

Argyle Street Bridge Preliminary Design and Class EA Study  
**Net Effects Table –1.0 Natural Environmental Factor Group**

FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS AFTER MITIGATION
<b>1. NATURAL ENVIRONMENTAL FACTOR GROUP</b>					
<b>1.1 Fisheries and Aquatic Ecosystems</b>	1.1.1 Fish and Aquatic Habitat 1.1.2 Fish and Aquatic Community  <b>NOTES</b> Total New Pier Footprint = 38 m <sup>2</sup>  Total Temporary Traffic Bailey Bridge Footprint = 512 m <sup>2</sup>  Total Temporary Construction Access Causeway Footprint = 2800 m <sup>2</sup>  Total Temporary Cofferdam Footprint = 200 m <sup>2</sup>  Existing 8 bridge piers provide fish habitat by creating calm eddies downstream of the piers that provide feeding opportunities, shelter and temporary refuge in high flows. Fine materials settle out in these areas and may provide spawning habitat for some fish species and habitat for molluscs.  DFO policy that in-water work shall not result in a "Net Loss" of aquatic species or habitat.  Fisheries Act protects aquatic species and habitat from harmful alterations, disruptions or destruction resulting from project designs or construction	Potential to affect sensitive aquatic habitat and fish community  <u><b>RATIONALE</b></u> <ul style="list-style-type: none"> <li>The crossing of water bodies by transportation facilities has the potential to affect fish and aquatic habitat features through impediments to fish passage, loss of vegetation, changes to channel geomorphology (channel form and function), substrate and cover, changes to the water quality due to erosion and sedimentation, stormwater discharge and temperature changes.</li> <li>The Federal Fisheries Act prohibits the harmful alteration, disruption or destruction of fish habitat, the introduction of deleterious substances to fish habitat and the blockage of fish passage. Where impacts cannot be mitigated, a Fisheries Compensation Plan is prepared in consultation with DFO to address agency concerns/requirements.</li> <li>Subsection 36(3) of the Fisheries Act prohibits the deposit of a deleterious substance, directly or indirectly, into waters frequented by fish.</li> </ul>	<u><b>Design of Alternatives RH3, RH4, RP1, RP2, RP3, and RP4:</b></u>  The placement of a new bridge across the Grand River has the potential to affect aquatic species or their habitat in various ways: <ul style="list-style-type: none"> <li>New pier footprint has the potential to cause loss of fish habitat as follows:               <ul style="list-style-type: none"> <li>alternatives which require the installation of new piers could result in the permanent loss of fish habitat of 152 m<sup>2</sup>. for 4 new replacement piers, 305 m<sup>2</sup> for 8 new replacement piers, or 38 m<sup>2</sup> for x number of additional piers for a new bridge beside the existing.</li> <li>alternatives which require the installation of new piers could result in permanent barriers to fish movement if sufficient migration channels are not provided;</li> <li>alternatives which require the installation of new piers may result in permanent changes to water velocity sufficient to render existing fish habitat uninhabitable or impassible;</li> </ul> </li> <li>Alternatives that require a permanent decrease in the number of piers have the potential to reduce the diversity of fish habit created by the existing piers</li> <li>Alternatives that require a widened structure or a new bridge beside the existing bridge may result in a permanent loss of aquatic habitat due to additional overhead enclosure</li> <li>Loss of shoreline vegetation as a result of the new abutment footprint may decrease the vegetation available for food production, overhead cover or regulating water temperature;</li> <li>The potential for shoreline erosion as a result of the new abutment footprint may impact upon water quality and degrade or destroy fish or mollusc habitat</li> </ul> <u><b>Design of Alternatives RH1and RH2:</b></u>  The long-term rehabilitation of the existing bridge across the Grand River has the potential to affect aquatic species or their habitat in various ways: <ul style="list-style-type: none"> <li>New footprint area as a result of foundation underpinning or grouting may result in the permanent loss of fish habitat of 384 m<sup>2</sup>.</li> </ul> <u><b>Construction of All Alternatives:</b></u> Work in/adjacent to the river has the potential to cause	<u><b>Design of Alternatives RH3, RH4, RP1, RP2, RP3, and RP4:</b></u> <ul style="list-style-type: none"> <li>New piers will be designed to create similar back eddies downstream of the piers to create similar habitat diversity that is provided by the existing piers</li> <li>Rock scour protection around the new piers will utilize rock that is suitable to create additional aquatic habitat diversity</li> <li>The hydraulic capacity of a new bridge will be designed to minimize any increases in flow velocities or quantities, which will mitigate against impacts to fish movements through the bridge area</li> <li>The hydraulic capacity of a new bridge will be designed to minimize any upstream flooding;</li> <li>Shoreline vegetation that is removed to accommodate the footprint of a new bridge design will be replaced and enhanced with new, native vegetation in areas beside the new bridge to minimize the potential for erosion and sedimentation in the river and to maintain or enhance the shoreline vegetation contribution to food production, overhead cover and thermal regulation</li> <li>Near shore areas underneath the abutments of the new bridge alternatives can be designed to provide for a mixture of mudflat areas and rock habitat to provide improved habitat for molluscs to promote repopulation of the species following relocation</li> <li>Where mitigation measures for new bridge alternatives are deemed insufficient to adequately maintain the quantity and quality of aquatic habitat in the bridge area, compensation measures, in the form of new or diverse habitat, will be designed to increase aquatic habitat at the bridge area. All mitigation and compensation measures will be reviewed with DFO, MNR and the GRCA, and MTO will seek an Authorization under Section 35(2) of the Fisheries Act for all in-water works.</li> </ul> <b>Note:</b> If feasible, from a navigational safety and hydraulic capacity concern, the bases of the existing bridge piers could be left in place to maintain the aquatic habitat provided by the existing piers  <u><b>Design of Alternatives RH1and RH2:</b></u> <ul style="list-style-type: none"> <li>Rehabilitation work on the existing pier foundations will be designed to maintain the existing aquatic habitat following completion of the repairs and the addition of scour protection around the existing piers will improve aquatic habitat in these areas</li> <li>Rehabilitation work on the existing piers will be conducted in stages to ensure that fish movements through the area are maintained</li> <li>Rehabilitation alternatives will be designed to ensure that the existing hydraulic capacity at the bridge site is not reduced or altered</li> <li>Where mitigation measures for bridge rehabilitation alternatives are deemed insufficient to adequately maintain the quantity and quality of aquatic habitat in the bridge area, compensation measures, in the form of new or diverse habitat, will be designed to increase aquatic habitat at the bridge area. All mitigation and compensation measures will be reviewed with DFO, MNR and the GRCA, and MTO will seek an Authorization under Section 35(2) of the Fisheries Act for all in-water works.</li> </ul> <u><b>Construction of All Alternatives:</b></u> <ul style="list-style-type: none"> <li>In-water work, such as the construction of cofferdams, bailey         </li> </ul>	<u><b>All Design Alternatives (Rehabilitation and Replacement)</b></u>  The mitigation measures to be implemented will result in a neutral net effect to all temporary impacts to aquatic habitat however mitigation measures alone are insufficient to minimize the net effect of permanent impacts to aquatic habitat and compensation designs can be implemented to provide an overall <b>net benefit</b> to aquatic species and habitat which will adhere to DFO's No Net Loss of Fish Habitat policy.  <u><b>Construction of All Alternatives:</b></u> The potential for negative net effects can be minimized by implementing the

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			<p>the following:</p> <ul style="list-style-type: none"> <li>• Alternatives which involve the installation of a temporary Bailey bridge may result in the temporary loss of aquatic habitat of approximately 512 m<sup>2</sup>. or a permanent loss of aquatic species from the footings footprint</li> <li>• Alternatives which involve the installation of a temporary causeway for construction access may result in the temporary loss of aquatic habitat of approximately 2800 m<sup>2</sup>. from the causeway footprint or an impairment to fish movement</li> <li>• Alternatives that require the installation of cofferdams to construct new pier footings or to rehabilitate existing pier footings may result in a temporary loss of aquatic habitat of approximately 200 m<sup>2</sup> from the footprint of the cofferdam or an impairment to fish movement</li> <li>• Construction operations, such as dewatering or debris removal may result in the release of deleterious materials to the river which may result in a loss, disruption or alteration of aquatic habitat, such as sediment deposition on spawning sites or impaired water quality</li> <li>• Debris from construction or demolition of bridge components has the potential to drop in the river and destroy aquatic species or their habitat.</li> <li>• Construction access along the shoreline may result in the temporary loss of riparian vegetation which could cause erosion and sedimentation of the river or a loss of shoreline food production and cover</li> </ul>	<p>bridges, or causeways, will be scheduled during the period to July 1<sup>st</sup> through to September 30<sup>th</sup> to avoid sensitive coldwater spawning periods outside of this window.</p> <ul style="list-style-type: none"> <li>• Sensitive molluscs will be physically relocated from areas that will necessitate a permanent or temporary footprint in the river prior to the commencement of construction to avoid harm or loss;</li> <li>• Work areas in the river, for pier construction or rehabilitation, will be isolated from the river by installing cofferdam enclosures to allow construction to be conducted in dry conditions. Work inside the cofferdams can thereby proceed during the restricted period for in-water work.</li> <li>• Causeways, if required for construction access, will only extend a maximum of 50% of the width of the river at any time to maintain fish movements through the bridge area. Causeways will employ the use of culverts to allow flow to pass through the area of the river covered by the causeway to ensure that flows through the remaining section of the river are not increased to a level that impairs fish movement through the bridge area. Causeways will be removed prior to the extreme flows associated with the spring run-off to prevent washouts and to ensure that flows during this period do not impair fish movements.</li> <li>• De-watering activities inside of cofferdams or along the shoreline will be designed to capture and filter sediments from the water prior to discharge into the river.</li> <li>• Emissions and debris from concrete removal activities will be contained and prevented from entering the river through the use of protection platforms or containment systems</li> <li>• Shoreline vegetation that is not required to be removed for construction access or staging will be protected with a barrier to prevent damage to the vegetation.</li> <li>• Shoreline vegetation that is removed to accommodate construction access or staging will be replaced and enhanced with new, native vegetation in areas beside the new bridge to minimize the potential for erosion and sedimentation in the river and to maintain or enhance the shoreline vegetation contribution to food production, overhead cover and thermal regulation.</li> <li>• Areas of shoreline that may be subjected to disturbance from construction activities, will be isolated from the river by installing a double row of heavy duty silt fence along the shoreline to prevent sediments from entering the river.</li> <li>• Construction machinery being used in the river or along the shoreline will be required to use biodegradable fluids, such as lubricating oil or hydraulic fluid, to prevent contamination in the instance of a fluid leak. In most cases, machinery will not be allowed to be re-fueled in the river and a designated re-fueling area and storage area for chemicals or fluids will be required away from the river and equipped with a containment system to prevent the migration of spills into the river.</li> <li>• Rock or other aggregate materials being used in the river will be required to be washed and cleaned prior to placement in the river to prevent sediment from being deposited in the river.</li> <li>• All in-water and shoreline construction operations will be monitored by a qualified environmental specialist to ensure compliance with the mitigation measures designed.</li> </ul>	<p>mitigation measures considered and good construction practices to maintain the overall quality and quantity of aquatic habitat. In this instance, the <b>overall net effects would be temporary and negligible.</b></p>
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<p><b>1.2 Terrestrial Ecosystems</b></p>	<p>1.2.1 Wildlife Habitat and Wildlife          1.2.2 Vegetation</p>	<p>Potential to affect sensitive wildlife habitat and wildlife</p> <p>Potential to affect trees and other vegetation communities</p> <p><u>RATIONALE</u></p> <ul style="list-style-type: none"> <li><i>The presence of species identified by COSEWIC and COSSARO as vulnerable, threatened or endangered (VTE) requires consideration. Species or populations may be under pressure or susceptible to stress as a result of development. Since habitat for these species is often limited, impacts to areas where the presence of species at risk is suspected or confirmed should be avoided or minimized. Species of Conservation Concern (as defined by MNR in the Significant Wildlife Habitat Technical Guides (SWHTG – MNR, 2000) and GRCA species of concern will also be considered.</i></li> <li><i>The general prohibitions under the Species at Risk Act, which apply to federally protect migratory bird and aquatic species at risk as well as to all endangered and threatened species on federal lands.</i></li> <li><i>Section 6 of the Migratory Bird Regulations under the Migratory Birds Convention Act, 1994, which prohibits the incidental take of migratory birds and the disturbance and destruction of taking of the nest of a migratory bird.</i></li> <li><i>It is important that potential impacts to riparian vegetation are identified.</i></li> </ul>	<p><b><u>Design of Alternatives RH3, RH4, RP1, RP2, RP3, and RP4:</u></b></p> <p>The placement of a new bridge across the Grand River has the potential to affect wildlife species or their habitat in various ways:</p> <ul style="list-style-type: none"> <li>Birds currently nesting on the existing bridge may lose nesting habitat</li> <li>Loss of shoreline vegetation as a result of the new abutment footprint may decrease the vegetation available for perching or nesting – approximately - 250 m<sup>2</sup>. for alternatives RP1, RP2, RP3 and RP4, 160 m<sup>2</sup> for alternative RH3, and 200 m<sup>2</sup> for alternative RH4.</li> <li>New abutments may fragment habitat north and south of the bridge impairing shoreline movements for small mammals</li> </ul> <p><b><u>Design of Alternatives RH1and RH2:</u></b></p> <p>The comprehensive rehabilitation of the existing bridge across the Grand River has the potential to affect wildlife species or their habitat:</p> <ul style="list-style-type: none"> <li>Loss of shoreline vegetation as a result of removals to accommodate the rehabilitated bridge may decrease the vegetation available for perching or nesting</li> <li>Birds currently nesting on the existing bridge may lose nesting habitat</li> </ul> <p><b><u>Construction of All Alternatives:</u></b></p> <p>Work in/adjacent to the river has the potential to cause the following:</p> <ul style="list-style-type: none"> <li>Alternatives which involve the installation of a temporary bailey bridge may result in the temporary loss of shoreline terrestrial habitat of approximately 16 m<sup>2</sup>.</li> <li>Construction access along the shoreline may result in the temporary loss of riparian vegetation which could cause a loss of habitat for terrestrial species or result in the displacement of terrestrial species</li> <li>During construction, birds will be prevented from nesting on the existing structure, either during rehabilitation or demolition, causing a loss of nesting and rearing habitat</li> </ul>	<p><b><u>Design of Alternatives RH3, RH4, RP1, RP2, RP3, and RP4:</u></b></p> <ul style="list-style-type: none"> <li>Shoreline vegetation that is removed to accommodate the footprint of a new bridge design will be replaced and enhanced with new, native vegetation in areas beside the new bridge to ensure that there is no net loss of productive terrestrial habitat and to maintain or enhance the shoreline vegetation</li> <li>Near shore areas underneath the abutments of the new bridge alternatives can be designed to provide for uninterrupted shoreline movements for small mammals to mitigate the effects of habitat fragmentation</li> <li>Bird species currently nesting on the existing bridge are tolerant of urban settings and will return to a new bridge and take up nesting again.</li> </ul> <p><b><u>Design of Alternatives RH1and RH2:</u></b></p> <ul style="list-style-type: none"> <li>Shoreline vegetation that is removed to accommodate the rehabilitated bridge design will be replaced and enhanced with new, native vegetation in areas beside the bridge to ensure that there is no net loss of productive terrestrial habitat and to maintain or enhance the shoreline vegetation</li> <li>Bird species currently nesting on the exiting bridge are tolerant of urban settings and will return to the bridge and take up nesting again following the rehabilitation work.</li> </ul> <p><b><u>Construction of All Alternatives:</u></b></p> <ul style="list-style-type: none"> <li>Preventative measures will be included in the contract, to prevent birds from starting to nest on the existing bridge prior to construction.</li> <li>Shoreline vegetation that is not required to be removed for construction access or staging will be protected with a barrier to prevent damage to the vegetation.</li> <li>Shoreline vegetation that is removed to accommodate construction access or staging will be replaced and enhanced with new, native vegetation in areas beside the new bridge to maintain or enhance the shoreline vegetation contribution to terrestrial habitat</li> <li>Areas of shoreline that may be subjected to disturbance from construction activities, will be isolated from the river by installing a double row of heavy duty silt fence along the shoreline to prevent sediments from entering the river.</li> </ul>	<p><b><u>All Design Alternatives (Rehabilitation and Replacement) and Construction:</u></b></p> <p>The potential for negative net effects can be mitigated by providing new habitat, such as a new bridge for bird nesting, shoreline travel capabilities for terrestrial species or new vegetation planted to replace lost vegetation. In this instance, the overall net effects are neutral or have the potential to provide a net benefit through the planting of more habitat friendly vegetation species.</p>
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<b>2. SOCIO-ECONOMIC ENVIRONMENTAL FACTOR GROUP</b>					
<b>2.1 Land Use Planning Policies, Goals, Objectives</b>	2.1.1 First Nations Land Claims	Potential to affect areas for which there are First Nations land claims.  <i><b>RATIONALE:</b> It is important that First Nations land claims in the study area are documented. This project is within an area covered by three Six Nations land claims #5 - Hamilton-Port Dover Plank Road, Seneca &amp; Oneida Townships, #20 - Bed of the Grand River and Islands thereon and #21 - Tow Path Lands.</i>	<u><b>All Design Alternatives (Rehabilitation and Replacement)</b></u>  The potential adverse impact to Six Nations land claims will be determined after thorough discussions between Six Nations and the Province of Ontario based on the crossing at this location, and the footprint of the completed project and construction area.	<u><b>All Design Alternatives (Rehabilitation and Replacement)</b></u>  Potential accommodation will be determined after thorough discussions between Six Nations and the Province of Ontario	<u><b>All Design Alternatives (Rehabilitation and Replacement)</b></u>  Potential accommodation will be determined after thorough discussions between Six Nations and the Province of Ontario based on the crossing at this location and the footprint of the completed project and the construction area. All replacement options or provision of a new bridge adjacent to the existing bridge will be deemed to be within an area which is the subject of Six Nations land claims and will be considered for potential impacts on the claim area. Six Nations land claims are being addressed at the Six Nations / Canada / Ontario Side Table negotiations.
	2.1.2 Municipal (regional and local) land use planning goals and objectives	Potential to support municipal objectives of adequate connection across the river on Argyle Street.  <i><b>RATIONALE:</b> There is a need to co-ordinate transportation planning with the municipal land use planning as established through Official Plans, Secondary plans and Zoning by-laws as these specify land uses supported by residents, the municipality and the province.</i>  <i><b>NOTE:</b> Haldimand County has identified, through a Traffic Impact Study, that an additional lane is required at the existing Argyle Street Bridge crossing to address existing and future traffic volumes.</i>	<u><b>Design of Alternatives RH3, RH4, RP1, RP2, RP3, and RP4</b></u>  Alternatives that provide permanent additional lanes (1 or 2), at the Argyle Street Crossing meet the municipal land use planning as established through Official plans. Alternatives RH1 and RH2 do not provide additional lanes.	<u><b>Design Alternatives RH1 and RH2</b></u>  There are no mitigation measures for those alternatives that do not provide permanent additional lanes (1 or 2) at the existing Argyle Street Bridge Crossing.	<u><b>Design of Alternatives RH3, RH4, RP1, RP2, RP3, and RP4</b></u>  Alternatives that provide permanent additional lanes (1 or 2), at the Argyle Street Crossing <u>meet</u> the municipal land use planning as established through Official plans.  <u>Alternatives RH1 and RH2</u> do not provide permanent additional lanes (1 or 2), at the Argyle Street Crossing and <u>do not meet</u> municipal land use planning under the Official plans.
<b>2.2 Land Use/Community – Long Term</b>	2.2.1 Urban Residential	Potential to affect urban residential areas  <i><b>RATIONALE:</b> Property takings / displacements and changes / effects on local residents, as well as the broader community.</i>	<u><b>Design Alternatives RH1 and RH2</b></u>  Alternatives that provide for rehabilitation of the bridge with no additional lanes, have impacts to:  PROPERTY • No permanent property acquisition required. RESIDENTS • No loss of residential units required.	<u><b>Design Alternatives RH1 and RH2</b></u>  Mitigation measures include:  PROPERTY • No mitigation measures required. RESIDENTS • No mitigation measures required.	<u><b>Design Alternatives RH1 and RH2</b></u>  Net effects include:  PROPERTY No net effects. RESIDENTS No net effects.

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			<p><b>Design Alternatives RH3 and RH4</b>                      These alternatives will have impacts to:</p> <p>PROPERTY</p> <ul style="list-style-type: none"> <li>Permanent property acquisition required along the west side of Argyle Street to provide the north and south approaches to the new bridge.</li> </ul> <p>RESIDENTS</p> <ul style="list-style-type: none"> <li>• No loss of residential units required for a 1 lane bridge adjacent to the existing bridge.</li> <li>• Loss of 2 residential units (above commercial units) for a 2 lane bridge adjacent to the existing bridge.</li> </ul> <p><b>Design Alternatives RP1, RP2, RP3, and RP4</b>                      The bridge replacement alternatives, will have impacts to:</p> <p>PROPERTY</p> <ul style="list-style-type: none"> <li>No permanent property acquisition required.</li> </ul>	<p><b>Design Alternatives RH3 and RH4</b>                      Mitigation measures include:</p> <p>PROPERTY</p> <ul style="list-style-type: none"> <li>North and south approaches must be designed to meet current design standards therefore no mitigation measures available to reduce property acquisition.</li> </ul> <p><b>Design Alternatives RP1, RP2, RP3, and RP4</b>                      Mitigation measures include:</p> <p>PROPERTY</p> <ul style="list-style-type: none"> <li>No mitigation measures required.</li> </ul>	<p><b>Design Alternatives RH3 and RH4</b>                      Net effects include:</p> <p>PROPERTY</p> <ul style="list-style-type: none"> <li>Net effect is permanent property acquisition required.</li> </ul> <p>RESIDENTS</p> <ul style="list-style-type: none"> <li>Net affect for a two lane bridge is permanent loss of 2 residential units.</li> </ul> <p><b>Design Alternatives RP1, RP2, RP3, and RP4</b>                      Net effects include:</p> <p>PROPERTY</p> <ul style="list-style-type: none"> <li>No property required.</li> </ul>
	2.2.2 Commercial / Industrial / Local Businesses / Economy	Potential to affect local businesses and local economy  <i>RATIONALE: Property takings / displacements and changes / effects on local access have a significant impact on local businesses, owners, tenants, customer/client base, as well as the broader community.</i>	<p><b>Design Alternatives RH1 and RH2</b>                      Alternatives that provide for rehabilitation of the bridge with no additional lanes, have impacts to:</p> <p>PROPERTY</p> <ul style="list-style-type: none"> <li>No permanent property acquisition required.</li> </ul> <p>LOCAL BUSINESSES</p> <ul style="list-style-type: none"> <li>No business relocations required as a result of property acquisition.</li> <li>Due to existing traffic volumes, access to local businesses will continue to be difficult during peak hours.</li> <li>Customer/clientele may be discouraged by traffic within the vicinity of the bridge, today and in the future, and may opt to modify their shopping habits/locations to avoid the traffic congestion.</li> </ul>	<p><b>Design Alternatives RH1 and RH2</b>                      Mitigation measures include:</p> <p>PROPERTY</p> <ul style="list-style-type: none"> <li>No mitigation measures required.</li> </ul> <p>LOCAL BUSINESSES</p> <ul style="list-style-type: none"> <li>No mitigation measures required.</li> </ul>	<p><b>Design Alternatives RH1 and RH2</b>                      Net effects include:</p> <p>PROPERTY</p> <ul style="list-style-type: none"> <li>No property required.</li> </ul> <p>LOCAL BUSINESSES</p> <ul style="list-style-type: none"> <li>Net effect is that customers/clientele will continue to experience a substantial delays when crossing the Argyle Street Bridge during peak hours since number of lanes at crossing maintained. This may result in:                             <ul style="list-style-type: none"> <li>customers/clientele experiencing difficulty accessing the local businesses; and</li> <li>customers/clientele being discouraged by traffic within the vicinity of the bridge, today and in the future, and opting to modify their shopping habits/locations to avoid the traffic congestion.</li> </ul> </li> </ul>

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			<p><b><u>Design Alternatives RH3 and RH4</u></b>                      This alternative will have impacts to:</p> <p><b>PROPERTY</b></p> <ul style="list-style-type: none"> <li>Permanent property acquisition required along the west side of Argyle Street to provide the north and south approaches to the new bridge.</li> </ul> <p><b>LOCAL BUSINESSES</b></p> <ul style="list-style-type: none"> <li>Relocation of 5 businesses for both a 1-lane and 2-lane bridge will reduce the number of businesses within the vicinity of the bridge and may reduce the customers/clientele to the local businesses.                             <ul style="list-style-type: none"> <li>customers/clientele experiencing less difficulty accessing the local businesses; and</li> </ul> </li> <li>Customer/clientele may be encouraged to modify their shopping habits/locations and frequent local businesses due to reduced traffic congestion.</li> </ul> <p><b>BROADER COMMUNITY</b></p> <ul style="list-style-type: none"> <li>Relocation of 5 businesses for both the 1-lane and 2-lane bridges will reduce the number of businesses within the vicinity of the bridge and may reduce the customers/clientele to the local businesses.</li> </ul> <p><b><u>Design Alternatives RP1, RP2, RP3, and RP4</u></b>                      The bridge replacement alternatives, will have impacts to:</p> <p><b>PROPERTY</b></p> <ul style="list-style-type: none"> <li>No permanent property acquisition required.</li> </ul> <p><b>LOCAL BUSINESSES</b></p> <ul style="list-style-type: none"> <li>Customer/clientele may be encouraged to modify their shopping habits/locations and frequent local businesses due to reduced traffic congestion.</li> </ul> <p><b>BROADER COMMUNITY</b></p> <ul style="list-style-type: none"> <li>Customer/clientele may be encouraged to modify their shopping habits/locations and frequent local businesses due to reduced traffic congestion.</li> </ul>	<p><b><u>Design Alternatives RH3 and RH4</u></b>                      Mitigation measures include:</p> <p><b>PROPERTY</b></p> <ul style="list-style-type: none"> <li>North and south approaches must be designed to meet current design standards therefore no mitigation measures available to reduce property acquisition.</li> </ul> <p><b>LOCAL BUSINESSES</b></p> <ul style="list-style-type: none"> <li>North and south approaches must be designed to meet current design standards therefore no mitigation measures available to reduce impacts to local businesses.</li> </ul> <p><b>BROADER COMMUNITY</b></p> <ul style="list-style-type: none"> <li>No mitigation measures available.</li> </ul> <p><b><u>Design Alternatives RP1, RP2, RP3, and RP4</u></b>                      Mitigation measures include:</p> <p><b>PROPERTY</b></p> <ul style="list-style-type: none"> <li>No mitigation measures required.</li> </ul> <p><b>LOCAL BUSINESSES</b></p> <ul style="list-style-type: none"> <li>No mitigation measures required.</li> </ul> <p><b>BROADER COMMUNITY</b></p> <ul style="list-style-type: none"> <li>No mitigation measures required.</li> </ul>	<p><b><u>Design Alternatives RH3 and RH4</u></b>                      Net effects include:</p> <p><b>PROPERTY</b></p> <ul style="list-style-type: none"> <li>Net affect is permanent property is required from commercial property for both a 1-lane bridge and 2-lane bridge.</li> </ul> <p><b>LOCAL BUSINESSES</b></p> <ul style="list-style-type: none"> <li>Net affect is that the relocation of 5 existing businesses is required for both a 1-lane bridge and 2-lane bridge.                             <ul style="list-style-type: none"> <li>Customer/clientele may be encouraged to modify their shopping habits/locations and frequent local businesses due to reduced traffic congestion.</li> </ul> </li> </ul> <p><b>BROADER COMMUNITY</b></p> <ul style="list-style-type: none"> <li>Net affect is that the relocation of 5 existing businesses is required for both a 1-lane bridge and 2-lane bridge.</li> </ul> <p><b><u>Design Alternatives RP1, RP2, RP3, and RP4</u></b>                      Net effects include:</p> <p><b>PROPERTY</b></p> <p>No property required, therefore there no net effects.</p> <p><b>LOCAL BUSINESSES</b></p> <p>Positive Net effect to local businesses</p> <p><b>BROADER COMMUNITY</b></p> <p>Positive Net effect to the community</p>

FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS AFTER MITIGATION
<b>2. SOCIO-ECONOMIC ENVIRONMENTAL FACTOR GROUP</b>					
<p><b>2.3 Community Disruption –</b></p> <p><i>Short Term</i></p>	<p>2.3.1 Duration of Construction Disruption to the traffic and downtown area / economy (during initial construction and subsequent rehabilitations)</p>	<p>Potential to reduce the overall duration of disruption to traffic and the downtown area and local economy due to construction activities. (2 construction seasons is the normal duration for disruptions for most alternatives)</p> <p><i>RATIONALE: Construction activities may adversely affect traffic and the downtown area. There is a need to minimize duration and degree of disruption.</i></p>	<p><b>Design Alternative RH1 &amp; RH2:</b></p> <p>Major construction disruption to the community occurs twice over the next 50 years.</p> <ul style="list-style-type: none"> <li>• 30 year rehabilitation with a 1 lane Bailey will require traffic to be reduced to a single lane throughout construction (2 construction seasons and winter shut down).</li> <li>• The 20 year rehabilitation will require traffic to be reduced to a single lane throughout construction (1 to 2 construction seasons, open to 2 lanes during winter shut down).</li> </ul> <p><b>Design Alternatives RH3 and RH4:</b></p> <ul style="list-style-type: none"> <li>• Major construction disruption to the community occurs twice over the next 50 years.</li> <li>• During construction of the new bridge, traffic remains on the existing Argyle Street Bridge</li> <li>• During the 30 year rehabilitation of the existing Argyle Street Bridge:                             <ul style="list-style-type: none"> <li>○ Traffic reduced to 1 lane of traffic over the new bridge (New 1 Lane Bridge); or</li> <li>○ 2 lanes maintained over the new bridge (New 2 Lane Bridge).</li> </ul> </li> <li>• The construction of a new bridge and rehabilitation of the existing bridge extends the length for disruption for an additional 1 to 2 years.</li> <li>• During the 20 year rehabilitation of the existing Argyle Street Bridge:                             <ul style="list-style-type: none"> <li>○ 2 lanes of traffic maintained, 1 lane on the existing Argyle Street Bridge and 1 lane on the new bridge (New 1 Lane Bridge); or</li> <li>○ 2 lanes of traffic maintained, both lanes on the new bridge (New 2 Lane Bridge).</li> </ul> </li> </ul>	<p><b>Design Alternative RH1 &amp; RH2:</b></p> <p>Provision of a 1 or 2 lane Bailey will allow for 1 or 2 lanes of traffic to cross the river throughout construction (2 construction seasons and winter shut down).</p> <p><b>Design Alternatives RH3 and RH4:</b></p> <p>No mitigation measures are available</p>	<p><b>Design Alternative RH1 &amp; RH2:</b></p> <p>The net effects are average construction time of 2 years during both construction events. Traffic impacts during construction can be minimized with a temporary 2-lane bailey bridge however a 1-lane bailey bridge will require increased disruption to traffic by requiring northbound traffic to use the By-Pass.</p> <p><b>Design Alternatives RH3 and RH4:</b></p> <p>The net effects are an increased construction time to 3 to 4 years during the first construction event and 1 or 2 year disruption during the following construction event. Traffic impacts can be minimized with a new 2-lane bridge</p>

FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS AFTER MITIGATION
<b>2. SOCIO-ECONOMIC ENVIRONMENTAL FACTOR GROUP</b>					
			<p><b>Design Alternatives - All Replacement Alternatives</b></p> <ul style="list-style-type: none"> <li>2 construction disruption to the community, during construction of replacement, followed by a less disruptive construction for rehabilitation of the new bridge over the next 50 years.</li> <li>During construction of the replacement bridge, provision of a 1 lane Bailey will require traffic to be reduced to a single lane throughout construction (2 construction seasons)</li> <li>20 year rehabilitation would be able to provide a minimum of 1 lane, likely 2 lanes, of traffic on the replacement bridge throughout construction (1 to 2 construction seasons, open to 3 lanes during winter shut down).</li> </ul>	<p><b>Design Alternatives - All Replacement Alternatives</b></p> <p>Provision of a 2 lane Bailey will allow for 2 lanes of traffic to cross the river throughout construction (2 construction seasons and winter shut down).</p>	<p><b>Design Alternatives - All Replacement Alternatives</b></p> <p>The net effects are average construction time of 2 years for construction of the new bridge followed by a 1 year construction season for the rehabilitation of the new bridge. Traffic impacts during initial construction can be minimized with a temporary 2-lane bailey bridge. Traffic disruptions during subsequent rehabilitation are minimized by keeping 2 lanes of traffic open on the new bridge</p> <p>These disruptions are as follows: to be totaled and discussed at scoring meeting.</p>
	<p>2.3.2 Degree of Traffic Disruption between the north and south sides of Caledonia (during initial construction and subsequent rehabilitations)</p> <p><i>NOTE TO SCORERS: The previous 2.3.6 (Before/After Disruption to business was incorporated into 2.3.2 during the weighting workshop).</i></p>	<p>Potential impact to traffic operations during construction due to traffic staging requirements</p> <p><i>RATIONALE: Construction activities may adversely affect traffic and the downtown area. There is a need to minimize duration and degree of disruption.</i></p> <p><i>NOTE: 2 construction seasons is the normal duration for disruptions for most alternatives</i></p>	<p><b>Design Alternative RH1 &amp; RH2:</b></p> <p><u>DURATION/DEGREE</u></p> <p>Major construction disruption to the community occurs twice over the next 50 years.</p> <ul style="list-style-type: none"> <li>30 year rehabilitation with a 1 lane Bailey will require traffic to be reduced to a single lane throughout construction (2 construction seasons and winter shut down).</li> <li>The 20 year rehabilitation will require traffic to be reduced to a single lane throughout construction (1 to 2 construction seasons, open to 2 lanes during winter shut down).</li> </ul> <p>The potential effects are: Continued impacts to traffic operations to allow for the construction and maintenance activities.</p> <p>The potential effects are: Continued impacts to traffic operations to allow for the construction and maintenance activities.</p>	<p><b>Design Alternative RH1 &amp; RH2:</b></p> <p><u>DURATION/DEGREE</u></p> <p>No mitigation measures available.</p>	<p><b>Design Alternative RH1 &amp; RH2:</b></p> <p><u>DURATION/DEGREE</u></p> <p>The net effect is considerable disruption of travel between north and south Caledonia during construction.</p> <p>Any future maintenance and/or emergency events could result in a higher degree of impact due to the two lane cross-section.</p>



FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS AFTER MITIGATION
<b>2. SOCIO-ECONOMIC ENVIRONMENTAL FACTOR GROUP</b>					
			<p><u>BEFORE/AFTER IMPACTS</u></p> <p><b>BEFORE CONSTRUCTION</b></p> <ul style="list-style-type: none"> <li>Due to existing traffic volumes, access to local businesses will continue to be difficult during peak hours.</li> <li>Customer/clientele may be discouraged by traffic within the vicinity of the bridge, and may opt to modify their shopping habits/locations to avoid the traffic congestion.</li> </ul> <p><b>DURING CONSTRUCTION – TRAFFIC REDUCED TO ONE LANE</b></p> <ul style="list-style-type: none"> <li>Due to construction presence, customers/clientele may avoid the local businesses in the vicinity of the bridge.</li> <li>Due to reduced traffic (i.e. one lane southbound), traffic congestion will be reduced and may attract customers/clientele.</li> </ul> <p><b>DURING CONSTRUCTION – TWO LANES OF TRAFFIC MAINTAINED</b></p> <ul style="list-style-type: none"> <li>Due to construction presence, customers/clientele may avoid the local businesses in the vicinity of the bridge.</li> </ul> <p><b>AFTER CONSTRUCTION</b></p> <ul style="list-style-type: none"> <li>Following construction, customer/clientele who avoided the area of the bridge, due to construction, may not immediately return.</li> <li>Customer/clientele may be discouraged by traffic within the vicinity of the bridge, today and in the future, and may opt to modify their shopping habits/locations permanently.</li> <li>During the 20 year rehabilitation of the existing Argyle Street Bridge:                             <ul style="list-style-type: none"> <li>2 lanes of traffic maintained, 1 lane on the existing Argyle Street Bridge and 1 lane on the new bridge (New 1 Lane Bridge); or</li> <li>2 lanes of traffic maintained, both lanes on the new bridge (New 2 Lane Bridge).</li> </ul> </li> </ul> <p><u>Design Alternatives RH3 and RH4</u></p> <p><u>DURATION/DEGREE</u></p> <ul style="list-style-type: none"> <li>Major construction disruption to the community occurs twice over the next 50 years.</li> <li>During construction of the new bridge, traffic remains on the existing Argyle Street Bridge</li> <li>During the 30 year rehabilitation of the existing Argyle Street Bridge:</li> </ul>	<p><u>BEFORE/AFTER IMPACTS</u></p> <p><b>BEFORE CONSTRUCTION – Not Applicable</b></p> <p><b>DURING CONSTRUCTION – TRAFFIC REDUCED TO ONE LANE</b></p> <p>Mitigation measures include:</p> <ul style="list-style-type: none"> <li>maintaining access to local businesses; and provision of enhanced signing program to advise customers/clientele that the local businesses are open and operating.</li> </ul> <p><b>DURING CONSTRUCTION – TWO LANES OF TRAFFIC MAINTAINED</b></p> <p>Mitigation measures include:</p> <ul style="list-style-type: none"> <li>maintaining access to local businesses and provision of enhanced signing program to advise customers/clientele that the local businesses are open and operating.</li> </ul> <p><b>AFTER CONSTRUCTION – Not Applicable</b></p> <p><u>Design Alternatives RH3 and RH4:</u></p> <p><u>DURATION/DEGREE</u></p> <p>No mitigation measures are available</p>	<p><u>BEFORE/AFTER IMPACTS</u></p> <p><b>BEFORE CONSTRUCTION</b></p> <p>There is no net effect since conditions are unchanged from current conditions.</p> <p><b>DURING CONSTRUCTION – TRAFFIC REDUCED TO ONE LANE</b></p> <p>Net effects include minimal impact to businesses since business accesses maintained, and enhanced signing program provided.</p> <p><b>DURING CONSTRUCTION – TWO LANES OF TRAFFIC MAINTAINED</b></p> <p>Less impact than one lane Bailey bridge, since number of traffic lanes maintained.</p> <p><b>AFTER CONSTRUCTION</b></p> <p>There is no net effect since conditions are unchanged from current conditions.</p> <p><u>Design Alternatives RH3 and RH4:</u></p> <p><u>DURATION/DEGREE</u></p> <p>The net effects are an increased construction time to 3 to 4 years during the first construction event. Reduced traffic disruption during future construction, maintenance or emergency events due to additional lanes on the new adjacent bridge.</p>

FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS AFTER MITIGATION
<b>2. SOCIO-ECONOMIC ENVIRONMENTAL FACTOR GROUP</b>					
			<ul style="list-style-type: none"> <li>o Traffic reduced to 1 lane of traffic over the new bridge (New 1 Lane Bridge); or</li> <li>o 2 lanes maintained over the new bridge (New 2 Lane Bridge).</li> </ul> <ul style="list-style-type: none"> <li>• The construction of a new bridge and rehabilitation of the existing bridge extends the length for disruption for an additional 1 to 2 years.</li> <li>• During the 20 year rehabilitation of the existing Argyle Street                             <ul style="list-style-type: none"> <li>o 2 lanes of traffic maintained, 1 lane on the existing</li> <li>o 2 lanes of traffic maintained, both lanes on the</li> </ul> </li> </ul> <p>The potential effects are:                      Continued impacts to traffic operations to allow for the construction and maintenance activities.</p> <p><u>BEFORE/AFTER IMPACTS</u>                      BEFORE CONSTRUCTION</p> <ul style="list-style-type: none"> <li>• Due to existing traffic volumes, access to local businesses will continue to be difficult during peak hours.</li> <li>• Customer/clientele may be discouraged by traffic within the vicinity of the bridge, and may opt to modify their shopping habits/locations to avoid the traffic congestion.</li> </ul> <p>DURING CONSTRUCTION – TRAFFIC REDUCED TO ONE LANE</p> <ul style="list-style-type: none"> <li>• Due to construction presence, customers/clientele may avoid the local businesses in the vicinity of the bridge.</li> <li>• Due to reduced traffic (i.e. one lane southbound), traffic congestion will be reduced and may attract customers/clientele.</li> </ul> <p>DURING CONSTRUCTION – TWO LANES OF TRAFFIC MAINTAINED</p> <ul style="list-style-type: none"> <li>• Due to construction presence, customers/clientele may avoid the local businesses in the vicinity of the bridge.</li> </ul> <p>AFTER CONSTRUCTION</p> <ul style="list-style-type: none"> <li>• Following construction, customer/clientele who avoided the area of the bridge, due to construction, may not immediately return.</li> </ul>	<p><u>BEFORE/AFTER IMPACTS</u>                      BEFORE CONSTRUCTION – Not Applicable</p> <p>DURING CONSTRUCTION – TRAFFIC REDUCED TO ONE LANE</p> <p>Mitigation measures include:</p> <ul style="list-style-type: none"> <li>• maintaining access to local businesses; and</li> <li>• provision of enhanced signing program to advise customers/clientele that the local businesses are open and operating.</li> </ul> <p>DURING CONSTRUCTION – TWO LANES OF TRAFFIC MAINTAINED</p> <p>Mitigation measures include:</p> <ul style="list-style-type: none"> <li>• maintaining access to local businesses; and provision of enhanced signing program to advise customers/clientele that the local businesses are open and operating.</li> </ul> <p>AFTER CONSTRUCTION</p> <p>AFTER CONSTRUCTION – Not Applicable</p>	<p><u>BEFORE/AFTER IMPACTS</u>                      BEFORE CONSTRUCTION</p> <p>There is no net effect since conditions are unchanged from current conditions.</p> <p>DURING CONSTRUCTION – TRAFFIC REDUCED TO ONE LANE</p> <p>Net effects include minimal impact to businesses since business accesses maintained, and enhanced signing program provided.</p> <p>DURING CONSTRUCTION – TWO LANES OF TRAFFIC MAINTAINED</p> <p>Less impact than one lane new bridge, since number of traffic lanes maintained.</p> <p>AFTER CONSTRUCTION</p> <p>Customers/Clientele will no longer experience substantial delays in the vicinity of the Argyle Street Bridge during peak hours resulting in better access to local businesses.</p>

FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS AFTER MITIGATION
<b>2. SOCIO-ECONOMIC ENVIRONMENTAL FACTOR GROUP</b>					
			<ul style="list-style-type: none"> <li>Customers/Cienteles will no longer experience substantial delays in the vicinity of the Argyle Street Bridge during peak hours resulting in better access to local businesses.</li> <li>Customer/clientele, who did not regularly frequent the local businesses in the vicinity of the bridge, may be encouraged to modify their shopping habits/locations due to reduced traffic congestion.</li> </ul> <p><b>All Design Replacement Alternative</b>  <u>DURATION/DEGREE</u></p> <ul style="list-style-type: none"> <li>2 construction disruption to the community, during construction of replacement, followed by a less disruptive construction for rehabilitation of the new bridge.</li> <li>During the 1st construction event one lane will be provided for two years.</li> <li>20 year rehabilitation would be able to provide a minimum of 1 lane, likely 2 lanes, of traffic on the Argyle Street Bridge throughout construction (1 to 2 construction seasons, open to 3 lanes during winter shut down).</li> </ul> <p>The potential effects are:                      Continued impacts to traffic operations to allow for the construction and maintenance activities.</p> <p><u>BEFORE/AFTER CONSTRUCTION</u>  <u>BEFORE CONSTRUCTION</u></p> <ul style="list-style-type: none"> <li>Due to existing traffic volumes, access to local businesses will continue to be difficult during peak hours.</li> <li>Customer/clientele may be discouraged by traffic within the vicinity of the bridge, and may opt to modify their shopping habits/locations to avoid the traffic congestion.</li> </ul> <p><u>DURING CONSTRUCTION – TRAFFIC REDUCED TO ONE LANE</u></p> <ul style="list-style-type: none"> <li>Due to construction presence, customers/clientele may avoid the local businesses in the vicinity of the bridge.</li> <li>Due to reduced traffic (i.e. one lane southbound), traffic congestion will be reduced and may attract customers/clientele.</li> </ul> <p><u>DURING CONSTRUCTION – TWO LANES OF TRAFFIC MAINTAINED</u></p> <ul style="list-style-type: none"> <li>Due to construction presence, customers/clientele may avoid the local businesses in the vicinity of the bridge.</li> </ul>	<p><b>All Design Replacement Alternative</b>  <u>DURATION/DEGREE</u></p> <p>No mitigation measures are available</p> <p><u>BEFORE/AFTER CONSTRUCTION</u></p> <p>No mitigation measures.</p>	<p><b>All Design Replacement Alternative</b>  <u>DURATION/DEGREE</u></p> <p>The net effects are average construction time of 2 years during the first construction event and 1 year during the second construction event.</p> <p>However traffic impacts during initial construction are increased when providing 1 lane of traffic during construction (on existing/bailey bridge or the adjacent 1 lane Bailey bridge) and reduced when providing 2 lanes of traffic (bailey bridge).</p> <p>Reduced traffic disruption during construction, maintenance or emergency events due to additional lane on the bridge.</p> <p><u>BEFORE/AFTER CONSTRUCTION</u>  <u>BEFORE CONSTRUCTION</u></p> <p>There is no net effect since conditions are unchanged from current conditions.</p> <p><u>DURING CONSTRUCTION – TRAFFIC REDUCED TO ONE LANE</u></p> <ul style="list-style-type: none"> <li>minimal impact to businesses since business accesses maintained, enhanced signing program provided.</li> </ul> <p><u>DURING CONSTRUCTION – TWO LANES OF TRAFFIC MAINTAINED</u></p> <p>Less impact than one lane new bridge, since number of traffic lanes maintained.</p>

FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS AFTER MITIGATION
<b>2. SOCIO-ECONOMIC ENVIRONMENTAL FACTOR GROUP</b>					
			<p>AFTER CONSTRUCTION</p> <ul style="list-style-type: none"> <li>Following construction, customer/clientele who avoided the area of the bridge, due to construction, may not immediately return.</li> <li>Customers/Clientele will no longer experience substantial delays in the vicinity of the Argyle Street Bridge during peak hours resulting in better access to local businesses.</li> <li>Customer/clientele, who did not regularly frequent the local businesses in the vicinity of the bridge, may be encouraged to modify their shopping habits/locations due to reduced traffic congestion.</li> </ul>		<p>AFTER CONSTRUCTION</p> <ul style="list-style-type: none"> <li>Customers/Clientele will no longer experience substantial delays in the vicinity of the Argyle Street Bridge during peak hours resulting in better access to local businesses.</li> <li>Customer/clientele, who did not regularly frequent the local businesses in the vicinity of the bridge, may be encouraged to modify their shopping habits/locations due to reduced traffic congestion.</li> </ul>
	<p>2.3.3 Impact to Police and Emergency Services (Fire and Ambulance) (allows EMS unimpeded)</p>	<p>Potential to impact emergency service response times (Police, Fire and Ambulance) during construction</p> <p><i>RATIONALE: There is a need to maintain emergency service response times throughout construction</i></p>	<p><b>TRAFFIC REDUCED TO 1 LANE DURING CONSTRUCTION - Alternatives RH1, RH3 and RP2</b></p> <ul style="list-style-type: none"> <li>Volunteer fire fighters are not permitted to attend an emergency in their personal vehicles. Since the fire station is located on the north side of the bridge, some volunteer fire fighters would need to cross the river on the by-pass resulting negative impacts fire</li> <li>May require police and EMS providers to travel across the Grand River using alternate bridge sites This may lead to delayed response times or the inability to provide an effective service to the community</li> <li>One-way traffic flow will be better through the construction zone</li> <li>An accident may occur in the one-lane traveled portion of the bridge, or EMS may have to respond to a construction incident on</li> </ul> <p><b>TWO LANES OF TRAFFIC MAINTAINED THROUGHOUT CONSTRUCTION - Alternatives RH2, RH4, RP1, RP3, and RP4</b></p> <ul style="list-style-type: none"> <li>Traffic flow will be slightly slower through the construction zone</li> </ul>	<p><b>TRAFFIC REDUCED TO 1 LANE DURING CONSTRUCTION - Alternatives RH1, RH3 and RP2</b></p> <p>Mitigation measures include:</p> <ul style="list-style-type: none"> <li>all traffic will be designated to travel in a single direction on the one travel lane to avoid confusion in an emergency situation.</li> <li>Provision of an Opticom remote traffic signal control system to be able to stop the flow of traffic onto the one traveled lane during an emergency so that emergency vehicles have unimpeded access across the bridge in either direction.</li> <li>provision of housing for another fire truck can be built on the south side of the river to allow volunteer fire fighters access to emergency vehicles on both the south or the north sides of the bridge</li> <li>provision of a public education and awareness program can be implemented to inform drivers of</li> </ul> <p><b>TWO LANES OF TRAFFIC MAINTAINED THROUGHOUT CONSTRUCTION - Alternatives RH2, RH4, RP1, RP3, and RP4</b></p> <ul style="list-style-type: none"> <li>For alternatives that provide two lanes of traffic on a temporary bailey bridge during construction, no special needs are required for Police or EMS providers as traffic will flow in both directions across a 2-lane bridge as it does now. However, the following mitigation measures can be implemented to enhance Police and EMS during construction:</li> </ul>	<p><b>TRAFFIC REDUCED TO 1 LANE DURING CONSTRUCTION - Alternatives RH1, RH3 and RP2</b></p> <ul style="list-style-type: none"> <li>The net effects during construction are that emergency services will be able to meet their response times for all alternatives.</li> </ul> <p><b>TWO LANES OF TRAFFIC MAINTAINED THROUGHOUT CONSTRUCTION - Alternatives RH2, RH4, RP1, RP3, and RP4</b></p> <ul style="list-style-type: none"> <li>The net effects during construction are that emergency services will realize a slight delay in response times for all alternatives.</li> </ul>

FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS AFTER MITIGATION
<b>2. SOCIO-ECONOMIC ENVIRONMENTAL FACTOR GROUP</b>					
				<ul style="list-style-type: none"> <li>o provision of a public education and awareness program can be implemented to inform drivers of proper use of the temporary bridge, both under normal driving conditions and in emergency response situations to ensure that traffic flows as quickly and smoothly as possible under all conditions.</li> </ul>	
	2.3.4 Accommodation for pedestrians and cyclists during construction (during initial construction and subsequent rehabilitations)	Potential to provide passage for pedestrians and cyclists during construction  <i><b>RATIONALE:</b> There is a need to accommodate pedestrians and cyclists during construction.</i>	<p><b>Construction of Alternatives RH1 and RH2</b></p> <p>Potential for loss of pedestrian or cyclist passage on the existing bridge during construction.</p> <p>Potential for loss of pedestrian or cyclist passage on the existing bridge during construction.</p> <p><b>Construction of Alternatives RH3, RH4, RP1, RP2, RP3 and RP4</b></p> <p>Potential for pedestrian and cyclists having to travel through a construction zone.</p>	<p><b>Construction of Alternatives RH1 and RH2</b></p> <p>Pedestrian or cyclist passage can be provided on a temporary Bailey bridge during construction.</p> <p><b>Construction of Alternatives RH3, RH4, RP1, RP2, RP3 and RP4</b></p> <p>Safe pedestrian or cyclist passage across the river can be provided through the construction zone, either on a small, temporary footbridge across the river or on a dedicated travelway on the existing bridge.</p>	<p><b>Construction of Alternatives RH1 and RH2</b></p> <p>No net effects.</p> <p><b>Construction of Alternatives RH3, RH4, RP1, RP2, RP3 and RP4</b></p> <p>No net effects</p>
	2.3.5 Navigation (during construction)	Potential to affect navigation following construction.  <i><b>RATIONALE:</b> The construction impacts to a navigable waterway need to be considered in accordance with the federal Navigable Waters Protection Act.</i>	<p><b>All Alternatives</b></p> <p>Work in/adjacent to the river has the potential to cause the following:</p> <ul style="list-style-type: none"> <li>• Alternatives which involve the installation of a temporary Bailey bridge may result in the temporary loss of navigation past the temporary bridge for some types of watercraft</li> <li>• Alternatives which involve the installation of a temporary causeway for construction access may result in the temporary reduction of navigational channels from the causeway footprint or an impairment to fish movement</li> <li>• Alternatives that require the installation of cofferdams to construct new pier footings or to rehabilitate existing pier footings may result in a temporary reduction of navigational channels, particularly between the piers where the channels are somewhat deeper due to scouring, from the footprint of the cofferdam</li> </ul>	<p><b>All Alternatives:</b></p> <p>Mitigation measures include:</p> <ul style="list-style-type: none"> <li>• Designated navigational channels will be maintained during construction. Minimum navigational channel specifications, set by Transport Canada, will be maintained.</li> <li>• Construction warning signs will be placed upstream and downstream to warn watercraft of the construction zone and direct users to a safe channel to navigate through the construction zone</li> <li>• If required, navigational channels will be lit during the night</li> </ul>	<p><b>All Alternatives:</b></p> <p>The overall net effects are temporary and negligible.</p>

FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS AFTER MITIGATION
<b>2. SOCIO-ECONOMIC ENVIRONMENTAL FACTOR GROUP</b>					
			<ul style="list-style-type: none"> <li>Debris from construction or demolition of bridge components has the potential to drop in the river impair navigation or the safety for users within the river</li> <li>Alternatives that require a temporary decrease in height of the navigational channels underneath the bridge may impair the ability of certain watercraft to pass underneath the bridge</li> </ul>	<ul style="list-style-type: none"> <li>Work areas in the river, for pier construction or rehabilitation, will be isolated from watercraft to provide safety buffers.</li> <li>Causeways, if required for construction access, will only extend a maximum of 50% of the width of the river at any time to maintain navigation within the river. Causeways will be removed prior to the extreme flows associated with the spring run-off to ensure that flows during this period do not impair navigation.</li> <li>Emissions and debris from concrete removal activities will be contained and prevented from entering the river through the use of protection platforms or containment systems</li> </ul>	
<b>2.4 Land Use / Resources</b>	2.4.1 First Nations Treaty Rights and Interests and Use of Land and Resources for Traditional Purposes	Potential to affect First Nations Treaty Rights and interests, and use of land and resources for traditional purposes (e.g. hunting, fishing, harvesting of traditional foods and medicinal plants, trails)  <i><b>RATIONALE:</b> Planning of transportation facilities must address First Nations or treaty rights, and be conducted in accordance with Ontario's New Approach to Aboriginal Affairs (Spring 2005) and the Grand River Notification Agreement.</i>	Six Nations Treaty Rights and Interests within the scope of this project may include fishing (changes to the fisheries and aquatic habitat could reduce the viability of the fishing in the Grand River), navigation (in general, the potential effect of constructing fewer piers provides improved navigation on the Grand River) and trails (new abutments may impair access to trails along the banks of the Grand River).	Subject to further discussion between Six Nations and the Province of Ontario, the following shall apply. For fishing MTO will review the fisheries impact and proposed mitigation/compensation measures (as required under the Fisheries Act) with Six Nations and DFO. Mitigation may include enhancements such as the creation of new spawning beds. The timing of in-water work will be controlled to minimize the impact on the fisheries.  For navigation no mitigation required for completed bridge alternatives. A navigable channel will be left open during construction (See section 2.3.5). MTO will obtain a permit under Navigable Waters Protection Act.  For trails, design of all alternatives will restore access and improve trails within the MTO right-of-way to provide for uninterrupted shoreline movement (See section 2.4.2). No mitigation is possible during construction (i.e. no foot traffic through construction area along shoreline).	There is no difference among the alternatives. In general, the net effect of constructing fewer piers provides improved navigation on the Grand River.
	2.4.2 Parks and Recreational Areas	Potential to affect parks, green space, recreational areas, public gardens and trails.  <i><b>RATIONALE:</b> It is important to consider the adjacent parks, green space, recreational areas, public gardens and trails that may be affected.</i>	<b>Design Alternative RH3, RH4 and All Replacement Alternatives</b>  The placement of a new bridge across the Grand River has the potential to affect parks, green space, recreational areas, public gardens and trails in various ways:  <ul style="list-style-type: none"> <li>Loss of parks and recreational area as a result of the new abutment footprint may negatively impact on the local aesthetics through the loss of landscaping vegetation</li> </ul>	<b>Design Alternative RH3, RH4 and All Replacement Alternatives</b>  <ul style="list-style-type: none"> <li>Park or Greenspace vegetation that is removed to accommodate the footprint of a new bridge design will be replaced and enhanced with new, vegetation in areas beside the new bridge to maintain or enhance the local aesthetics and landscape qualities in local parks and gardens</li> <li>Near shore areas underneath the abutments of the new bridge alternatives can be designed to provide for uninterrupted shoreline movements for recreational users to restore recreational movement.</li> </ul>	<b>Design Alternative RH3, RH4 and All Replacement Alternatives</b>  <ul style="list-style-type: none"> <li>The overall net effects are neutral or have the potential to provide a net benefit through improving the local park and garden landscapes with increased vegetation plantings.</li> </ul>

FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS AFTER MITIGATION
<b>2. SOCIO-ECONOMIC ENVIRONMENTAL FACTOR GROUP</b>					
			<ul style="list-style-type: none"> <li>New abutments may impact movements for recreational users</li> </ul>		
			<p><b><u>Design Alternatives RH1 and RH2</u></b>                      The comprehensive rehabilitation of the existing bridge across the Grand River has minimal effect.</p> <p><b><u>All Alternatives - Construction</u></b>                      Retained parks and recreational areas may be damaged during construction.</p>	<p><b><u>Design Alternatives RH1 and RH2</u></b>                      Mitigation measures not required.</p> <p><b><u>All Alternatives - Construction</u></b></p> <ul style="list-style-type: none"> <li>Where possible, fence off retained parks and recreational areas from the construction work area.</li> <li>Repair any construction damage to the retained parks and recreational areas.</li> </ul>	<p><b><u>Design Alternatives RH1 and RH2</u></b>                      Overall net effects are neutral or have the potential to provide a net benefit through improving the local park and garden landscapes with increased vegetation plantings.</p> <p><b><u>All Alternatives - Construction</u></b>                      The overall net effects are temporary and neutral.</p>
<b>2.5 Tourism</b>	2.5.1 Tourism It is important to consider the tourism in the area.	Potential to affect area tourism <i>RATIONALE: It is important to consider the tourism in the area.</i>	<p><b><u>All Replacement Alternatives</u></b>                      Removal of existing bridge will reduce the overall heritage experience associated with travelling in the Caledonia area.</p> <p>A new signature bridge will provide new tourism opportunities due to the unique design.</p> <p><b><u>All Rehabilitation Options</u></b>                      No Impact</p>	<p>No mitigation measures available.</p> <p>No mitigation measures required.</p>	<p><b><u>All Replacement Alternatives</u></b>                      With the exception of RP4, there is no net effect. In the case of RP4, the overall tourism experience is reduced.</p> <p><b><u>All Rehabilitation Options</u></b>                      No net effect.</p>

Argyle Street Bridge Preliminary Design and Class EA Study  
**Net Effects Table – 3.0 Cultural Environmental Factor Group**

FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS (after application of mitigation measures)
<b>3. CULTURAL ENVIRONMENTAL FACTOR GROUP</b>					
<b>3.1 Cultural Heritage – Heritage Bridge in the Nationally Designated Grand River Heritage Watershed</b>	3.1.1 Bridge listed on the Ontario Heritage Bridge List and the Grand River Heritage Bridge Inventory	<p>Potential to maintain a significant heritage bridge.</p> <p><i>RATIONALE: MTO is required to operate in accordance with the Ontario Heritage Act, the Ontario Heritage Bridge Guidelines (1991), MTO's Environmental Guide for Built Heritage and Cultural Landscapes (part of MTO's Environmental Standards and Practices), and the Guideline for Preparing the Cultural Heritage Resource Component of Environmental Assessments (1992).</i></p> <p><i>Heritage Bridges in Provincial Ownership - listed bridge status must be considered as an important factor in the process of environmental assessment. Due regard should be given to the heritage attributes of the listed bridge and the various conservation strategies described in the Bridge guidelines (p13).</i></p> <p><i>One of the objectives of the Ontario Heritage Bridge Program is to make carefully considered and consistent decisions in allocating scarce funds for the conservation of heritage road bridges. MTO should give special consideration to those conservation strategies identified the heritage bridge program. The principle of establishing a provincial list of heritage road bridges is to guide and inform decision-making, but it not a statutory obligation.</i></p> <p><i>The Ontario Heritage Act makes provisions for Standards and Guidelines for Provincially Owned Heritage that will set out the criteria and process for identification of provincially owned properties that have cultural heritage value or interest.</i></p> <p><i>Mitigation management for displacement by removal or demolition and/or disruption of built heritage resources and cultural heritage landscapes (provincially owned properties and properties designated under the OHA, Part IV and V) is to be undertaken within MTO's planning, design and construction process (excerpt from MTO's Environmental Guide for Built Heritage and Cultural Landscapes – part of MTO's Environmental Standards and Practices).</i></p>	<p><b><u>Bridge Rehabilitation Alternatives – RH1 and RH2,</u></b></p> <ul style="list-style-type: none"> <li>Rehabilitation that is not according to Heritage Bridge Guidelines and relevant conservation principles could cause major modification to the heritage attributes of the existing bridge.</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH3 and RH4</u></b></p> <p><u>Design:</u></p> <ul style="list-style-type: none"> <li>Rehabilitation that does not follow Heritage Bridge Guidelines and that does not meet relevant conservation principles, could cause major modification to the heritage attributes of the existing bridge.</li> <li>New bridge will partially block the view of the west side of the heritage bridge.</li> <li>New bridge, 1 or 2 lanes could visually detract from the appearance of the heritage bridge.</li> </ul> <p><u>Construction:</u></p> <ul style="list-style-type: none"> <li>Construction could compromise the stability of the existing bridge.</li> </ul> <p><b><u>Bridge Replacement – RP 1, RP2, RP3 and RP4</u></b></p> <ul style="list-style-type: none"> <li>Original bridge would be demolished.</li> </ul>	<p><b><u>All Bridge Rehabilitation – RH1 and RH2</u></b></p> <ul style="list-style-type: none"> <li>Rehabilitation will be undertaken with no major modifications to heritage attributes (such as the form, material, visual appearance), according to the Heritage Bridge Guidelines and relevant conservation principles.</li> <li>Detailed design of rehabilitation will be guided by heritage consultant, heritage architect, and heritage engineer and based on additional documentation including photography, measured as-found drawings, additional research.</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH3 and RH4</u></b></p> <p><u>Design:</u></p> <ul style="list-style-type: none"> <li>Rehabilitation will be undertaken with no major modifications to heritage attributes (such as the form, material, visual appearance), according to the Heritage Bridge Guidelines and relevant conservation principles.</li> <li>Detailed design of rehabilitation will be guided by heritage consultant, heritage architect, and heritage engineer and based on additional documentation including photography, measured as-found drawings, additional research</li> <li>Design of new bridge to incorporate appropriate choice of pier placement, railing design, materials/ colour/ texture to minimize visual distraction of the heritage bridge.</li> </ul> <p><u>Construction:</u></p> <ul style="list-style-type: none"> <li>Construction methodology to recognize the stability requirements.</li> </ul> <p><b><u>Bridge Replacement – RP1, RP2 and RP3</u></b></p> <ul style="list-style-type: none"> <li>Documentation including photography, measured as-found drawings, additional research</li> <li>Historic plaque erected and possible retention of arch(s) to be preserved and relocated</li> <li>Replacement Bridge, RP 1, RP2, RP3, is a signature bridge that references the historic qualities of the demolished bridge.</li> </ul> <p><b><u>Bridge Replacement – RP4</u></b></p> <ul style="list-style-type: none"> <li>No mitigation is possible.</li> </ul>	<p><b><u>All Bridge Rehabilitation – RH1 and RH2</u></b></p> <ul style="list-style-type: none"> <li>Historic structure is retained and well preserved; as per Heritage Bridge Guidelines and relevant conservation principles and documentation.</li> <li>Historic structure is retained and well preserved, as per Heritage Bridge Guidelines and relevant conservation principles.</li> <li>Some loss of the original material of bridge.</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH3 and RH4</u></b></p> <p><u>Design:</u></p> <ul style="list-style-type: none"> <li>Historic structure is retained and well preserved; as per Heritage Bridge Guidelines and relevant conservation principles and documentation.</li> <li>Some loss of the original material in historic bridge</li> <li>New bridge will obstruct (MH % to be determined ) view of the historic bridge from the west and no visual impact to east side of bridge</li> <li>New bridge will have minimal visual impact on the original bridge and clear visual distinction will be made between historic structure and new bridge.</li> </ul> <p><u>Construction:</u></p> <ul style="list-style-type: none"> <li>No destabilization of existing bridge.</li> </ul> <p><b><u>Bridge Replacement – RP 1, RP2 and RP3</u></b></p> <ul style="list-style-type: none"> <li>Historic bridge is demolished; record will be maintained; potential salvage of some elements.</li> <li>New Replacement Bridge (RP1, RP2 and RP3) will be a signature bridge. New Signature Bridge has future potential to be placed on Heritage Bridge List because of its design and contextual value.</li> </ul> <p><b><u>Bridge Replacement – RP4</u></b></p> <ul style="list-style-type: none"> <li>Has no heritage value.</li> </ul>



**Net Effects Table – 3.0 Cultural Environmental Factor Group**

FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS (after application of mitigation measures)
<b>3. CULTURAL ENVIRONMENTAL FACTOR GROUP</b>					
	3.1.2 Heritage Community Landmark/Gateway	Potential to provide heritage community landmark/gateway.	<p><b><u>Bridge Rehabilitation – RH1 and RH2</u></b></p> <ul style="list-style-type: none"> <li>Heritage bridge continues to function as a landmark for the community</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH3 and RH4</u></b></p> <ul style="list-style-type: none"> <li>Heritage bridge continues to function as a landmark for the community.</li> <li>New bridge could detract from the landmark function of heritage bridge.</li> </ul> <p><b><u>Bridge Replacement – RP1, RP2, RP3</u></b></p> <ul style="list-style-type: none"> <li>Loss of existing historic structure and community landmark/ gateway to and from the heritage downtown area.</li> <li>Signature bridge alternatives: RP1, RP2, and RP3, could fail to become a new landmark with high aesthetic value.</li> </ul> <p><b><u>Bridge Replacement – RP4</u></b></p> <ul style="list-style-type: none"> <li>New Bridge would fail to function as new community landmark/gateway.</li> </ul>	<p><b><u>Bridge Rehabilitation – RH1 and RH2</u></b></p> <ul style="list-style-type: none"> <li>Not required.</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH3 and RH4</u></b></p> <p><u>Design:</u></p> <ul style="list-style-type: none"> <li>Rehabilitation will be undertaken with no major modifications to heritage attributes (such as the form, material, visual appearance), according to the Heritage Bridge Guidelines and relevant conservation principles.</li> <li>Detailed design of rehabilitation will be guided by heritage consultant, heritage architect, and heritage engineer and based on additional documentation including photography, measured as-found drawings, additional research</li> <li>Design of new bridge to incorporate appropriate choice of pier placement, railing design, materials/ colour/ texture to minimize visual distraction with the heritage bridge.</li> </ul> <p><b><u>Bridge Replacement – RP1, RP2, RP3</u></b></p> <ul style="list-style-type: none"> <li>None</li> <li>Not required because new 5 or 9 span through truss arch structure ( RP1, RP2, RP3) will be designed to reflect the key heritage attributes of the historic bridge.</li> </ul> <p><b><u>Bridge Replacement – RP4</u></b></p> <ul style="list-style-type: none"> <li>Design bridge to be aesthetically pleasing by means of arterials, railings, etc.</li> </ul>	<p><b><u>Bridge Rehabilitation – RH1 and RH2</u></b></p> <ul style="list-style-type: none"> <li>Heritage bridge continues to function as a landmark and a gateway for the community.</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH3 and RH4</u></b></p> <ul style="list-style-type: none"> <li>Historic structure continues to be a community landmark and gateway to and from the heritage downtown area.</li> <li>New bridge will somewhat obstruct view of the original bridge from the west.</li> </ul> <p><b><u>Bridge Replacement – RP1, RP2, RP3</u></b></p> <ul style="list-style-type: none"> <li>Loss of Heritage Landmark for all alternatives.</li> <li>RP1, RP2 and RP3 continue to provide landmark recognition of site as historic crossing; 5 span structure more dramatic than 9 span structure due to size of arches.</li> </ul> <p><b><u>Bridge Replacement – RP4</u></b></p> <ul style="list-style-type: none"> <li>Provides no new landmark value.</li> </ul>

**Net Effects Table – 3.0 Cultural Environmental Factor Group**

FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS (after application of mitigation measures)
<b>3. CULTURAL ENVIRONMENTAL FACTOR GROUP</b>					
<p><b>3.2 Cultural Heritage – Built Heritage and Cultural Landscapes</b></p>	<p>3.2.1 Buildings, Structures or Resources of Heritage Value</p>	<p>Potential to affect buildings, structures or resources of local, provincial or national interest.</p>	<p><b><u>Bridge Rehabilitation – RH1 and RH2</u></b></p> <ul style="list-style-type: none"> <li>No buildings, structures or heritage resources will be impacted.</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH3</u></b></p> <ul style="list-style-type: none"> <li>Streetscape on east side of Argyle Street is not impacted.</li> <li>On the west side of Argyle Street:                             <ul style="list-style-type: none"> <li>A new 1 lane bridge beside existing bridge will be extremely close to 1 potential heritage building</li> <li>Other potential heritage buildings may be in close proximity to the new alignment.</li> </ul> </li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH4</u></b></p> <ul style="list-style-type: none"> <li>Streetscape on east side of Argyle Street is not impacted.</li> <li>On west side of Argyle , a new 2 lane bridge beside the existing bridge will cause the removal of 1 potential heritage building</li> <li>Other potential heritage buildings may be in close proximity to the new alignment.</li> </ul> <p><b><u>Bridge Replacement - RP1, RP2, RP3</u></b></p> <ul style="list-style-type: none"> <li>No buildings, structures or heritage resources will be impacted.</li> </ul> <p><b><u>Bridge Replacement - RP4</u></b></p> <ul style="list-style-type: none"> <li>Possible wing wall to be placed in front of toll house, a designated heritage building</li> </ul> <p><b><u>Construction of All Alternatives</u></b></p> <ul style="list-style-type: none"> <li>Risk of vibration could damage buildings during construction.</li> </ul>	<p><b><u>Bridge Rehabilitation – RH1 and RH2</u></b></p> <ul style="list-style-type: none"> <li>No mitigation is necessary.</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH3</u></b></p> <ul style="list-style-type: none"> <li>Prepare conservation plan for individually affected structures.</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH4</u></b></p> <ul style="list-style-type: none"> <li>Prepare conservation plan for individually affected structures.</li> </ul> <p><b><u>Bridge Replacement - RP1, RP2, RP3</u></b></p> <ul style="list-style-type: none"> <li>No mitigation is necessary.</li> </ul> <p><b><u>Bridge Replacement - RP4</u></b></p> <ul style="list-style-type: none"> <li>No mitigation possible.</li> </ul> <p><b><u>Construction of All Alternatives</u></b></p> <ul style="list-style-type: none"> <li>Inspect 'at risk' buildings such as the former Toll-keepers house before and after construction. Monitor during construction. Undertake repairs as necessary.</li> </ul>	<p><b><u>Bridge Rehabilitation – RH1 and RH2</u></b></p> <ul style="list-style-type: none"> <li>No net effects.</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH3</u></b></p> <ul style="list-style-type: none"> <li>Close proximity of new structure requires relocation of 1 potential heritage building.</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH4</u></b></p> <ul style="list-style-type: none"> <li>Removal of 1 potential heritage building is required for a new 2 lane bridge.</li> </ul> <p><b><u>Bridge Replacement - RP1, RP2, RP3</u></b></p> <ul style="list-style-type: none"> <li>No net effects.</li> </ul> <p><b><u>Bridge Replacement - RP4</u></b></p> <ul style="list-style-type: none"> <li>Moderate impact, wall located in front of toll house.</li> </ul> <p><b><u>Construction of All Alternatives</u></b></p> <ul style="list-style-type: none"> <li>No net effect on adjacent heritage resources.</li> <li>Improvement of drainage in the vicinity of the designated heritage Toll House.</li> </ul>

**Net Effects Table – 3.0 Cultural Environmental Factor Group**

FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS (after application of mitigation measures)
<b>3. CULTURAL ENVIRONMENTAL FACTOR GROUP</b>					
	<p>3.2.2 Cultural Heritage Landscapes</p>	<p>Potential to affect the cultural heritage landscapes <b>views of the bridge</b>.</p> <p>Potential to affect the drivers' view and pedestrians' view of the cultural heritage landscape <b>from the bridge</b>.</p>	<p><b><u>Bridge Rehabilitation – RH1 and RH2</u></b></p> <ul style="list-style-type: none"> <li>Rehabilitation could adversely impact the cultural heritage landscape.</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH3</u></b></p> <ul style="list-style-type: none"> <li>Rehabilitation could adversely impact the cultural heritage landscape.</li> <li>The new bridge could be detrimental to the cultural heritage landscape.</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH4</u></b></p> <ul style="list-style-type: none"> <li>Increased footprint and the abutments of the new 2 lane bridge would adversely impact the cultural heritage landscapes.</li> </ul> <p><b><u>Bridge Replacement - RP1, RP2, RP3</u></b></p> <ul style="list-style-type: none"> <li>Cultural heritage landscape could be adversely impacted.</li> <li>A new bridge could be detrimental to the cultural heritage landscape.</li> <li>Signature bridge will fail to be a beneficial new addition to the cultural landscape.</li> </ul> <p><b><u>Bridge Replacement - RP4</u></b></p> <ul style="list-style-type: none"> <li>Viewing opportunities from the bridge could be compromised.</li> </ul>	<p><b><u>Bridge Rehabilitation – RH1 and RH2</u></b></p> <ul style="list-style-type: none"> <li>Rehabilitation will be undertaken with no major modifications to the heritage attributes.</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH3 and RH4</u></b></p> <ul style="list-style-type: none"> <li>Rehabilitation will be undertaken with no major modifications to heritage attributes according to Heritage Bridge Guidelines and conservation principles.</li> <li>Design of new bridge to incorporate appropriate choice of pier placement, railing design, materials/ colour/ texture to minimize visual impact on cultural landscape.</li> </ul> <p><b><u>Bridge Replacement - RP1, RP2, RP3</u></b></p> <ul style="list-style-type: none"> <li>Replacement Bridge, RP 1, RP2, RP3 will be designed to harmonize with the cultural landscape through the use of colour, texture, railing design, etc.</li> <li>Outlooks on new bridge will be installed for viewing public.</li> </ul> <p><b><u>Bridge Replacement - RP4</u></b></p> <ul style="list-style-type: none"> <li>No viewing outlooks but mitigate through addition of features to harmonize with the cultural heritage landscape.</li> </ul>	<p><b><u>Bridge Rehabilitation – RH1 and RH2</u></b></p> <ul style="list-style-type: none"> <li>No impacts to the cultural heritage landscapes and all existing viewsheds are maintained.</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH3</u></b></p> <ul style="list-style-type: none"> <li>All existing view sheds to the east are maintained; view to the west compromised by new bridge.</li> <li>New bridge will have minimal visual impact on the cultural heritage landscape.</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH4</u></b></p> <ul style="list-style-type: none"> <li>All existing view sheds to the east are maintained; view to the west compromised by new bridge.</li> <li>New bridge will have moderate visual impact on the cultural heritage landscape that includes the original bridge.</li> </ul> <p><b><u>Bridge Replacement - RP1, RP2, RP3</u></b></p> <ul style="list-style-type: none"> <li>Loss of significant landscape element through demolition of the bridge.</li> <li>New Replacement Bridge (RP1, RP2 and RP3) will be a signature bridge that adds to a new cultural landscape.</li> </ul> <p><b><u>Bridge Replacement – RP4</u></b></p> <ul style="list-style-type: none"> <li>Loss of significant landscape element through demolition of the bridge.</li> <li>RP4 would provide views of the cultural heritage landscape from the bridge.</li> </ul>

**Net Effects Table – 3.0 Cultural Environmental Factor Group**

FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS (after application of mitigation measures)
<b>3. CULTURAL ENVIRONMENTAL FACTOR GROUP</b>					
	3.2.3 Cultural Heritage Streetscape	Potential to affect downtown heritage streetscape.	<p><b><u>Bridge Rehabilitation – RH1 and RH2</u></b></p> <ul style="list-style-type: none"> <li>Existing downtown streetscape is not affected.</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH3</u></b></p> <ul style="list-style-type: none"> <li>Streetscape on east side of Argyle Street is not impacted.</li> <li>On the west side of Argyle Street:                             <ul style="list-style-type: none"> <li>A new 1 lane bridge beside existing bridge will be extremely close to 1 potential heritage heritage building</li> <li>Other potential heritage buildings may be in close proximity to the new alignment.</li> </ul> </li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH4</u></b></p> <ul style="list-style-type: none"> <li>Streetscape on east side of Argyle Street is not impacted.</li> <li>On west side of Argyle , a new 2 lane bridge beside the existing bridge will cause the removal of 1 potential heritage building</li> <li>Other potential heritage buildings may be in close proximity to the new alignment.</li> </ul> <p><b><u>Bridge Replacement Alternatives – RP1, RP2, RP3</u></b></p> <ul style="list-style-type: none"> <li>A new bridge could create discontinuity between the historic downtown streetscape and a new structure.</li> </ul> <p><b><u>Bridge Replacement Alternatives – RP4</u></b></p> <ul style="list-style-type: none"> <li>Major grading changes between existing downtown streetscape and new bridge.</li> </ul>	<p><b><u>Bridge Rehabilitation – RH1 and RH2</u></b></p> <ul style="list-style-type: none"> <li>No mitigation required.</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH3 and RH4</u></b></p> <ul style="list-style-type: none"> <li>Prepare conservation plan for individually affected structures and parkettes.</li> </ul> <p><b><u>Bridge Replacement Alternatives – RP1, RP2, RP3</u></b></p> <ul style="list-style-type: none"> <li>Documentation including photography, measured as-found drawings, additional research, historic plaque and possible retention of arch(s) to be preserved and relocated</li> <li>Historic plaque and possibly retention of arches to be preserved and relocated.</li> </ul> <p><b><u>Bridge Replacement Alternatives – RP4</u></b></p> <ul style="list-style-type: none"> <li>No mitigation possible.</li> </ul>	<p><b><u>Bridge Rehabilitation – RH1 and RH2</u></b></p> <ul style="list-style-type: none"> <li>No net effects.</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH3</u></b></p> <ul style="list-style-type: none"> <li>Streetscape viewsheds of bridge will be maintained with minimal impacts</li> <li>Relocation of 1 potential heritage building for new one lane bridge</li> </ul> <p><b><u>Bridge Rehabilitation with New Bridge Beside Existing – RH4</u></b></p> <ul style="list-style-type: none"> <li>Streetscape viewsheds of bridge will be maintained with minimal impacts</li> <li>Relocation of 1 potential heritage building for two lane new bridge</li> </ul> <p><b><u>Bridge Replacement Alternatives – RP1, RP2, RP3</u></b></p> <ul style="list-style-type: none"> <li>The transition from the historic downtown streetscape to the new bridge will be minimized.</li> </ul> <p><b><u>Bridge Replacement Alternatives – RP4</u></b></p> <ul style="list-style-type: none"> <li>Significant impact to the cultural heritage streetscape.</li> </ul>

**Net Effects Table – 3.0 Cultural Environmental Factor Group**

FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS (after application of mitigation measures)
<b>3. CULTURAL ENVIRONMENTAL FACTOR GROUP</b>					
<b>3.3 Cultural Heritage – Archaeology</b>	3.3.1 Pre-Historic and Historic First Nations Archaeological Sites and Burial Sites	Potential to affect significant pre-historic and historic native peoples' archaeological sites of local, provincial or national significance.  <u><b>RATIONALE</b></u> <i>Disturbance or destruction of certain archaeological sites of local, provincial or national interest represents a significant cultural loss.</i>  <i>Significant archaeological sites shall be preserved, salvaged or avoided, where possible, in accordance with the Ontario Ministry of Culture (MCL) and Aboriginal People's policies and procedures and all others shall be excavated to MCL standards.</i>	<u><b>All Alternatives</b></u> <ul style="list-style-type: none"> <li>All alternatives that result in a wider permanent or temporary footprint have the potential to impact a prehistoric and historic archaeological site.</li> </ul>	<u><b>All Alternatives</b></u> <ul style="list-style-type: none"> <li>During design, conduct archaeological surveys and mitigation in the designated work area, as per <i>Ontario Heritage Act</i> and Ministry of Culture Regulations and guidelines and with involvement of the Six Nations of the Grand River.</li> <li>During design, if any areas beyond existing survey areas are required, these areas will be surveyed (i.e. construction staging, storage, access roads etc.).</li> <li>During construction, archaeological monitoring will be undertaken by a licensed archaeologist and with the involvement of Six Nations of the Grand River.</li> <li>During construction, Six Nations will be notified if there are any archaeological finds. Any archaeological finds will be salvaged where possible or otherwise mitigated during construction.</li> </ul>	<u><b>All Alternatives</b></u> <ul style="list-style-type: none"> <li>The larger the construction footprint, the greater the potential to impact archaeological resources.</li> </ul>
	3.3.2 Historic Euro-Canadian Archaeological Sites	Potential to affect significant historic Euro-Canadian archaeological sites of extreme local, provincial or national interest  <u><b>RATIONALE</b></u> <i>Disturbance or destruction of certain archaeological sites of extreme local, provincial or national interest represents a significant cultural loss.</i>  <i>Significant archaeological sites shall be preserved and avoided in accordance with the Ontario Ministry of Culture (MCL) and shall be excavated to MCL standards.</i>	<u><b>All Alternatives</b></u> <ul style="list-style-type: none"> <li>All alternatives that result in a wider permanent or temporary footprint have the potential to impact a Euro-Canadian archeological site.</li> </ul>	<u><b>All Alternatives</b></u> <ul style="list-style-type: none"> <li>During design, conduct archaeological surveys and mitigation in the designated work area, as per <i>Ontario Heritage Act</i> and Ministry of Culture Regulations and guidelines.</li> <li>During design, if any areas beyond existing survey areas are required, these areas will be surveyed (i.e. construction staging, storage, access roads etc.).</li> <li>During construction, archaeological monitoring will be undertaken by a licensed archaeologist. Protocols will be established to mitigate deeply buried archaeological features.</li> <li>During construction, if there are any archaeological finds they will be salvaged where possible or otherwise mitigated during construction.</li> </ul>	<u><b>All Alternatives</b></u> <ul style="list-style-type: none"> <li>The larger the construction footprint, the greater the potential to impact archaeological resources.</li> <li>The net effects are anticipated to be the same for all alternatives since areas are previously disturbed.</li> </ul>

## Net Effects Table – 4.0 Transportation and Engineering Factor Group

FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS
<b>4. TRANSPORTATION AND ENGINEERING FACTOR GROUP</b>					
<b>4.1 Traffic Operations – Long Term</b>	<b>4.1.1 Traffic capacity and operations</b>  <b>Notes:</b> <ul style="list-style-type: none"> <li>There is a need to determine how transportation solutions address future municipal needs in relation to existing and proposed future transportation infrastructure.</li> <li>There is a need to determine how well transportation solutions operate during peak periods, across the bridge and at adjacent intersections.</li> </ul>	<p>Potential to address needs of through traffic across the bridge and adequate turning movements at Caithness St. and Forfar St.</p> <p><b>Measures:</b></p> <p>Level of Service or Delay (LOS A-F or total delay time) at the bridge approaches, Caithness intersection, and Forfar intersection.</p> <p>Level of Service or Delay (LOS A-F or total delay time) at the bridge approaches during future rehabilitation.</p> <p><b>Note:</b></p> <p>LOS calculations/projections are limited to a 10 year horizon due to the uncertainty of future conditions beyond this horizon.</p>	<p><b>Bridge Replacement Design- 3-lane cross section (RP1, RP2, RP3, RP4)</b></p> <ul style="list-style-type: none"> <li>Improved level of service at bridge approaches and intersections. Residents and broader community will no longer experience substantial delays when crossing the Grand River on Argyle Street during peak hours</li> <li>Allows for 2 lanes of traffic during future rehabilitation</li> <li>Provides the opportunity to accommodate left turn movements at adjacent intersections (reduced queuing/delay)</li> <li>Provides LOS required by emergency services to meet response time mandate</li> </ul>	<ul style="list-style-type: none"> <li>No mitigation required.</li> </ul>	<ul style="list-style-type: none"> <li>The LOS without the addition of a third lane is projected to be D/F (poor) in 2014. The LOS with the addition of the third lane will improve the projected LOS to C (acceptable).</li> <li>Maintains LOS required by emergency services to meet response time mandate</li> </ul>
			<p><b>Bridge Rehabilitation Design – 2-lane cross section (RH1, RH2)</b></p> <ul style="list-style-type: none"> <li>Residents will continue to experience delays when crossing the Argyle Street Bridge. LOS becomes worse in time with increase traffic volumes</li> <li>Broader community will continue to experience substantial delays. Use of Highway 6 by-pass increases with time as delays increase at the Argyle St. Bridge</li> </ul>	<ul style="list-style-type: none"> <li>No mitigation required.</li> </ul>	<ul style="list-style-type: none"> <li>The LOS decreases with time due to increasing traffic volumes. The projected LOS for 2014 is D/F (poor).</li> </ul>
			<p><b>Bridge Rehabilitation Design with new 1-lane bridge adjacent (RH3)</b></p> <ul style="list-style-type: none"> <li>Improved LOS at bridge approaches and intersections. Residents and broader community will no longer experience substantial delays when crossing the Grand River on Argyle Street during peak hours.</li> <li>Allows for 2 lanes of traffic during future rehabilitation</li> <li>Provides the opportunity to accommodate left turn movements at adjacent intersections (reduced queuing/delay)</li> <li>Maintains LOS required by emergency services to meet response time mandate</li> </ul>	<ul style="list-style-type: none"> <li>No mitigation required.</li> </ul>	<ul style="list-style-type: none"> <li>The LOS is improved by the addition of 1 lane. Projected LOS of C (acceptable) for year 2014.</li> <li>Maintains LOS required by emergency services to meet response time mandate</li> </ul>
			<p><b>Bridge Rehabilitation Design with new 2-lane bridge adjacent (RH4)</b></p> <ul style="list-style-type: none"> <li>Improved LOS at bridge approaches and intersections. Residents and broader community will no longer experience substantial delays when crossing the Grand River on Argyle Street during peak hours</li> <li>Allows for 2 lanes of traffic during future rehabilitation</li> <li>Provides the opportunity to accommodate left turn movements at adjacent intersections (reduced queuing/delay)</li> <li>Maintains LOS required by emergency services to meet response time mandate</li> </ul>	<ul style="list-style-type: none"> <li>No mitigation required.</li> </ul>	<ul style="list-style-type: none"> <li>The LOS is improved by the addition of 2 lanes. Projected LOS of C (acceptable) for year 2014.</li> <li>Maintains LOS required by emergency services to meet response time mandate</li> </ul>

**Net Effects Table – 4.0 Transportation and Engineering Factor Group**

FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS
4.1 Traffic Operations – Long Term	4.1.2 Accommodation for pedestrians and cyclists  Note: <ul style="list-style-type: none"><li>There is a need to accommodate pedestrians and cyclists across the river.</li></ul>	Potential to provide passage for pedestrians and cyclists  Measures:  Sidewalk on one or both sides of bridge – sidewalk widths in meters  Cycling accommodation on road one or both sides – width of bicycle lanes  Cycling accommodation on sidewalks/shared use	<b>Bridge Replacement Design- 3-lane cross section (RP1, RP2, RP3, RP4)</b> <ul style="list-style-type: none"><li>Allows for cycling lane on shoulders (both sides on road) removing commuter cyclist from sidewalk</li><li>Sidewalks on both sides of the bridge.</li></ul>	<ul style="list-style-type: none"><li>No mitigation required.</li></ul>	<ul style="list-style-type: none"><li>Sidewalks on both sides of the new bridge, and cyclists can use the 1 metre shoulder.</li></ul>
			<b>Bridge Rehabilitation Design – 2-lane cross section (RH1, RH2)</b> <ul style="list-style-type: none"><li>No change from current conditions</li><li>Sidewalks on both sides of the bridge.</li><li>No shoulder for cyclists</li></ul>	<ul style="list-style-type: none"><li>No mitigation available.</li></ul>	<ul style="list-style-type: none"><li>Access for pedestrians and cyclists remains unchanged. Sidewalks on both sides of the bridge. No shoulders for cyclists.</li></ul>
			<b>Bridge Rehabilitation Design with new 1 or 2-lane bridge adjacent (RH3, RH4)</b> <ul style="list-style-type: none"><li>Allows for cycling lane in southbound direction on the new bridge, and northbound direction on the existing bridge without shoulders.</li><li>Sidewalk on east side of existing bridge remain, but sidewalk on west side of existing bridge will be closed for pedestrians. Provision for sidewalk on west side of new bridge?</li></ul>	<ul style="list-style-type: none"><li>No mitigation available.</li></ul>	<ul style="list-style-type: none"><li>Access for cyclists the same as existing for the northbound direction, but improved due to shoulders available on the new bridge for the southbound direction.</li><li>Access for pedestrians available on the outside of both structures. Those travelling on the west side of the new bridge will have a slightly increased travel time due to the increased width of the new 1 or 2 lane bridge.</li></ul>
4.2 Geometrics	4.2.1 Permanent Alignment  Horizontal Alignment (Smooth continuous alignment, without abrupt turns)  Vertical Alignment (comfortable, providing sight distance)	Potential to provide smooth continuous alignment and meet current design standards.  <i>Provincial Transportation Highway Improvement Act (PTHIA), MTO Geometric Design Manual, Ontario Provincial Standards and Specifications (OPSS) and Ontario Provincial Standard Drawings (OPSD).</i>	<b>Bridge Replacement Design (RP1, RP2, RP3, RP4)</b>  Horizontal - Rehabilitation or replacement alternatives provided at the existing crossing without the need for an adjacent bridge will maintain the alignment and have no impacts. Vertical – Improvement on north side of bridge by reducing the “hump” at the limit of the bridge.	Not Applicable	Horizontal – No not effect Vertical – minor improvement
			<b>Rehabilitation without adjacent bridge (RH1, RH2)</b>  Horizontal - Rehabilitation or replacement alternatives provided at the existing crossing without the need for an adjacent bridge will maintain the alignment and have no impacts. Vertical – No change	Not Applicable	No net effect
			<b>Rehabilitation with a New Bridge Adjacent Existing Bridge (RH3, RH4)</b>  Horizontal - To accommodate the new bridge the alignment will need modified. The new alignment requires the provision of “S” curves at both approaches to the new bridge which results in: <ul style="list-style-type: none"><li>Non-typical alignment approaching the bridge;</li><li>Inconsistency with driver expectations; and</li><li>Although minimum geometric standards will be achieved, desirable standards will not be met.</li></ul> Vertical – No change	<b>Horizontal -</b> To reduce the impacts of the bridge approach geometrics, the bridge will be built as close as possible to the existing bridge (i.e. minimize separation) without compromising ability to construct.	Horizontal – Southbound traffic required to negotiate additional curves. Vertical – No net effect

**Net Effects Table – 4.0 Transportation and Engineering Factor Group**

FACTORS	SUB-FACTORS	CRITERIA	POTENTIAL EFFECTS	MITIGATION MEASURES	NET EFFECTS
<p><b>4.2 Geometrics</b></p>	<p>4.2.2 Operational Safety (lane widths, etc.)</p>	<p>Provide side clearance to obstacles/hazards Provide protection for obstacles/hazards including guide rail and crash cushions Access for emergency service vehicles</p> <p><i>Provincial Transportation Highway Improvement Act (PTHIA), MTO Geometric Design Manual, Ontario Provincial Standards and Specifications (OPSS) and Ontario Provincial Standard Drawings (OPSD).</i></p>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <p>Alternatives which rehabilitate the existing bridge require the existing cross section to be maintained. This results in no improvements to:</p> <ul style="list-style-type: none"> <li>• clearance to hazards</li> <li>• protection of bridge</li> <li>• snow removal operation</li> <li>• emergency response</li> </ul>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <p>Provide protection to hazards such as barrier and end treatments to the extent possible. The application of protection measures will be limited and not meet current standards.</p>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <p>Minor improvements to protection of hazards and bridge structure.</p>
			<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge (RH3, RH4)</u></b></p> <p>The rehabilitated bridge will maintain the existing cross section. The new bridge adjacent to the existing bridge, will be built to existing design standards:</p> <ul style="list-style-type: none"> <li>• Providing shoulders (1.5m clearance) from travel way to hazard/ standard barrier reducing the potential for collisions and damage to the new structure.</li> <li>• Shoulders provide refuge for vehicles (damaged, broken down)</li> <li>• Allows for provision of crash protection at ends of barrier, reducing the potential for damage to the structure.</li> </ul> <p>Snow removal operations improved due to additional space. This alternative provides emergency services the opportunity to utilize two crossings and therefore enhancing emergency response times.</p>	<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge (RH3, RH4)</u></b></p> <p>REHABILITATION</p> <p>Provide protection to hazards such as barrier and end treatments to the extent possible. The application of protection measures will be limited and not meet current standards.</p> <p>NEW BRIDGE</p> <p>New bridge will be built to current standards therefore no mitigation measures required.</p>	<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge</u></b></p> <p>The rehabilitated bridge will maintain the existing cross section:</p> <ul style="list-style-type: none"> <li>• Minor improvements to protection of hazards and bridge structure.</li> </ul> <p>The new bridge, adjacent to the existing bridge, will be built to existing design standards:</p> <ul style="list-style-type: none"> <li>• Improved clearance to hazards</li> <li>• Improved protection of bridge</li> <li>• Improved snow removal operation</li> <li>• Improved emergency response</li> </ul>
			<p><b><u>Bridge Replacement Alternatives (RP1, RP2, RP3, RP4)</u></b></p> <p>Replacement alternatives provide an additional lane on the bridge, resulting in a three lane cross-section, and will be built to meet current standards:</p> <ul style="list-style-type: none"> <li>• Providing shoulders (1.5m clearance) from travel way to hazard/ standard barrier reducing the potential for collisions and damage to the new structure.</li> <li>• Allows for provision of crash protection at ends of barrier.</li> <li>• Collisions or any other temporary emergency condition that results in a short-term lane closure should not impact emergency response times due the ability of a new bridge to provide refuge areas (i.e. additional lane and shoulder area).</li> <li>• Snow removal operations improved due to additional space.</li> </ul> <p>This alternative provides emergency services the opportunity to utilize two crossings and therefore enhancing emergency response times.</p>	<p><b><u>Bridge Replacement Alternatives (RP1, RP2, RP3, RP4)</u></b></p> <p>Replacement Alternatives will be built to current standards therefore no mitigation measures required.</p>	<p><b><u>Bridge Replacement Alternatives</u></b></p> <ul style="list-style-type: none"> <li>• Improved clearance to hazards</li> <li>• Improved protection of bridge</li> <li>• Improved snow removal operation</li> <li>• Improved emergency response</li> </ul>



**Net Effects Table – 4.0 Transportation and Engineering Factor Group**

4.3 Structural Engineering	4.3.1 Structural Durability and Future Maintenance Requirements	<p>Potential to provide a durable structure with reasonable future maintenance requirements.</p> <p><i>MTO Financial Analysis approach on project design life of rehabilitated and replaced components</i></p>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>Members and components that are not replaced will continue to deteriorate being of lower quality material and workmanship and subject to exposure deleterious materials and environment.</li> <li>Junction potential between existing and replaced members will actually accelerate deterioration at these areas.</li> <li>Junction potential between patched and un-patched areas of a particular member will also accelerate deterioration at the repair boundaries.</li> </ul>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>Use sacrificial anode to minimize junction potential at repair / replaced locations.</li> <li>Replace as many members as possible (currently members remaining in place include arches, tie girders, piers and abutments).</li> </ul>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>On going maintenance efforts/requirements will be greater and more frequent than for a replacement bridge.</li> </ul>
			<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge (RH3, RH4)</u></b></p> <ul style="list-style-type: none"> <li>Members and components that are not replaced will continue to deteriorate being of lower quality material and workmanship and subject to exposure deleterious materials and environment.</li> <li>Junction potential between existing and replaced members will actually accelerate deterioration at these areas.</li> <li>Junction potential between patched and un-patched areas of a particular member will also accelerate deterioration at the repair boundaries.</li> <li>See box below for new bridge adjacent</li> </ul>	<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge (RH3, RH4)</u></b></p> <ul style="list-style-type: none"> <li>Use sacrificial anode to minimize junction potential at repair / replaced locations.</li> <li>Replace as many members as possible (currently members remaining in place include arches, tie girders, piers and abutments).</li> <li>See box below for new bridge adjacent</li> </ul>	<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge</u></b></p> <ul style="list-style-type: none"> <li>On going maintenance efforts/requirements will be greater and more frequent than for a replacement bridge.</li> </ul>
			<p><b><u>Bridge Replacement Alternatives (RP1, RP2, RP3, RP4)</u></b></p> <ul style="list-style-type: none"> <li>New bridges design in accordance with the bridge code and MTO standards are expected to last at least 75 years with general maintenance and no structural alterations.</li> </ul>	<p><b><u>Bridge Replacement Alternatives (RP1, RP2, RP3, RP4)</u></b></p> <ul style="list-style-type: none"> <li>No mitigation is required</li> </ul>	<p><b><u>Bridge Replacement Alternatives</u></b></p> <ul style="list-style-type: none"> <li>On going maintenance efforts/requirements will be smaller and less frequent than for a rehabilitated bridge.</li> </ul>
	4.3.2 Structural Foundation Performance	<p>Potential to stabilize structural foundation</p> <p><i>Bridge Replacement: New foundations to sound bedrock</i>  <i>Bridge Rehabilitation: Underpinning of existing foundations likely by micropiles ties back to the existing footings.</i></p>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>Bridge will continue to settlement as more and more gypsum is solutioned out of the bedrock.</li> </ul>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>Underpinning is required at all foundations to stabilize the bridge from further settlement.</li> </ul>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>Underpinning provides stable foundations.</li> </ul>

**Net Effects Table – 4.0 Transportation and Engineering Factor Group**

			<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge (RH3, RH4)</u></b></p> <ul style="list-style-type: none"> <li>Bridge will continue to settlement as more and more gypsum is solutioned out of the bedrock.</li> <li>See box below for new bridge adjacent</li> </ul>	<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge (RH3, RH4)</u></b></p> <ul style="list-style-type: none"> <li>Underpinning is required at all foundations to stabilize the bridge from further settlement.</li> <li>See box below for new bridge adjacent</li> </ul>	<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge</u></b></p> <ul style="list-style-type: none"> <li>Underpinning provides stable foundations.</li> <li>See box below for new bridge adjacent</li> </ul>
			<p><b><u>Bridge Replacement Alternatives (RP1, RP2, RP3, RP4)</u></b></p> <ul style="list-style-type: none"> <li>All new foundations will be installed to competent rock layer below the bed surface.</li> </ul>	<p><b><u>Bridge Replacement Alternatives (RP1, RP2, RP3, RP4)</u></b></p> <ul style="list-style-type: none"> <li>No mitigation is required</li> </ul>	<p><b><u>Bridge Replacement Alternatives</u></b></p> <ul style="list-style-type: none"> <li>New deep foundations required for founding the new bridges (replacement or new).</li> <li>New foundations provide greater assurance of adequate foundations compared to rehabilitation completed with underpinning.</li> </ul>
	4.3.3 Hydraulic Capacity (ability to handle 100 year storm flow)	<p>Potential to provide hydraulic capacity for the 100 year storm event.</p> <p><i>CHBDC requires a minimum freeboard of 1.0m above surface water level to clear debris and ice floating on water surface.</i></p>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>The existing bridge opening does not provide the required a 1m of freeboard above high water during the 100 storm event.</li> <li>Currently the 50 year design flood levels are at the bridge soffit.</li> </ul>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>No mitigation is possible for this structure.</li> </ul>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>The hydraulic capacity of the existing bridge will continue to be substandard.</li> </ul>
			<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge (RH3, RH4)</u></b></p> <ul style="list-style-type: none"> <li>The existing bridge opening does not provide the required a 1m of freeboard above high water during the 100 storm event.</li> <li>Currently the 50 year design flood levels are at the bridge soffit.</li> <li>See box below for new bridge adjacent</li> </ul>	<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge (RH3, RH4)</u></b></p> <ul style="list-style-type: none"> <li>No mitigation is possible for this structure.</li> <li>See box below for new bridge adjacent</li> </ul>	<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge</u></b></p> <ul style="list-style-type: none"> <li>The hydraulic capacity of the existing bridge will continue to be substandard.</li> <li>See box below for new bridge adjacent</li> </ul>

**Net Effects Table – 4.0 Transportation and Engineering Factor Group**

			<p><b><u>Bridge Replacement Alternatives (RP1, RP2, RP3, RP4)</u></b></p> <ul style="list-style-type: none"> <li>New bridge will be raised at the centre span to provide the required freeboard.</li> </ul>	<p><b><u>Bridge Replacement Alternatives (RP1, RP2, RP3, RP4)</u></b></p> <ul style="list-style-type: none"> <li>No mitigation is required</li> </ul>	<p><b><u>Bridge Replacement Alternatives</u></b></p> <ul style="list-style-type: none"> <li>New bridge will meet bridge code requirements.</li> </ul>
4.3.4 Constructability (Ease to build, construction access, etc.) (initial and subsequent construction / rehabilitations)	Ease of implementation considering feasibility and difficulty of physical, property or environmental constraints.	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>Rehabilitation involving replacement of individual components is very delicate operations and requires attention and prone to problems and unforeseen findings.</li> <li>Require bailey bridge for deck replacement works (for 2<sup>nd</sup> round rehabilitation for RP1 and first round rehab for RP2).</li> <li>Overhead work required for soffit and underdeck rehab work.</li> <li>Temporary easement required for bailey bridge constructions.</li> <li>In-water work limited by available window prescribed.</li> </ul>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>No mitigation is available to address nature of rehabilitation works.</li> <li>No mitigation is available to provide temporary crossing for deck replacement operations, and requirement for temporary easement to access bailey bridge on west side of existing crossing.</li> <li>No mitigation for soffit rehab requirements.</li> </ul>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>Complicated work in component replacement.</li> <li>One or 2 lanes of traffic will be provided during construction provided on the existing structure or via bailey bridge.</li> <li>Complex construction methods required to accommodate In water work.</li> </ul>	
		<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge (RH3, RH4)</u></b></p> <ul style="list-style-type: none"> <li>Rehabilitation involving replacement of individual components is very delicate operations and requires attention and prone to problems and unforeseen findings.</li> <li>Require bailey bridge for deck replacement works (for 2<sup>nd</sup> round rehabilitation for RP1 and first round rehab for RP2).</li> <li>Overhead work required for soffit and underdeck rehab work.</li> <li>Temporary easement required for bailey bridge constructions.</li> <li>In-water work limited by available window prescribed.</li> <li>Construction of new bridge, in close proximity to the existing bridge, presents unique construction challenges.</li> <li>For new bridge work see box below</li> </ul>	<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge (RH3, RH4)</u></b></p> <ul style="list-style-type: none"> <li>No mitigation is available to address nature of rehabilitation works.</li> <li>No mitigation is available to provide temporary crossing for deck replacement operations, and requirement for temporary easement to access bailey bridge on west side of existing crossing.</li> <li>No mitigation for soffit rehab requirements.</li> <li>For new bridge work see box below</li> </ul>	<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge</u></b></p> <ul style="list-style-type: none"> <li>Complicated work in component replacement.</li> <li>One or 2 lanes of traffic will be provided during construction provided on the existing structure or via bailey bridge.</li> <li>Complex construction methods required to accommodate In water work.</li> <li>Construction of new bridge, in close proximity to the existing bridge, presents unique construction challenges.</li> <li>For new bridge work see box below</li> </ul>	

**Net Effects Table – 4.0 Transportation and Engineering Factor Group**

			<p><b><u>Bridge Replacement Alternatives (RP1, RP2, RP3, RP4)</u></b></p> <ul style="list-style-type: none"> <li>• New bridge can be constructed using on bridge detour (RP2) of using bailey bridge (RP1, 3 and 4), including the need for temporary easement to access the bailey structure.</li> <li>• In water work (causeway and cofferdams) to construct the foundations.</li> <li>• Conventional method of construction</li> </ul>	<p><b><u>Bridge Replacement Alternatives (RP1, RP2, RP3, RP4)</u></b></p> <ul style="list-style-type: none"> <li>• Consider using precasting if feasible.</li> <li>• No mitigation is available for other impacts.</li> </ul>	<p><b><u>Bridge Replacement Alternatives</u></b></p> <ul style="list-style-type: none"> <li>• Construction of replacement bridge will be straightforward compared with rehabilitation, except RP2 where staged work is required.</li> <li>• RP1, 3 and 4 facilitate construction by allowing the existing bridge to be closed for uninterrupted work.</li> <li>• Complex construction methods required to accommodate In water work.</li> </ul>
<p><b>4.4 Construction Cost</b></p>	<p>4.4.1 Construction Cost for Bridge (except property and engineering costs) (Cost effectiveness</p>	<p>Estimated cost (initial investment) for the bridge construction, excluding property and engineering costs, as well as future maintenance costs (to be scored in items following).</p>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>• Mid-term rehabilitation without deck replacement will be the lowest for all rehabilitation options.</li> <li>• Long-term rehabilitation with deck replacement (RH2) will be more expensive.</li> </ul>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>• Not applicable.</li> </ul>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>• Estimated construction cost of these alternatives, are as follows:                             <ul style="list-style-type: none"> <li>o RH1 =</li> <li>o RH2 =</li> </ul> </li> </ul>
			<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge (RH3, RH4)</u></b></p> <ul style="list-style-type: none"> <li>• The addition of new bridges adjacent structure to include both rehabilitation and new bridge will be the most expensive alternatives reviewed.</li> <li>• RP4 may be slightly more expensive based on the larger deck area.</li> </ul>	<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge (RH3, RH4)</u></b></p> <ul style="list-style-type: none"> <li>• Not applicable</li> </ul>	<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge</u></b></p> <ul style="list-style-type: none"> <li>• Estimated construction cost of these alternatives, are as follows:                             <ul style="list-style-type: none"> <li>o RH3 =</li> <li>o RH4 =</li> </ul> </li> </ul>

**Net Effects Table – 4.0 Transportation and Engineering Factor Group**

			<p><b><u>Bridge Replacement Alternatives (RP1, RP2, RP3, RP4)</u></b></p> <ul style="list-style-type: none"> <li>• The construction of the 9 span structure will be most expensive replacement option due to the number of foundation units in the water and the ineffective use of arch spans.</li> <li>• Options RP2 and RP3 are similar and are slightly less expensive than RP1.</li> <li>• Option RP4 is a conventional MTO highway bridge and is the cheapest options of all.</li> </ul>	<p><b><u>Bridge Replacement Alternatives (RP1, RP2, RP3, RP4)</u></b></p> <ul style="list-style-type: none"> <li>• Not applicable</li> </ul>	<p><b><u>Bridge Replacement Alternatives</u></b></p> <ul style="list-style-type: none"> <li>• Estimated construction cost of these alternatives, are as follows:             <ul style="list-style-type: none"> <li>○ RP1 =</li> <li>○ RP2 =</li> <li>○ RP3 =</li> <li>○ RP4 =</li> </ul> </li> </ul>
	4.4.2 Construction Cost for Detour and Construction Staging (initial and subsequent construction)	Estimated cost for detours and traffic staging during construction (including cost of maintaining emergency services crossing).	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>• Bailey required for RP2 is a significant increase in construction cost compared with option RP1.</li> <li>• Maintenance of EM service crossing is required including advance signals.</li> </ul>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>• Not applicable.</li> </ul>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>• Estimated construction staging cost of these alternatives, are as follows:             <ul style="list-style-type: none"> <li>○ RH1 =</li> <li>○ RH2 =</li> </ul> </li> </ul>
			<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Exiting Bridge (RH3, RH4)</u></b></p> <ul style="list-style-type: none"> <li>• Bailey is not required as traffic can use newly built structure to cross the river.</li> </ul>	<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Exiting Bridge (RH3, RH4)</u></b></p> <ul style="list-style-type: none"> <li>• Not applicable</li> </ul>	<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Exiting Bridge</u></b></p> <ul style="list-style-type: none"> <li>• Estimated construction staging cost of these alternatives, are as follows:             <ul style="list-style-type: none"> <li>○ RH3 =</li> <li>○ RH4 =</li> </ul> </li> </ul>

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			<p><b><u>Bridge Replacement Alternatives (RP1, RP2, RP3, RP4)</u></b></p> <ul style="list-style-type: none"> <li>Difference in cost will be determined by whether bailey bridge will be used.</li> </ul>	<p><b><u>Bridge Replacement Alternatives (RP1, RP2, RP3, RP4)</u></b></p> <ul style="list-style-type: none"> <li>Not applicable</li> </ul>	<p><b><u>Bridge Replacement Alternatives</u></b></p> <ul style="list-style-type: none"> <li>Estimated construction staging cost of these alternatives, are as follows:                             <ul style="list-style-type: none"> <li>RP1 =</li> <li>RP2 =</li> <li>RP3 =</li> <li>RP4 =</li> </ul> </li> </ul>
	4.4.3 Property Cost	Estimated cost of required property	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>No property is required for these options.</li> </ul>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>Not applicable.</li> </ul>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>No permanent property required, therefore no property costs.</li> </ul>
			<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge (RH3, RH4)</u></b></p> <ul style="list-style-type: none"> <li>Properties on both north and south side of the bridge will be required for the new parallel bridges.</li> </ul>	<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge (RH3, RH4)</u></b></p> <ul style="list-style-type: none"> <li>Not applicable</li> </ul>	<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge</u></b></p> <ul style="list-style-type: none"> <li>This alternative has the highest property costs.</li> </ul>

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			<p><b><u>Bridge Replacement Alternatives (RP1, RP2, RP3, RP4)</u></b></p> <ul style="list-style-type: none"> <li>No property will be required for all replacement options.</li> </ul>	<p><b><u>Bridge Replacement Alternatives (RP1, RP2, RP3, RP4)</u></b></p> <ul style="list-style-type: none"> <li>Not applicable</li> </ul>	<p><b><u>Bridge Replacement Alternatives</u></b></p> <ul style="list-style-type: none"> <li>No permanent property required, therefore , no property costs.</li> </ul>
	4.4.4 Life Cycle Cost	This should be interpreted as the future maintenance requirements since the initial investment has already been evaluated under item 4.4.1	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>Both options carry future maintenance requirements, which will be significant works, something of the scale similar to the current project.</li> </ul>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>Not applicable.</li> </ul>	<p><b><u>Rehabilitation Alternatives without an adjacent new bridge (RH1, RH2)</u></b></p> <ul style="list-style-type: none"> <li>Estimated life cycle cost of these alternatives, are as follows:                             <ul style="list-style-type: none"> <li>RH1 =</li> <li>RH2 =</li> </ul> </li> </ul>
			<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge (RH3, RH4)</u></b></p> <ul style="list-style-type: none"> <li>Similar, probably worse, since each option now has 2 bridges to take care of, instead of just the existing one.</li> </ul>	<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge (RH3, RH4)</u></b></p> <ul style="list-style-type: none"> <li>Not applicable</li> </ul>	<p><b><u>Rehabilitation Alternatives with a New Bridge Adjacent to the Existing Bridge</u></b></p> <ul style="list-style-type: none"> <li>Estimated life cycle cost of these alternatives, are as follows:                             <ul style="list-style-type: none"> <li>RH3 =</li> <li>RH4 =</li> </ul> </li> </ul>

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			<p><u>Bridge Replacement Alternatives (RP1, RP2, RP3, RP4)</u></p> <ul style="list-style-type: none"> <li>Maintenance cost of newly constructed bridges is expected to be minimal with the span of period of evaluation (50 years).</li> </ul>	<p><u>Bridge Replacement Alternatives (RP1, RP2, RP3, RP4)</u></p> <ul style="list-style-type: none"> <li>Not applicable</li> </ul>	<p><u>Bridge Replacement Alternatives</u></p> <ul style="list-style-type: none"> <li>Estimated life cycle cost of these alternatives, are as follows:                             <ul style="list-style-type: none"> <li>RP1 =</li> <li>RP2 =</li> <li>RP3 =</li> <li>RP4 =</li> </ul> </li> </ul>
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