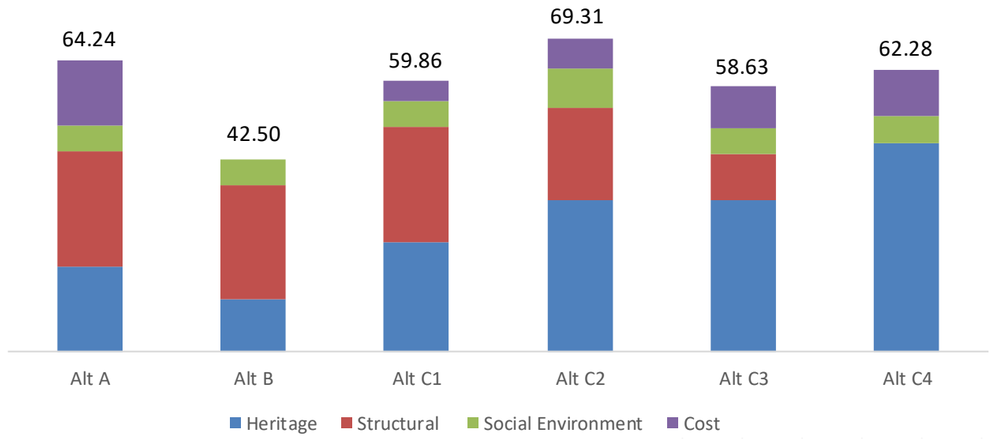


Figure 7: Scores (Average Weights of Evaluation Team)

7.2 Sensitivity Tests

The determination of the relative weights of the evaluation criteria and alternative scores require professional judgment and are not exact. Sensitivity testing is used to check how sensitive the alternative evaluation score is to the weights assigned to each criterion.

There is a spread of weight (values) among the groups of evaluators for the selection of weights (values) assigned to each subfactor during the evaluation. The range is dependent on the value judgment of individuals and specialists. Using the average of a group of evaluators does not necessarily capture the standard deviation among individual scores. Sensitivity testing is conducted to assess the range of weights either higher or lower than the average.

A separate test was completed for each factor using the highest weight (value) given to a global factor by anyone in the Evaluation Team as well as the lowest weight.

Following this methodology, a series of tests were completed varying the weight for each global factor. The three tests included:

- Average Evaluation Team Weight.
- Highest Weight in a factor group by any Evaluation Team member.
- Lowest Weight in a factor group by any Evaluation Team member.

Following this series of tests, the results were reviewed to assess whether the preferred alternative changed when the weights were varied.

This information alone is not the only justification for selecting a particular alternative, but it provides a level of confidence in the selection and the ability to assess trade-offs. This information is considered and used in the decision-making process before a TPA is recommended to be carried forward. The results of the sensitivity testing were presented at Public Consultation No. 3 and are shown in **Table 3.** The results indicate there are trade-offs with Alternative C2, which consistently came second or third in the sensitivity tests. However, using the average weights provides the best overall performing alternative in all categories, balancing heritage and structural importance. Alternative C2 is recommended to be carried forward as the TPA.

Table 3: Sensitivity Testing

		Alt A	**Alt B**	**Alt C1**	**Alt C2**	**Alt C3**	**Alt C4**
FACTORS	WEIGHT	64.24	42.50	59.86	69.31	58.63	62.28
TAC Weights		2	6	4	1	5	3
Heritage	High	5	6	4	2	3	1
	Low	1	6	5	3	4	2
Structural	High	1	4	2	3	6	5
	Low	4	6	5	2	3	1
Social Environment	High	2	6	5	3	4	1
	Low	1	6	5	3	4	2
Cost	High	1	6	5	3	4	2
	Low	2	6	4	3	5	1

The Analysis and Evaluation Report is in **Appendix L**.

8.0 RECOMMENDED PLAN

The Recommended Plan is a combination of the TPA and refinements based on public, agency and stakeholder input from Public Consultation No. 3. It includes overall strengthening of the bridge by repairs or replacement of specific wooden truss members. The existing steel Bailey truss will be removed, and the wooden trusses will be the primary structural system carrying 100% of the vehicular live load and the entire weight of the bridge. The design vehicular live load for the rehabilitation is 10 tonnes, while the posted load limit will remain at 3 tonnes.

The recommended design concept proposes the following:

1. Reducing the existing sag on the bridge
2. Replacing the roof with new cedar shingles.
3. Replacing the red exterior wooden cladding, matching the existing paint colour.
4. Replacing the window louvres
5. Removing the existing steel Bailey truss
6. Reinstating the tar and chip wearing surface after replacement of the nail-laminated deck.
7. Hanger Rods: Replace with new steel rods.
8. Replacing the roof rafters as necessary
9. Replacing the tie beams, as necessary
10. Replacing the wooden curbs
11. Replacing the interior light bulbs as necessary
12. Needle Beams: Replacing the needle beams with new 16” x 16” Douglas fir beams
13. Floor Beams: Replacing the floor beams with new 16” x 16” Douglas fir beams
14. Stone mortar repairs and placement of scour protection at the bridge pier
15. Replacing the external sway bracing
16. Stringers: Replace in kind (i.e. sawn wood stringers).
17. Replacing the existing nail-laminated wooden deck
18. Removing the Bailey truss hanger system
19. Removing the non-functioning tension rods (1959)
20. Bottom Lateral Bracing: Replace in kind (i.e., steel threaded rods with turnbuckles).
21. Bottom Chords: Replace with new Douglas Fir chords. This will involve adapting the ends of all diagonals and lower diagonals at the bottom chords to receive the replacement bottom chord members
22. Repairing the concrete at the bridge abutments and placing scour protection at the abutments
23. Keeping the same bridge deck elevation and approach grades
24. Adding a height restriction bar to prevent heavy vehicles from using the bridge
25. Fire protection: Apply fire-retardant to all existing wood surfaces; apply pressure-impregnated fire retardant to all new cladding and roof elements.
26. Replacing the end diagonals at the pier and strengthening the end diagonals at the abutments
27. Adding new overhead wood lateral bracing.
28. Adding a new timber guiderail
29. Reinforcing the top chord with the lower top chord
30. Removing the interior cladding and reinstatement in short sections at each end of the bridge

Items #1 to #25 are common to all of the alternatives that were considered. Items #26 to #30 are specific to the Preferred Alternative C2 – Wooden Truss Repairs to a 10 tonne design live load limit.

Additionally, the following will be performed:

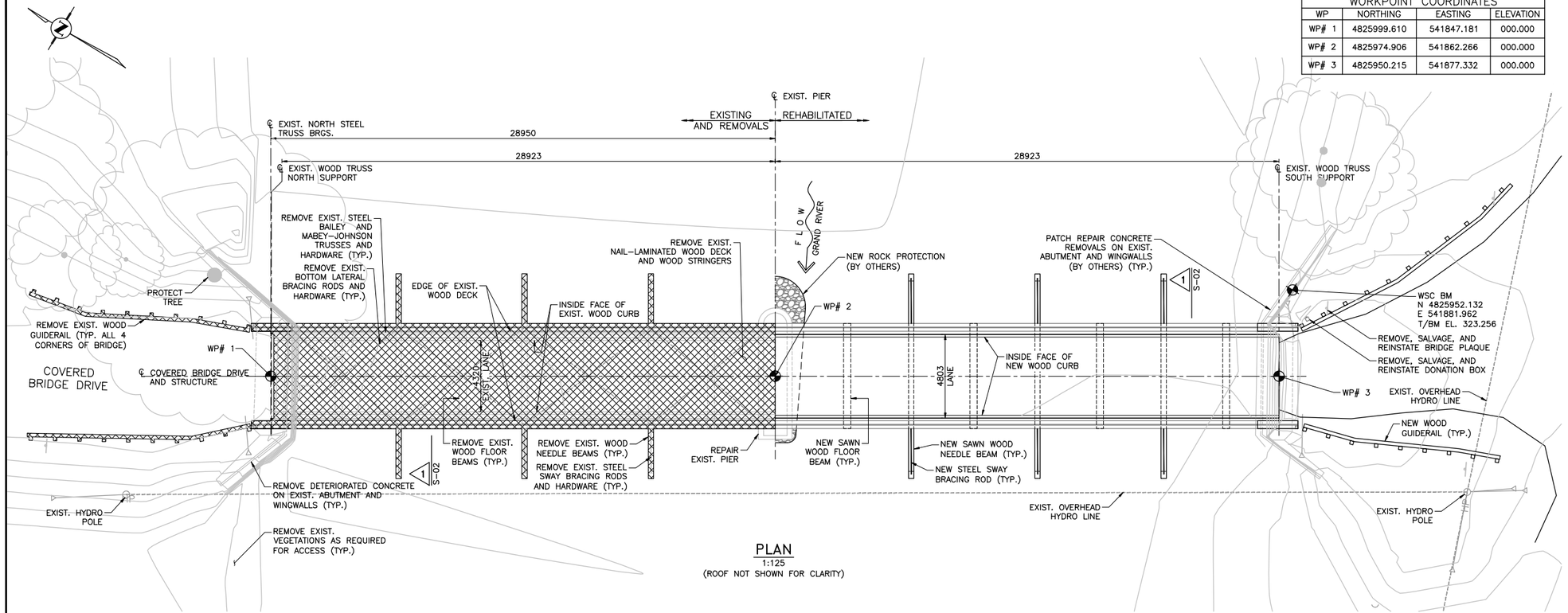
- All new cladding and roof elements will be incised and pressure-treated with permissible wood preservative (likely water-borne preservative).
- Replace bolster beams with elastomeric bearings on concrete pedestals
- Repair checks and splits in existing wood members by injecting with epoxy resin and reinforcing with screws.
- Eliminate racking by means of replumbing trusses. Additional means of rack prevention will be investigated including replacement of tie beams at top chord level and/or installation of ship’s knees (some ship’s knees already exist).
- Locally replace the upper end of lower diagonal member LD10 due to decay

Replacement wooden truss members will be comprised entirely of sawn wood elements. Glulam and other engineered wood products will not be used.

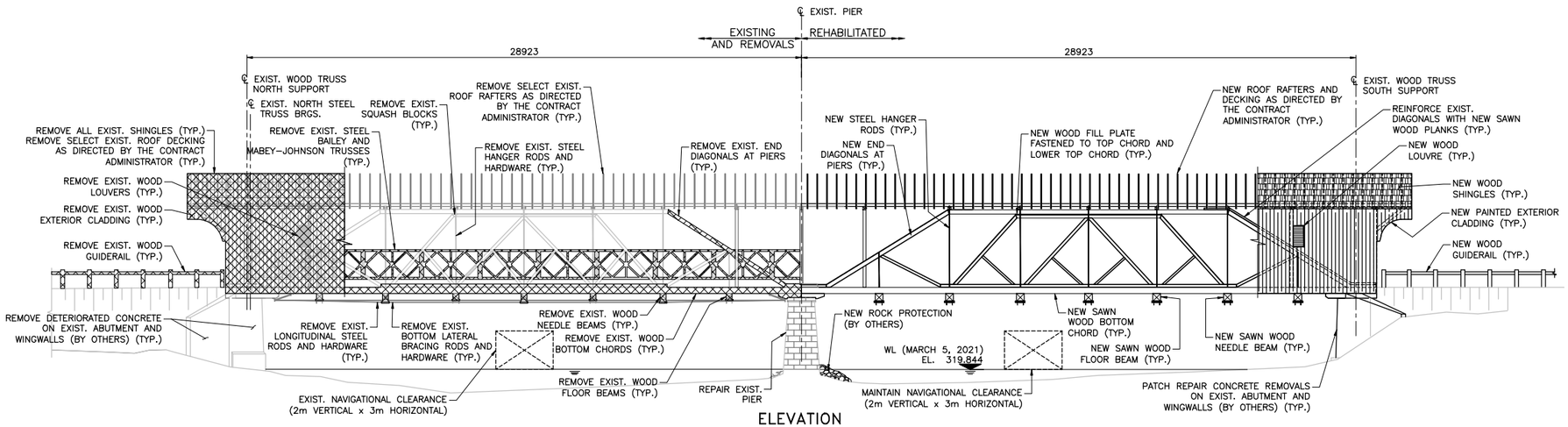
Preliminary general arrangement drawings are in **Figure 8** and **Figure 9**. The construction laydown area and preliminary property access is in **Figure 10**. Renderings of Alternative C2 are in **Figure 11** to **Figure 19**.

A key consideration of the EA was a request from the Township of Woolwich Heritage Committee to consider changing the operation of the bridge to restrict vehicular traffic. Closing the bridge to vehicular traffic would not result in a significant delay to vehicular traffic, however, horse and buggies would still need to be permitted on the bridge. While signage can be posted that restricts motorized vehicles from using the bridge, it would be difficult to physically prevent all vehicles from accessing the bridge while maintaining adequate passage for horse & buggies. After public consultation on this topic, the design is proceeding as originally intended, with the Covered Bridge being rehabilitated to remain open to vehicles not exceeding 3 tonnes. This recommendation was supported by Regional Council.

WORKPOINT COORDINATES			
WP	NORTHING	EASTING	ELEVATION
WP# 1	4825999.610	541847.181	000.000
WP# 2	4825974.906	541862.266	000.000
WP# 3	4825950.215	541877.332	000.000



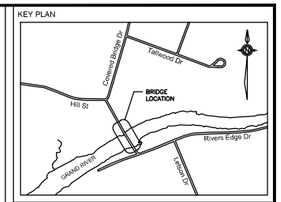
PLAN
1:125
(ROOF NOT SHOWN FOR CLARITY)



ELEVATION
1:125
(ROOF AND EXTERIOR CLADDING NOT SHOWN ALONG FULL LENGTH FOR CLARITY)

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

KEY PLAN



DISCLAIMER:
THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS, AND OTHER UNDERGROUND AND ABOVE GROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

NOT FOR CONSTRUCTION

ENTUITIVE

Region of Waterloo

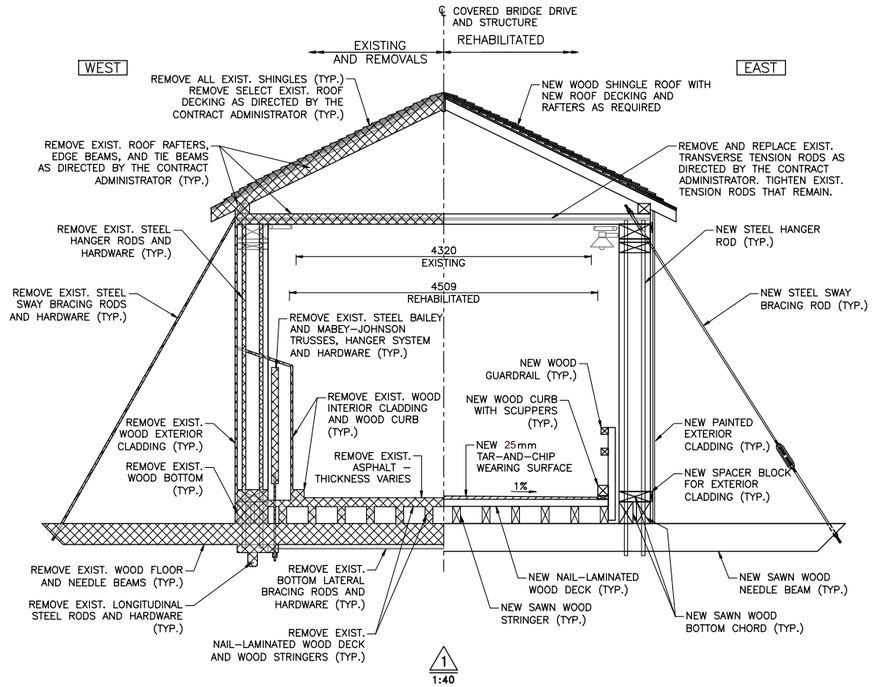
No.	ISSUE/REVISION	BY	DATE
1	ISSUED FOR PRE–60% REVIEW	A.L.	2024/08/02

REHABILITATION OF WEST MONTROSE COVERED BRIDGE

GENERAL ARRANGEMENT I

DRAWN BY: G.D.	CONTRACT No. 2024–XXX
CHECKED BY: A.L.	FILE No.
DATE: November 15, 2023	DRAWING No. S–01
SCALE 1:125	SHEET No. OF
LAYOUT NAME:	

FILEPATH: \\ENTUITIVE.LOCAL\Data\Projects\2022\2022-0220 West Montrose Covered Bridge\4 Draft\43 Structural\S-01 West Montrose_Covered Br_Struct_Rehab.dwg Aug 02, 2024 - 1:49pm



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1:40

LEGEND:

– DENOTES EXIST. MATERIAL

– DENOTES REMOVAL OF EXIST. MATERIAL

– DENOTES ASPHALT

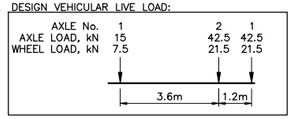
ABBREVIATIONS

ABUT. – DENOTES ABUTMENT
BRGS. – DENOTES BEARINGS
C.J. – DENOTES CONSTRUCTION JOINT
CONC. – DENOTES CONCRETE
EXIST. – DENOTES EXISTING
EL. – ELEVATION
MIN. – DENOTES MINIMUM
T/D – DENOTES TOP OF DECK
TYP. – DENOTES TYPICAL
U.N.O. – DENOTES UNLESS NOTED OTHERWISE
WO – DENOTES WORKPOINT
CJ – CONSTRUCTION JOINT
T/P – TOP OF PAVEMENT
WP – WORKING POINT

GENERAL NOTES:

DESIGN LOADING

1. DESIGN CODE: CSA S6:19 CANADIAN HIGHWAY BRIDGE DESIGN CODE
2. DESIGN VEHICULAR LIVE LOAD:



3. DESIGN WHEEL FOOTPRINT = 0.6m WIDE X 0.25m LONG
4. DESIGN VEHICULAR LANE LOAD: 2.4 kPa APPLIED UNIFORMLY OVER ENTIRE DECK
5. DESIGN PEDESTRIAN LOAD: 4.0 kPa APPLIED ACROSS FULL DECK WIDTH AND ALONG 2.5m DECK LENGTH (ASSUMED 70 PERSON OCCUPANCY)
6. DESIGN EQUESTRIAN LOAD: 5 kN APPLIED OVER 0.1m X 0.1m FOOTPRINT
7. DESIGN WIND LOAD: $q_{1/50}$ =370 Pa, Ce =1.0, Cg =2.0, Ch =1.3, Cv =1.0
8. DESIGN SNOW LOAD:
   1) UNIFORM = 1.6 kPa
   2) NON–UNIFORM = 2.1 kPa (WINDWARD HALF) + 0.5 kPa (LEEWARD HALF)
9. DESIGN STORM EVENT: REGIONAL FLOOD (HWL EL. 324.26m)
10. FLOOD LOADING:
    HYDROSTATIC DRAG = 6.4 kN/m
    HYDRODYNAMIC DRAG = 11.4 kN/m
    HYDROSTATIC UPLIFT = 22.5 kN/m
    HYDRODYNAMIC UPLIFT = –0.14 kN/m

STRUCTURAL WOOD

1. ALL LUMBER SHALL CONFORM TO THE STANDARD GRADING RULES OF THE NATIONAL LUMBER GRADES AUTHORITY AND TO CSA O86–19.
2. ALL WOOD SHALL BE STRUCTURALLY SOUND AND FREE OF SPLITS, CRACKS, AND LOOSE AND OPEN KNOTS.
3. ALL SPECIFIED WOOD SIZES ARE DRESSED SIZES UNLESS NOTED OTHERWISE.
4. ALL WOOD SHALL BE PRESSURE PRESERVATIVE TREATED IN ACCORDANCE WITH CAN/CSA–O80 AND AWPA STANDARDS M1, M2, AND M4. THE USE CATEGORY SHALL BE U4.1. ALL WOOD IN THE CURBS AND GUARDRAILS SHALL BE TREATED WITH A PRESERVATIVE PERMITTED FOR DIRECT PEDESTRIAN CONTACT PER THE CANADIAN HIGHWAY BRIDGE DESIGN CODE.
5. ALL TREATED WOOD SHALL BE CUT TO FINISHED SIZE. ALL SURFACING, HOLES, AND OTHER CUTS SHALL BE COMPLETED PRIOR TO PRESSURE PRESERVATIVE TREATMENT.
6. NO CHAINS, HOOKS, OR PEAVES SHALL BE USED IN HANDLING TREATED WOOD. SURFACES EXPOSED BY FIELD CUTTING OR DRILL SHALL BE TREATED BY SOAKING WITH AN APPROVED PRESERVATIVE EQUAL IN TOXICITY TO THE ORIGINAL PRESERVATIVE. THREE APPLICATIONS ARE REQUIRED, EACH TO AIR DRIED SURFACES.
7. NAILS AND SPIKES SHALL CONFORM TO THE REQUIREMENTS OF CSA B111, "WIRE NAILS, SPIKES AND STAPLES" FOR COMMON ROUND WIRE NAILS OR COMMON SPIRAL NAILS. USE SPIRAL NAILS FOR ALL PERMANENT NAILING UNLESS NOTED OTHERWISE. NAILING SHALL CONFORM TO THE REQUIREMENTS OF PART 9 OF THE ONTARIO BUILDING CODE.
8. THE CONTRACTOR SHALL ENSURE THE STABILITY OF ALL COMPONENTS DURING HANDLING, TRANSPORTATION, AND ERECTION UNTIL THE WOOD FRAMING IS IN ITS FINAL LOCATION WITH ALL PERMANENT BRACING, CONNECTIONS, AND SUPPORTS IN PLACE.
9. PLACE LUMBER MARKINGS DOWN OR AWAY FROM VISIBLE FACES OF WOOD WHERE POSSIBLE. REMOVE ALL STAPLES AND TAGS.
10. ALL WOOD SHALL BE SEASONED TO A MAXIMUM 20% MOISTURE CONTENT BEFORE INSTALLATION.

STRUCTURAL STEEL

1. ALL STRUCTURAL STEEL SHALL CONFORM TO CSA G40.20/G40.21 GRADE 350AT. THE CHARPY IMPACT ENERGY REQUIREMENTS SHALL BE 27 JOULES AND THE TEST TEMPERATURE SHALL BE –20°C.
2. BOLTS ON ATMOSPHERIC CORROSION RESISTANT STEEL SHALL BE ASTM F3125/F3125M, GRADE A325 TYPE 3. BOLT THREADS SHALL BE EXCLUDED FROM THE SHEAR PLANES.
3. BOLTS CLAMPING WOOD COMPONENTS SHALL BE TIGHTENED TO A SNUG–TIGHT CONDITION ONLY. BOLTS CLAMPING STRUCTURAL STEEL COMPONENTS SHALL BE PRETENSIONED PER CSA S6:19.
4. ALL WELDING IS TO CONFORM TO CSA STANDARD W59.1 AND IS TO BE UNDERTAKEN BY A FABRICATOR QUALIFIED IN ACCORDANCE WITH CSA STANDARD W47.1.
5. UNLESS NOTED OTHERWISE, THE MINIMUM FILLET WELD SHALL BE AS FOLLOWS:

MATERIAL THICKNESS OF THICKER PART JOINED (mm)	MINIMUM SIZE OF FILLET WELD (mm)
TO 12 INCLUSIVE	5
OVER 12 TO 20	6
OVER 20 TO 40	8
OVER 40 TO 60	10
OVER 60 TO 120	12

6. THE CONTRACTOR SHALL ENSURE THE STABILITY OF ALL COMPONENTS DURING HANDLING, TRANSPORTATION, AND ERECTION UNTIL THE STRUCTURAL STEEL IS IN ITS FINAL LOCATION WITH ALL PERMANENT BRACING, CONNECTIONS, AND SUPPORTS IN PLACE.

SCOPE OF WORK

THE GENERAL SCOPE OF REHABILITATION WORK OUTLINE BELOW AND DESIGNATED ON THIS DRAWING SHALL BE CONSIDERED SYMMETRICAL ABOUT THE CENTRELINE OF THE STRUCTURE, UNLESS NOTED OTHERWISE. IT IS NOT PRESENTED IN A SUGGESTED OR RESTRICTIVE SEQUENCE.

REMOVAL

1. REMOVE THE EXISTING SHINGLES AND DETERIORATED ROOF DECKING AND RAFTERS.
2. REMOVE THE EXTERIOR AND INTERIOR CLADDING.
3. REMOVE THE EXISTING FLOOR SYSTEM (TAR AND CHIP WEARING SURFACE, NAIL–LAMINATED DECK AND CURBS, STRINGERS, FLOOR BEAMS, AND NEEDLE BEAMS).
4. REMOVE THE EXISTING SWAY BRACING AND ASSOCIATED HARDWARE.
5. REMOVE THE EXISTING TRUSS HANGER RODS AND ASSOCIATED HARDWARE
6. REMOVE THE EXISTING STEEL RODS AND ASSOCIATED HARDWARE UNDER THE DECK (LONGITUDINAL BOTTOM CHORD REINFORCING RODS, BOTTOM LATERAL BRACING RODS, AND BAILEY TRUSS HANGERS).
7. REMOVED THE EXISTING STEEL BAILEY TRUSSES.
8. REMOVE THE WOOD TRUSS MEMBERS THAT ARE INDICATED FOR REPLACEMENT.

REPAIRS AND NEW CONSTRUCTION

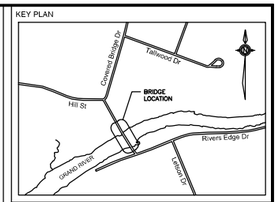
1. REPLACE THE TRUSS BOTTOM CHORD MEMBERS.
2. LOCALLY REPLACE OR ADJUST THE BOTTOM ENDS OF THE DIAGONAL AND LOWER DIAGONAL MEMBERS AS NECESSARY TO CONNECT WITH NEW BOTTOM CHORDS.
3. REPLACE THE END DIAGONALS AT THE PIERS.
4. REINFORCE THE END DIAGONALS AT THE ABUTMENTS.
5. REINFORCE THE TOP CHORDS AND LOWER TOP CHORDS BY MAKING THEM COMPOSITE.
6. INSTALL THE NEW WOOD FLOOR SYSTEM (FLOOR BEAMS AND NEEDLE BEAMS, STRINGERS, AND NAIL–LAMINATED DECK).
7. INSTALL THE NEW BOTTOM LATERAL BRACING.
8. INSTALL THE NEW CURBS AND GUARDRAILS.
9. REPLACE ALL DETERIORATED ROOF DECKING AND RAFTERS AND INSTALL NEW SHINGLES.
10. CONSTRUCT THE NEW EXTERIOR CLADDING.
11. CONSTRUCT THE NEW INTERIOR CLADDING AT ENDS OF BRIDGE.
12. PAVE THE DECK WITH A NEW TAR AND CHIP WEARING SURFACE.

CONSTRUCTION NOTES:

1. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, DETAILS AND ELEVATIONS OF THE EXISTING STRUCTURE THAT ARE RELEVANT TO THE WORK SHOWN ON THE DRAWINGS PRIOR TO THE COMMENCEMENT OF THE WORK. ANY DISCREPANCIES SHALL BE REPORTED TO THE CONTRACT ADMINISTRATOR AND THE PROPOSED ADJUSTMENT OF THE WORK TO MATCH THE EXISTING STRUCTURE SHALL BE SUBMITTED FOR APPROVAL.
2. TYPICAL AREAS OF REPAIRS ARE INDICATED ON THE DRAWINGS. WHERE REPAIR LIMITS ARE NOT SHOWN, LIMITS SHALL BE IDENTIFIED BY THE CONTRACT ADMINISTRATOR.
3. ANY DAMAGE DURING CONSTRUCTION TO THE EXISTING STRUCTURE NOT DESIGNATED FOR REPAIR, UTILITIES, AND ADJACENT PROPERTIES SHALL BE REPAIRED BY THE CONTRACTOR TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR AT NO COST TO THE OWNER.
4. THE CONTRACTOR IS FULLY RESPONSIBLE FOR ADEQUATE PROTECTION OF ALL UTILITIES, SERVICES, ROADWAYS, AND THE ENVIRONMENTS.
5. THE CONTRACTOR SHALL PROVIDE DEBRIS PLATFORM AND NECESSARY CONTAINMENT MEASURES DURING CONSTRUCTION TO COLLECT FALLING CONCRETE AND CONSTRUCTION DEBRIS AND ENSURE THAT NO DEBRIS OR MATERIALS RESULTING FROM REMOVAL ENTER THE WATERCOURSE AND OTHER AREAS BELOW THE BRIDGE.
6. THE CONTRACTOR SHALL NOT PERMIT ANY TOOLS, EQUIPMENT, VEHICLES, TEMPORARY STRUCTURES OR PARTS THEREOF USED OR MAINTAINED FOR THE PURPOSE OF BUILDING OR PLACING A WORK IN A NAVIGABLE WATER TO REMAIN IN THE WATER AFTER COMPLETION OF THE PROJECT. WHERE A WORK OR A PART OF A WORK THAT IS BEING CONSTRUCTED OR MAINTAINED IN A NAVIGABLE WATER CAUSES DEBRIS OR OTHER MATERIAL TO ACCUMULATE ON THE BED OR ON THE SURFACE OF SUCH WATER, THE CONTRACTOR OF THAT WORK OR PORTION OF THAT WORK SHALL REMOVE THE MATERIAL OR DEBRIS TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR AND REGULATORY AUTHORITY.
7. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING THE STABILITY OF THE ORIGINAL STRUCTURE DURING CONSTRUCTION. CONSTRUCTION VEHICLES, EQUIPMENT, ERECTION OF GIRDERS, AND OTHER CONSTRUCTION ACTIVITIES SHALL NOT IMPOSE LOADS THAT EXCEEDS THE CAPACITY OF THE EXISTING STRUCTURE AND THE TEMPORARY SUPPORT SYSTEM DESIGNED AND INSTALLED BY THE CONTRACTOR.
8. THE CONTRACTOR IS RESPONSIBLE FOR THE DESIGN OF A TEMPORARY SUPPORT SYSTEM THAT IS CAPABLE OF CARRYING ALL LOADS DURING CONSTRUCTION AND WILL MAINTAIN THE STABILITY OF THE ORIGINAL STRUCTURE. THE CONTRACTOR SHALL SUBMIT THE STAMPED STRUCTURAL ANALYSIS RESULTS AND DESIGN CALCULATIONS TO THE CONTRACT ADMINISTRATOR FOR REVIEW.
9. ALL WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE CSA S6:19 CANADIAN HIGHWAY BRIDGE DESIGN CODE AND THE ONTARIO BUILDING CODE.
10. WHERE REFERENCE IS MADE TO A CSA OR ASTM STANDARD, THE LATEST EDITION IS IMPLIED, INCLUDING ALL UPDATES, SUPPLEMENTS, AND ADDENDUMS.

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

KEY PLAN



DISCLAIMER:
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NOT FOR CONSTRUCTION

ENTUITIVE

Region of Waterloo

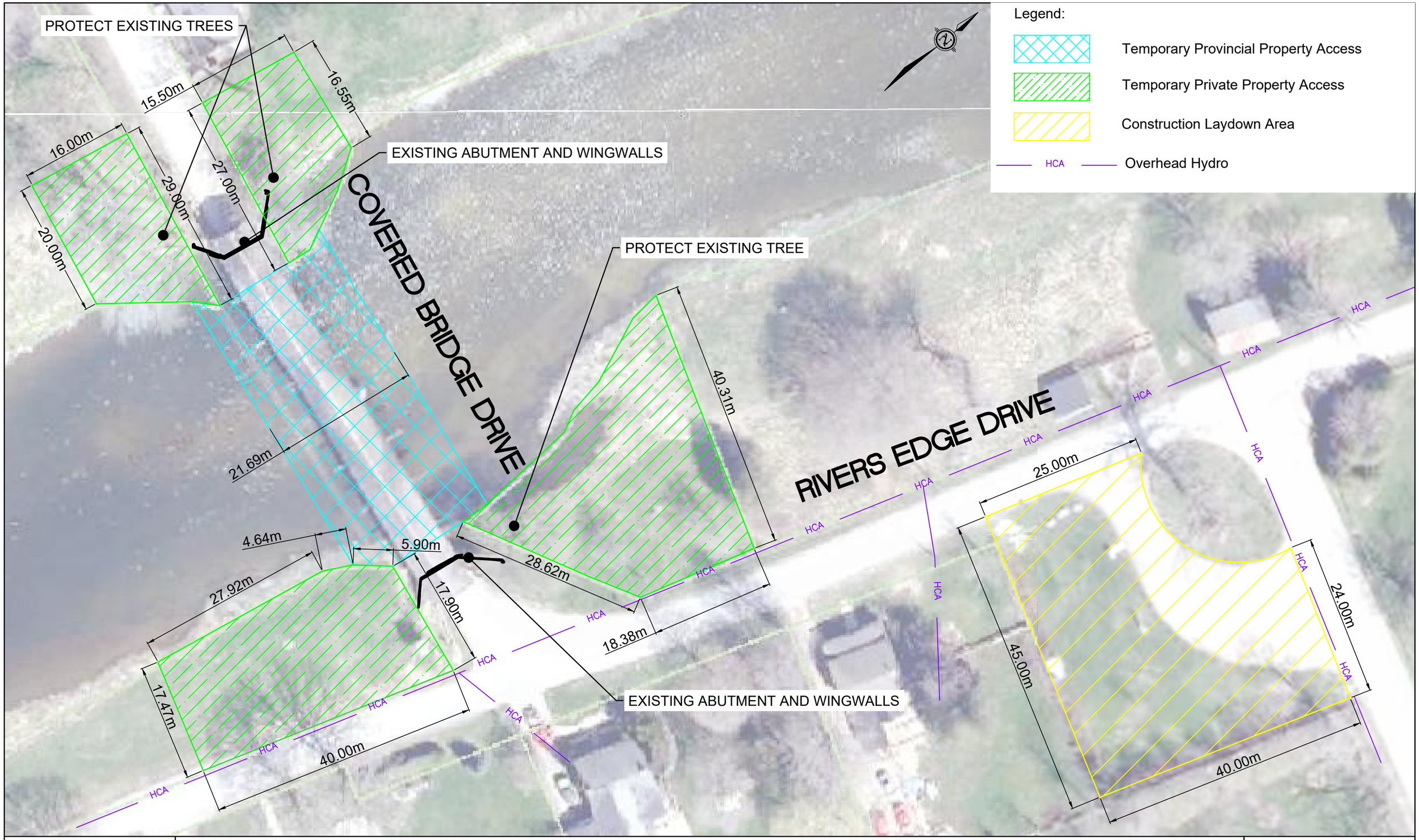
No.	ISSUE/REVISION	BY	DATE
1	ISSUED FOR PRE–60% REVIEW	A.L.	2024/08/02

REHABILITATION OF WEST MONTROSE COVERED BRIDGE

GENERAL ARRANGEMENT II

DRAWN BY: G.D.	CONTRACT No. 2024–XXX
CHECKED BY: A.L.	FILE No.
DATE: November 15, 2023	DRAWING No. S–02
SCALE AS SHOWN	SHEET No. OF
LAYOUT NAME:	

FILEPATH: \\ENTUITIVELOCAL\Data\Projects\2022\2022-0233 West Montrose Covered Bridge\4 Draft\43 Struct\433 CAD\S-01 West Montrose_Covered Br_Struct_Rehab.dwg Aug 02, 2024 - 1:00pm



BTE 22-058 2023-11-22	**West Montrose Covered Bridge** Preliminary Construction Laydown Area and Property Access	BT ENGINEERING BTE

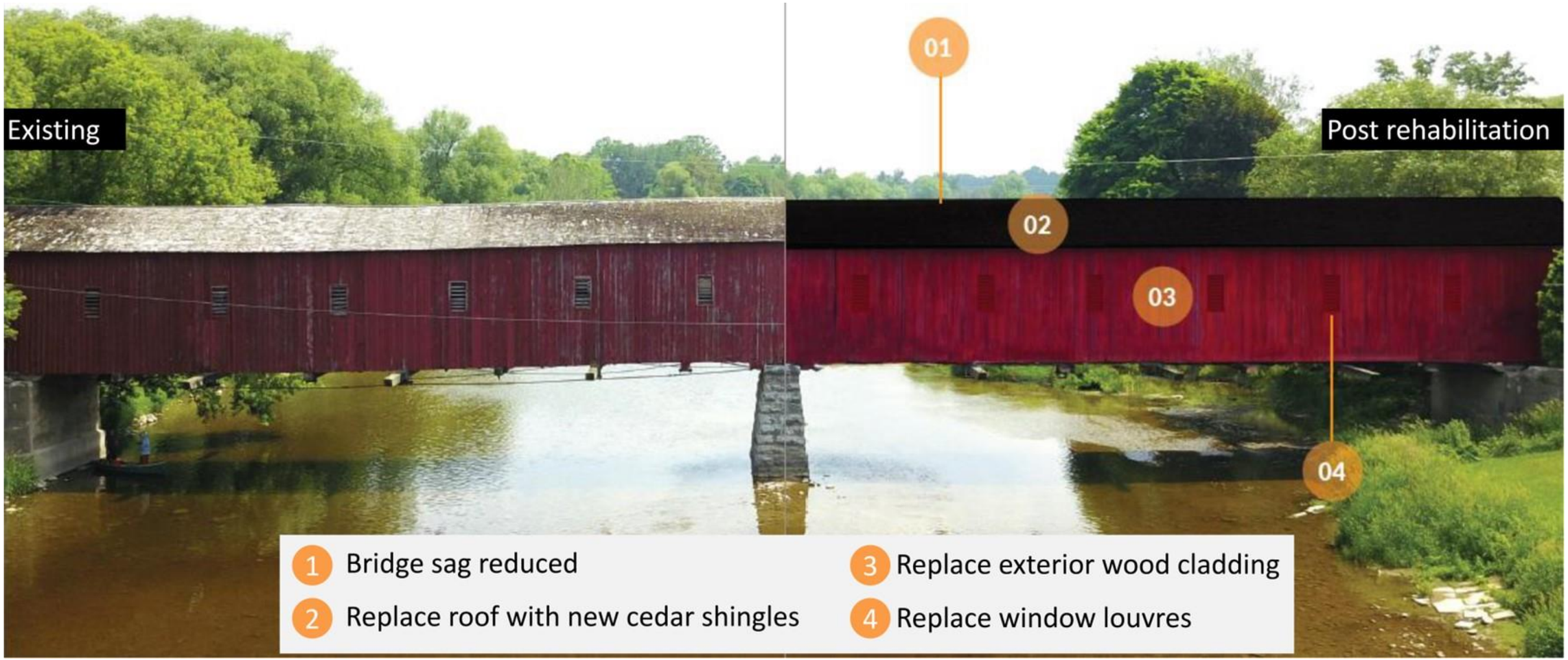


Figure 11: Proposed Rehabilitation for the Recommended Plan - Exterior

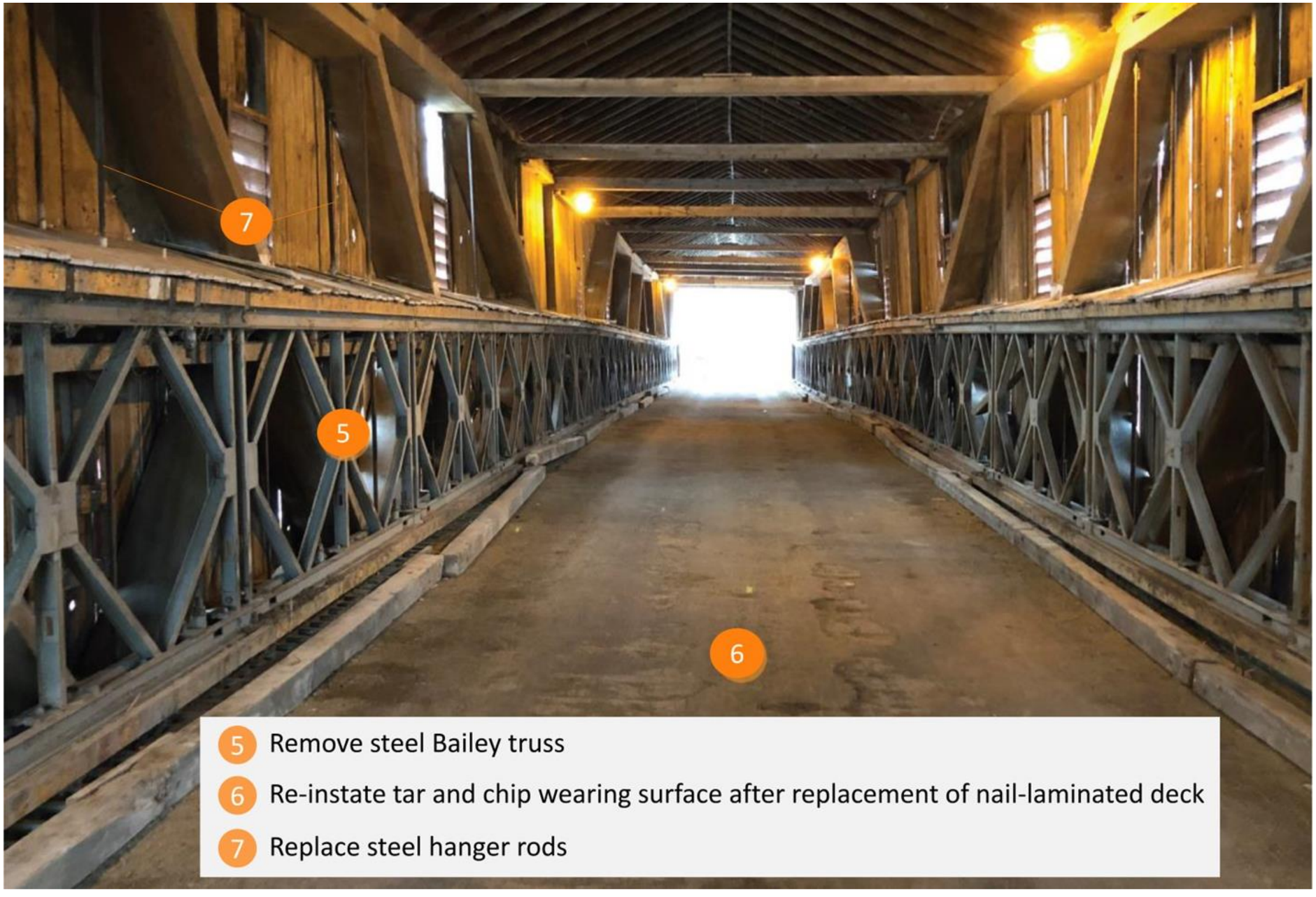


Figure 12: Proposed Rehabilitation for the Recommended Plan - Interior



Figure 13: Proposed Rehabilitation for the Recommended Plan - Interior



Figure 14: Proposed Rehabilitation for the Recommended Plan - Exterior

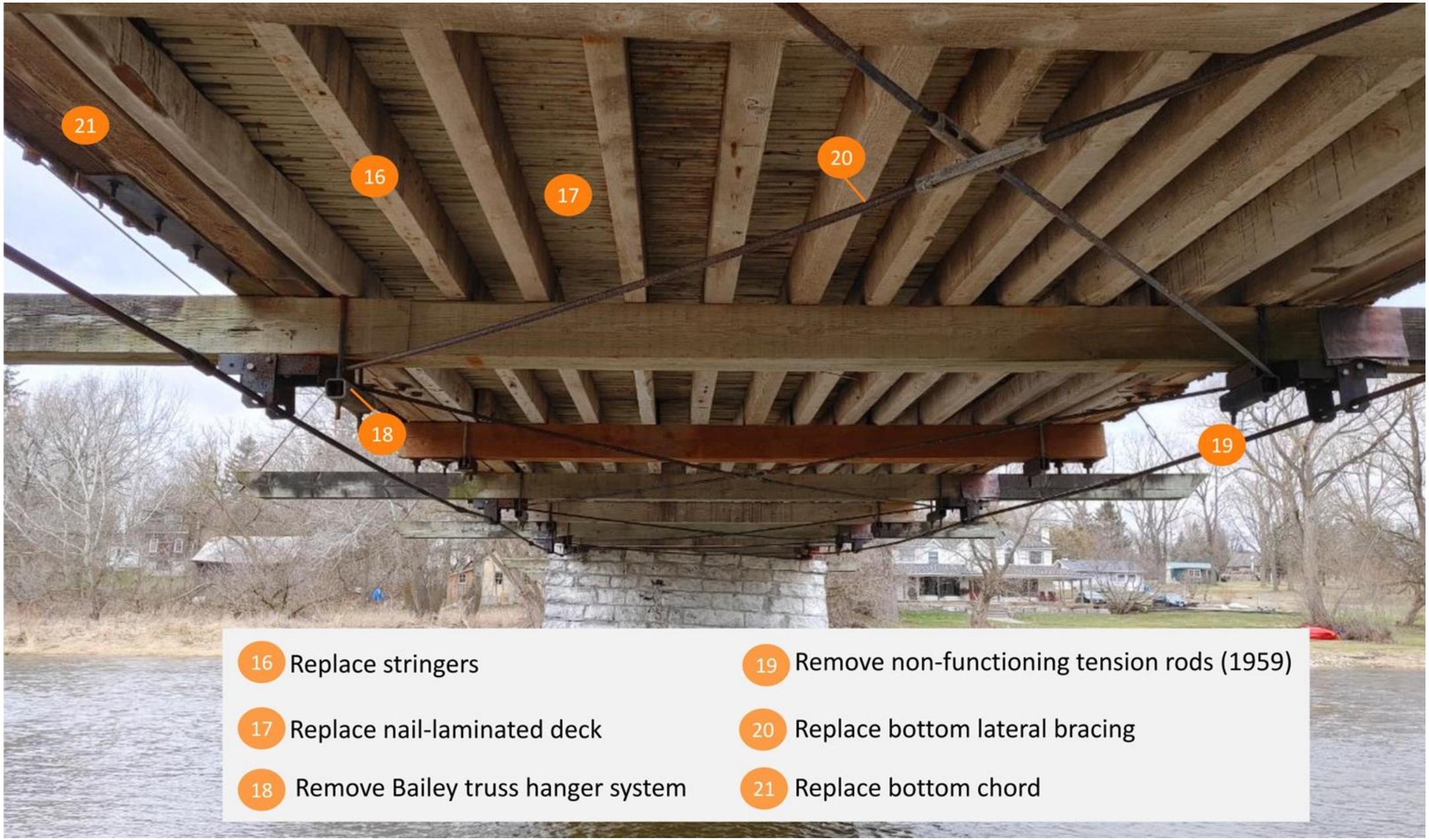


Figure 15: Proposed Rehabilitation for the Recommended Plan - Soffit



Figure 16: Proposed Rehabilitation for the Recommended Plan - Soffit



Figure 17: Proposed Rehabilitation for the Recommended Plan - Truss and Deck Level

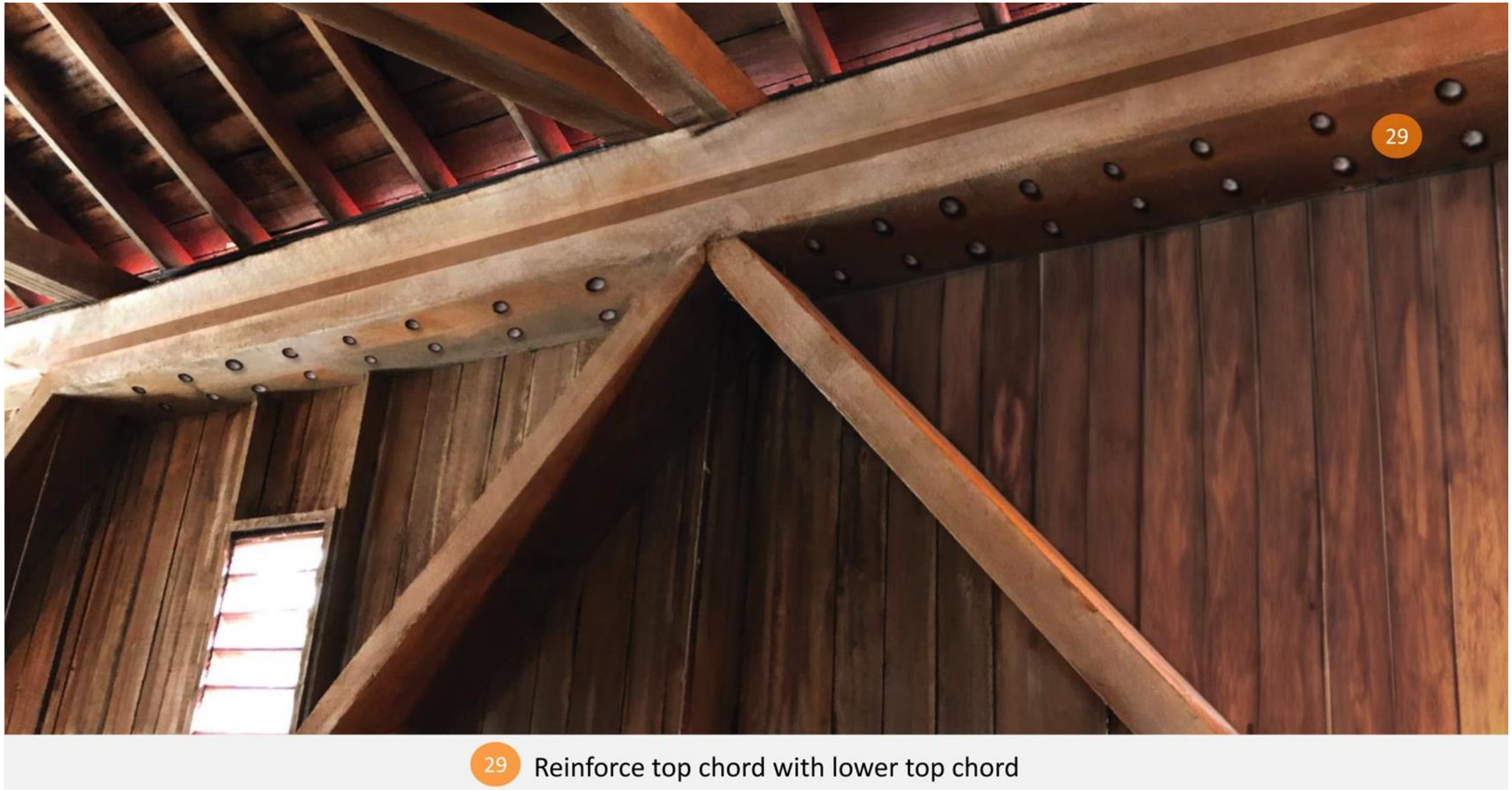


Figure 18: Proposed Rehabilitation for the Recommended Plan - Top Chord

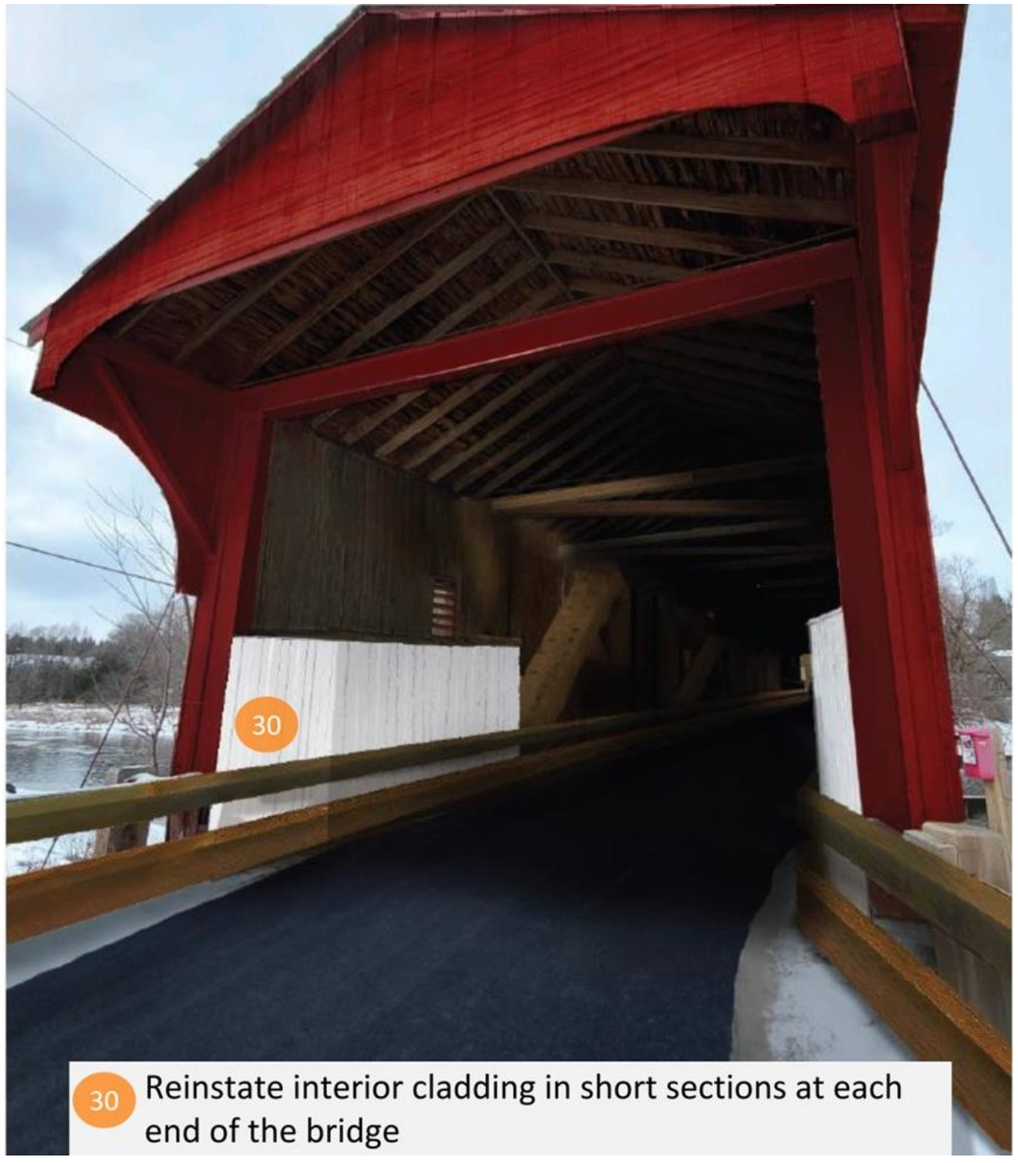


Figure 19: Proposed Rehabilitation for the Recommended Plan - Interior Cladding

8.1 Endorsement of the Recommended Plan

The Preferred Design Concept was presented to the Township of Woolwich Heritage Committee and to the Region of Waterloo Council where it was endorsed. The resolutions are included in **Appendix M.**

8.2 Cost Estimate

The preliminary cost estimate for the Recommended Plan is $6, 058,000, including an allowance for contingency. This project is being partially funded by the Investing in Canada Infrastructure Program, Community, Culture and Recreation (CCR) Stream, with a 40% contribution from the Federal Government and a 33.33% contribution from the Provincial Government.

8.3 Project Schedule and Construction Process

Construction is planned to begin in Spring 2025 and be complete by Spring 2026. It is important that this work begin in 2025 to prevent further deterioration of the bridge and any historic timber truss materials.

The general order of work is anticipated as follows:

- Mobilization and site set-up.
- Close Covered Bridge Drive.
- Install erosion and sediment control measures
- Install the temporary works and temporarily support the existing bridge.
- Complete the following removals:
  - Remove the existing shingles and deteriorated roof decking and rafters.
  - Remove the exterior and interior cladding.
  - Remove the existing floor system (nail-laminated deck, stringers, floor beams, and needle beams).
  - Remove the existing sway bracing and associated hardware.
  - Remove the existing truss hanger rods and associated hardware
  - Remove the existing steel rods and associated hardware under the deck (longitudinal bottom chord reinforcing rods, bottom lateral bracing rods, and bailey truss hangers).
  - Removed the existing steel Bailey trusses.
  - Remove the wood truss members that are indicated for replacement.

- Complete the following wood truss repairs:
  - Replace the bottom chord members.
  - Locally replace or adjust the bottom ends of the diagonal and lower diagonal members as necessary to connect with new bottom chords. Adjustments are preferred over local replacements.
  - Replace the end diagonals at the piers.

    - Reinforce the end diagonals at the abutments.
    - Reinforce the top chords and lower top chords by making them composite.
- Construct the new wood floor system:
    - Install the new floor beams and needle beams.
    - Install the new bottom lateral bracing.
    - Install the new stringers.
    - Install the new nail-laminated deck.
    - Install the new curbs and guardrails.
- Construct the new roof:
    - Replace all the deteriorated roof decking and rafters.
    - Install the new shingles.
- Install the new exterior cladding.
- Construct the new interior cladding at ends of bridge only.
- Lower the existing bridge from its temporary supports and transfer loads to permanent structure.
- Remove the temporary works.
- Pave the deck with a new tar and chip wearing surface
- Construct improvements to bridge approaches, including an overhead height restrictor on the north approach and narrowing of the road on the south approach.
- Restoration and grading.
- Demobilize.

In-water work is not permitted between March 15 – July 15, therefore, the placement of scour protection at the pier and abutments is planned in August 2025. The in-water work will take place in two stages. Stage 1 will be for the south span of the bridge, including the installation of a cofferdam and placement of scour protection around the pier and south abutment. Stage 2 will be for the installation of a cofferdam and placement of the scour protection around the north bridge abutment.

The anticipated hours of work are between 7a.m. – 7p.m. to comply with local noise by-laws. Water and dust suppressants (non-chloride) will be applied during construction if necessary to protect air quality due to dust.

Disposal of waste materials and excess soil generated during construction will comply with all applicable By-Laws and Regulations, including the Excess Soil Management Regulation (O.Reg. 406/19). The local community has expressed interest in reusing some of the materials from the bridge rehabilitation such as the exterior siding and the historic timber truss members that will be replaced. This will be co-ordinated with the Contractor during construction.

9.0 EFFECTS AND MITIGATION

Public comments were received during the comment period for Public Consultation No. 1, No. 2 and No. 3. Adjacent property owners impacted by the construction of the works were contacted regarding temporary access to the bridge during construction.

Effects on the environment were considered in accordance with the Municipal Class EA process.

Remaining concerns related to the Recommended Plan will be mitigated to minimize or eliminate any detrimental effects. **Table 4** provides a description of the effects and mitigation proposed with the Recommended Plan, which include:

- Potential environmental impact of the proposed fire protection and wood preservative treatment for Species at Risk (SAR) in the river. Fire protection and wood preservative treatment is required for the wood elements of the bridge.
- Potential environmental impacts of proposed scour protection placement at the bridge pier and abutments. Cofferdams, dewatering and a causeway will be required to place the scour protection at the bridge pier and abutments which may result in displacement of SAR using the area as well as the loss of specific habitat features and components.
- The West Montrose Covered Bridge is a significant historical and heritage bridge structure. The recommendations must protect and retain the heritage elements of the bridge recognizing this is an evolving structure that has had changes overtime.
- Noise from construction equipment and vehicles during construction.
- Temporary property impacts during construction.
- Erosion and Sediment Control.
- Height restriction bar restricts oversized vehicles from accessing the bridge.
- Bridge closure during construction restricting pedestrians, cyclists and buggies.

Table 4: Effects and Impacts of the Study and Proposed Mitigation		
Effects/Impact/Comment	**Interested Party**	**Mitigation**
Potential environmental impact of the proposed fire protection and wood preservative treatment for Species at Risk (SAR) in the river. Fire protection and wood preservative treatment is recommended for the wood elements of the bridge.	MECP, DFO, GRCA	The specific wood preservative and fire retardant products to be used will be determined during design, and will be selected based on having a low aquatic toxicity and environmental impact, in consultation with any relevant stakeholders. Bridge elements will be treated prior to arriving on site as much as possible. For wooden truss members to be treated in-situ, a covering may be used if required to mitigate impacts to the River.
Potential environmental impacts of proposed scour protection placement at the bridge pier and abutments. Cofferdams, dewatering and a causeway will be required to place the scour protection at the bridge pier and abutments which may result in displacement of SAR using the area as well as the loss of specific habitat features and components.	MECP, DFO, GRCA	Should the level of scour protection outlined in the Hydraulic report be provided, the following requirements shall be met and approvals shall be obtained: - No in-water work is permitted between March 15 – July 15 of any year, as this is the critical spawning and rearing periods - Work should be conducted in the dry - All fish and freshwater mussels are to be removed from within the coffer dam enclosure - Due to the potential presence of mussel and fish SAR within the project limits, an Information Gathering Form (IGF) will be submitted to the MECP to confirm any permit requirements under the ESA - An updated Request for Review will be sent to DFO during design - A hydrogeological investigation will be undertaken to determine the estimated groundwater dewatering rates and a Permit to Take Water (PTTW) will be obtained if necessary - Ongoing engagement and consultation with First Nations - Application for a Transport Canada Navigable Waterways permit - GRCA permit outlining construction staging, erosion and sediment controls, and temporary works (e.g. isolation / dewatering)
The West Montrose Covered Bridge is a significant historical and heritage bridge structure. The recommendations must protect and retain the heritage elements of the bridge recognizing this is an evolving structure that has had changes overtime.	MCM, Public, Township of Woolwich	The design preserves as much as the original material as possible, with the replacement of various elements that are in a deteriorated condition to provide the necessary strengthening. Where material must be removed and replaced due to condition, the material is replaced in kind to the extent possible. Sawn wood is to be used for all replacement truss members.
Noise from construction equipment and vehicles during construction.	Township of Woolwich	Restrict idling of equipment to the minimum necessary to perform the work. Contractor will be required to abide by noise control by-laws for day-to-day operations.
Property impacts.	Private property owners on four corners of the bridge	Consultation and co-ordination with impacted property owners, with necessary agreements to be established prior to construction for construction staging and access to the bridge. Restoration of private property following construction completion to the satisfaction of the private property owners.

Table 4: Effects and Impacts of the Study and Proposed Mitigation		
Effects/Impact/Comment	**Interested Party**	**Mitigation**
Height restriction bar restricts oversized vehicles from accessing the bridge.	Public	Engaging with a specialist to refine the design of the overhead height restriction bar on the north approach. The height restriction bar was removed on the south approach, where many photos of the bridge are taken. Instead, the road will be narrowed on the south approach by moving the wooden guiderails closer to each other to eliminate the need for the height restriction bar on the south approach.
Bridge closure during construction restricting pedestrians, cyclists and buggies.	Residents and Mennonite community	Consideration of access through construction will be given during stages of the work, if possible. However, during construction, the site will be the responsibility of the contractor and closure of access will be necessary during certain periods. Advance communication of closure and potential periods to be open will be given to the community and signs will be posted on adjacent roads. Potential options for traffic calming on Line 86 will be investigated to accommodate the increased usage by horse and buggies, pedestrians and cyclists.
Sediment and erosion control for potential impacts to the Grand River.	MECP/GRCA	A Sediment and Erosion Control plan will be prepared to prevent the entry of sediment into the Grand River. • Any construction activities at the pier and abutments will be isolated from the river with a cofferdam and conducted “in the dry”. The cofferdam will allow the bridge pier, as well as north and south abutment work areas, to be adequately dewatered and prevent the release of sediment downstream. • To mitigate the transport of sediment, environmental protection measures (such as straw bale- and rock- flow checks and silt fence barriers) must be incorporated into the final design and installed during construction. Ontario Provincial Standard Specification (OPSS) 805 Construction Specification for Temporary Erosion and Sediment Control Measures must be followed by the Contractor. • Double-row silt fencing will be installed along the perimeter of the construction site prior to commencing any construction activities, straw bales must be placed between the rows of silt fencing to provide additional treatment capacity and improve stability of the silt fencing. Silt fencing shall remain in place throughout the construction process and will only be decommissioned once vegetation has been established and soil is stabilized. Silt fencing shall be inspected weekly or after significant rainfall by the contractor. • Following the decommissioning of all erosion and sediment control measures, all accumulated sediments shall be removed from site and disposed of appropriately. • All construction debris must be disposed of off-site in an appropriate manner. • Where dewatering is required, effluent will be discharged a minimum distance of 30 m from the river and outlet into a filter bag to prevent entry of sediment to the river. • All stockpiled materials must be placed 15 metres away from the river and away from the top of any slope. • All earth material stockpiles will be surrounded with double-row silt fence barrier until such time that they are removed from site or blended into the existing site grading. • Following the completion of final site grading and topsoil application, a suitable seed mixture will be applied to all exposed soil. • Exposed slopes will be protected by requiring the Contractor to limit the time that such areas are exposed prior to final application of topsoil and seed.

Table 4: Effects and Impacts of the Study and Proposed Mitigation		
Effects/Impact/Comment	**Interested Party**	**Mitigation**
Surface Water Contamination and Debris Accumulation	MECP/GRCA	To prevent surface water contamination during construction, precautions will be taken to avoid accidental spillage or discharge of chemical contaminates (e.g., gasoline, oils and lubricants). These precautions will include the following: • All mobile equipment refueling will take place no closer than 30 m from the river to prevent water contamination due to accidental fuel spills. For non-mobile equipment, refueling will be carried out in a controlled manner to prevent fuel spillage. In addition, a drip pan should be installed under any non-mobile equipment working within the construction zone. • All equipment operating near the river shall be properly maintained to avoid contaminant leakage and will be free of excess oil/grease. • The contract package should provide contact information for the Spills Action Centre (1-800-268-6060). An emergency spill response kit should be on site at all times and in the event that a spill occurs, proper containment, clean up and reporting, in accordance with provincial requirements, is required. The Contractor should take all necessary precautions to prevent the accumulation of litter and construction debris within any natural areas and the Grand River. This should include the following: • Use of scaffolding to prevent wood and construction debris from falling in the river during bridge re-construction activities. The scaffolding will have kick plates installed around the perimeter to prevent debris from accidentally falling into the river. • Daily cleanup of working platforms over the river and disposal of material in a container located on shore away from the river. • The establishment of garbage bins within the work limits for depositing construction debris and lunch litter.
Loss of components of various vegetation communities found within the project study limits.	MECP	It is recommended that the permanent displacement of vegetation communities within the bridge rehabilitation work area be minimized, where possible, and appropriate restrictions and mitigation measures be implemented to reduce the potential for negative impacts. These measures should include the following: • Vegetation clearing shall be minimized, where possible; • Following completion of grading and topsoil application, disturbed areas shall be reseeded with a seed mixture that will promote suitable native vegetation regeneration; • Tree barrier protection should be in accordance with OPSS 801 Construction Specification for the Protection of Trees to demarcate and protect existing trees along cut lines from equipment damage; • Delineation of vegetation clearing zones and vegetation retention zones shall be made clear on construction specifications and in the field; • Specifications for appropriate tree felling and grubbing procedures shall be implemented to minimize impacts on surrounding vegetation; • No equipment shall enter woodlands outside of the grading limits; • Construction activities adjacent to woodlands shall occur from within the grading limits; and • No long-term stockpiling of excavated material shall occur within 30 m of a woodland.

Table 4: Effects and Impacts of the Study and Proposed Mitigation		
Effects/Impact/Comment	**Interested Party**	**Mitigation**
Removal of vegetation during construction activities may result in displacement of wildlife using the area. Clearing of vegetation within the proposed grading limits will result in the loss of habitat for species requiring terrestrial habitat. Construction activities may also increase exposure of wildlife to predation by domestic animals as well as unwarranted persecution from the public.	MECP	To minimize the temporary displacement of birds and wildlife species potentially utilizing the study area, it is recommended that efforts be made to minimize vegetation removal within the project limits. It is also recommended that any removal of shrubs and trees take place outside the bird nesting season of April 1st - August 30th. If clearing work must be conducted during the breeding bird season, a breeding/nesting bird survey should be conducted by an avian specialist prior to the beginning of clearing activities to verify potential nesting activity. Furthermore, if nesting activities are observed during clearing/construction, works in that area should cease and the MNRF should be contacted immediately. If evidence of bird nesting activity is noted on the bridge structure in 2024, it is recommended that bird exclusion netting be installed on the bridge prior to spring 2025 nesting activities in order to exclude birds during 2025 construction.
Fisheries and Aquatic Habitat	MECP, DFO	In order to protect fisheries and aquatic habitat resources within the project limits, the Contractor's operations must be controlled to prevent the entry of deleterious materials to the river. Where the contract requires work in the river and/or on its banks, operation of equipment within such areas will be kept to the minimum necessary to perform work and comply with operational constraints that will be specified in the contract. OPSS 182 provides construction specifications for these measures. In-water timing windows will be employed to ensure in-water work does not occur during critical spawning and rearing periods. No in-water work is permitted between March 15th and July 15th of any year. Natural flows downstream of any work will be maintained at all times during construction. All pumps for dewatering shall have fine screening placed over the intake to prevent entrainment of fish and other aquatic species during operation. Screening to be implemented as per the Department of Fisheries and Oceans (DFO) guidelines (Freshwater Intake End-of-Pipe Fish Screen Guideline (1995). All fish will be removed from the work area before works are undertaken. This work is to be completed under a Licence to Collect Fish for Scientific Purposes from the MNRF. A qualified Fisheries Biologist should be retained for this work. Removal or disturbance of riparian vegetation will be minimized during construction operations to prevent unnecessary loss of river shading, overhead cover, or bank stability. Any streambed disturbed because of proposed works should be covered with suitable-sized rock protection, rounded river stone gravel, cobble material, or replaced with the original bed material. Prior to application of the rock protection around the in-water pier and work at the abutments, a cofferdam will be installed around the pier and abutment work areas and all fish and freshwater mussels will be removed from within the coffer dam enclosure. A Fisheries Specialist should be retained to carry out the fish and mussel relocation under an MNRF License to Collect Fish. Any fish or mussel species at risk encountered during the removal should be reported to the MECP and DFO.

Table 4: Effects and Impacts of the Study and Proposed Mitigation		
Effects/Impact/Comment	**Interested Party**	**Mitigation**
Seven SAR and their associated habitat (rainbow mussel, wavyrayed lampmussel, silver shiner, black redhorse, barn swallow, western chorus frog, and snapping turtle) may be found within the project construction limits. Removal of vegetation, existing bridge components planned for replacement, and in-water construction activities may result in displacement of the SAR using the area and as well as the permanent loss of specific habitat features and components	MECP	Given the nature of the proposed bridge rehabilitation works and the habitat requirements noted above for species at risk in the area, there is potential for disturbance to sensitive species and their habitat. Mitigation measures should be included in the contract to protect these species and their habitat. • The Contractor shall be aware of the requirements and prohibitions of the federal Species at Risk Act (2002) and the provincial Endangered Species Act (2007). Section 9 (1) of the Endangered Species Act (2002) states that “no person shall kill, harm, harass, capture or take living member of a species that is listed on the Species at Risk in Ontario List as an extirpated, endangered, or threatened species”. • Prior to application of the rock protection around the in-water pier and bridge abutments, a cofferdam should be installed around the work area and all fish and freshwater mussels should be removed from within the coffer dam enclosure. Any fish or mussel species at risk encountered during the removal should be reported to the MECP and DFO. • Silt fence barrier should be installed adjacent to the river to deter turtle species at risk from entering the work area. • Caution should be taken during the turtle nesting season in June and early July as turtles use embankments and other terrestrial sites for nesting. During the active season (April 1 – December 30), it is recommended that a thorough sweep of the area before works begin to encourage any turtles using the site to move away. • All clearing and grubbing, as well as the installation of bird exclusion netting on the bridge, should take place outside the bird nesting season of April 1st - August 30th to avoid nesting impacts to avian SAR within the study area. • On-site personnel should receive training on all potential species at risk to be found within the project limits. Information and orientation should be provided to the Contractor so that those working on-site are familiar with the identification and biology of all potential SAR as well as liabilities associated with interaction with these species. • If during construction activities any species at risk are observed, the MECP must be contacted within two (2) business days. Injury to a SAR must be reported to MECP immediately; • Avoid creating habitat for SAR inadvertently (e.g. un-protected [i.e. with silt fence barrier] stock piles, exposed substrates, brush piles) inside active construction areas by ensuring silt fence barrier or temporary exclusion fencing is installed and maintained appropriately. Due to the potential presence of mussel and fish SAR within the project limits, an Information Gathering Form (IGF) will be submitted to the MECP in order to outline proposed mitigation measures as well as to verify if permits will be required for this project. As well, DFO will be sent a revised Request for Review in order to update this agency as to the additional project logistics of causeway construction.

Table 4: Effects and Impacts of the Study and Proposed Mitigation

Effects/Impact/Comment	Interested Party	Mitigation
Heritage Attributes and Potential Impacts	MECP/MCM	• Any repair work to the original wood trusses should be compatible physically and visually with the structure and its distinctive materials, features and construction techniques or craftsmanship and any repairs should match the original material in composition, design, colour and texture of the original wood element if possible while meeting code requirements. Reinforcing the original wood trusses with new 4” (89mm) thick, fastened wood plank preserves the original wood trusses in place and service. • The removal of the Bailey steel truss should be documented photographically and existing condition notes should form part of the Region’s bridge record. Reuse of the Bailey bridge in part or whole can be considered for light pedestrian and cycle use if found structurally adequate. • Any general repairs to the pier stone masonry above the water line should be compatible physically and visually with the structure and match the exiting stonework and mortar in mortar mix composition, design, and colour. • The new exterior wood siding should replicate as much as possible the construction dimensions and materials stated in the 1880 specifications. This will restore the original design intent and ensure the bridge is compatible physically and visually with the distinctive materials, features and craftsmanship of the original structure. The selected wood species used should match the original in design and texture as much as possible even if it is to be repainted red. (Original tongue and groove board with raised batten siding has been located in certain siding sections. It has been replaced over time in most areas with a raised batten fixed between two vertical boards). • If structurally feasible, the portal ends should be reconstructed using the original 1880 design intent. Consider restoring the exterior structure to its earliest documented appearance when all siding is replaced. • Existing interior wood splash panelling to be replaced in kind in the four corners at both ends of the bridge is considered to be a satisfactory rehabilitation design solution. • Replacement of the entire roof structure with new cedar shingles should be in keeping with the original materials and be compatible physically and visually with the structure and its distinctive materials, features and construction techniques or craftsmanship. The new roof structure and wood shingles should use the same wood species as the original specifications, if possible, and should match the original specified roof material in composition, design, colour and texture. • Re-installment of the conserved light fixtures should be in the approximate location of the existing fixtures. • Views to and into the bridge from the north and south banks of the Grand River should be maintained as detailed in the new restored portal design. Expert advice should be retained to prepare the final design of the height restriction bar and the preferred location.
Utilities	Enova, GRCA	• Overhead hydro lines on the south approach of the bridge and on the west side of the bridge may limit the size of equipment that has the ability to access the bridge • There is a GRCA monitoring station near the south abutment of the bridge. Care must be taken during construction to ensure protection of this infrastructure.

10.0 MONITORING

On site construction inspection and administration personnel will monitor the work site ensuring any requirements of the GRCA and DFO approvals are met by the contractor. On-site construction administration staff will ensure that the environmental measures outlined in the contract documents are carried out. Post-construction monitoring will be carried out as required by environmental permits. Should unexpected issues arise, appropriate agencies will be contacted to provide additional input and recommendations as necessary and the Contractor will be required to adjust their operations to address any issues. Recommended monitoring for this project includes monitoring to ensure compliance with permit conditions, and effectiveness monitoring to evaluate the performance of mitigation measures. Monitoring will also include:

- Monitoring success and growth of new vegetation planted as part of the bridge construction;
- Inspection of detour signage throughout the duration of construction;
- Monitoring Line 86 during construction for accommodation of horse and buggies;
- Construction monitoring by an independent environmental monitor to determine if any wildlife has been inadvertently trapped or are found within construction areas during construction;
- Management of construction access, delivery and removal of materials;
- Documentation of all historic material prior to disposal;
- Monitoring daily dewatering rates to ensure compliance with permits;
- Monitoring effectiveness of sediment and erosion control; and
- Monitoring effectiveness of narrowed south approach following construction.

11.0 FUTURE ACTIVITIES

At the end of the 30-day review period, should there be no objections to the project, or Section 16 Orders received, the Region may proceed with design and construction of the Recommended Plan. Construction is currently planned to proceed in Spring 2025 until Spring 2026.

Mitigation measures listed in **Table 4** are to be incorporated during detailed design and construction, as appropriate.

GLOSSARY OF TERMS

AADT	Annual Average Daily Traffic - the average 24-hour, two-way traffic for the period from January 1st to December 31st.
Alignment	The vertical and horizontal position of a road.
Alternative	Well-defined and distinct course of action that fulfils a given set of requirements. The EA Act distinguishes between alternatives to the undertaking and alternative methods of carrying out the undertaking.
Alternative Planning Solutions	Alternative ways of solving problems or meeting demand (Alternatives to the Undertaking).
Alternative Design Concepts	Alternative ways of solving a documented transportation deficiency or taking advantage of an opportunity. (Alternative methods of carrying out the undertaking).
Alternative Project	Alternative Planning Solution, see above.
ARA	Aquatic Resource Area
Bridge Keepers	West Montrose Resident's Association
Canadian Environmental Assessment Act (CEAA)	The CEAA applies to projects for which the federal government holds decision-making authority. It is legislation that identifies the responsibilities and procedures for the environmental assessment.
Class Environmental Assessment Document	An individual environmental report documenting a planning process which is formally submitted under the EA Act. Once the Class EA document is approved, projects covered by the class can be implemented without having to seek further approvals under the EA Act provided the Class EA process is followed.
Class Environmental Assessment Process	A planning process established for a group of projects in order to ensure compliance with the Environmental Assessment (EA) Act. The EA Act, in Section 13 makes provision for the establishment of Class Environmental Assessments.
Compensation	The replacement of natural habitat lost through implementation of a project, where implementation techniques and other measures could not alleviate the effects.
Corridor	A band of variable width between two locations. In transportation studies a corridor is defined area where a new or improved transportation facility might be located.
Criterion	Explicit feature or consideration used for comparison of alternatives.
Cross Section	Configuration of the road at a right angle to the centreline. Typical sections show the width, thickness and descriptions of the pavement section, as well as the geometrics of the graded roadbed, side ditches, and side slopes.
Cumulative Effects Assessment	Cumulative Effects Assessment assesses the interaction and combination of the residual environmental effects of the project during its construction and operational phases on measures to prevent or lessen the predicted impacts with the same environmental effects from other past, present, and reasonably foreseeable future projects and activities.
Detail Design	The final stage in the design process in which the engineering and environmental components of preliminary design are refined and details concerning, for example, property, drainage, utility relocations and quantity estimate requirements are prepared, and contract documents and drawings are produced.
DFO	Fisheries and Oceans Canada
EA	Environmental Assessment
EA Act	Ontario Environmental Assessment Act (as amended by S.O. 1996 C.27), RSO 1980.

Environment	Air, land or water, Plant and animal life, including man, The social, economic and cultural conditions that influence the life of man or a community, Any building structure, machine or other device or thing made by man, Any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from the activities or man, or Any part or combination of the foregoing and the interrelationships between any two or more of them, in or of Ontario.
Environmental Effect	A change in the existing conditions of the environment which may have either beneficial (positive) or detrimental (negative) effects.
Environmentally Sensitive Areas (ESA's)	Those areas identified by any agency or level of government which contain natural features, ecological functions or cultural, historical or visual amenities which are susceptible to disturbance from human activities and which warrant protection.
ESR	Environmental Study Report
Equivalent Sound Level (Leq)	The level of a continuous sound having the same energy as a fluctuating sound in a given time period. In this report Leq refers to 24-hour, 16 or 18-hour averages.
Evaluation	The outcome of a process that appraises the advantages and disadvantages of alternatives.
Evaluation Process	The process involving the identification of criteria, rating of predicted impacts, assignment of weights to criteria, and aggregation of weights, rates and criteria to produce an ordering of alternatives.
External Agencies	Include Federal departments and agencies, Provincial ministries and agencies, conservation authorities, municipalities, Crown corporations or other agencies other than MTO.
Factor	A category of sub-factors.
FRP	Fiber-reinforced plastic
Grade Raise	Increase the elevation of the road.
Hydraulic	Civil engineering concerned with the flow of fluids, primarily water and sewage.
Individual Environmental Assessment	An environmental Assessment for an undertaking to which Assessment the EA Act applies and which requires formal review and approval under the Act.
LIO	Land Information Ontario
MCEA	Municipal Class Environmental Assessment
MECP	Ministry of the Environment, Conservation and Parks
Mitigating Measure	A measure that is incorporated into a project to reduce, eliminate or ameliorate detrimental environmental effects.
Mitigation	Taking actions that either remove or alleviate to some degree the negative impacts associated with the implementation of alternatives.
MNRF	Ministry of Natural Resources and Forestry
NHIC	Natural Heritage Information Centre
Planning Alternatives	Planning alternatives are "alternative methods" under the EA Act. Identification of significant transportation engineering opportunities while protecting significant environmental features as much as possible.
Planning Solutions	That part of the planning and design process where alternatives to the undertaking and alternative routes are identified and assessed. Also described as "Alternative Project" under the federal EA Act.
Prime Agricultural Areas	Prime agricultural areas as defined in municipal official plans and other government policy sources.
Project	A specific undertaking planned and implemented in accordance with this Class EA including all those activities necessary to solve a specific transportation problem.
Project File	The final product of a Schedule B project. This is a completion of all data/reports produced for the project.

Proponent	A person or agency that carries or proposes to carry out an undertaking, or is the owner or person having change, management, or control of an undertaking.
Public	Includes the general public, interest groups, associates, community groups, and individuals, including property owners.
Recommended Plan	That part of the planning and design process, during which various alternative solutions are examined and evaluated including consideration of environmental effects and mitigation; the recommended design solution is then developed in sufficient detail to ensure that the horizontal and vertical controls are physically compatible with the proposed site, that the requirements of lands and rights-of-way are satisfactorily identified, and that the basic design criteria or features to be contained in the design, have been fully recognized and documented in sufficient graphic detail to ensure their feasibility.
ROP	Regional Official Plan
RSCHR	Regionally Significant Cultural Heritage Resource
Screening	Process of eliminating alternatives from further consideration, which do not meet minimum conditions or categorical requirements.
Sub-factor	A single criterion used for the evaluation. Each sub-factor is grouped under one of the factors.
Source protection plan	A document that is prepared by a source protection committee under Section 22 of the Ontario Clean Water Act, 2006 to direct source protection activities in a source protection area. Each plan is approved by the Ontario Ministry of the Environment.
SAR	Species at Risk
TAC	Technical Advisory Committee
TMP	Transportation Master Plan
TPA	Technically Preferred Alternative
Traceability	Characteristics of an evaluation process which enables its development and implementation to be followed with ease.
Tributary	A stream or river that flows into a larger river or lake.
Undertaking	In keeping with the definition of the Environmental Assessment Act, a project or activity subject to an Environmental Assessment.
Watershed	Land that channels water from rainfall and snowmelt into streams and rivers that have an outflow to lakes, oceans, bays, and reservoirs.
Wellhead protection area (WHPA)	An area of land surrounding a well, where human activities may need to be regulated to protect the quality and quantity of groundwater that supplies that well.