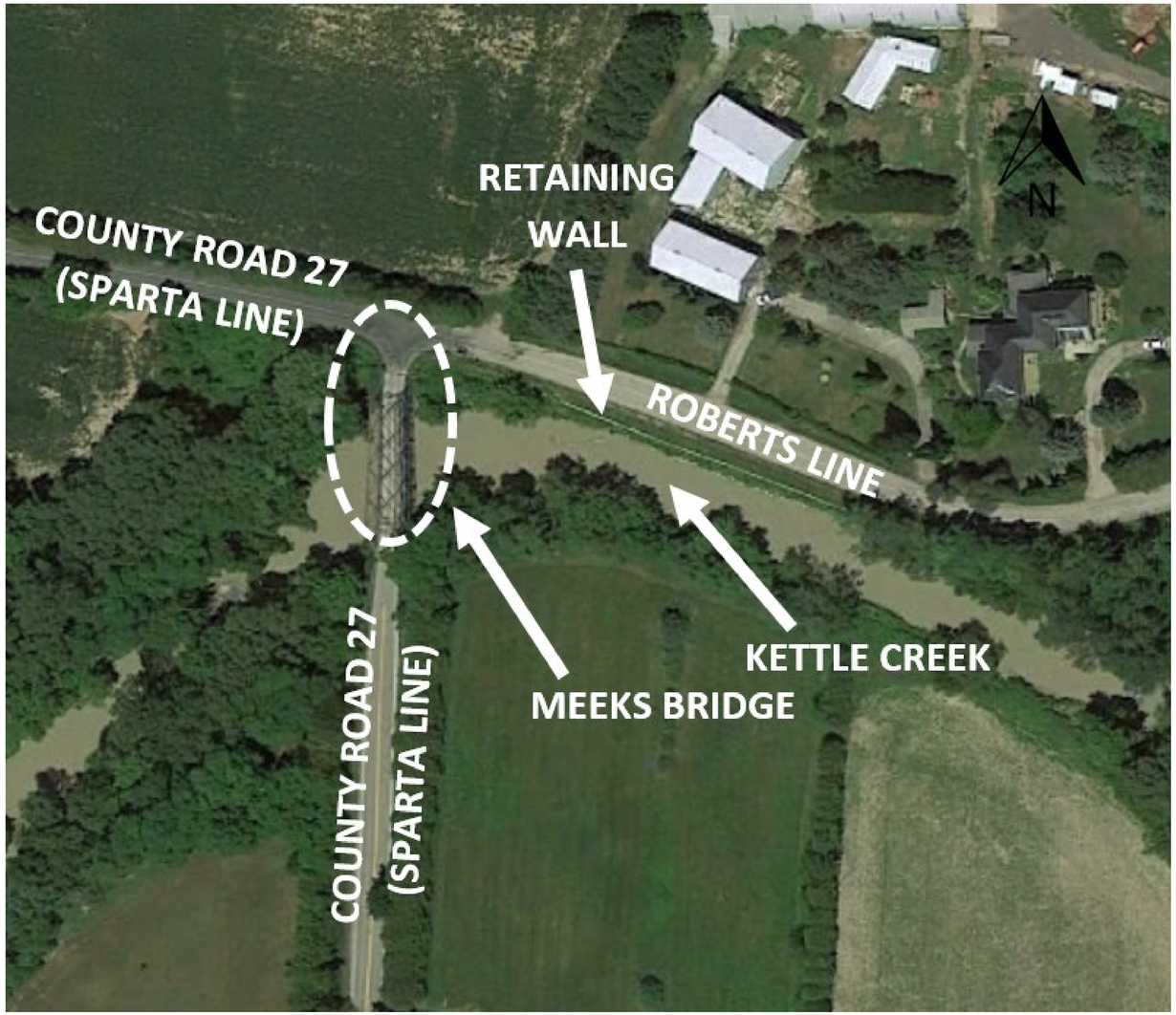
Municipal Class Environmental Assessment
Meeks Bridge Replacement

County of Elgin

Public Information Centre

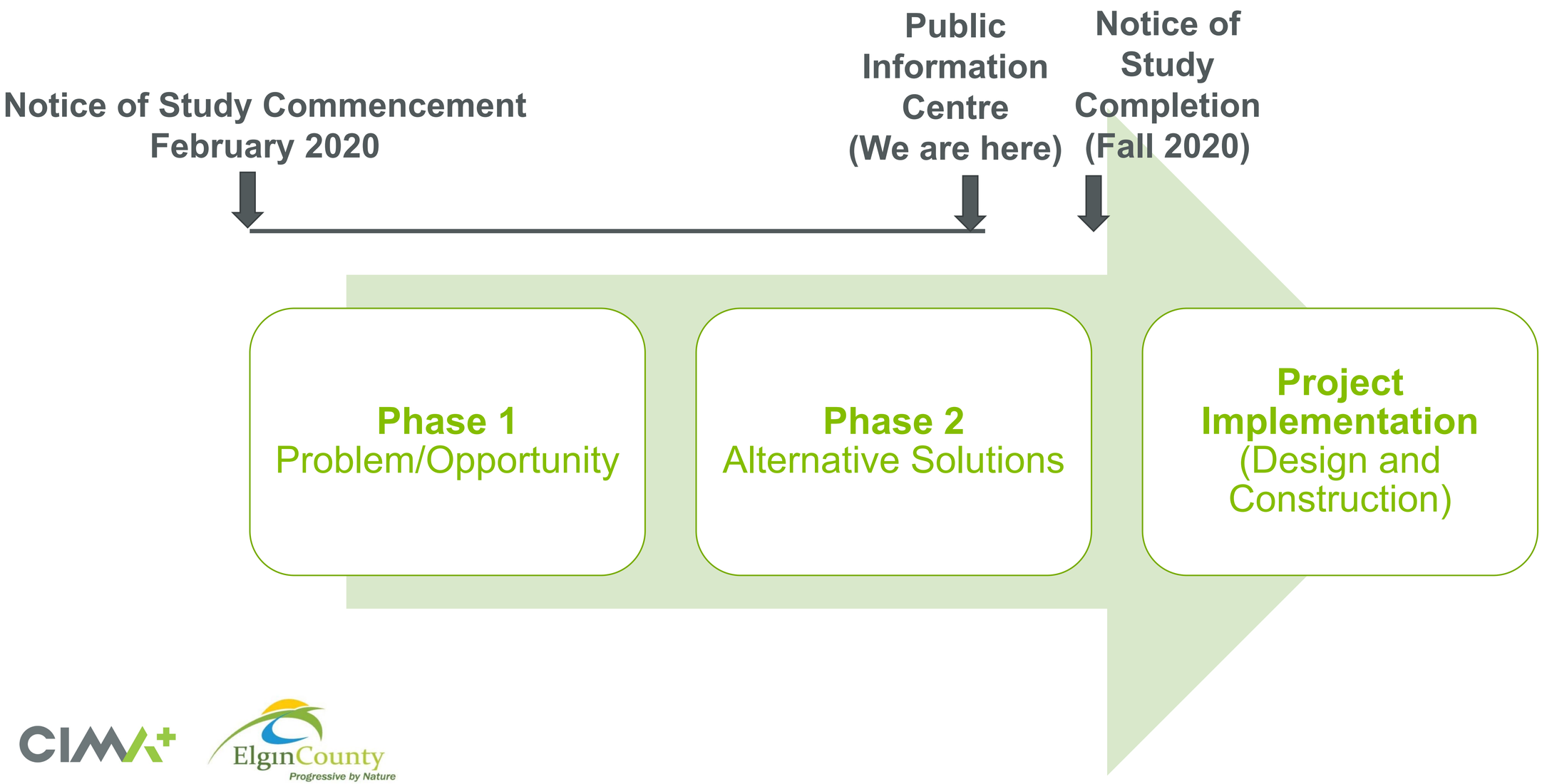
Study Area Overview

- Meeks Bridge is a single span bridge located on Sparta Line in the Township of Southwold, south of the City of St. Thomas
- Meeks Bridge was constructed in 1900 and is a steel double-intersection Warren truss (Double Warren) bridge structure that crosses Kettle Creek
- The bridge has a total deck length and width of 38.7 metre and 4.9 metres, respectively
- Just downstream of Meeks Bridge on the north bank, a 2.5 m high, 60 m long retaining wall supports the bank
- The bridge is located within the jurisdiction of the Kettle Creek Conservation Authority



Municipal Class EA Process

- The Municipal Class EA is a planning and design process approved by the Ministry of the Environment, Conservation and Parks to meet the requirements of the Ontario Environmental Assessment Act. This Study follows the Class EA process for **Schedule 'B'** projects. Key components of the study include:



Problem and Opportunity Statement

Based on an assessment of Meeks Bridge, the problem being addressed is described as follows:

- The bridge currently has a load posting of 8 tonnes due to the structural capacity of truss bottom chords (2- C230 X 20) and transverse beams (W460 X 67).
- Underside bracing has fallen off on numerous panels and the remainder is corroded.
- The concrete deck exhibits spalling, cracking and severe scaling.

The 2019 bridge inspection report recommended rehabilitation in 1-5 years and replacement in 6-10 years.

Overall, Meeks Bridge is in poor structural condition and is in need of replacement or reconstruction.

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Existing Conditions – Structures

The existing Meeks bridge was built in 1900. It currently has a load posting of 8 tonnes due to multiple structural deficiencies including but not limited to:

1. Steel truss structure's bottom chords (2xC230) and floor beams (W460x67) exhibit section loss due to rusting and deterioration. Most floor system cross bracing members have fallen off on numerous panels and also have section loss;

2. Typically steel manufactured circa 1900 has a significantly lower yield strength than modern steels. The specified yield strength is most likely 180 MPa compared to 350MPa min. required strength and this dramatically affects the structural capacity of the bridge;

3. Concrete deck exhibits spalling, cracking and severe scaling;

4. Abutment condition and age of concrete used on the substructure creates a challenge for rehabilitation.
Based on the year the bridge was built, the substructure concrete would not have been air-entrained and is prone to spalling and scaling due to corrosion of reinforcing bars and freeze thaw action.

Existing Conditions – Environmental Sensitivities

Wildlife Habitat

- The existing bridge structure provides nesting habitat for Common Grackle and American Robin (American Robin is a protected species)
    - Impacts to the species will be avoided through implementation of timing restrictions for project works.
- A pair of Barn Swallows (threatened and protected) was observed foraging over Kettle Creek during breeding bird surveys

Existing Conditions – Environmental Sensitivities

Vegetation Communities

- Vegetation communities surrounding the bridge are comprised of a mix of deciduous forest, swamp and culturally influenced community types
- No species at risk plants were observed

LEGEND

- Breeding Bird Point Count Station
- Concrete Retaining Wall
- Eroded Bank
- Sediment Deposition
- Watercourse Riffle
- Watercourse
- Study Area

Vegetation Communities

- Vegetation Community Boundary
- Ag — Agriculture
- CUM1-1 — Dry-Moist Old Field Meadow Type
- CUP3-8 — White Spruce-European Larch Coniferous Plantation Type
- CUT1-1 — Sumac Cultural Thicket Type
- FOD4 — Dry-Fresh Deciduous Forest Ecosite
- H — Hedgerow
- M — Manicured
- SWD4-1 — Willow Mineral Deciduous Swamp Type
- SWT2-2 — Willow Mineral Thicket Swamp Type

Data Source: Ontario Ministry of Natural Resources and Forestry (LIO).

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0 10 20 30 40 m

N

FIELD INVESTIGATION RESULTS

LGL LIMITED environmental research associates

Project: TA8986	Figure: 4
Date: July, 2020	Prepared By: JJP
Scale: 1 : 1,400	Checked By: LRE

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Existing Conditions – Environmental Sensitivities

Aquatic Habitat

- Surface water quality within Kettle Creek is characterized as negatively impacted by increasing summer temperatures, extensive nutrient and sediment concentrations, low levels of dissolved oxygen, and decreasing baseflows
- Habitat for Silver Chub (threatened and protected) is documented approximately 2 km downstream of the study area
  - No impact to habitat for this species is anticipated

Existing Conditions - Hydraulics

- The existing bridge passes the clearance criteria for the 25-year design storm
- The bridge can convey up to the 25-year flow with 0.25m of freeboard (clearance)
- During the regional storm, the roadway running east west parallel to Kettle Creek upstream of the bridge (Sparta Line/Roberts Line), as well as the roadway south of the bridge (Sparta Line) and farmland to the north is overtopped
- On February 20, 2018, there was a storm event which created flows which climbed near the top of the retaining wall on the north bank downstream of the bridge

February 2018 Storm – Water Levels at Retaining Wall Downstream of Bridge

Existing Conditions – Heritage

Cultural Heritage

- Meeks Bridge has been identified as having cultural heritage value for design/physical and contextual reasons
- Meeks Bridge and its location is illustrative of and a physical/ tangible reminder of the road network development in the Township of Southwold and the County of Elgin in the 19th century and in the early 20th century
- A Heritage Impact Assessment is being completed for Meeks Bridge to identify potential mitigation measures to protect the cultural heritage value of the structure

South Bridge Abutment

Maker's Plaque on the Northwest End Post

Existing Conditions – Heritage

Stage 1 Archaeological Assessment

- A Stage 1 Archaeological Assessment was conducted for the study area
- The assessment concluded that portions of the study area may require a Stage 2 Archaeological Assessment should the proposed work extend into these areas (shown in green and orange)
- The remainder of the Study Area does not retain archaeological potential on account of deep and extensive land disturbance, low and wet conditions

Alternative Solutions

Four alternative solutions are under consideration for Meeks Bridge:

Option 1 – Do Nothing

- Structure remains in an as-is state
- No improvements to current structural state
- Meeks Bridge would be monitored regularly until eventual full closure

Option 2 – Rehabilitate

- Rehabilitate the superstructure by adding supplementary steel components
- Resurface the substructure and replace the concrete deck

Option 3 – Replace

- Replace the existing structure with a structure capable of accommodating all vehicles

Option 4 – Remove and Retire Road

- Includes removal of the existing bridge and retirement of the road at the water crossing including construction of a vehicle turn-around on Sparta Line.

Alternative Solution – Pre-Screening

- In advance of the analysis and evaluation of alternative solutions, a structural analysis pre-screening was conducted to confirm the feasibility of Alterative 2 - Rehabilitation
- Based on the screening, it is not considered practical or economically viable to rehabilitate the existing bridge (Alternative 2)
- Additional rehabilitation work will be required on a recurring basis depending on the extents of the initial rehabilitation works
- Bridges of this vintage were typically originally coated with red lead paint which is now considered to be a hazardous substance
- Any rehabilitation works would disturb the lead paint and require major environmental protection and remediation measures, greatly adding to any cost of work and the potential risk to the local environment.
- With rehabilitation, it may be necessary to increase the depth of the lower truss members to achieve the desired capacity increases. This would reduce the freeboard of the existing bridge and add to local flooding concerns.

Therefore, Alternative 2 – Rehabilitation of Meeks Bridge was not carried forward to the evaluation of alternative solutions as it is considered infeasible.

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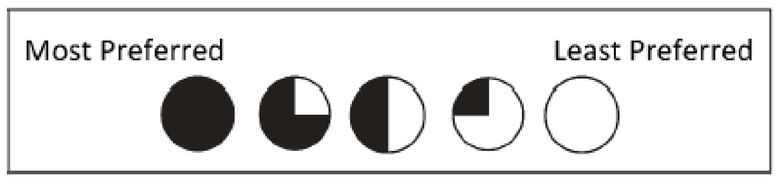
Evaluation Criteria

- **Transportation/Maintenance:** ability to maintain existing access to Sparta Line and improve road geometry
- **Structural:** ability to address structural deficiencies and load limit
- **Hydraulics:** ability to improve hydraulic conditions
- **Natural Environment:** direct and/or indirect impacts on watercourses, fisheries, aquatic habitat, terrestrial ecosystems, and shoreline habitat
- **Socio-Economic Environment:** direct and/or indirect impacts related to property, access and construction staging
- **Cultural Environment:** impact on archaeology, built heritage and cultural landscape resources
- **Cost Estimate:** approximate construction costs.

The alternative solutions have been ranked using the above noted evaluation criteria from least preferred to preferred:



Analysis and Evaluation of Alternative Solutions

TECHNICAL CRITERIA	Alternative 1 Do Nothing	Alternative 3 Replace the Bridge	Alternative 4 Remove Existing Bridge and Retire Road
Transportation / Maintenance	To ensure public safety, this alternative will eventually lead to the closure of Meeks Bridge and eliminate access to Sparta Line from Union Road (Highway 20).	Maintains access to Sparta Line from Union Road (Highway 20). Provides a two-lane bridge and improvements to the Sparta Line & Roberts Line intersection.	Eliminates access to Sparta Line from Union Road (Highway 20).
Structural	Assumes no further work is completed on the existing structure. Existing load limit of 8 tonnes will remain in place.	Bridge is replaced with a structure capable of accommodating all vehicles. Current load limit of 8 tonnes is removed.	Existing bridge is removed, and no replacement structure is provided.
Hydraulics	No opportunity to improve current hydraulic conditions. Stream levels will continue to reach the height of the lower part of the existing bridge during high flow events. Significant erosion and ice scour will continue.	Opportunity to improve hydraulic conditions with a shallower bridge deck. The proposed structure will provide approximately a 0.3m reduction in Regulatory water levels due to increased hydraulic capacity under the bridge. New structure can convey the 100-year design flow.	Opportunity to improve hydraulic conditions without a bridge in place.

Analysis and Evaluation of Alternative Solutions

TECHNICAL CRITERIA	Alternative 1 Do Nothing	Alternative 3 Replace the Bridge	Alternative 4 Remove Existing Bridge and Retire Road
Natural Environment	No change to existing conditions. High flow events will continue to result in debris from the bridge entering the watercourse, erosion of stream banks, bank scour, and sedimentation impacting the quality of fish habitat and surface water quality. However, no construction impact or permanent removal of vegetation/ habitat. ◕	Given the increased footprint of the bridge compared to existing, permanent vegetation removal in proximity to the creek bank is anticipated (i.e. riparian cover and associated wildlife habitat) and may reduce bank stability. The improvements to the hydraulic capacity of the bridge will reduce the amount of erosion/scour of creek banks, and the introduction of deleterious substances (e.g. road salt and debris) thereby resulting in some improvement to water quality in Kettle Creek long term. A planting plan is recommended to mitigate impacts to the creek bank post construction. Near water work will consider timing windows to avoid sensitive periods for fish. ◑	Bridge removal will result in the defragmentation of aquatic and terrestrial habitats along the creek, improvements to water quality (e.g. reduced road salt) and improved hydraulic capacity to reduce impacts related to frequency of elevated stream levels. Restoration of the roadbed at the crossing will improve riparian cover and infiltration/permeability of the surface to help to stabilize creek banks. Overall, this alternative benefits aquatic and terrestrial habitat quality over the long term. ●
Socio-Economic Environment	No construction impacts. ●	Construction duration is anticipated to be less than Alternative 4 or Alternative 1. Temporary closure of bridge is required. ◑	Construction impacts include a temporary closure, followed by a full closure. ●

Analysis and Evaluation of Alternative Solutions

TECHNICAL CRITERIA	Alternative 1 Do Nothing	Alternative 3 Replace the Bridge	Alternative 4 Remove Existing Bridge and Retire Road
Cultural Environment	Alternative 1 would result in the complete removal of all identified physical, historical, and contextual values of the subject bridge and would sever the functional and historical association of Sparta Line as a watercourse crossing in this location. ○	Alternative 3 would result in the complete removal of the subject bridge and physical heritage attributes that were outlined in the Cultural Heritage Evaluation Report (CHER) with the exception of the bridge abutments which will be maintained. Consideration can be given to a sympathetically-designed replacement structure that would continue the historical association as a road crossing in this location as part of a potential mitigation strategy. Additional mitigation measures may include the salvage and retention of the subject bridge for reuse at a different crossing, or for use in a commemorative interpretation. Portions of the study area may require a Stage 2 Archaeological Assessment. ◑	Alternative 4 would result in the complete removal of all identified physical, historical, and contextual values of the subject bridge and would sever the functional and historical association of Sparta Line as a watercourse crossing in this location. ○
Cost Estimate	No cost associated with this alternative. Cost of eventually removing the bridge and retiring road is less that Alterative 3. ●	Higher cost than Alternative 1 or 4. ◑	Lower cost that Alternative 3. Similar cost to Alternative 1. ●
Recommendation	Not recommended	**Recommended**	Not recommended

Analysis and Evaluation of Alternative Solutions

- Alternative 2 was screened out as this option is infeasible
- Alternative 1 and 4 do not provide an opportunity to maintain the existing access to Sparta Line or improve the existing hydraulic conditions
- Alternative 4 would result in complete removal of all identified heritage value of the existing bridge. Alternative 1 would eventually lead to full removal
- Alternatives 1 and 4 do not address the problem and opportunity statement

Therefore, Alternative 3 - Replacement of Meeks Bridge has been identified as the preferred alternative.

Preferred Design Alternative

- It is proposed to use the existing Port Bruce temporary modular bridge as the replacement structure for Meeks Bridge
- The Port Bruce temporary modular bridge's width can be adjusted to provide various lane widths for traffic and shoulder width for pedestrians
- Two options for the span of the Meeks Bridge replacement were considered:
  1. 130 ft (39.6 m) span*
  2. 140 ft (42.5 m) span - PREFERRED

- Four sub-options were considered for each of the span options:
  a) 1 traffic lane + additional space for pedestrians
  b) 2 traffic lanes (3.5 m) including buffer but no pedestrian space - PREFERRED
  c) 2 traffic lanes (3.75 m) including buffer but no pedestrian space
  d) 2 traffic lanes (3.75 m) including buffer + additional space for pedestrians

* Note: the modular bridge is available in 10-foot increments

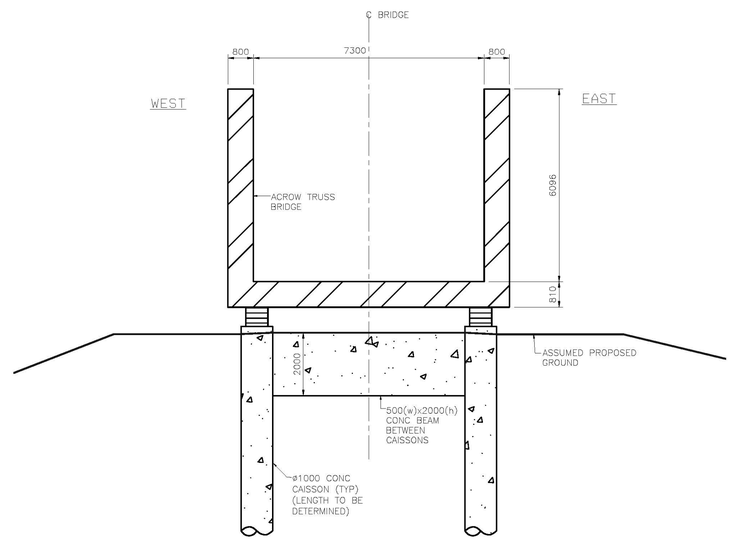
Preferred Design Alternative

- Option 2 - 140 ft (42.5m) span was selected as the preferred alternative as the new bearings can be located behind the existing abutments and founded on piles or caissons.
- The existing abutments can remain in place but be modified to allow the Port Bruce bridge to pass over them.
- Using a 130 ft (39.6 m) span (Option 1) would have required extensive modification to the existing abutments and this is noted as being a high-risk option as the condition of the existing abutments has not been assessed to determine the potential extents of modification required (noting they are 120 years old).

- Sub-option b) was selected as the preferred cross-section alternative as two 3.5 m traffic lanes is an improvement over existing conditions and pedestrian facilities were not identified as being required since there are no facilities upstream or downstream of the bridge, and there is very little pedestrian activity on the bridge.

- The estimated cost of replacing Meeks Bridge based on the preferred design is $2M.

Preferred Design Alternative



1 CROSS SECTION
SCALE 1:75

GENERAL NOTES

DESIGN CODE/LOADING

- CAN/CSA-S6-14 (CANADIAN HIGHWAY BRIDGE DESIGN CODE) CL-625-ONT.

CLASS OF CONCRETE

- ALL CONCRETE 35MPa
- MAX. AGGREGATE SIZE
  PATCHES 13mm
  ALL OTHER 20mm

CLEAR COVER TO REINFORCING STEEL

- 70mm ± 20mm UNLESS OTHERWISE NOTED

REINFORCING STEEL

- BLACK REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
- BAR MARKS WITH PREFIX 'S' DENOTE STAINLESS STEEL BARS.
- STAINLESS REINFORCING STEEL SHALL BE TYPE 316N OR DUPLEX 2205 AND HAVE A MINIMUM YIELD STRENGTH OF 500MPa.
- UNLESS OTHERWISE NOTED, TENSION LAP SPLICES SHALL BE CLASS B.
- BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING MINIMUM BEND DIAMETERS; WHILE STIRRUPS AND TIES SHALL HAVE MINIMUM HOOK DIMENSIONS. ALL HOOKS SHALL BE IN ACCORDANCE WITH THE STRUCTURAL STANDARD DRAWINGS SS12-1, UNLESS INDICATED OTHERWISE.

LIST OF DRAWINGS

1- GENERAL ARRANGEMENT

LEGEND

DENOTES TRUSS SUPERSTRUCTURE

DENOTES NEW CONCRETE

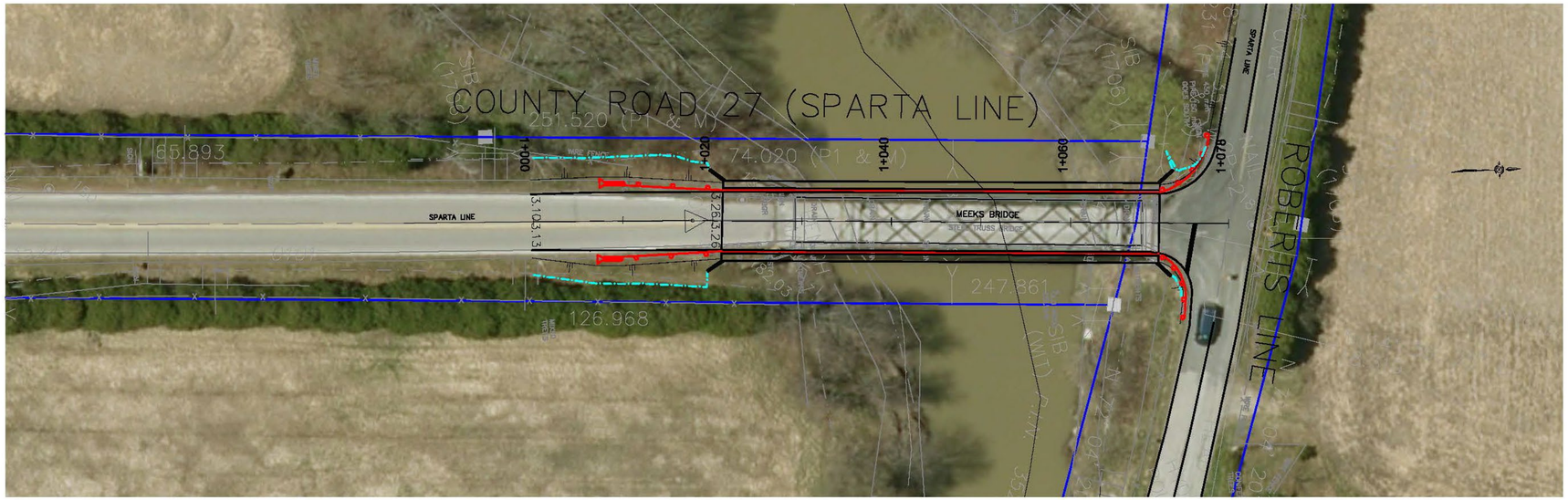
REFERENCE DRAWINGS

DETAILS OF THE ACROW BRIDGE SHOULD BE PROVIED BY SUPPLIER.

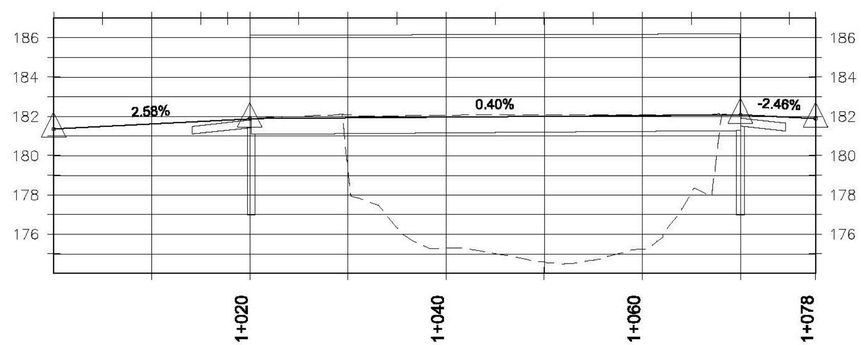
NOTE: ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.

	CIMA		NO.	DATE	NAME	REVISIONS	DRAWN: XXXXX DATE:			COUNTY OF ELGIN WORKS DEPARTMENT ONTARIO	CONTRACT NO. XXXXX
							DESIGN: XXXXX DATE:				
							CHECKED: XXXXX DATE:				
							APPROVED: XXXXX DATE:				
							AREA MUNICIPALITY SOUTHWOLD			MEEKS BRIDGE GENERAL ARRANGEMENT	DRAWING NO. 01
						SCALE HORIZONTAL VERTICAL	SURVEY DATA DATE XXXX	CONCESSION XX	REG. RD. NO. 27		SHEET XX OF XXX

Preferred Design Alternative



County Road 27 PROFILE



LEGEND:

- ROW
- PROPOSED EDGE OF PAVEMENT
- PROPOSED GRADING LIMIT
- PROPOSED GUIDERAIL

	COUNTY OF ELGIN REPLACEMENT OF MEEKS BRDIGE FUNCTIONAL DESIGN	DATE AUGUST 2020	PROJECT NO. B001175
		SCALE 1:500	DRAWING NO. 1

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Next Steps

Following this PIC the Project Team will:

- Review public and agency comments
- Confirm the preferred solution
- Finalize the preliminary design
- Prepare the Project File Report (PFR) to document the study and decision-making process
- File the PFR on the public record for 30-day public review period

How to get involved:

- **Read about our progress**: Project information will be posted on our website at https://www.elgincounty.ca/meeks-bridge-replacement/

- **Join our mailing list:** Send us your name and email address so we can keep you informed.

Please share your comments with either Project Manager:

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Please complete a comment sheet online to submit your comments to the Project Team.

Your comments are also welcome at any time throughout the study however, **we kindly ask that you provide comments with respect to the PIC materials by September 18, 2020** to allow us to incorporate critical information into the next stage of the study.

Thank you!