

To: Rhonda Gribbon
Senior Environmental Planner
Ontario Ministry of Transportation

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From: Roger Holmes (AECOM)
Katie Easterling (AECOM)

cc: John MacKinnon, MTO, Project Manager
Larry Sarris, MTO, Project Manager
Harinder Singh, MTO, Project Manager

Memorandum

Subject: **Fish and Fish Habitat Assessment Technical Memorandum –
Highway 400 – Highway 404 Link (Bradford Bypass) County Road 4 Early Works (GWP 2008-21-00), Ontario Ministry of Transportation**

1. Introduction

The Ontario Ministry of Transportation (the Ministry) has retained AECOM Canada Ltd. (AECOM) to undertake a Preliminary Design and assessment study for the new County Road 4 bridge over the future Highway 400 – Highway 404 Link (Bradford Bypass). The Study Area is located in the Town of Bradford West Gwillimbury and Simcoe County. This study will advance as an early works contract package for the Bradford Bypass Project. The new bridge will be designed to include the widening of County Road 4 approved by Simcoe County.

Under this assignment, AECOM ecologists have prepared a fish and fish habitat assessment to document existing aquatic features in the Study Area (refer to **Figure 1** for location). Field investigations as described in **Section 2.2** were completed in the Fall of 2021. As such, this memorandum contains a preliminary screening of aquatic habitat existing conditions based on desktop review of available secondary source information and the field investigation results. The purpose of this memorandum is to:

- Document existing aquatic habitat features within the County Road 4 Study Area; and,
- Identify anticipated impacts to fish and fish habitat and potential project permitting needs, future constraints and considerations that may be required to facilitate the proposed road works.

As AECOM is preparing the 30% design at this time, the anticipated impacts and permitting needs discussed in this memorandum are preliminary at this time and will need to be assessed further once the design is finalized by the Design Build Contractor. The following assessment was conducted in accordance with MTO Environmental Guide for Fish and Fish Habitat (the Guide) (2020), and the 2020 pilot protocol entitled MTO/DFO/MNRF Protocol for Protecting Fish and Fish Habitat on Provincial Transportation Undertakings, Version 4 (the Protocol) (2020).

The County Road 4 Study Area is located within the Aurora Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry (NDMNRF) District. As per Section 3.1.2 of the Environmental Reference for Highway Design (ERHD), for the purposes of investigating the potential impacts of the proposed works on fish

and fish habitat, the area of assessment is divided into two (2) zones: the Zone of Detailed Assessment (ZDA), which includes the area within MTO right-of-way (ROW), from 0 m to 50 m downstream of the ROW, and from 0 m to 20 m upstream of the ROW and the Zone of General Assessment (ZGA), which includes from 50 m to 200 m downstream of the ROW and from 20 m to 50 m upstream of the ROW (of which only a general description of the aquatic environment is documented). **Table 1.** Location of Work Table (Template D1) below provides the Universal Transverse Mercator (UTM) co-ordinates for the watercourse crossing that was assessed under the MTO/DFO/MNRF Fisheries Protocol in this report.

Table 1. Location of Work Table (Template D1)

Waterbody	Municipality	Location of Stream (GPS Co-ordinates)	
		Easting	Northing
Unnamed Tributary North Branch	Township of Bradford West Gwillimbury	614531.11 m E	4887161.37 m N
Stormwater Management Pond (SWMP) – Countryside Estates Subdivision	Township of Bradford West Gwillimbury	614457.97 m E	4887158.81 m N

2. Methods

2.1 Background Information Review

AECOM documented aquatic conditions within 1 km of the Country Road 4 Study Area as shown on **Figure 2** via desktop review of available secondary sources. The following sources were used to conduct the background information review:

- Land Information Ontario (LIO) base mapping data for fish community records and thermal regime information, Areas of Natural and Scientific Interest (ANSI), Woodlands, Wetlands and Provincial Parks (2021);
- The Ministry of Natural Resources and Forestry (NDMNRF) Make-a-Map: Natural Heritage Areas Application (2021);
- Fisheries and Oceans Canada (DFO) Species at Risk (SAR) Online Mapping Tool (2021);
- NDMNRF Fish ON-Line (NDMNRF, 2021);
- Lake Simcoe Region Conservation Authority Open Data Portal (2021);
- Correspondence with Lake Simcoe Region Conservation Authority (LSRCA) for the larger Bradford Bypass project (Response received on December 10th, 2019);
- AECOM Ministry of Transportation (MTO) Fish and Fish Habitat Existing Conditions Report – FINAL Highway 400 – Highway 404 Link (Bradford Bypass)
- County of Simcoe, Class Environmental Assessment Municipal Road Project, Widening of County Road 4 from the 8th Line to just North of the Intersection with County Road 89, Environmental Study Report (2012),
- West Holland River Subwatershed Management Plan (2010); and,
- Aerial photographic imagery.

For the purposes of this assessment, information request letters that were submitted for the larger Bradford Bypass project were used because the overall Study Area for the Bradford Bypass contains the Country Road 4 Study Area. The SWMP and watercourse associated with this assessment were not specifically included in the information request letters due to their small size and expectation that they were only drainage features, along with their exclusion from the original Bradford Bypass footprint. However, given their proximity to the Bradford Bypass Study Area, it is anticipated that any sensitive aquatic habitat features, SAR, and/or fish habitat community data would have been included in these background data requests. Background information requests were submitted on December 4, 2019 to the Aurora District office of the NDMNRF, the LSRCA, and the Ministry of the Environment, Conservation and Parks (MECP) to obtain/confirm fisheries data within the Study Area. The information request included the following: watercourse names and crossing locations, watercourse classifications, habitat information/location, fish community data, absence/presence of any vulnerable species and/or critical habitat, in-water work timing window, NDMNRF management objectives, groundwater discharge areas and benthic invertebrate data. A similar request was submitted to the MECP with regards to confirming the absence of any aquatic SAR records within the Study Area. No correspondence with DFO at this stage of the project has been completed; however, DFO's online aquatic SAR mapping has been reviewed.

2.2 Field Investigations

AECOM ecologists completed a field investigation on September 30, 2021 to document existing aquatic habitat conditions within the Study Area. A detailed aquatic field investigation was completed at the County Road 4 crossing of the Unnamed Tributary North Branch and the adjacent stormwater management pond (SWMP), including a general investigation 50 m upstream and 200 m downstream. The aquatic assessment for this project was completed following methodologies outlined in the MTO Environmental Guide for Fish and Fish Habitat (2020) ("the Guide") and in conjunction with the MTO/DFO/MNRF Protocol for Protecting Fish and Fish Habitat on Provincial Transportation Undertakings, Version 4 (Pilot, 20120) ("the Protocol").

The aquatic habitat assessment included the characterization of habitat features that may influence fish community composition and determined the presence of any specialized habitat within assessed reaches such as spawning, feeding and migratory habitat. Representative photographs of the existing aquatic conditions were also gathered as part of the aquatic assessment.

Fish community surveys via electrofishing were not completed as there was anticipated to be sufficient available background information of the fish community structure in the County Road 4 Study Area. Both online databases/resources and agency correspondence were used to supplement the characterization of existing fish and fish habitat conditions and have been incorporated herein.

3. Background Data Collection

The County Road 4 Study Area is contained within the West Holland River subwatershed, which flows in a northeast direction and drains into Cook's Bay (Lake Simcoe). The main tributaries of the West Branch of the Holland River include: Ansnorveldt Creek, Glenville Creek, East Kettleby Creek, 400 Creek, Pottageville Creek, South Schomberg River, North Schomberg River, Fraser Creek, Scanlon Creek, William Neeley Creek, Coulson's Creek and the Holland Marsh and its extensive canal and Municipal Drain system (LSRCA, 2010). The headwaters originate from discharge springs and seepages along the northern parts of the Oak Ridges Moraine (LSRCA, 2010); however, tributaries to the West Branch of the Holland River that do not originate on the Oak Ridges Moraine, like Fraser Creek, have different characteristics such as temperature regime and

substrate, and thus fish community assemblages may differ to other Holland River Tributaries (LRSCA, 2010). This subwatershed has a large range of thermal regimes, from cold headwater communities to diverse, warm, large order systems (LRSCA, 2010). The watercourse assessed in this memo as part of the County Road 4 Study Area drains directly into the West Branch of the Holland River via an unnamed tributary described below.

Information request letters were submitted on December 4, 2019 to the Aurora District offices of the NDMNRF, the LSRCA, and the MECP to obtain/confirm fisheries data associated with the larger study area of the Bradford Bypass project. As explained previously, the specific pond and Unnamed Tributary North Branch associated with the County Road 4 works were not included in the initial background review information request due to the recent changes to the proposed works in the area. The nearest location from which data was received for was a watercourse crossing approximately 1.3 km downstream to the east named WC-07 (C16-A-1), which was included in the background information request for the larger Bradford Bypass project. NDMNRF background information received for the WC-07 crossing location is provided in **Table 2**. The watercourse at WC-07 is also unnamed and is a tributary of the West Branch of the Holland River, which it flows into approximately 350 m downstream (east) of the crossing. At the WC-07 watercourse crossing, flow travels east through a culvert underneath a railway crossing and into the Holland March Provincially Significant Wetland (PSW) before entering the West Branch of the Holland River. The watercourse at the WC-07 railway crossing receives flows directly from the Unnamed Tributary North Branch (EX-CL-9) in the County Road 4 Study Area to the west.

The unnamed WC-07 watercourse and Unnamed Tributary North Branch are classified as warmwater watercourses with permitted in-water timing window of July 15 to March 1 based on available background information from the LSRCA (2010). WC-07 is also a confirmed spawning area for muskellunge species (NDMNRF, 2019). NDMNRF (2019) correspondence identified the thermal regime for WC-07 as warmwater (based on temperature data and fish community assemblage) (see Table 2 below for fish community).

Previous environmental studies completed in the area for the County of Simcoe Class EA (2012) identified both the Unnamed Tributary North Branch and WC-07 watercourse as permanent warmwater features. However, both were also classified as indirect fish habitat. Given these environmental assessments were completed in 2011, the natural heritage conditions may have changed. In addition, given they were previously classified as permanent features, it would be anticipated that fish could inhabit these features seasonally at a minimum.

3.1 Aquatic Species at Risk

As per the completed desktop screening (sources listed in Section 2.1) and the aforementioned correspondence with the LSRCA and NDMNRF, no provincial aquatic SAR or aquatic SAR habitats were identified to be present within the County Road 4 Study Area.

No correspondence with DFO has been completed at this stage of the project; however, DFO's online aquatic SAR mapping has been reviewed and no aquatic SAR have been identified in the Study Area.

4. Field Investigations

Fish Habitat, as defined by the *Fisheries Act*, are spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes. Fish Habitats are those associated with aquatic features including, but not limited to, lakes, rivers, streams, roadside and agricultural drains, online ponds and some wetlands.

AECOM ecologist completed a fish habitat assessment of the County Road 4 Study Area on September 30, 2021. The Existing Fish and Fish Habitat Conditions Summary Table (Template D2A) for the Unnamed Tributary North Branch is provided in **Table 2**. Fish collection was not completed as part of this assessment, but the Existing Fish Community Summary Table (Template D2B) for WC-07 is also included in **Table 3**. MTO field mapping forms are provided in **Appendix A**, and representative photographs of the fish habitat features are provided in **Appendix B**. For both this project and the Bradford Bypass project, an online database was used to collect data following the MTO Fish Guide. All the data collected is similar to that on the Watercourse Field Collection Record Form (Appendix 4.A) and the Ponds/Lakes Field Collection Record Form (Appendix 4.B), but it is presented in a table format instead of a paper document.

Based on aerial review and recent field work in the area for the Bradford Bypass project, a defined channel feature appeared to originate from a SWMP on the west side of County Road 4. The SWMP outlets into the Unnamed Tributary North Branch, which then crosses County Road 4 200 m north of 8th Line through the EX-CL-9 culvert. At the culvert outlet on the east side of County Road 4, the watercourse continues to flow east where it collects ephemeral flows from an agricultural drainage swale to the north. All these features can be seen on **Figure 2** attached. The Unnamed Tributary continues to flow in an easterly direction where it eventually outlets into the West Branch of the Holland River.

The SWMP on the west side of County Road 4 is an offline feature. The inlet of the pond is a 1050 mm stormwater drain in the southwest corner of the pond that collects drainage from the subdivision to the west. A forebay is present which collects the initial drainage, which then flows into the larger detention bay to the east. The outlet of the pond consists of a hickenbottom/drop structure at the southeast corner of the detention bay. Flowing water was observed to be entering the outlet structure via the hickenbottom system at the time of the site visit. An overflow weir was present which would allow high flows to enter the outlet structure, although fish passage upstream would still not be possible given the vertical drop (2+m). The vegetation growth throughout the overflow channel indicates that the overflow feature is not commonly used. The pond itself was densely covered in aquatic vegetation consisting of floating pond lilies and cattails around the perimeter. An abundance of algae growth was also noted in the detention pond with water depths observed to be greater than 1 m. Overall, the vegetation and algae growth cover approximately 70% of the pond surface. There were minimal riparian trees which reduced the amount of riparian shading of the pond, and a large earth berm was present to the north. No fish were observed in the pond, but it is anticipated that small-bodied pollution tolerant warmwater fish would be present given the size of the pond, observed water depths, and abundant aquatic vegetation.

At the pond outlet on the west side of County Road 4, water flows into a defined channel approximately 1.2 m wide and 25 cm deep. The substrate consisted of clay with gravel and silt overtop, and the water was clear with no obvious staining or colouration. Approximately 15 m downstream of the pond outlet, the water flows into a 1.5 x 1.5 m concrete box culvert underneath County Road 4. Dense vegetation growth was present around the culvert inlet consisting of grasses and cattails. Drainage ditches flow towards the watercourse from the north and south along the road, but both were dry during the field investigation. Shallow laminar flow was observed overtop of the culvert bottom, which may restrict fish passage upstream at this location and be a seasonal fish barrier, most notable during low flow conditions. No substrate was noted in the culvert at the inlet. Riparian lands consisted of grassed roadside ditches with no trees or large shrubs near the culvert inlet.

At the culvert outlet on the east side of County Road 4, the culvert outlet was embedded and filled with silt substrate. The depth in the culvert outlet was approximately 15 cm, and clear flow was again noted. Surrounding land uses consisted of actively farmed crop fields to the south and an abandoned farmhouse to the north. Immediately downstream of the culvert outlet, the watercourse and riparian lands consist of dense

invasive phragmites (European Common Reed) which choke out the channel and heavily shade the watercourse. Due to the dense phragmites, no channel morphology or variation in fish habitat was noted. Flow did appear to be concentrated in a channel feature approximately 1.2 m wide through the dense phragmites. The phragmites patch was approximately 15-20 m wide on either side of the watercourse and extended approximately 125 m downstream to the east before it started to thin out in sections. No visible permanent fish barriers were noted downstream of the culvert. The dense phragmites may create a seasonal fish barrier during low flow conditions in the summer. Given the presence of flowing water in early Fall, and the lack of permanent fish barriers throughout the assessed reaches, it would be expected that fish would inhabit the Unnamed Tributary North Branch downstream of the SWMP. Based on available fish habitat community information downstream of the Study Area as described in Section 3, a similar warmwater fish community would be anticipated in this area. No aquatic SAR or significant/exceptional fish habitat features were noted. The Unnamed Tributary North Branch may only function as seasonal fish habitat during the summer months, but this could not be determined from a single season site investigation. Regardless, a warmwater in-water timing window would apply given the direct connection to downstream fish habitat (i.e., in-water work is permitted from July 15 – March 1). Timing windows should be confirmed with NDMNRF during the detail design stage.

Approximately 100 m downstream (east) of the culvert outlet at EX-CL-9, an unnamed ephemeral drainage feature drains into the Unnamed Tributary North Branch from the north as shown on **Figure 2**. This drainage feature collects water from culvert EX-CL-8 and agricultural fields to the north and was dry during previous field investigations in the area. Therefore, this drainage feature is considered to be indirect fish habitat.

Table 2. Existing Fish and Fish Habitat Conditions Summary Table (Template D2A)

Waterbody ID	Work Location (UTM Coordinates)	Flow	Thermal Regime	Fish Habitat*	Habitat Information	Substrate Type	Channel Morphology	Vegetation	Constraints & Opportunities	Significant Fish Habitat
WC-07: Holland River Tributary (C16-A-1)	615762.66 m E, 4887454.45 m N	Permanent (AECOM, 2021)	LIO (2019) and NDMNRF (2019): Warmwater	Direct	<p>Upstream Habitat: Watercourse has a moderate flow that drains east through an industrial area, then continues under a railway crossing heading south/ southeast until its confluence with West Branch of the Holland River. Valley land surrounding channel is dense thicket/forest on the upstream reaches then open wet meadow/wetland towards the downstream reach. Watercourse has a natural morphology and is deeply incised through a primarily clay substrate. Channel is completed shaded by thicket and woody debris overhanging the channel.</p> <p>Downstream Habitat: Watercourse enters a wetland feature with multiple channels and backwater locations. No defined bankfull or channel banks. with riparian grass hummocks and deep (>1 m) water observed. Dense riparian grasses and cattails.</p>	<p>Upstream: Clay/gravel/silt/ cobble</p> <p>Downstream: muck</p>	<p>Upstream: Flat/ run/ pool</p> <p>Downstream: Flat/ Pool</p>	<p>Upstream: upstream is dominated by an agricultural thicket/ deciduous swamp community that transitions into a shallow cattail marsh community close to the rail crossing and downstream.</p> <p>Downstream: Overhanging cattails and grasses shaded parts of the channel; grass hummocks provide additional shading.</p>	N/A	Mapped Northern Pike spawning habitat
Unnamed Tributary North Branch - EX-CL-9 (County Road 4)	614527.83 m E, 4887130.24 m N	Permanent (AECOM, 2021)	NDMNRF (2019): Warmwater	Direct	<p>Upstream: a defined channel feature appeared to originate from a SWMP on the west side of County Road 4. The SWMP outlets into the Unnamed Tributary, which then crosses Country Road 4 200 m north of 8th Line. At the culvert outlet on the east side of County Road 4, the watercourse continues to flow east where is collects ephemeral flows from an agricultural drainage swale to the north. The SWMP on the west side of County Road 4 is an offline feature. At the pond outlet on the west side of County Road 4, water flows into a defined channel approximately 1.2 m wide and 25 cm deep.</p> <p>Downstream: watercourse and riparian lands consist of dense invasive phragmites (European Common Reed) that choke out the channel and heavily shade the watercourse. Due to the dense phragmites, no channel morphology or variation in fish habitat was noted. Flow did appear to be concentrated in a channel feature approximately 1.2 m wide through the dense phragmites. The dense phragmites may create a seasonal fish barrier during low flow conditions in the summer.</p>	<p>Upstream: clay with gravel and silt overtop</p> <p>Downstream: detritus and silt</p>	<p>Upstream: run/riffle</p> <p>Downstream: run</p>	<p>Upstream: grasses and cattails.</p> <p>Downstream: invasive phragmites (European Common Reed)</p>	Remove invasive phragmites.	None.

Table 3. Existing Fish Community Summary Table (Template D2B)

Waterbody ID	Fish Species Present	Year Class(es)	Species at Risk Present	In-water Works Timing Window*
WC-07: Holland River Tributary	Blacknose Dace, Bluntnose Minnow, Bowfin, Brook Stickleback, Brown Bullhead, Carps and Minnows, Central Mudminnow, Common Shiner, Creek Chub, Emerald Shiner, Fathead Minnow, Golden Shiner, Johnny Darter, Largemouth Bass, Northern Pike, Northern Redbelly Dace, Pumpkinseed, Rock Bass, White Sucker, Yellow Perch (LIO, nd) (record from 300 m u/s of C16-A-1 crossing). AECOM 2021 fish survey: Creek Chub, Brook Stickleback.	All	None	NDMNRF (2019): July 15 to March 1

5. Proposed Works

The proposed works in the area include the construction of the County Road 4 bridge over the future Bradford Bypass and the widening of County Road 4 from two to four lanes from 8th Line to approximately 200 m south of 9th Line in accordance with the County of Simcoe's Environmental Assessment, located in the Town of Bradford West. The following provides a summary of the activities proposed in or near fish habitat at the 30% design stage. A copy of the 30% design drawings are provided in **Appendix C**.

SWMP west of County Road 4:

- No in-water work is proposed. The wetted portion of the pond should remain untouched throughout the construction process.
- Grading and fill will be placed in proximity to the east side of the pond but should be approximately 10-15 m from the pond edge.
- It is understood that the existing function of the pond will remain the same post-construction.

Unnamed Tributary North Branch (EX-CL-9)

- To accommodate the road widening and traffic staging along County Road 4, culvert extensions will be required at both the inlet and outlet of the existing 33.45 m culvert structure - EX-CL-9. At this time, approximately a 5 m extension at the culvert inlet and a 25 m extension at the culvert outlet are proposed to allow for additional fill and grading in the area along the road.
- Relocation of the existing ditches on the west side of County Road 4 to accommodate the fill/grading and culvert extension. No existing defined ditches were observed on the outlet (east) side of County Road 4. Ditches may be proposed on the east side if required during subsequent design stages.
- A new 67.2 m culvert will be installed immediately north of the existing culvert to convey flows underneath County Road 4. The existing culvert will then be plugged and abandoned once the new culvert is online.
- The need for scour protection in the channel at the inlet and outlet is still being assessed and should be reviewed further during subsequent design stages. At this time, it was only confirmed with the engineering team that no scour protection stone is needed at the culvert inlet due to the slow flow velocities calculated for this area. It is recommended that the installation of river stone at the channel tie-in locations be considered to both naturalize and stabilize the channel in these areas.

A culvert extension is proposed at EX-CL-8 (location shown on Figure 2). However, during the field investigations it was determined that this is an offline drainage feature and indirect fish habitat and has not been considered further in this assessment.

A summary of the proposed works is provided in **Table 4**.

Table 4. Summary of Proposed Works

Waterbody ID/Crossing # /Station	Existing Structure				New Structure (preliminary design)				Proposed Works
	Type	Length (m)	Width (mm)	Height (mm)	Type	Length (mm)	Width (mm)	Height (mm)	
Unnamed Tributary North Branch (County Road 4) EX-CL-9 Structure I.D.	Concrete box culvert	33.45	1200	80	Concrete box culvert	67.20	1800	900	The existing 33.45 m culvert will be temporarily extended during construction to assist with road staging works. A new 67.2 m culvert will be installed immediately north of the existing culvert. The existing culvert will then be plugged and abandoned.

Based on the proposed works at the 30% detail design stage described above, no significant impacts or changes to the SWMP are anticipated. Standard erosion and sediment control (ESC) measures should be effective at isolating the pond from the work area to avoid any unintentional impacts to the pond (such as sediment laden site runoff entering the pond). **Table 5** highlights the constraints and design considerations provided to the Design Team. The means of and feasibility for implementation as noted in Column 3 is subject to revisions as the detailed design process advances.

Table 5: Design Considerations Table (Template D3)

Factors to Consider	Design Considerations Provided by the Fisheries Assessment Specialist	Describe How Each Factor Was Addressed Through Design
In-water Works Timing Window	Review of background information determined that the Unnamed Tributary North Branch has a warmwater thermal regime. Therefore, in-water work is permitted from July 15 – March 1.	In-water work will abide by the timing windows.
Fish Passage	Field studies identified seasonal (potentially permanent) barriers to fish movement upstream through the culvert due to shallow laminar flows. The dense invasive phragmites	To be addressed at detail design stage. Design Build Contractor shall ensure the culvert is properly embedded and that notes are

Factors to Consider	Design Considerations Provided by the Fisheries Assessment Specialist	Describe How Each Factor Was Addressed Through Design
	<p>may also serve as a fish barrier during low flow periods.</p> <p>During installation of the proposed culvert, the culvert should be embedded a minimum of 10% to eliminate a perch at the outlet and create a smooth transition at the inlet and outlet by placing appropriate substrate to smoothly tie into the culvert.</p> <p>If possible, the culvert grade should also be reduced to lessen flow velocities throughout the culvert to improve fish passage. It should also be noted that there is only a small section (less than 10 linear meters) of fish habitat upstream of the culvert before a permanent fish passage barrier is present (i.e., the SWMP outlet).</p>	<p>included on the drawings to ensure substrate it placed in a manner that smoothly ties into the culvert at the inlet and outlet.</p>
Significant Fish Habitat*	There was no significant fish habitat identified in the Study Area at the Unnamed Tributary North Branch	Not applicable.
Constraints and Opportunities	Realignment/shifting the culvert to the north will result in channel tie-ins to the existing culvert. It is recommended that river stone be added to the channel at these locations to both naturalize and stabilize the areas.	During the detail design stage, it is recommended that the Design Team consider the installation of river stone at the channel tie-in locations to both naturalize and stabilize the channel upstream and downstream of the proposed culvert.
Other considerations	A large area of invasive phragmites was observed at the outlet of the culvert on the east side of County Road 4. During works in the area, phragmites should be removed and disposed of properly. The area should then be naturalized using native species that colonize quickly to prevent the invasive phragmites from reestablishing in the area.	Include details on the removal drawings to remove invasive phragmites in the ROW to the extent possible. Include requirements on the landscape drawings to restore lands shortly after disturbance to prevent invasive phragmites from reestablishing in the area.

6. Preliminary Impact Assessment

As a result of the proposed works, there will be a permanent loss of approximately 80.64 m² of direct warmwater fish habitat when the existing culvert (EX-CL-9) is abandoned and the channel is infilled upstream and downstream of the culvert (67.20 linear meters of channel x 1.2 meters channel width). The new culvert will convey flows underneath County Road 4 immediately north of the existing culvert. The existing culvert will be plugged and abandoned once the new culvert is online. The proposed culvert will create 120.96 m² of habitat (proposed culvert dimensions: 67.2 m x 1.8 m).

6.1 M.T.O. Routine Works

Project activities were assessed against the list of MTO Routine Works in Table 2 of the *MTO/DFO/MNRF Protocol for Protecting Fish and Fish Habitat on Provincial Transportation Undertakings – Version 4, 2020*. Routine works are those within the MTO ROW, which includes the shoulders and paved area that do not occur within the waterbody and can be mitigated to prevent sediment / debris from entering an aquatic feature. Proposed works associated with drainage (where no in-water work is proposed within fish habitat), electrical, signage, and pavement resurfacing are all covered by MTO Routine Works. Activities such as culvert replacement with extensions, grading within 30 m of a water, riparian vegetation removal, ditch tie-ins, etc., have all been carried forward to Step 3.

6.2 M.T.O. Best Management Practices

Project activities for all the culvert replacements and extensions in fish habitat were assessed against the M.T.O. Best Management Practices (BMP) Manual for Fisheries (M.T.O., 2020) to determine which activities can be addressed by BMPs as per Step 3 in the Protocol. Application of BMPs requires adherence to the Operational Constraints and Protection Measures identified in each BMP. Certain conditions and provisions are outlined in each BMP (e.g. work must be completed within the allowable in-water work timing window, etc.) which must be met in order to remain in compliance. Applicable notification procedures are required for use of BMPs. Error! Reference source not found. summarizes the activities carried forward from Step 2 and the applicable BMP.

Table 6. Summary of Construction Activity and Associated B.M.P.

Activity	Associated BMP.
Vegetation removal within the road ROW. to accommodate the culvert replacement and extension	Maintenance of Riparian Vegetation in Existing Right-of-Way BMP.
Culvert extensions, removal, and replacements that are not like-for-like	None

There is no applicable BMP for the proposed culvert replacements and extensions, and the BMP for the Maintenance of Riparian Vegetation does not cover the complete clearing of riparian vegetation (which will be required during culvert extension work. Therefore, these proposed works will need to be carried forward for a full impact assessment. Once the detail design has reached 60% to 90%, the impact assessment for these proposed works will need to be reevaluated and updated.

6.3 Fisheries Assessment Protocol

Step 4 of the Protocol is a Fisheries Assessment Process that applies to project activities that may impact fish habitat and that do not qualify as MTO Routine Works (Step 1) nor meet the conditions of the MTO Best Management Practices Manual for Fisheries (Step 3).

6.3.1 Potential Impacts

The proposed culvert replacement (and related activities) associated with the work described in **Section 5** that did not meet the MTO Routine Works or Fisheries BMP requirements have been assessed to determine the potential impacts to the fish and fish habitat. This is accomplished through the use of pathways, stressors, and residual effects flow charts and have been developed for both in-water and land-based construction activities. Potential impacts to fish habitat have been identified using the Pathway of Effects (PoE) diagrams provided in the Guide. The PoE diagrams are used to display how activities may impact the aquatic environment and determine the mitigation and protection measures required to minimize or avoid these impacts.

6.3.2 Pathways of Effects Assessment

The following summarizes the potential negative effects on fish and fish habitat which may result from activities associated with the proposed work that is applicable to all works described in **Section 5.1** unless specifically noted. The Aquatic Effects Assessment Table (Template D3) is provided in **Table 7**.

▪ **Land-based Activities**

- Use of industrial equipment may result in alterations to contaminant concentrations from fuel or fluid leaks. An increase in sediment may result from increased erosion potential where industrial equipment has exposed and loosened soils. Cleaning or maintenance of structures may result in changes to contaminant and sediment concentrations if wash water is allowed to enter a waterbody.
- Vegetation clearing may result in alterations to sediment concentrations and habitat structure and cover as a result of increased erosion potential and sediment deposition. Changes in food supply and nutrient concentrations may result from the loss of external inputs with a reduction in riparian vegetation. The use of herbicides may result in changes in contaminant concentrations.
- Grading may result in alterations to sediment concentrations and habitat structure and cover as a result of increased erosion potential and sediment deposition.

▪ **In-water Activities**

- Placement of material or structures in water can result in changes in channel or shoreline morphology, aquatic macrophytes, and substrate composition. This can lead to changes in sediment concentration, habitat structure and cover, food supply, nutrient concentrations and may result in direct or indirect fish mortality.
- Removal of aquatic vegetation may result in changes in dissolved oxygen concentrations, food supply, nutrient concentrations, habitat structure and cover, sediment concentrations or contaminant concentrations as a result of the release of sediment, nutrient inputs, habitat and light penetration.
- Use of industrial equipment below the high-water mark (HWM) could result in fish mortality, as well as alterations to sediment concentrations from the release of sediment or an increase in contaminant concentrations from fluid leaks from equipment.
- The installation of in-water work isolations measures may result in the incidental entrainment and potential mortality of fish and limit access for fish to habitats.

- Any dewatering and pumping of isolated in-water work areas could displace or kill fish, change access to and composition of habitat features. Alterations to flows could increase erosion and scour potential and result in alterations to temperatures and concentrations of sediment, food, contaminants or nutrients. Water extraction using pumps could result in fish mortality by entrainment in pumps and machinery.
- Improper management of wastewater can result in a change in water temperature, change in migration access to habitat, change of dissolved oxygen concentration, change in nutrient concentrations, change in contaminant concentrations and introduction of pathogens, disease vectors and exotics.
- Alterations to flows could increase erosion and scour potential and result in alterations to temperatures and concentrations of sediment, food, contaminants or nutrients.
- Changes to fish passage could result in changes in water chemistry/temperature and flow alternation, which may lead to incidental entrainment, impingement or mortality of resident species and changes to habitat access.
- Structure removals could result in changes to channel morphology or shoreline morphology and habitat structure or cover.

Table 7. Modified Pathway of Effects (PoE) Table (Template D3)

Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects	HADD (Yes/No)
<p>B2 – Use of Industrial Equipment</p>	<ul style="list-style-type: none"> ■ Use of mobile industrial equipment may promote changes to bank stability/exposed soils, re-suspension and entrainment of sediment and oil/grease/fuel leaks that can result in: <ul style="list-style-type: none"> – potential for mortality of fish/egg/ova from equipment; – change in sediment concentration; and – change in contaminant concentration. 	<ul style="list-style-type: none"> ■ O-1 – Access <ul style="list-style-type: none"> ○ Prohibit or limit access to banks or areas adjacent to waterbodies, to the extent required to protect the structural integrity of banks or shorelines ■ O-3 – Timing of In-water works <ul style="list-style-type: none"> ○ Implement timing restrictions for in-water work to protect sensitive life stages/processes of migratory and resident fish ○ additional timing considerations: <ul style="list-style-type: none"> ▪ minimize duration of in-water work ▪ conduct in-stream work during periods of low flow to allow work in water to be isolated from flows ▪ schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation and allow for proper re-stabilization and re-vegetation as appropriate prior to winter. ■ M-2 – Dewatering Discharge <ul style="list-style-type: none"> ○ manage and treat dewatering (or other) discharge water to prevent erosion and/or release of sediment-laden or contaminated water to the waterbody. ○ Considerations: <ul style="list-style-type: none"> ▪ Use of appropriately designed and sited temporary settling basin, filter bag, etc. such as sediment is filtered out prior to the water entering a waterbody ▪ Use of energy dissipation measures to prevent bank or bed erosion. ■ M-3 – Equipment <ul style="list-style-type: none"> ○ Whenever possible, operate machinery on land above the high-water level, on ice, or from floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody ○ Operate, store and maintain (e.g. refuel, lubricate) all equipment, vehicles and associated materials in a manner that prevents the entry of any deleterious substance from entering the water ○ Any part of equipment entering the water or operating on the bank shall be free of fluid leaks, invasive species and noxious weeds and externally cleaned/degreased to prevent any deleterious substance from entering the water ■ M-4 – Erosion and Sediment Controls <ul style="list-style-type: none"> ○ Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. ○ Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: <ul style="list-style-type: none"> ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ■ M-9 – Spills <ul style="list-style-type: none"> ○ Ensure Spill Management Plan (including spill kit materials, instructions regarding their use, education of contract personnel, emergency contact numbers) on-site at all times for immediate implementation in event of accidental spill. ■ M-10 - Temporary Flow <ul style="list-style-type: none"> ○ design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should: <ul style="list-style-type: none"> ▪ use only clean materials free of particulate matter for temporary coffer dams ▪ situate or otherwise manage flow withdrawal and discharge (e.g. see dewatering discharge) to prevent erosion and sediment release to the waterbody ▪ ensure the work zone is stabilized against the impacts of high flow events during the work period ▪ remove fish from the isolated in-water work zones if necessary ○ see: management – Fish Screens and Management – Fish Transfer for managing fish. ■ R-1 – Waterbody Bank <ul style="list-style-type: none"> ○ Minimize the removal of natural woody debris, rocks or other materials from below the banks or the shoreline of the waterbody 	<ul style="list-style-type: none"> ■ No residual effects. Machinery will be limited to existing ROW and will not intrude into natural areas. 	<ul style="list-style-type: none"> ■ No

Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects	HADD (Yes/No)
		<ul style="list-style-type: none"> ○ Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: <ul style="list-style-type: none"> ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g. tree and shrub plantings, bioengineering), rock/stone material (e.g. rip-rap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately-sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankful channel profile. ▪ May incorporate temporary measures (e.g. biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ R-3 – Exposed Soils/ Surfaces <ul style="list-style-type: none"> ○ Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: <ul style="list-style-type: none"> ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. 		
<p>L1 – Vegetation Clearing</p>	<ul style="list-style-type: none"> ▪ Alteration of riparian vegetation, changes in shading, and changes to bank stability/exposed soils and the addition or removal of in-stream organic structure can result in: <ul style="list-style-type: none"> – changes in habitat structure and cover; – change in water temperature; – changes in sediment concentration; – changes in food supply; and – changes in nutrient concentrations. 	<ul style="list-style-type: none"> ▪ M-11 – Vegetation <ul style="list-style-type: none"> ○ Use existing trails, roads or cut lines wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction ○ Clearing of riparian vegetation should be kept to a minimum and if removal is necessary use proper clearing techniques and protect retained vegetation. When practical, prune or top the vegetation instead of grubbing/uprooting ○ Selective or phased vegetation removal or species management to maintain or reduce shade may be desirable for the management of certain species and/or to provide specialized riparian communities or habitat, such as for warmwater species at risk or coldwater species. ○ Salvage and re-instate of seedbank materials or root mats may be appropriate for certain vegetation communities such as wetlands and/or to expedite re-establishment of vegetation cover. ▪ M-1 – Chemicals <ul style="list-style-type: none"> ○ Use only specified amounts and types of fertilizer in areas draining to waterbodies ○ Avoid use of chemical dust suppressants, pesticides and herbicides in areas near or draining waterbodies ○ Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish ▪ M-4 – Erosion and Sediment Controls <ul style="list-style-type: none"> ○ Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. ○ Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: <ul style="list-style-type: none"> ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ R-1 – Waterbody Bank <ul style="list-style-type: none"> ○ Minimize the removal of natural woody debris, rocks or other materials from below the banks or the shoreline of the waterbody ○ Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: <ul style="list-style-type: none"> ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g. tree and shrub plantings, bioengineering), rock/stone material (e.g. rip-rap, boulders). 	<ul style="list-style-type: none"> ▪ No residual effects. While there will be the loss of 33.75 linear meters of riparian vegetation on either side of the channel, the majority of the riparian vegetation consists of dense invasive phragmites which does not provide any fish habitat function. Riparian vegetation will also be restored following construction which should provide a net benefit to fish habitat. 	<ul style="list-style-type: none"> ▪ No

Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects	HADD (Yes/No)
		<ul style="list-style-type: none"> ▪ If rock reinforcement/armouring is required, ensure that appropriately-sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankful channel profile. ▪ May incorporate temporary measures (e.g. biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ R-3 – Exposed Soils/ Surfaces <ul style="list-style-type: none"> ○ Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: <ul style="list-style-type: none"> ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ R-4 – In-stream cover <ul style="list-style-type: none"> ▪ Minimize the removal of natural woody debris, rocks or other materials from below the high-water level ▪ Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered or disturbed during construction ▪ This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders or in-stream aquatic vegetation. ▪ R-5 – Riparian Vegetation Plantings <ul style="list-style-type: none"> ○ Design and implement vegetation rehabilitation plan following construction to replant riparian vegetation to pre-construction or better condition (e.g. trees for shade to cool water and provide overhead cover). Considerations: <ul style="list-style-type: none"> ▪ Design and install riparian plantings to avoid or minimize encroachment into and/or alteration of bank and bed profile. ▪ Usually includes re-instatement of native soils or replacement with topsoil/suitable planting medium. ▪ May include local seed bank or root mass/mat salvage, vegetation transplant or bioengineering (e.g. live stakes, cuttings) techniques. ▪ Use native species compatible with site conditions. ▪ Integrate provisional fish cover where feasible. ▪ Integrate appropriate techniques for interim stabilization measures such as biodegradable blanket, tackifier to maintain soil stability until vegetation becomes established. ▪ M-4 – Erosion and Sediment Controls <ul style="list-style-type: none"> ○ Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. ○ Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: <ul style="list-style-type: none"> ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. 		
<p>L2 – Grading</p>	<ul style="list-style-type: none"> ▪ Alteration to bank stability/ exposed soils and slope that can change landscape patterns, increase erosion potential and sediment deposition that can result in: <ul style="list-style-type: none"> – change in habitat cover and structure; 	<ul style="list-style-type: none"> ▪ D-2 – Drainage System <ul style="list-style-type: none"> ○ Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not divert across waterbody boundaries). ▪ M-4 – Erosion and Sediment Controls 	<ul style="list-style-type: none"> ▪ No residual effects. The Design Build Contractor shall determine during the detail design stage if scour protection is needed in the channel. At this time, scour protection was confirmed to not be needed at the culvert inlet due to low flow velocities. If scour protection is needed in the 	<ul style="list-style-type: none"> ▪ No

Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects	HADD (Yes/No)
	<ul style="list-style-type: none"> - change in slope and land drainage patterns; and - change in sediment concentrations. 	<ul style="list-style-type: none"> o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: <ul style="list-style-type: none"> ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ R-1 – Waterbody Bank <ul style="list-style-type: none"> o Minimize the removal of natural woody debris, rocks or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: <ul style="list-style-type: none"> ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g. tree and shrub plantings, bioengineering), rock/stone material (e.g. rip-rap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately-sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankful channel profile. ▪ May incorporate temporary measures (e.g. biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ R-3 – Exposed Soils/ Surfaces <ul style="list-style-type: none"> o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: <ul style="list-style-type: none"> ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ R-4 – In-stream cover <ul style="list-style-type: none"> o Minimize the removal of natural woody debris, rocks or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered or disturbed during construction o This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders or in-stream aquatic vegetation ▪ O-1 – Access <ul style="list-style-type: none"> o Prohibit or limit access to banks or areas adjacent to waterbodies, to the extent required to protect the structural integrity of banks or shorelines 	<p>channel, natural river stone should be used below the 2-year high water mark.</p>	
<p>L3- Excavation</p>	<ul style="list-style-type: none"> ▪ Creation of pond, pit or trench that can affect bank stability and exposed soils, changes to slope or drainage, lead to the removal of topsoil and increase frequency of dewatering of a pit or trench, or the improper management of spoil/material stockpiles that can result in: <ul style="list-style-type: none"> - change in water temperatures; - change in sediment concentrations; and - change in base flow. 	<ul style="list-style-type: none"> ▪ D-2 – Drainage System <ul style="list-style-type: none"> o Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not divert across waterbody boundaries). ▪ D-4 – Site Selection <ul style="list-style-type: none"> o Design and plan activities and works in waterbody such that loss or disturbance to aquatic habitat is minimized and sensitive spawning habitats are avoided o Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation and select narrow, straight channel sections to minimize requirements for piers and/or abutment fills. ▪ M-2 – Dewatering Discharge <ul style="list-style-type: none"> o manage and treat dewatering (or other) discharge water to prevent erosion and/or release of sediment-laden or contaminated water to the waterbody. 	<ul style="list-style-type: none"> ▪ No residual effects. Anticipated impacts from excavation works near the creek should be mitigated using standard ESC measures and BMPs for working in and near water. All in-water work shall be completed in the dry in isolation of flowing water, and ESC measures shall be installed to isolate the channel from the work area. 	<ul style="list-style-type: none"> ▪ No

Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects	HADD (Yes/No)
		<ul style="list-style-type: none"> ○ Considerations: <ul style="list-style-type: none"> ▪ Use of appropriately designed and sited temporary settling basin, filter bag, etc. such as sediment is filtered out prior to the water entering a waterbody ▪ Use of energy dissipation measures to prevent bank or bed erosion. ▪ M-4 – Erosion and Sediment Controls <ul style="list-style-type: none"> ○ Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. ○ Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: <ul style="list-style-type: none"> ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ M-5 – Excess Materials ▪ Temporarily store, handle and dispose of all materials used or generated (e.g. organics, soils, uprooted or cut aquatic plants, woody debris, dredging spoils, commercial logging waste, temporary stockpiles, construction waste and materials such as concrete, sheet pile, wood forms etc.) during site preparation, construction and clean-up in a manner that prevents their entry to the waterbody, including temporarily storing and stockpiling materials a safe distance from the waterbody and stabilizing/ containing them. ▪ R-1 – Waterbody Bank <ul style="list-style-type: none"> ○ Minimize the removal of natural woody debris, rocks or other materials from below the banks or the shoreline of the waterbody ○ Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: <ul style="list-style-type: none"> ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g. tree and shrub plantings, bioengineering), rock/stone material (e.g. rip-rap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately-sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankful channel profile. ▪ May incorporate temporary measures (e.g. biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ R-3 – Exposed Soils/ Surfaces <ul style="list-style-type: none"> ○ Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: <ul style="list-style-type: none"> ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. 		
L4 Riparian Planting	<ul style="list-style-type: none"> ▪ Change in sediment concentrations ▪ Change in contaminant concentrations ▪ Change in water temperature ▪ Change in habitat structure and cover ▪ Change in food supply 	<ul style="list-style-type: none"> ▪ M-1 – Chemicals <ul style="list-style-type: none"> ○ Use only specified amounts and types of fertilizer in areas draining to waterbodies ○ Avoid use of chemical dust suppressants, pesticides and herbicides in areas near or draining to waterbodies ○ Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish. ▪ M-4 – Erosion and Sediment Controls <ul style="list-style-type: none"> ○ Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. 	<ul style="list-style-type: none"> ▪ No residual effects. Riparian vegetation will be restored as discussed above following construction. 	<ul style="list-style-type: none"> ▪ No

Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects	HADD (Yes/No)
		<ul style="list-style-type: none"> ○ Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: <ul style="list-style-type: none"> ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ R-1 – Waterbody Bank <ul style="list-style-type: none"> ○ Minimize the removal of natural woody debris, rocks or other materials from below the banks or the shoreline of the waterbody ○ Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: <ul style="list-style-type: none"> ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g. tree and shrub plantings, bioengineering), rock/stone material (e.g. rip-rap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately-sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankful channel profile. ▪ May incorporate temporary measures (e.g. biodegradable materials, ‘nurse’-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ R-3 – Exposed Soils/ Surfaces <ul style="list-style-type: none"> ○ Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: <ul style="list-style-type: none"> ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ R-5 – Riparian Vegetation Plantings <ul style="list-style-type: none"> ○ Design and implement vegetation rehabilitation plan following construction to re-plant riparian vegetation to pre-construction or better condition (e.g. trees for shade to cool water and provide overhead cover) ○ Considerations: <ul style="list-style-type: none"> ▪ Design and install riparian plantings to avoid or minimize encroachment into and/or alteration of bank/bed profiles ▪ Usually includes re-instatement of native soils or replacement with topsoil/suitable planting medium ▪ May include local seed bank or root mass/mat salvage, vegetation transplant or bioengineering (e.g. live stakes, cuttings) techniques ▪ Use native species compatible with site conditions ▪ Integrate provision of fish cover where feasible ▪ Integrate appropriate techniques for interim stabilization measures such as biodegradable blanket, tackifier to maintain soil stability until vegetation becomes established 		
<p>W1 – Placement of material or structures in water</p>	<ul style="list-style-type: none"> ▪ Changes in channel or shoreline morphology, hydraulics, aquatic macrophytes, and substrate composition can result in: <ul style="list-style-type: none"> – change in sediment concentrations; – change in habitat structure and cover; – change in food supply; and – change in nutrient concentration. 	<ul style="list-style-type: none"> ▪ D-1 – Bridge, Culvert or other in-water structures <ul style="list-style-type: none"> ○ Reduce or eliminate constriction of flow through structure design. Design and site piers, abutments and other structures to avoid or otherwise minimize encroachment into waterbody and avoid sensitive habitats. Design structure to avoid or minimize effects on existing or natural flow regimes. Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains or any other area that is inherently unstable and may result in erosion and scouring of the waterbody bed or the built structures ○ Additional considerations for bridges and culverts: <ul style="list-style-type: none"> ▪ Design deck drainage to avoid direct discharge into the waterbody ▪ Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation ▪ Consider access requirements in sitting structures (e.g. need to access floodplain of deep pristine valley for construction). 	<ul style="list-style-type: none"> ▪ Permanent loss of approximately 80.64 m² of fish habitat as a result of the existing culvert being abandoned and the channel being infilled upstream and downstream of the culvert (67.20 linear meters of channel x 1.2 meters channel width). The existing 33.45 m culvert will be temporarily extended during construction and then abandoned, with the new culvert conveying flows underneath County Road 4 immediately north of the existing culvert. The existing culvert will be plugged and abandoned. The extent of the channel infilling upstream and downstream of the existing culvert is 	<ul style="list-style-type: none"> ▪ Yes, permanent loss of approximately 80.64 m² of fish habitat.

Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects	HADD (Yes/No)
		<ul style="list-style-type: none"> ▪ Design and install culverts to prevent creation of barriers to fish movement, and maintain bankfull channel functions and habitat functions to the extent possible, including proper sizing, embedment, re-instatement of low flow channel and properly designed and sized substrates to stay in-place under full range of flow conditions, compatible with existing native substrate, maintaining channel slope, etc. ▪ M-10 - Temporary Flow <ul style="list-style-type: none"> ○ design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should: <ul style="list-style-type: none"> ▪ use only clean materials free of particulate matter for temporary coffer dams ▪ situate or otherwise manage flow withdrawal and discharge (e.g. see dewatering discharge) to prevent erosion and sediment release to the waterbody ▪ ensure the work zone is stabilized against the impacts of high flow events during the work period ▪ remove fish from the isolated in-water work zones if necessary ○ see: management – Fish Screens and Management – Fish Transfer for managing fish. ▪ R-1 – Waterbody Bank <ul style="list-style-type: none"> ○ Minimize the removal of natural woody debris, rocks or other materials from below the banks or the shoreline of the waterbody ○ Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: <ul style="list-style-type: none"> ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g. tree and shrub plantings, bioengineering), rock/stone material (e.g. rip-rap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately-sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankful channel profile. ▪ May incorporate temporary measures (e.g. biodegradable materials, ‘nurse’-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ R-2 – Waterbody Bed and Substrate <ul style="list-style-type: none"> ○ Restore and re-stabilize any portion of the waterbody bed disturbed during construction to pre-construction (or better) condition, including: <ul style="list-style-type: none"> ▪ Restoration of the original contour and gradient ▪ Morphological elements, e.g. pools and riffles ▪ Substrates, which may include salvage and re-instatement of native materials ▪ R-4 – In-stream cover <ul style="list-style-type: none"> ○ Minimize the removal of natural woody debris, rocks or other materials from below the high-water level ○ Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered or disturbed during construction ○ This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders or in-stream aquatic vegetation 	<p>not known at this time and will need to be determined during detail design.</p> <ul style="list-style-type: none"> ▪ The proposed culvert will create 120.96 m² of habitat (proposed culvert dimensions: 67.2 m x 1.8 m) 	
<p>W3 – Organic Debris Management</p>	<ul style="list-style-type: none"> ▪ Change in contaminant concentrations ▪ Change in sediment concentrations ▪ Change in habitat structure and cover ▪ Change in nutrient concentrations ▪ Change in food supply 	<ul style="list-style-type: none"> ▪ R-1 – Waterbody Bank <ul style="list-style-type: none"> ○ Minimize the removal of natural woody debris, rocks or other materials from below the banks or the shoreline of the waterbody ○ Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: <ul style="list-style-type: none"> ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g. tree and shrub plantings, bioengineering), rock/stone material (e.g. rip-rap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately-sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankful channel profile. ▪ May incorporate temporary measures (e.g. biodegradable materials, ‘nurse’-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ R-2 – Waterbody Bed and Substrate 	<ul style="list-style-type: none"> ▪ No residual effects. 	<ul style="list-style-type: none"> ▪ No

Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects	HADD (Yes/No)
		<ul style="list-style-type: none"> ○ Restore and re-stabilize any portion of the waterbody bed disturbed during construction to pre-construction (or better) condition, including: <ul style="list-style-type: none"> ▪ Restoration of the original contour and gradient ▪ Morphological elements, e.g. pools and riffles ▪ Substrates, which may include salvage and re-instatement of native materials ▪ R-3 – Exposed Soils/ Surfaces <ul style="list-style-type: none"> ○ Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: <ul style="list-style-type: none"> ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ R-4 – In-stream cover <ul style="list-style-type: none"> ○ Minimize the removal of natural woody debris, rocks or other materials from below the high-water level ○ Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered or disturbed during construction ○ This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders or in-stream aquatic vegetation 		
<p>W4 – Addition or Removal of Aquatic Vegetation</p>	<ul style="list-style-type: none"> ▪ Change in water temperature ▪ Change in dissolved oxygen ▪ Change in food supply ▪ Change in nutrient concentrations ▪ Change in habitat structure and cover ▪ Change in contaminant concentrations ▪ Change in sediment concentrations 	<ul style="list-style-type: none"> ▪ M-3 – Equipment <ul style="list-style-type: none"> ○ Whenever possible, operate machinery on land above the high-water level, on ice, or from floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody ○ Operate, store and maintain (e.g. refuel, lubricate) all equipment, vehicles and associated materials in a manner that prevents the entry of any deleterious substance from entering the water ○ Any part of equipment entering the water or operating on the bank shall be free of fluid leaks, invasive species and noxious weeds and externally cleaned/degreased to prevent any deleterious substance from entering the water ▪ M-4 – Erosion and Sediment Controls <ul style="list-style-type: none"> ○ Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. ○ Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: <ul style="list-style-type: none"> ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ M-8 – In-water Turbidity Curtains or Other Appropriate Measures <ul style="list-style-type: none"> ○ Use properly sized, anchored and maintained in-water silt boom, turbidity curtains or other effective measures to contain suspended sediments. ▪ R-3 – Exposed Soils/ Surfaces <ul style="list-style-type: none"> ○ Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: <ul style="list-style-type: none"> ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ R-4 – In-stream cover <ul style="list-style-type: none"> ○ Minimize the removal of natural woody debris, rocks or other materials from below the high-water level 	<ul style="list-style-type: none"> ▪ No residual effects. No aquatic vegetation was noted in the ROW during field investigations aside from invasive phragmites. 	<ul style="list-style-type: none"> ▪ No

Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects	HADD (Yes/No)
		<ul style="list-style-type: none"> ○ Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered or disturbed during construction ○ This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders or in-stream aquatic vegetation 		
<p>W5 – Change in Timing, Duration and Frequency of Flow</p>	<ul style="list-style-type: none"> ■ Displacement or stranding of fish ■ Change in migration/ access to habitats ■ Change in sediment concentrations ■ Change in habitat structure and cover ■ Change in food supply ■ Change in water temperature ■ Change in contaminant concentrations ■ Change in nutrient concentrations 	<ul style="list-style-type: none"> ■ D-1 – Bridge, Culvert or other in-water structures <ul style="list-style-type: none"> ○ Reduce or eliminate constriction of flow through structure design. Design and site piers, abutments and other structures to avoid or otherwise minimize encroachment into waterbody and avoid sensitive habitats. Design structure to avoid or minimize effects on existing or natural flow regimes. Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains or any other area that is inherently unstable and may result in erosion and scouring of the waterbody bed or the built structures ○ Additional considerations for bridges and culverts: <ul style="list-style-type: none"> ■ Design deck drainage to avoid direct discharge into the waterbody ■ Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation ■ Consider access requirements in sitting structures (e.g. need to access floodplain of deep pristine valley for construction). ■ Design and install culverts to prevent creation of barriers to fish movement, and maintain bankfull channel functions and habitat functions to the extent possible, including proper sizing, embedment, re-instatement of low flow channel and properly designed and sized substrates to stay in-place under full range of flow conditions, compatible with existing native substrate, maintaining channel slope, etc. ■ D-2 – Drainage System <ul style="list-style-type: none"> ○ Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not across watershed boundaries). ■ D-5 – Stormwater Management Measures <ul style="list-style-type: none"> ○ Design stormwater management (SWM) measures to manage runoff to waterbody considering discharge (e.g. velocities to avoid erosion) as well as quality (e.g. formal SWM ponds, enhanced ditches, and filtration). ■ O-3 – Timing of In-water works <ul style="list-style-type: none"> ○ Implement timing restrictions for in-water work to protect sensitive life stages/processes of migratory and resident fish ○ additional timing considerations: <ul style="list-style-type: none"> ■ minimize duration of in-water work ■ conduct in-stream work during periods of low flow to allow work in water to be isolated from flows ■ schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation and allow for proper re-stabilization and re-vegetation as appropriate prior to winter. ■ M-7 – Fish Transfer <ul style="list-style-type: none"> ○ Avoid impacts to fishes by excluding, moving, or frightening fishes downstream or away from the work area. Retain a qualified environmental professional to ensure applicable permits for relocating fish are obtained ○ Capture any fish trapped within an isolated/enclosed area at the work site and safely relocate them to an appropriate location in the same waters using appropriate capture, handling and release techniques to prevent harm and minimize stress. Fish may need to be relocated again, should flooding occur on the site. ■ M-10 - Temporary Flow <ul style="list-style-type: none"> ○ design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should: <ul style="list-style-type: none"> ■ use only clean materials free of particulate matter for temporary coffer dams ■ situate or otherwise manage flow withdrawal and discharge (e.g. see dewatering discharge) to prevent erosion and sediment release to the waterbody ■ ensure the work zone is stabilized against the impacts of high flow events during the work period ■ remove fish from the isolated in-water work zones if necessary ○ see: management – Fish Screens and Management – Fish Transfer for managing fish. ■ M-12 – Water Flow <ul style="list-style-type: none"> ○ Flow management (e.g. minimum flows, seasonal flow augmentation, flushing flows) for specific aquatic habitat management goals or to mitigate other effects of flow management (e.g. fish passage, fish stranding). ■ R-1 – Waterbody Bank 	<ul style="list-style-type: none"> ■ No residual effects. During construction, all works should occur in the dry and maintain flows around the work area at all times. Following construction, the existing concrete box culvert will be abandoned and replaced with another concrete box culvert immediately north of the existing culvert. The new culvert should convey flows, food, and nutrients similar to that of the existing culvert. 	<ul style="list-style-type: none"> ■ No

Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects	HADD (Yes/No)
		<ul style="list-style-type: none"> ○ Minimize the removal of natural woody debris, rocks or other materials from below the banks or the shoreline of the waterbody ○ Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: <ul style="list-style-type: none"> ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g. tree and shrub plantings, bioengineering), rock/stone material (e.g. rip-rap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately-sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankful channel profile. ▪ May incorporate temporary measures (e.g. biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ R-2 – Waterbody Bed and Substrate <ul style="list-style-type: none"> ○ Restore and re-stabilize any portion of the waterbody bed disturbed during construction to pre-construction (or better) condition, including: <ul style="list-style-type: none"> ▪ Restoration of the original contour and gradient ▪ Morphological elements, e.g. pools and riffles ▪ Substrates, which may include salvage and re-instatement of native materials ▪ R-4 – In-stream cover <ul style="list-style-type: none"> ○ Minimize the removal of natural woody debris, rocks or other materials from below the high-water level ○ Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered or disturbed during construction ○ This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders or in-stream aquatic vegetation. ▪ R-5 – Riparian Vegetation Plantings <ul style="list-style-type: none"> ○ Design and implement vegetation rehabilitation plan following construction to re-plant riparian vegetation to pre-construction or better condition (e.g. trees for shade to cool water and provide overhead cover). Given the presence of invasive Phragmites on the east side of County Road 4, the vegetation rehabilitation plan should focus on reestablishing fast-growing native species to minimize the extent of Phragmites in the ROW. ○ Considerations: <ul style="list-style-type: none"> ▪ Design and install riparian plantings to avoid or minimize encroachment into and/or alteration of bank and bed profile ▪ Usually includes re-instatement of native soils or replacement with topsoil/suitable planting medium ▪ May include local seed bank or root mass/mat salvage, vegetation transplant or bioengineering (e.g. live stakes, cuttings) techniques ▪ Use native species compatible with site conditions ▪ Integrate provision of fish cover where feasible ▪ Integrate appropriate techniques for interim stabilization measures such as biodegradable blanket, tackifier to maintain soil stability until vegetation becomes established. 		
<p>W6 – fish passage issues</p>	<ul style="list-style-type: none"> – Incidental entertainment, impingement or mortality – Change in access to habitats 	<ul style="list-style-type: none"> ▪ D-1 – Bridge, Culvert or other in-water structures <ul style="list-style-type: none"> ○ Reduce or eliminate constriction of flow through structure design. Design and site piers, abutments and other structures to avoid or otherwise minimize encroachment into waterbody and avoid sensitive habitats. Design structure to avoid or minimize effects on existing or natural flow regimes. Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains or any other area that is inherently unstable and may result in erosion and scouring of the waterbody bed or the built structures ○ Additional considerations for bridges and culverts: <ul style="list-style-type: none"> ▪ Design deck drainage to avoid direct discharge into the waterbody ▪ Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation ▪ Consider access requirements in sitting structures (e.g. need to access floodplain of deep pristine valley for construction). ▪ Design and install culverts to prevent creation of barriers to fish movement, and maintain bankfull channel functions and habitat functions to the extent possible, including proper sizing, embedment, re-instatement of low flow channel and properly designed and sized substrates to stay in-place 	<ul style="list-style-type: none"> ▪ No residual effects. The existing culvert is likely not passable for fish travelling upstream due to the shallow laminar flows observed during the field investigation. The new culvert should be embedded to provide adequate water depths for fish passage. It should also be noted that there is only a small section (less than 10 liner meters) of fish habitat upstream of the culvert before a permanent fish passage barrier is present (i.e., the SWMP outlet). It is also recommended that river stone be added to the channel tie-in locations to ensure a smooth transition from the new culvert to the existing channel. 	<ul style="list-style-type: none"> ▪ No

Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects	HADD (Yes/No)
		<p>under full range of flow conditions, compatible with existing native substrate, maintaining channel slope, etc.</p> <ul style="list-style-type: none"> ▪ D-2 – Drainage System <ul style="list-style-type: none"> ○ Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not cross watershed boundaries). ▪ D-3 – Fish Passage <ul style="list-style-type: none"> ○ Design to maintain fish passage and minimize risk for fish passing upstream or downstream of an obstruction (e.g. downstream migration diversion methods, upstream migration via fish ladders, bypass channels). ▪ D-5 – Stormwater Management Measures <ul style="list-style-type: none"> ○ Design stormwater management measures to manage runoff to waterbody considering discharge (e.g. velocities to avoid erosion) as well as quality (e.g. formal SWMPs, enhanced ditches, and filtration). ▪ O-3 – Timing of In-water works <ul style="list-style-type: none"> ○ Implement timing restrictions for in-water work to protect sensitive life stages/processes of migratory and resident fish ○ additional timing considerations: <ul style="list-style-type: none"> ▪ minimize duration of in-water work ▪ conduct in-stream work during periods of low flow to allow work in water to be isolated from flows ▪ schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation and allow for proper re-stabilization and re-vegetation as appropriate prior to winter. ▪ M-6 - Fish Screens <ul style="list-style-type: none"> ○ Use fish screens to avoid entrainment and impingement of fish at water intakes. ○ Refer to DFO fish protection measures for design, installation and operation of fish screens https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html ▪ M-10 - Temporary Flow <ul style="list-style-type: none"> ○ design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should: <ul style="list-style-type: none"> ▪ use only clean materials free of particulate matter for temporary coffer dams ▪ situate or otherwise manage flow withdrawal and discharge (e.g. see dewatering discharge) to prevent erosion and sediment release to the waterbody ▪ ensure the work zone is stabilized against the impacts of high flow events during the work period ▪ remove fish from the isolated in-water work zones if necessary ○ see: management – Fish Screens and Management – Fish Transfer for managing fish. ▪ M-12 – Water Flow <ul style="list-style-type: none"> ○ Flow management (e.g. minimum flows, seasonal flow augmentation, flushing flows) for specific aquatic habitat management goals or to mitigate other effects of flow management (e.g. fish passage, fish stranding). 		
<p>W7 – Structure Removal</p>	<ul style="list-style-type: none"> – Change in food supply – Change in habitat structure and cover – Change in containment concentrations – Change in sediment concentrations 	<ul style="list-style-type: none"> ▪ O-1 – Access <ul style="list-style-type: none"> ○ Prohibit or limit access to banks or areas adjacent to waterbodies, to the extent required to protect the structural integrity of banks or shorelines ▪ O-3 – Timing of In-water works <ul style="list-style-type: none"> ○ Implement timing restrictions for in-water work to protect sensitive life stages/processes of migratory and resident fish ○ additional timing considerations: <ul style="list-style-type: none"> ▪ minimize duration of in-water work ▪ conduct in-stream work during periods of low flow to allow work in water to be isolated from flows ▪ schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation and allow for proper re-stabilization and re-vegetation as appropriate prior to winter. ▪ M-2 – Dewatering Discharge <ul style="list-style-type: none"> ○ manage and treat dewatering (or other) discharge water to prevent erosion and/or release of sediment-laden or contaminated water to the waterbody. ○ Considerations: <ul style="list-style-type: none"> ▪ Use of appropriately designed and sited temporary settling basin, filter bag, etc. such as sediment is filtered out prior to the water entering a waterbody ▪ Use of energy dissipation measures to prevent bank or bed erosion. 	<ul style="list-style-type: none"> ▪ No residual effects. No natural habitat structures are present in the ROW (i.e., woody debris, boulders, bank undercuts, etc.). The existing concrete box culvert will be abandoned and replaced with another concrete box culvert immediately north of the existing culvert. The new culvert should convey flows, food, and nutrients similar to that of the existing culvert. 	<ul style="list-style-type: none"> ▪ No

Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects	HADD (Yes/No)
		<ul style="list-style-type: none"> ▪ M-4 – Erosion and Sediment Controls <ul style="list-style-type: none"> ○ Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. ○ Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: <ul style="list-style-type: none"> ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ M-10 - Temporary Flow <ul style="list-style-type: none"> ○ design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should: <ul style="list-style-type: none"> ▪ use only clean materials free of particulate matter for temporary coffer dams ▪ situate or otherwise manage flow withdrawal and discharge (e.g. see dewatering discharge) to prevent erosion and sediment release to the waterbody ▪ ensure the work zone is stabilized against the impacts of high flow events during the work period ▪ remove fish from the isolated in-water work zones if necessary ○ see: management – Fish Screens and Management – Fish Transfer for managing fish. ▪ M-13 – Work Site Containment <ul style="list-style-type: none"> ○ Design and implement containment plan to isolate all work occurring above water and keep all deleterious substances (e.g. dust particulates, air-borne contaminants, paint, grout, poured concrete etc.) from entering the waterbody. ○ The design should include: <ul style="list-style-type: none"> ▪ ▪ R-1 – Waterbody Bank <ul style="list-style-type: none"> ○ Minimize the removal of natural woody debris, rocks or other materials from below the banks or the shoreline of the waterbody ○ Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: <ul style="list-style-type: none"> ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g. tree and shrub plantings, bioengineering), rock/stone material (e.g. rip-rap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately-sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankful channel profile. ▪ May incorporate temporary measures (e.g. biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ R-2 – Waterbody Bed and Substrate <ul style="list-style-type: none"> ○ Restore and re-stabilize any portion of the waterbody bed disturbed during construction to pre-construction (or better) condition, including: <ul style="list-style-type: none"> ▪ Restoration of the original contour and gradient ▪ Morphological elements, e.g. pools and riffles ▪ Substrates, which may include salvage and re-instatement of native materials ▪ R-5 – Riparian Vegetation Plantings <ul style="list-style-type: none"> ○ Design and implement vegetation rehabilitation plan following construction to re-plant riparian vegetation to pre-construction or better condition (e.g. trees for shade to cool water and provide overhead cover). ○ Considerations: <ul style="list-style-type: none"> ▪ Design and install riparian plantings to avoid or minimize encroachment into and/or alteration of bank and bed profile ▪ Usually includes re-instatement of native soils or replacement with topsoil/suitable planting medium 		

Memorandum

December 6, 2021

Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects	HADD (Yes/No)
		<ul style="list-style-type: none"> ▪ May include local seed bank or root mass/mat salvage, vegetation transplant or bioengineering (e.g. live stakes, cuttings) techniques ▪ Use native species compatible with site conditions ▪ Integrate provision of fish cover where feasible ▪ Integrate appropriate techniques for interim stabilization measures such as biodegradable blanket, tackifier to maintain soil stability until vegetation becomes established. 		

7. Preliminary Constraints and Mitigation Measures

The following outlines potential opportunities, constraints, and mitigation measures that should be assessed and considered during future design phases. The following is intended to provide guidance for future design plans and agency consultation, and further assessment will be required once the design plans are finalized:

Operational Constraints

- Access to waterbodies and banks should be limited to protect riparian vegetation and to minimize bank disturbance; and,
- In-water work below the HWM and work on watercourse banks shall be carried out during the appropriate in-water timing window: Given the warmwater characterization of the Unnamed Tributary North Branch, a warmwater fisheries timing window is anticipated for any in-water work. Warmwater in-water timing windows for similar watercourses throughout the Bradford Bypass project permit in-water work from July 15 – March 1 of any given year; however, this should be confirmed with NDMNRF during the detail design stage.

Management Practices and Controls

- An Erosion and Sediment Control Plan should be designed and implemented to contain/isolate exposed soils, stockpiled materials, and unstable areas in the work zone and to prevent the release of sediment to all waterbodies and ensure the work site is stabilized prior to removal of ESC measures following construction (as per OPSS 805). Site-specific ESC plans should be developed for the Unnamed Tributary North Branch and SWMP where work is proposed within 30 m of a watercourse/waterbody. While the SWMP is not protected under the Federal *Fisheries Act* as described earlier, the contractor is still required to avoid causing harm or the death of fish within the pond.
- An in-water work area isolation plan should be designed and implemented to maintain clean flow around the work area at the Unnamed Tributary North Branch crossing (EX-CL-9) where in-water work is proposed. The design should:
 - Use only clean materials free of particle matter for temporary cofferdams;
 - Manage flow withdrawal and discharge to prevent erosion and the release of sediment to a waterbody; and,
 - Ensure work zones are stabilized against high flows at the end of each work day.
- Design and install culvert extensions or replacement at the Unnamed Tributary North Branch crossing to prevent the creation of barriers to fish movement and maintain bankfull channel functions and habitat functions to the extent possible (D-C). Where permanent in-water structures are placed in fish habitat, naturalize these areas by placing river stone below the 2-year HWM (as per OPSS 825 and 1005). Design and install in-stream cover to replace or re-instate fish cover removed, altered or disturbed during construction.
- As per OPSS 182, any fish isolated in the work area should be transferred (using appropriate capture, handling and release techniques to prevent harm and minimize stress) downstream or away from the construction area. Fish screens shall be used to avoid entrainment of fish in pumps or hoses.
- Dewatering operations should be managed to prevent erosion or the release of sediment-laden water to a waterbody (as per OPSS 805);
- A Spills Management Plan should be prepared and shall include materials, instructions, education and emergency numbers. The plan shall be kept onsite at all times, communicated to work crews and be

properly implemented in the event of accidental spills (OC – Spill Prevention and Response Contingency Plan as per OPSS 182);

- Operate, store and maintain equipment and associated materials in a manner and at a distance that prevents the entry of any deleterious substance from entering a waterbody (as per OPSS 182). Any part of equipment entering the waterbody or operating from the bank shall be cleaned, free of fluid leaks and in good working condition; and,
- Isolated in-water work areas must be cleared of fish prior to commencement of work. Fish must be released unharmed downstream. Intakes of pumps and hoses for dewatering of in-water work areas shall be screened to avoid impingement and/or entrainment of fish (as per OPSS 182).

Rehabilitation

- Re-stabilize any portion of the bed of a waterbody disturbed during construction to pre-construction conditions. This shall include substrates as per OPSS 182 and OPSS 1005. Based on the 30% detail design drawings, riprap is shown at the culvert inlet and outlet. It is recommended that riprap be replaced with suitably sized river stone to naturalize the area and provide scour protection. During the detail design stage, it is also recommended that the Design Team consider the installation of river stone at the channel tie-in locations to both naturalize and stabilize the channel upstream and downstream of the proposed culvert.
- Re-stabilize the banks of a waterbody that have been disturbed during construction to pre-construction conditions or better (as per OPSS 182 and OPSS 804). This shall include riparian vegetation or stone material, temporary measures and the avoidance of hard engineering; Given the presence of dense invasive phragmites at the culvert outlet, a suitable native species should be planted in the area,
- Re-stabilize and re-vegetate soils exposed or disturbed during construction, including new or cleaned-out ditches (as per OPSS 182).

Environmental Provisions

The following Ontario Provincial Standard Specifications and MTO Central Region Special Provisions are recommended for inclusion in the contract documents. Further assessment and review of applicable OPSS's should be completed during detail design:

- Environmental Protection During Work in Watercourses and on Watercourse Banks in accordance with OPSS 182;
- Temporary Erosion and Sediment Control Measures in accordance with OPSS 805;
- Environmental Incident Management Under Legislation Protecting the Environment and Natural Resources in accordance with OPSS 100;
- Management of Excess Materials in accordance with OPSS 180;
- Timing of in-water Work in accordance with SSP101F23;
- Construction Specification for Dewatering in accordance with OPSS 517; and,
- Material Specification for Aggregates – Streambed Material with OPSS.PROV 1005.

8. Anticipated Permits and Approvals

Based on the known background information and proposed works at this time, submission to DFO under a Request for Review is anticipated for the culvert extension and replacement work due to the permanent loss of 80.64 m² of direct warmwater fish habitat when the existing culvert (EX-CL-9) is abandoned and the channel is infilled upstream and downstream of the culvert. The Federal *Fisheries Act* was amended on June 21, 2019 to

restore protections to fish and fish habitat. Habitat protection provisions came into force on August 28, 2019 that prohibit the death of fish and the Harmful Alteration, Destruction, or Disruption of fish habitat. The 2019 amendments to the Fisheries Act no longer provide for a self-assessment process unless activities can follow the measures to protect fish and fish habitat as stipulated by DFO, or if works are occurring in a waterbody that is not protected under the Fisheries Act. There is currently no MTO Best Management Practice for culvert extensions, replacements, or relocations that result in the permanent loss of direct fish habitat. Therefore, the proposed culvert works that result in the permanent loss of fish habitat at the EX-CL-9 crossing should be reviewed by DFO. The need for DFO submission will need to be further assessed during the detail design stage once the design plans are finalized. Once design plans are finalized, submission to DFO can be completed (if necessary). A summary of the impact assessment and rationale for DFO submission is provided in Table 8.

Table 8. Aquatic Effects Assessment Summary Table (Template D4)

Project W.P No	Project Title	Waterbody Name
2007-21-01	Highway 400 – Highway 404 Link (Bradford Bypass) County Road 4 Early Works (GWP 2008-21-00), Ontario Ministry of Transportation	Unnamed Tributary North Branch
Fisheries Assessment Specialist		Date
Roger Holmes		November 18, 2021
PROPOSED WORKS, ENVIRONMENTAL AND MANAGEMENT CONTEXT		
Proposed Works	<ul style="list-style-type: none"> - To accommodate the road widening and traffic staging along County Road 4, culvert extensions will be required at both the inlet and outlet of the existing 33.45 m culvert structure - EX-CL-9. At this time, approximately a 5 m extension at the culvert inlet and a 25 m extension at the culvert outlet are proposed to allow for additional fill and grading in the area along the road. - Relocation of the existing ditches on the west side of County Road 4 to accommodate the fill/grading and culvert extension. No existing defined ditches were observed on the outlet (east) side of County Road 4. Ditches may be proposed on the east side if required during subsequent design stages. - A new 67.2 m culvert will be installed immediately north of the existing culvert to convey flows underneath County Road 4. The existing culvert will then be plugged and abandoned once the new culvert is online. 	
Fish and Fish Habitat	<ul style="list-style-type: none"> - The Unnamed Tributary North Branch is characterized as direct warmwater fish habitat with no significant fish habitat features or SAR. The watercourse originates from a SWMP and outlets into the Unnamed Tributary North Branch, which then crosses County Road 4. At the culvert outlet on the east side of County Road 4, the watercourse continues to flow east where it collects ephemeral flows from an agricultural drainage swale to the north. The SWMP on the west side of County Road 4 is an offline feature. On the east side of County Road 4, riparian lands consist of dense invasive phragmites (European Common Reed) that choke out the channel and heavily shade the watercourse. Due to the dense phragmites, no channel morphology or variation in fish habitat was noted. 	
Fish Passage	<ul style="list-style-type: none"> - The dense phragmites on the east side of County Road 4 may create a seasonal fish barrier during low flow conditions in the summer. During detail design, removal drawings should require the removal of invasive phragmites in the ROW to the extent possible. Landscape drawings should also require that riparian lands be restored shortly after disturbance to prevent invasive phragmites from reestablishing in the area. - Field studies identified seasonal (potentially permanent) barriers to fish movement upstream through the culvert due to shallow laminar flows. During installation of the proposed culvert, the culvert should be embedded a minimum of 10% to eliminate a perch at the outlet and create a smooth transition at the inlet and outlet by placing appropriate substrate to smoothly tie into the culvert. If possible, the culvert grade should also be reduced to lessen flow velocities throughout the culvert to improve fish passage. It should also be noted that there is only a small section (less than 10 linear meters) of fish habitat upstream of the culvert before a permanent fish passage barrier is present (i.e., the SWMP outlet). 	
Fisheries Management Objectives (FMO)/In-Water Work Timing Window	<ul style="list-style-type: none"> - Review of background information determined that the Unnamed Tributary North Branch has a warmwater thermal regime. Therefore, in-water work is permitted from July 15 – March 1. 	
RESIDUAL EFFECTS ASSESSMENT		
Negative residual effects:		
<p>1. Permanent loss of approximately 80.64 m² of fish habitat as a result of the existing culvert being abandoned and the channel being infilled upstream and downstream of the culvert (67.20 linear meters of channel x 1.2 meters channel width). The existing 33.45 m culvert will be temporarily extended during construction and then abandoned, with the new culvert conveying flows underneath County Road 4 immediately north of the existing culvert. The existing culvert will be plugged and abandoned. The proposed culvert will create 120.96 m² of habitat (proposed culvert dimensions: 67.2 m x 1.8 m). The extent of the channel infilling upstream and downstream of the existing culvert is not known at this time and will need to be determined during detail design.</p>		
Spatial Scale	Approximately 80.64 m ² of fish habitat will be impacted, which affects the watercourse contained within the culvert and immediately upstream and downstream of the culvert in the ROW. No impacts to upstream of downstream fish habitat outside of the ROW is anticipated. Therefore, the spatial scale is relatively small.	
Duration	The loss of the existing fish habitat within will be permanent. Once the new culvert is online, permanent new fish habitat will then be created directly adjacent to the existing culvert.	
Intensity	Given the proposed works will result in the permanent loss of direct fish habitat, the intensity is considered high.	
DOCUMENTATION OF FISH AND FISH HABITAT IMPACT - Rationale and Conclusions		
Considering that the severity (spatial scale, duration, intensity) of all negative residual effects, taken together, are used to determine, provide a brief rationale for why <u>is</u> or <u>is not</u> likely to occur by addressing the following questions below:		
1.0 Will the project result in the death of fish? All in-water works are to follow the appropriate BMPs for working in-water, including that all works are to be completed in the dry and that a fish salvage shall occur prior to any in-water work.	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>

<p>2.0 Will the project result in harmful alteration, disruption or destruction of fish habitat?</p> <p>Approximately 80.64 m² of fish habitat will be permanent removed. Temporary impacts during construction can be mitigated by implementing standard ESC measures and applicable BMPs for working in and near water (i.e., working in the dry, maintain flow around the work area, complete a fish salvage, etc).</p>	<p>YES <input checked="" type="checkbox"/></p>	<p>NO <input type="checkbox"/></p>
<p>Relocating the existing culvert to the north will result in the permanent loss of direct fish habitat in the existing culvert as described above. Therefore, the existing fish habitat will be destroyed and recreated in the new culvert immediately to the north.</p>		
<p>Fisheries Assessment Specialist Recommendation: <i>Check one of the boxes based on the summary of findings.</i></p> <p><input type="checkbox"/> Proceed with project with identified mitigation measures (Complete MTO Project Notification Form)</p> <p><input checked="" type="checkbox"/> Recommendation to send project for review by DFO*</p> <p>*Project submission to DFO should be reassessed once the design process has been advanced further.</p>		
<p>MTO Review of the Fisheries Assessment Specialist's Recommendation (to be completed by MTO):</p> <p>All projects identified by the Fisheries Assessment Specialist as likely to result in the death of fish or HADD of fish habitat require a review by MTO prior to completion of any forms or submission to DFO. Only once advised by MTO should the Fisheries Assessment Specialist complete a DFO Request for Review Form to submit to MTO for signature and submission to DFO.</p>		

9. References

AECOM (2019). Fish and Fish Habitat Existing Conditions Report. Highway 400 – Highway 404 Link (Bradford Bypass. G.W.P. 2054-14-00.

County of Simcoe (2012). Class Environmental Assessment Municipal Road Project, Widening of County Road 4 from the 8th Line to just North of the Intersection with County Road 89, Environmental Study Report. Ainley and Associates Limited.

Fisheries and Oceans Canada (DFO). 2021:

Aquatic Species at Risk Mapping. Accessed October 2021 from: <https://www.dfo-mpo.gc.ca/species-especes/sara-lep/map-carte/index-eng.html>

Lake Simcoe Region Conservation Authority (LSRCA), 2010. West Holland River Subwatershed Management Plan. Available online at:

<https://www.lsrca.on.ca/Shared%20Documents/reports/west-holland-subwatershed-plan.pdf>. Accessed November 2019.

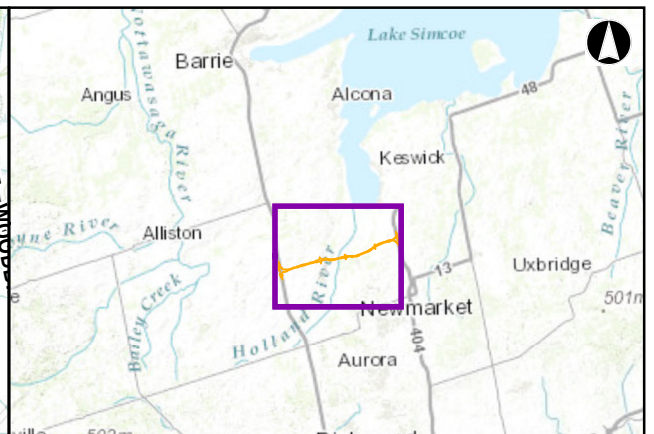
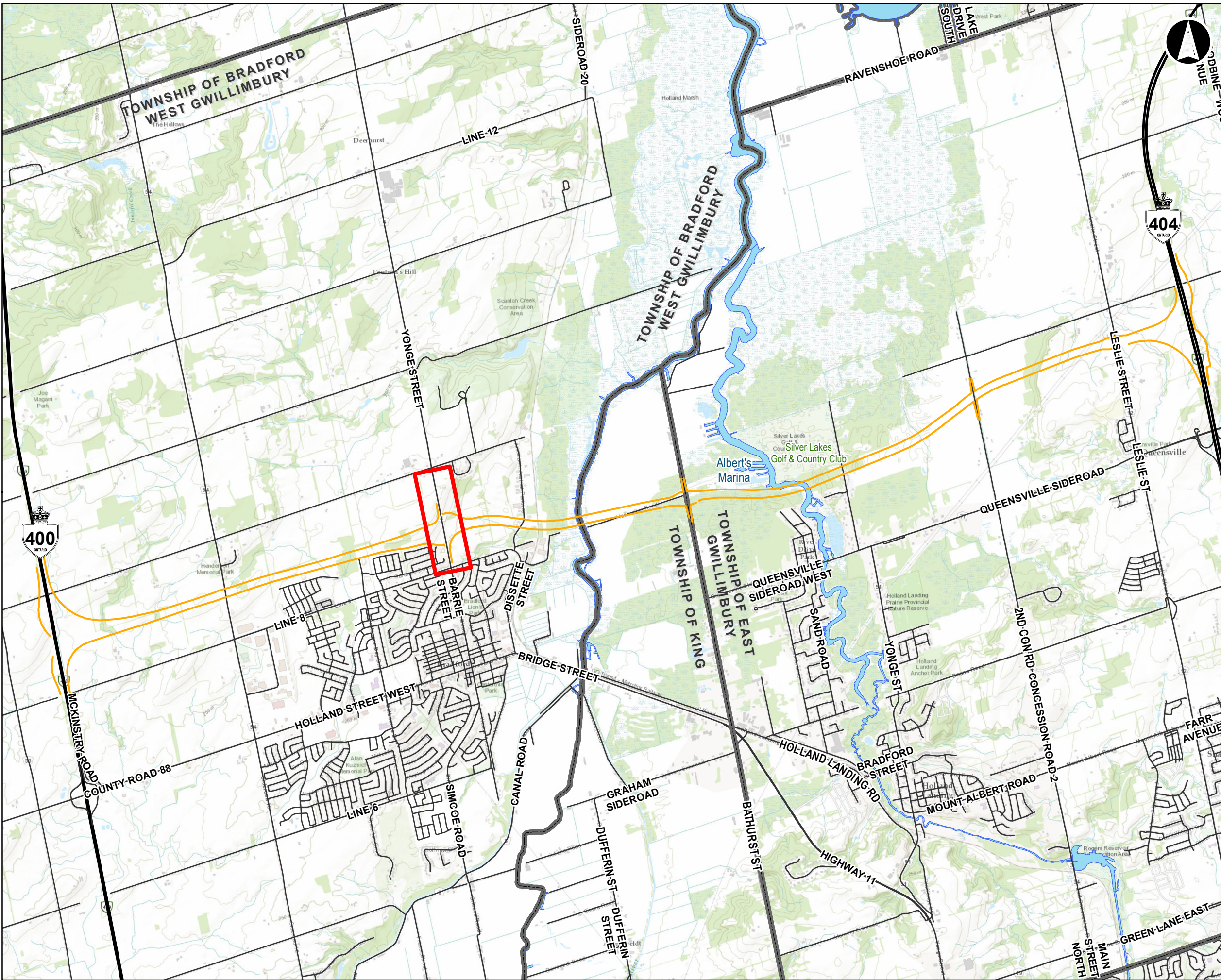
Ontario Ministry of Natural Resources and Forestry (MNRF), 2021: Make-a-Map: Natural Heritage Areas. Accessed October 2021 from:

http://www.giscopeapp.lrc.gov.on.ca/Mamnh/Index.html?site=MNR_NHLUPS_NaturalHeritage&viewer=NaturalHeritage&locale=en-US

Ontario Ministry of Natural Resources and Forestry, 2021: Fish ON-Line, online mapping application.

<https://www.gisapplication.lrc.gov.on.ca/FishONLine/Index.html?site=FishONLine&viewer=FishONLine&locale=en-US>. Accessed October 2021.

Figures



Legend

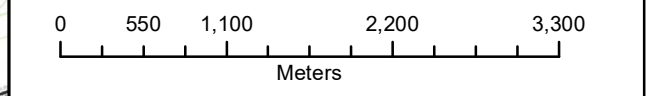
- CR4 Study
- Highway 400 - Highway 404 Link (Bradford Bypass) Right of Way

Roads

- Provincial Highway
- Other

Other

- Municipality Boundary
- Waterbody



**Highway 400 - Highway 404 Link
(Bradford Bypass) County Road 4 Advance
Works (GWP 2008-21-00)**

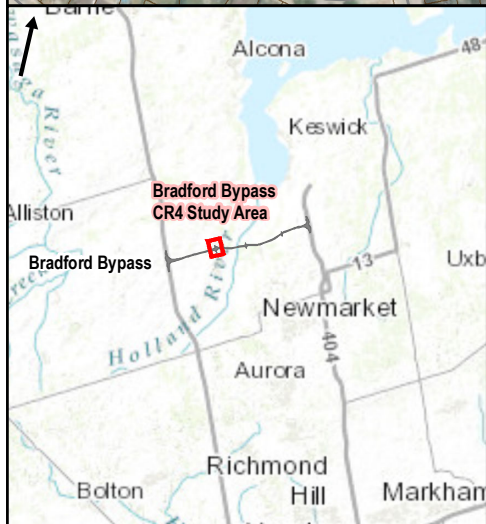
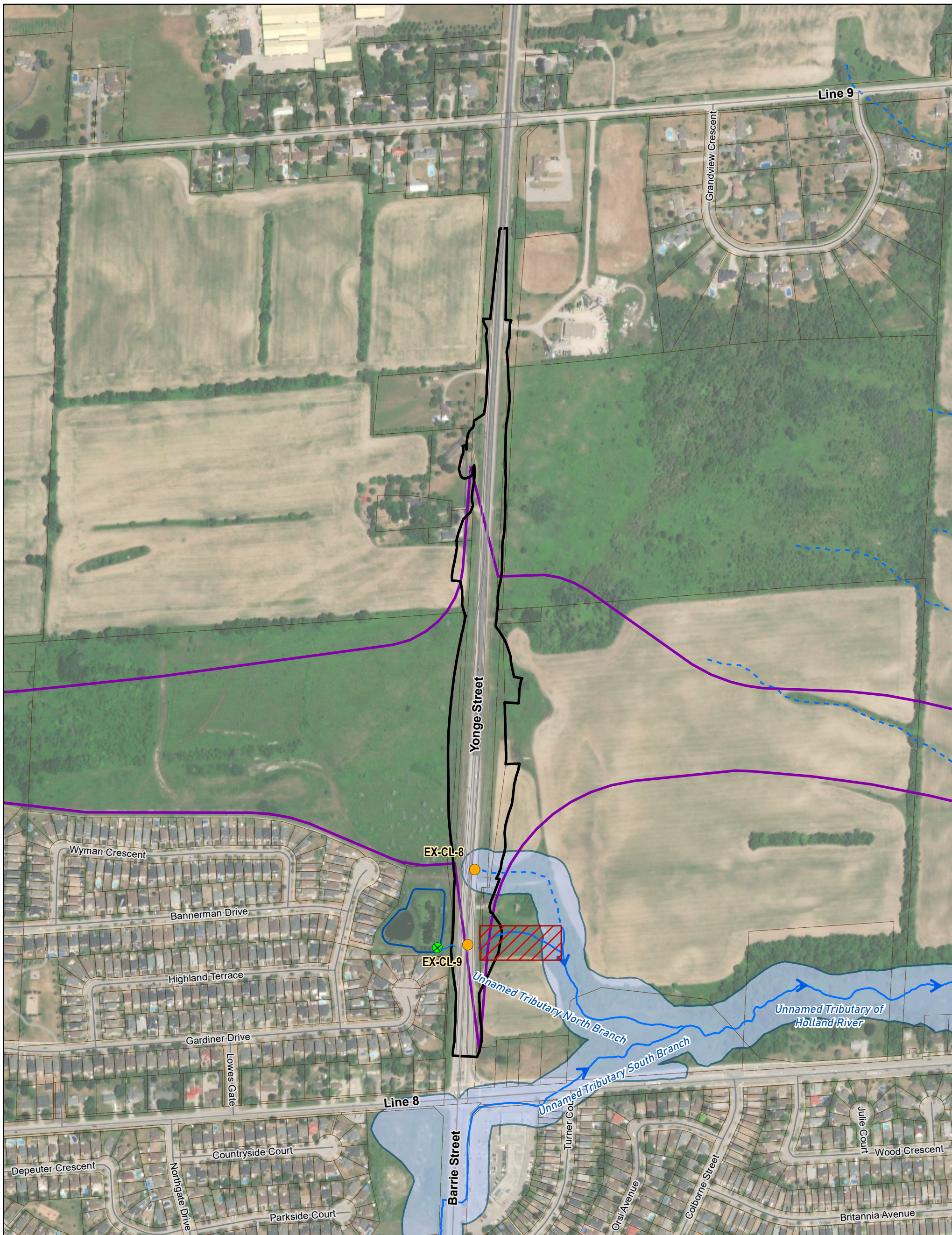
County Road 4 Study Area

October 2021	1:50,000 <small>* when printed 11"x17"</small>	Datum: NAD 1983 UTM Zone 17N Source: Imagery Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,
		Figure 1

AECOM

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Data Sourced: 10/12/2021 2:58:53 PM User Name: cambridge



Legend

- Fish Barrier
- Existing Culverts
- Roads
- Warmwater Watercourse
- Ephemeral Drainage Feature
- County Road 4 (CR4) Design
- CR4 Limit of Work
- Bradford Bypass Right of Way (ROW)
- Parcel Fabric
- Offline SWMP
- LSRCA Regulation Limit
- Dense invasive Phragmites




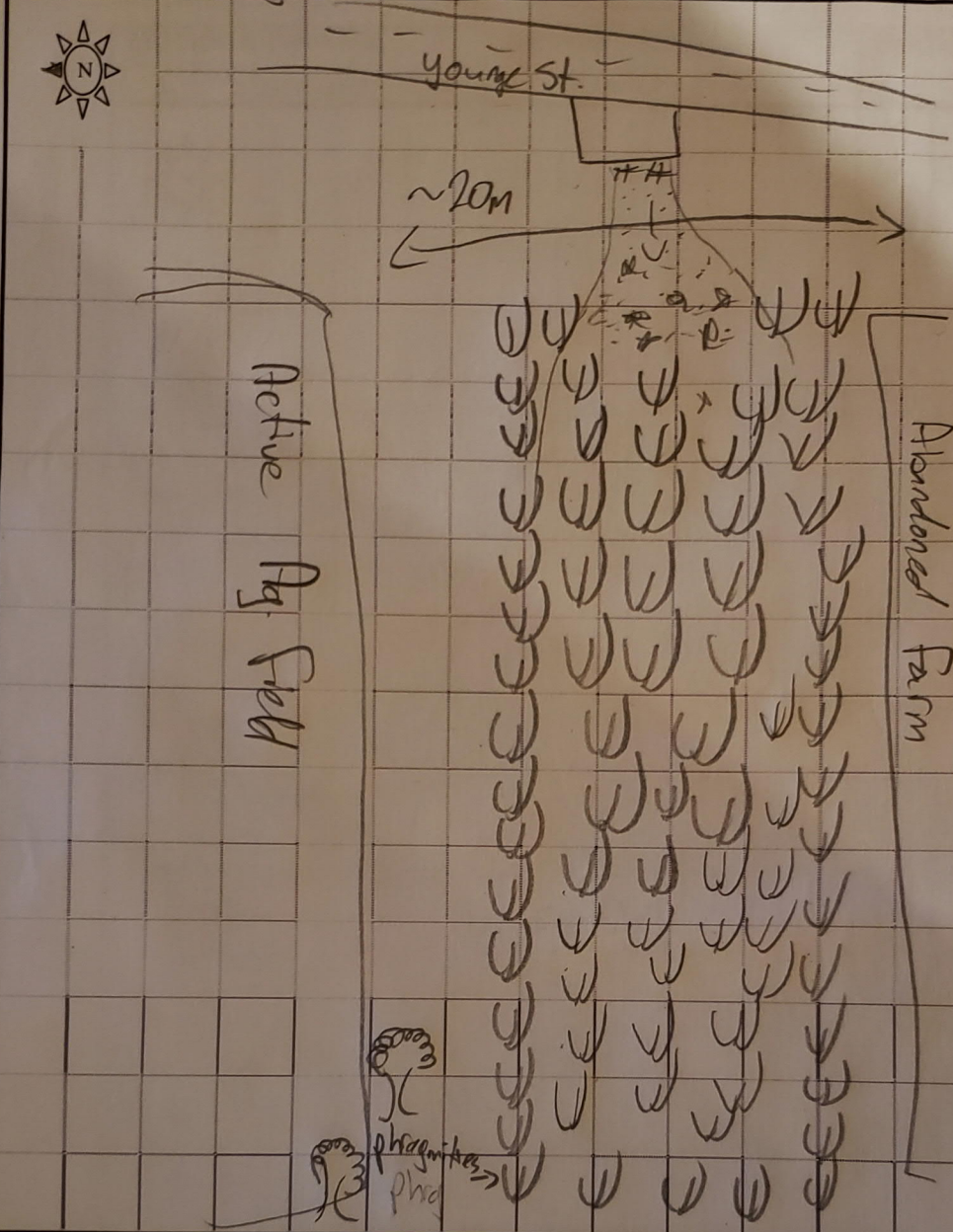
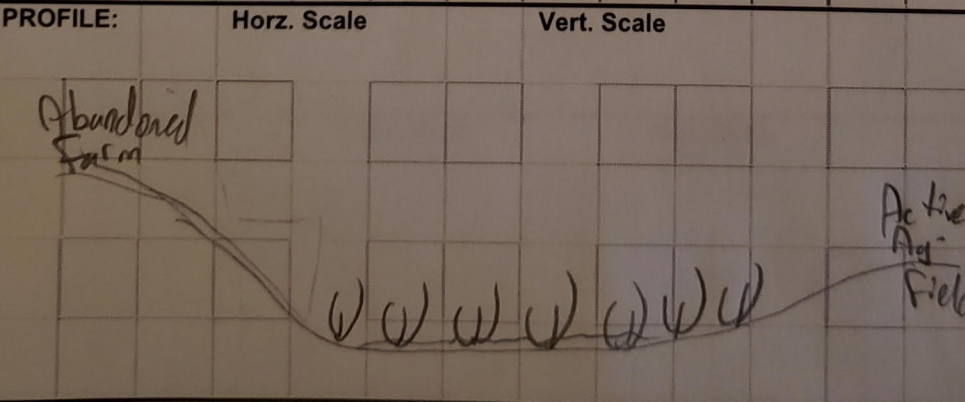
Highway 400 - Highway 404 Link (Bradford Bypass) County Road 4 Advance Works (GWP 2008-21-00)		
Aquatic Habitat Features Constraints and Opportunities		
November 2021	1:5,000	NAD 83 Zone 17 GeoHub, MTO, LSRCA
P#:	V#:	Figure 2
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Map Source: 1045540410010000080876161_BradfordBypassDesign01_Reports/CR4_Aquatic_20211116.mxd
 Date Saved: 12/29/2021 11:41:12 AM

Appendix **A**

MTO Field Forms

SECTION IDENTIFIER: CR4 Stormwater + Crossing	SECTION LOCATION: Upstream	SECTION LENGTH (m): 80	SCALE (cm / m): 1 / 10
			PROJECT #: 60636190
			MAPPER: KC
			NAME OF WATERBODY: Stormwater pond
			CROSSING #: CR4 - Stormwater + Crossing
			STATION #:
			DATE: DD-MMM-YY 30-Sept-21
LEGEND			
<p>10d depth (cm) 6w width</p> <p>→ Riffle ⇨ Run/Glide ○ Pool ■ Island/Bar ▨ Fine Substrate ### Gravel Substrate oOooO Cobble / Boulder *** Debris CT Cattail SV/FV Submerg/Float Veg EV Emergent Vegetation W Watercress Fe Iron Staining ///// Eroded Bank XXX Riprap / Other Stabilization</p>			
PROFILE:			<p>○ Instream Log/Tree ^^^ Dam/Weir/Obstruction Ⓡ Riparian Tree ▶ Seep/Spring ----- Undercut Bank — Barrier to Fish Movement -S- Seasonal Barrier -x-x- Fence line ┌└ Culvert</p>
Horz. Scale	Vert. Scale		

SECTION IDENTIFIER: <i>CR4 Crossing</i>	SECTION LOCATION: <i>Downstream</i>	SECTION LENGTH (m): <i>150m</i>	SCALE (cm / m): <i>1/10</i>
			PROJECT #: <i>60636190</i>
	MAPPER: <i>KC</i>		NAME OF WATERBODY: <i>Crossing - D/S</i>
	CROSSING #: <i>CR4 Crossing</i>		STATION #: <i>Downstream</i>
	DATE: DD-MMM-YY <i>30-Sept-21</i>		LEGEND
	10d depth (cm) 6w width → Riffle ⇨ Run/Glide ○ Pool ■ Island/Bar ● Fine Substrate ### Gravel Substrate oOooO Cobble /Boulder *** Debris CT Cattail SV/FV Submerg/Float Veg EV Emergent Vegetation W Watercress Fe Iron Staining // // // // Eroded Bank XXX Riprap / Other Stabilization ○ Instream Log/Tree ^^^ Dam/Weir/Obstruction ® Riparian Tree ▸ Seep/Spring - - - - - Undercut Bank — Barrier to Fish Movement -S- Seasonal Barrier -x-x- Fence line □ Culvert		
	PROFILE: Horz. Scale Vert. Scale 		

60636190-Pond and Lakes Field Collection Form MTO

Submitted by: roger.holmes@aecom.com_aecom

Submitted time: Sep 30, 2021, 1:32:21 PM

Project Name:

<i>Bradford Bypass</i>

Survey Metadata

Date:

Sep 30, 2021

Collectors:

RH, KC

Time Started:

Sep 30, 2021, 9:00:00 AM

Weather - latitude

44.1285763675952

Weather - longitude

-79.56937793818187

Location

Bradford

Weather Conditions:

clear sky

Air Temp (°C):

10.37

Surface Conditions:

East bay - 80% open water, calm.

West bay - 5% open water, calm.

Water Surface Condition:

Calm

Location Data

Name of Waterbody:

Unnamed

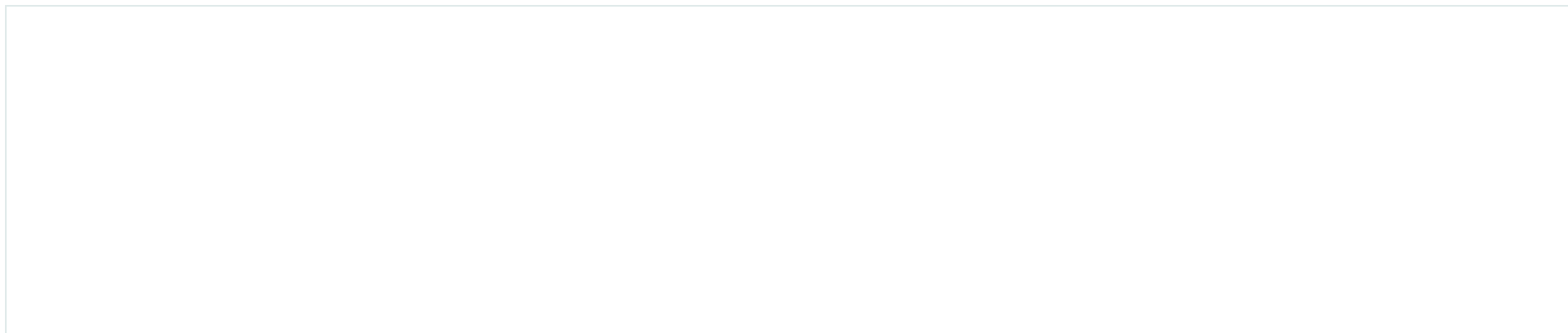
Crossing ID:

CR4 SWMP

Location of Station:

West side of CR4/Yonge st. East of Meadowvale Drive, north of Gardiner Dr.

Map Crossing Location:



Latitude

44.1285763675952

Longitude

-79.5693779381819

Township:

Bradford

MNRF District:

Aurora

Surrounding Land Use or Terrain:

Residential subdivision

Sources of Pollution

Runoff from subdivision, overland flow from roads.

Waterbody Type and Morphology

Waterbody Type

Pond

Waterbody Morphology

Run-off

Waterbody Length (m)

70

Waterbody Mean Width (m)

70

Water Chemistry

Water Colour:

Yellow / Brown

Bank Habitat

Bank Cover - Woody Debris (% surface area)

2

Bank Cover - Vascular Macrophytes (% surface area)

20

Near Shore Slope (%):

20

Shoreline Substrate - Detritus (%)

90

Shore Cover (% shaded):

1 to 29%

In-Water Habitat

Underwater Cover - Woody Debris (% surface area)

2

Underwater Cover - Vascular Macrophytes (% surface area)

75

Vegetation Type - Floating (%)

70

Predominant species of floating vegetation:

Lillies, algae

Vegetation Type - Emergent (%)

15

Predominant species of emergent vegetation:

Cattail, arrowhead

Migratory Observations

Permanent Migratory Obstructions:

Pond is an offline feature. Concrete outlet structure with bottom draw feature. Overflow channel present with grate, but was dry with overgrown vegetation indicating infrequent use.

Potential Critical Habitat

Potential Critical Habitat:

None.

Potential Enhancement Opportunities:

Additional riparian plantings to increase shading of pond.

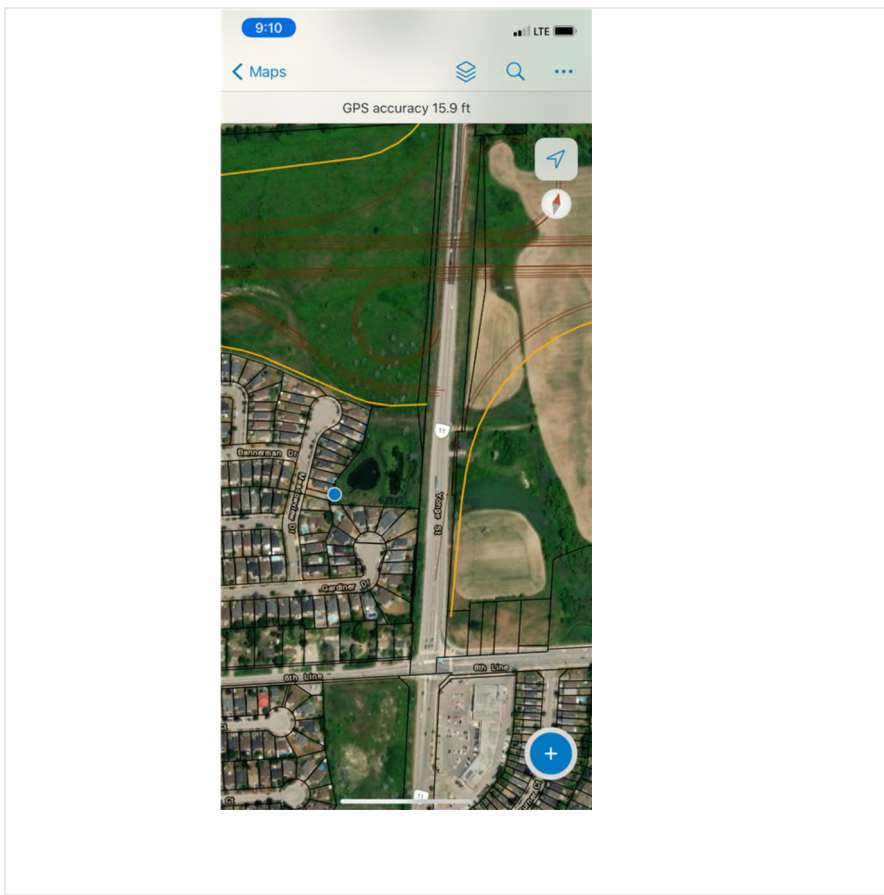
Final Comments

Additional Comments:

Offline pond, collects water from storm drains from subdivision. Banks covered in dense cattails with abundance of lillies and algae in the pond. No fish observed, but anticipated to have tolerant fish species present.

Append Notes

Attach image of note page



AppendNoteImages-20210930-132923.PNG

Attach image of note page



AppendNotelImages-20210930-132951.jpg



AppendNotelImages-20210930-132952.jpg

Attach image of note page



AppendNotelImages-20210930-133028.jpg

60636190-MTO Watercourse Field Collection Form

Submitted by: roger.holmes@aecom.com_aecom

Submitted time: Sep 30, 2021, 1:40:25 PM

Project Name:

Bradford Bypass

Survey Metadata

Date:

Sep 30, 2021

Is stream realignment required

Unknown

Collectors:

RH, KC

Time Started:

Sep 30, 2021, 9:36:00 AM

Time Finished:

Sep 30, 2021, 10:45:00 AM

Weather - latitude

44.128425949543924

Weather - longitude

-79.56870002144015

Location

Bradford

Weather Conditions

clear sky

Air Temperature (°C):

12.93

Velocity:

Slow

Location Data

Name of Waterbody:

Unnamed

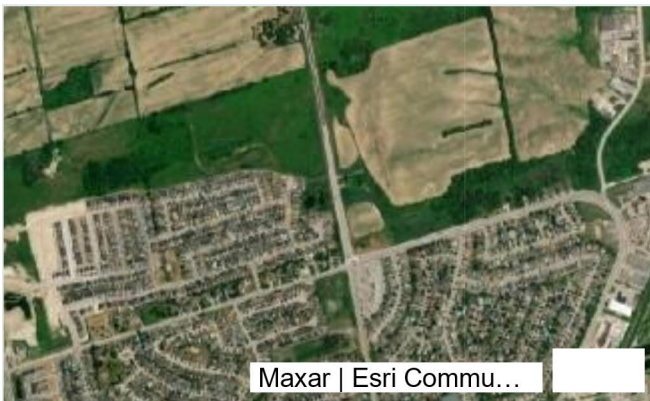
Crossing ID:

CR4 crossing

Location of Crossing:

220 m north of 8th line on Yonge St.

Map Crossing Location:



Latitude

44.1284259495439

Longitude

-79.5687000214402

Surrounding Land Use:

Residential subdivision on the west side of Yonge St, crop farm land on the east side.

Pollution Sources:

Residential and road runoff, farm field runoff.

Existing Structure Type:

Box Culvert

Existing Structure Width (m2):

1.5

Existing Structure Height (m2):

1

Downstream Survey

Downstream Section Type and Morphology:

Downstream Section (Reach) Identifier:

CR4 downstream

Downstream Section location:

CR4 downstream

Downstream Section Type:

Stream or River

Downstream Section Type Status:

Permanent

Downstream Subsections:

Downstream Run:

Yes

Downstream Run - Percentage of area:

100

Downstream Run - Mean wetted depth (m):

0.15

Downstream Run - Mean wetted width (m):

1.2

Downstream Run - Mean bankful depth (m):

0.2

Downstream Run - Substrate Type:

Detritus (D)

Downstream Run - Substrate Percentage:

80

Downstream Bank Stability

Downstream Left Bank Stability:

Stable

Downstream Right Bank Stability:

Stable

Downstream Left Bank Description:

Protected Bank

Downstream Right Bank Description:

Protected Bank

Downstream Habitat

Downstream In-Stream Cover (% Surface Area):

Downstream Vascular Macrophytes Total Cover (%):

100

Downstream Vascular Macrophytes Instream Cover (%):

100

Downstream Shore Cover

Downstream Shore Cover % of stream shaded:

90 - 100%

Downstream Shore Cover Comments:

Dense phragmites patch 20-30 m wide which channel flows through. No defined or specific morphology observed due to dense phragmites.

Downstream Vegetation Type

Downstream Emergent Vegetation(%):

100

Downstream Predominant Emergent Species:

Phragmites

Downstream Migratory Obstructions:

Downstream Permanent Obstructions:

Culvert not passable at upstream end due to shallow laminar flow overtop of concrete bottom.

Downstream Seasonal Obstructions:

Dense phragmites may choke out channel in some locations, making fish passage difficult - especially during low flow periods.

Downstream Potential Enhancement Opportunities:

Remove Phragmites along channel banks.

Downstream Additional Comments:

Channel inspected 150-200 m downstream. Dense phragmites were still present. Water was still present in channel but no observable flow.

Upstream Survey

Upstream Section Type and Morphology:

Upstream Section (Reach) Identifier:

CR4 crossing upstream

Upstream Section Location:

CR4 crossing

Upstream Section Type:

Stream or River

Upstream Section Type Status:

Permanent

Upstream Subsections:

Upstream Run:

Yes

Upstream Run - Percentage of area:

100

Upstream Run - Mean wetted depth (m):

0.25

Upstream Run - Mean wetted width (m):

1.2

Upstream Run - Mean bankful depth (m):

0.5

Upstream Run - Mean bankful width (m):

4

Upstream Run - Substrate Type:

Clay (Cl)

Upstream Run - Substrate Percentage:

50

Upstream Bank Stability

Upstream Left Bank Stability:

Stable

Upstream Right Bank Stability:

Stable

Upstream Left Bank Description:

Protected Bank

Upstream Right Bank Description:

Protected Bank

Upstream Habitat

Upstream In-Stream Cover (% Surface Area):

Upstream Vascular Macrophytes Species:

Cattails, grasses

Upstream Vascular Macrophytes Total Cover (%):

75

Upstream Vascular Macrophytes Instream Cover (%):

50

Upstream Vascular Macrophytes Overhanging Cover (%):

50

Upstream Woody Debris Total Cover (%):

0

Upstream Shore Cover

Upstream Shore Cover % of stream shaded:

60 - 89%

Upstream Comments:

Dense cattails and grasses in channel 3 m downstream of pond culvert outlet. Creates vegetation debris jam at end of open water section and near CR4 culvert inlet.

Upstream Additional Comments:

Clear water with clay substrate. Gravel and silt overtop of clay. Flowing water in channel to CR4 inlet. Ditch inlets from north and south, but both were dry.

Appendix **B**

Site Photographs

Client Name:
Ministry of Transportation

Site Location
County Road 4, Bradford West Gwillimbury

Project No.
60636910



Photograph 1: SWMP forebay, looking north.



Photograph 2: SWMP inlet at southwest corner of pond forebay.



Photograph 3: SWMP forebay and detention pond, looking south from earth berm.



Photograph 4: SWMP looking west. Dense cattails and pond lilies.



Photograph 5: SWMP outlet structure. Overgrown vegetation at overflow feature.



Photograph 6: SWMP outlet structure discharging into channel feature, west side of County Road 4.

Client Name:
Ministry of Transportation

Site Location
County Road 4, Bradford West Gwillimbury

Project No.
60636910



Photograph 7: County Road 4 culvert inlet on west side, dense vegetation growth around inlet.



Photograph 8: County Road 4 culvert inlet, laminar flow across concrete bottom.



Photograph 9: Looking west from County Road for at channel section between culvert inlet and SWMP outlet.



Photograph 10: Looking east from east side of County Road 4 above culvert outlet. Large invasive phragmites patch.



Photograph 11: County Road 4 culvert outlet looking west. Dense phragmites immediately downstream.



Photograph 12: County Road 4 culvert outlet.

Client Name: Ministry of Transportation	Site Location County Road 4, Bradford West Gwillimbury	Project No. 60636910
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Photograph 13: Approximately 150 m downstream of culvert inlet. Dense phragmites still present along Unnamed Tributary.



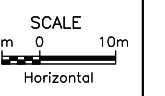
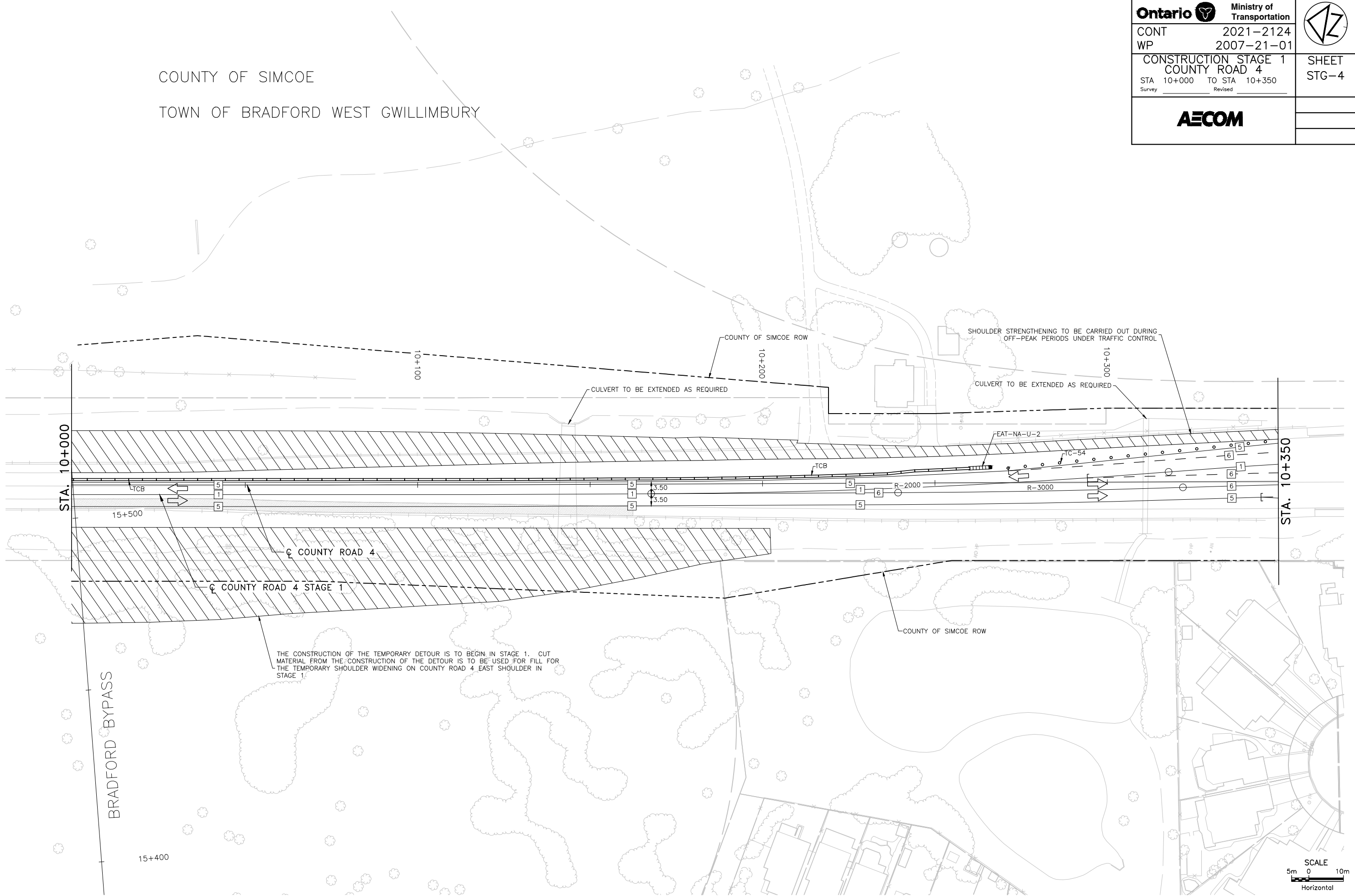
Photograph 14: Approximately 150 m downstream of culvert inlet. Dense phragmites still present along Unnamed Tributary, water present in channel.

Appendix **C**

30% Design Drawings



COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



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 ANS-D
 COUNTY OF SIMCOE
 TOWN OF BRADFORD WEST GWILLIMBURY
 MINISTRY OF TRANSPORTATION, ONTARIO



COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

STA. 10+000

STA. 10+350

BRADFORD BYPASS

15+400

ROADWAY PROTECTION FOR STAGE 2 & 3

ROADWAY PROTECTION FOR STAGE 2 & 3

☉ COUNTY ROAD 4 STAGE 2
☉ COUNTY ROAD 4 REALIGNMENT

COUNTY OF SIMCOE'S ROW

COUNTY OF SIMCOE'S ROW

TCB TYPE M (PINNED)

TCB TYPE M (PINNED)

TCB

EAR-NA-U-2

R-4005.6

R-2000

BC: 10+045.15

EC: 10+320.25

PRC: 10+173.72

15+500

10+100

10+200

10+300

SCALE
5m 0 10m
Horizontal

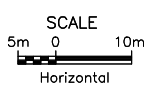
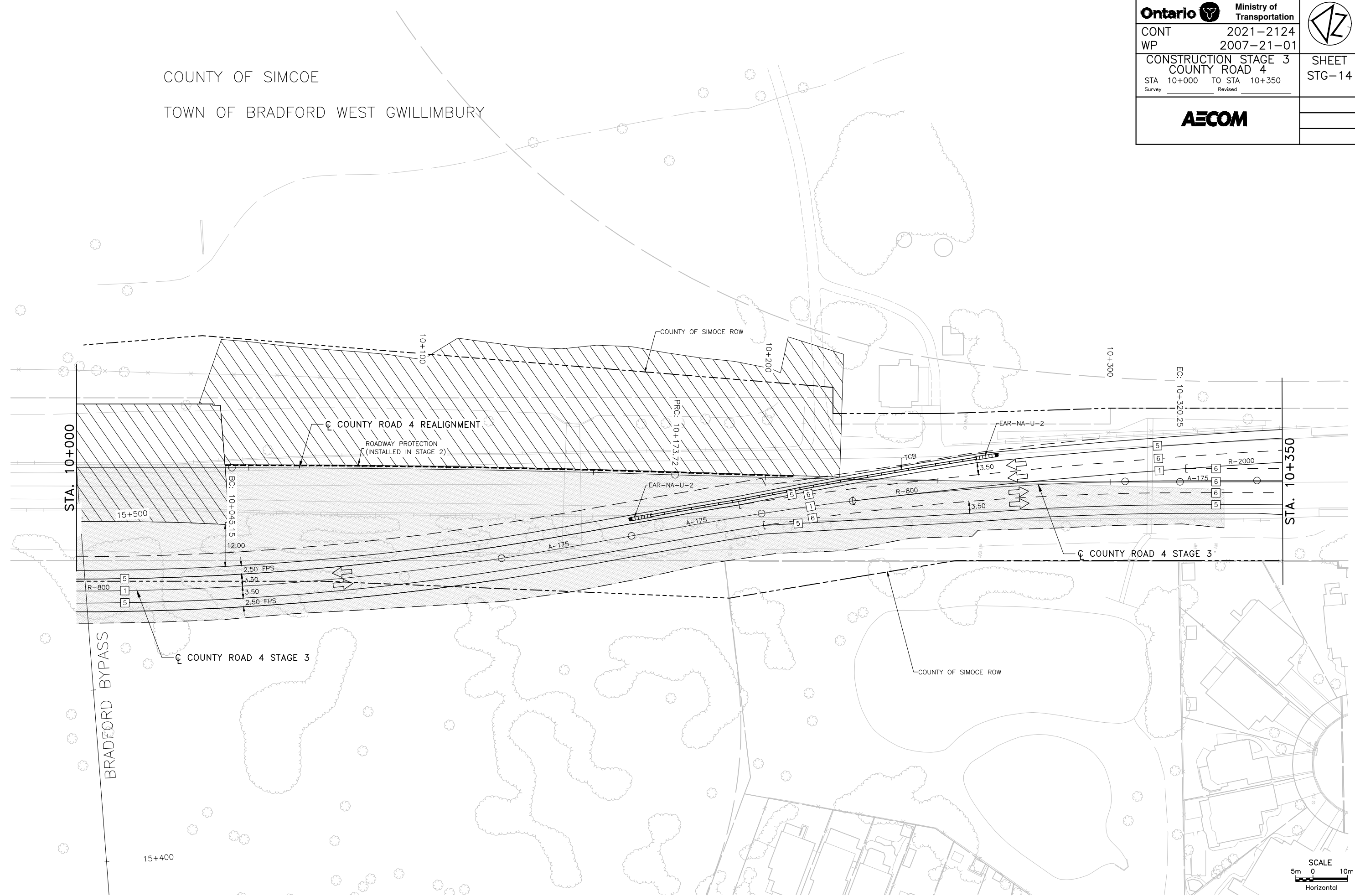
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2016-10
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MINISTRY OF TRANSPORTATION, ONTARIO



COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

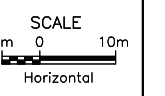
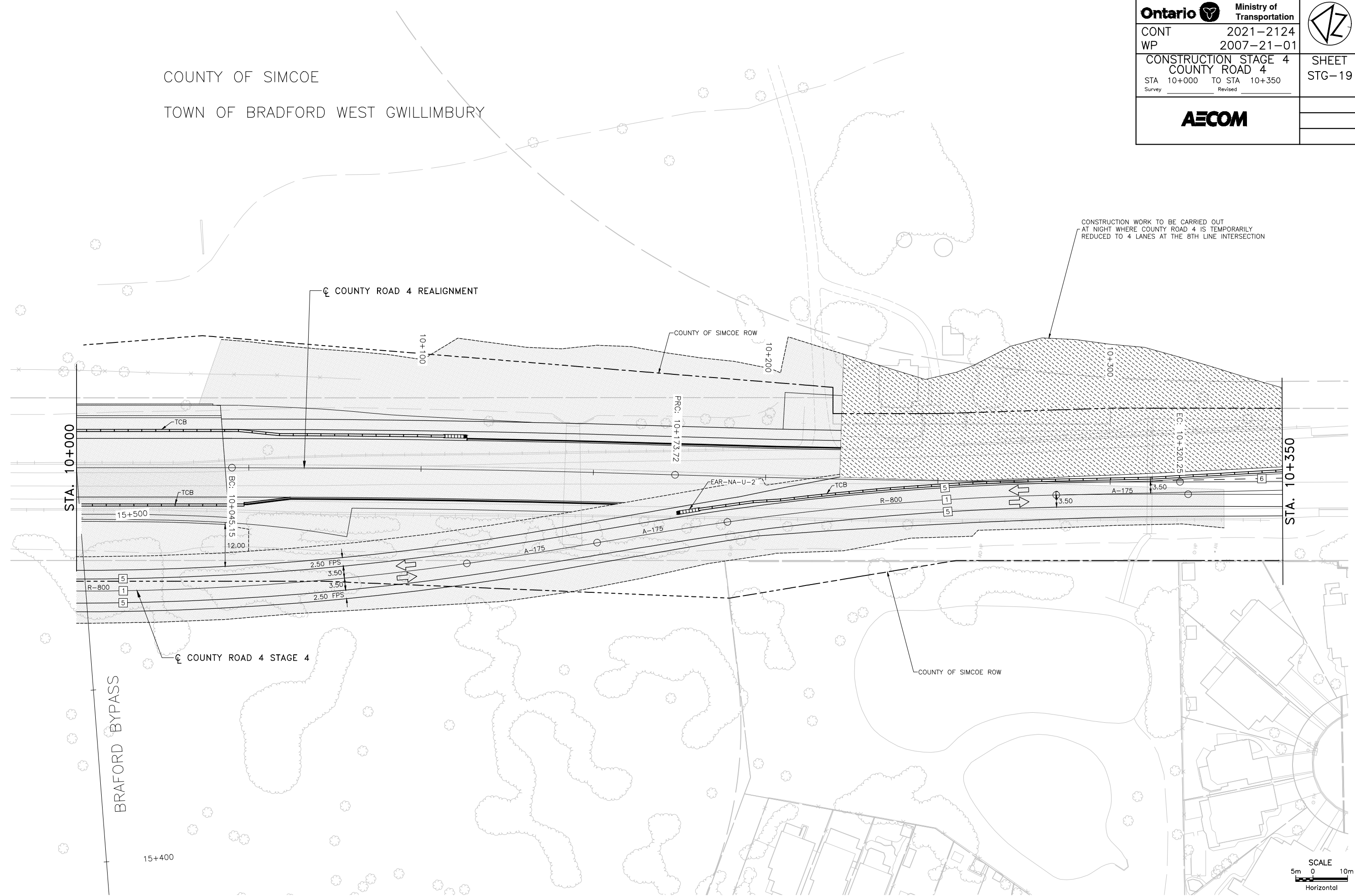
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 MINISTRY OF TRANSPORTATION, ONTARIO
 ANS-D
 2016-10





COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

CONSTRUCTION WORK TO BE CARRIED OUT
AT NIGHT WHERE COUNTY ROAD 4 IS TEMPORARILY
REDUCED TO 4 LANES AT THE 8TH LINE INTERSECTION

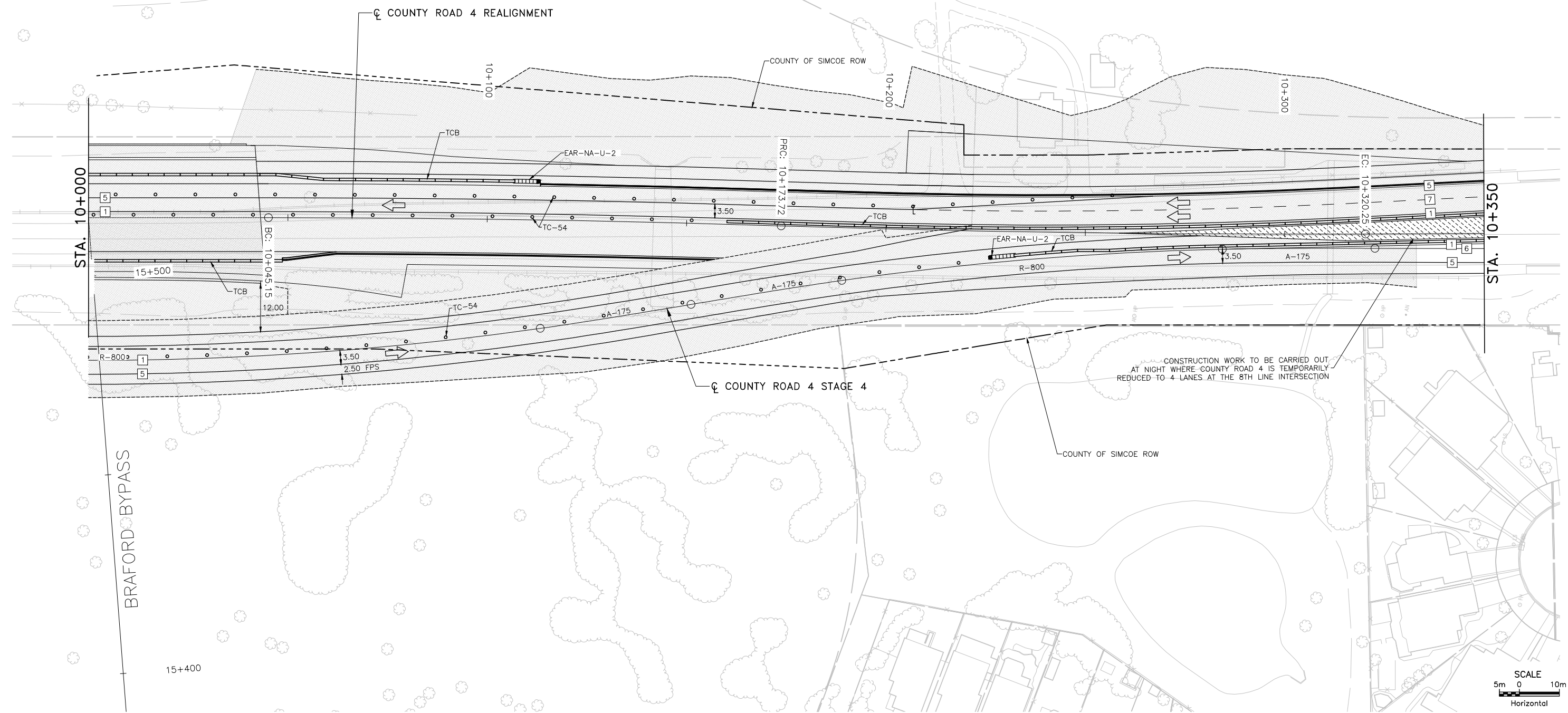


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 COUNTY OF SIMCOE
 TOWN OF BRADFORD WEST GWILLIMBURY
 COUNTY ROAD 4
 CONSTRUCTION STAGE 4
 STA 10+000 TO STA 10+350
 SHEET STG-19
 AECOM



COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

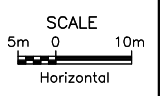
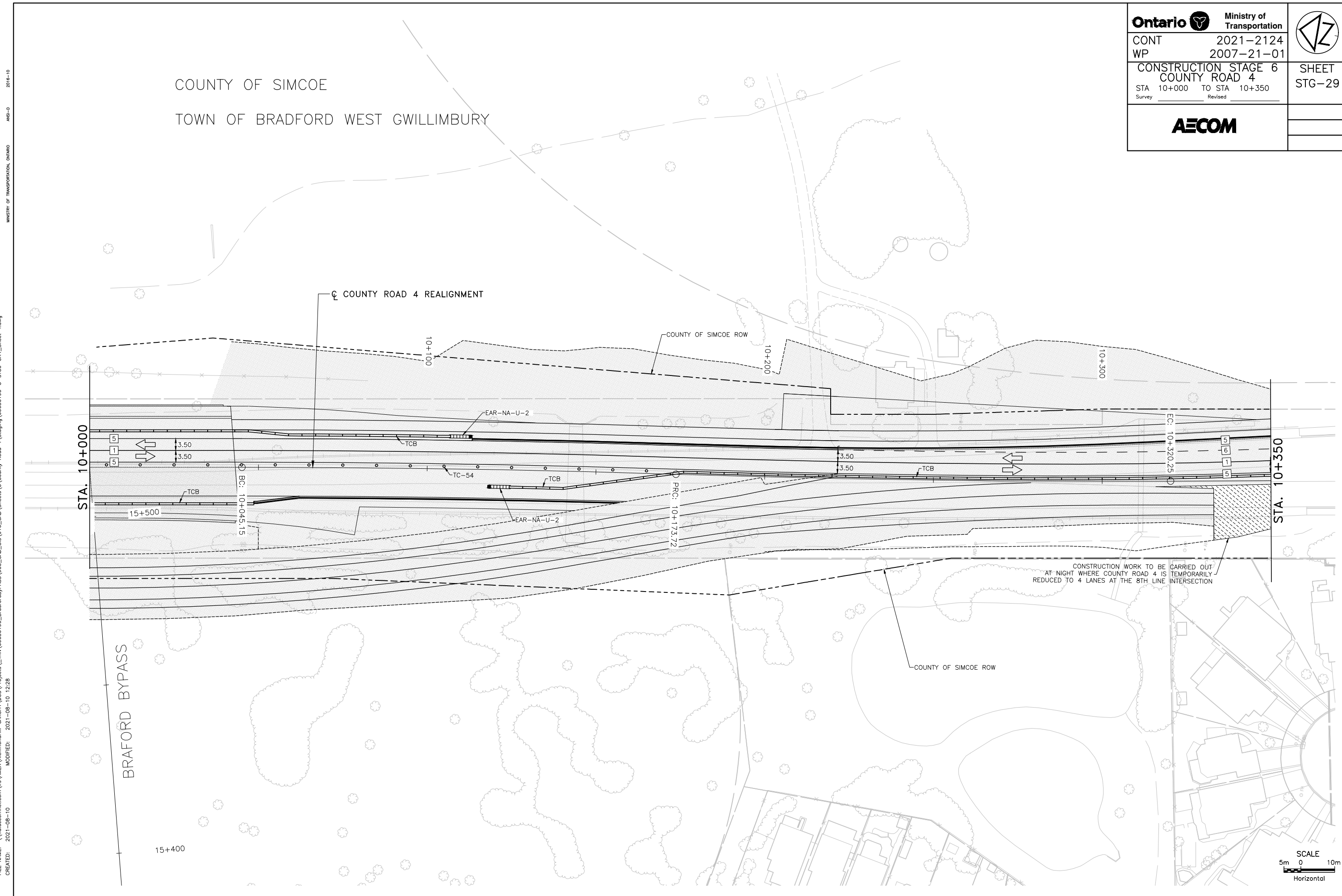
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 MINISTRY OF TRANSPORTATION, ONTARIO
 ANS-D
 2016-10





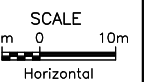
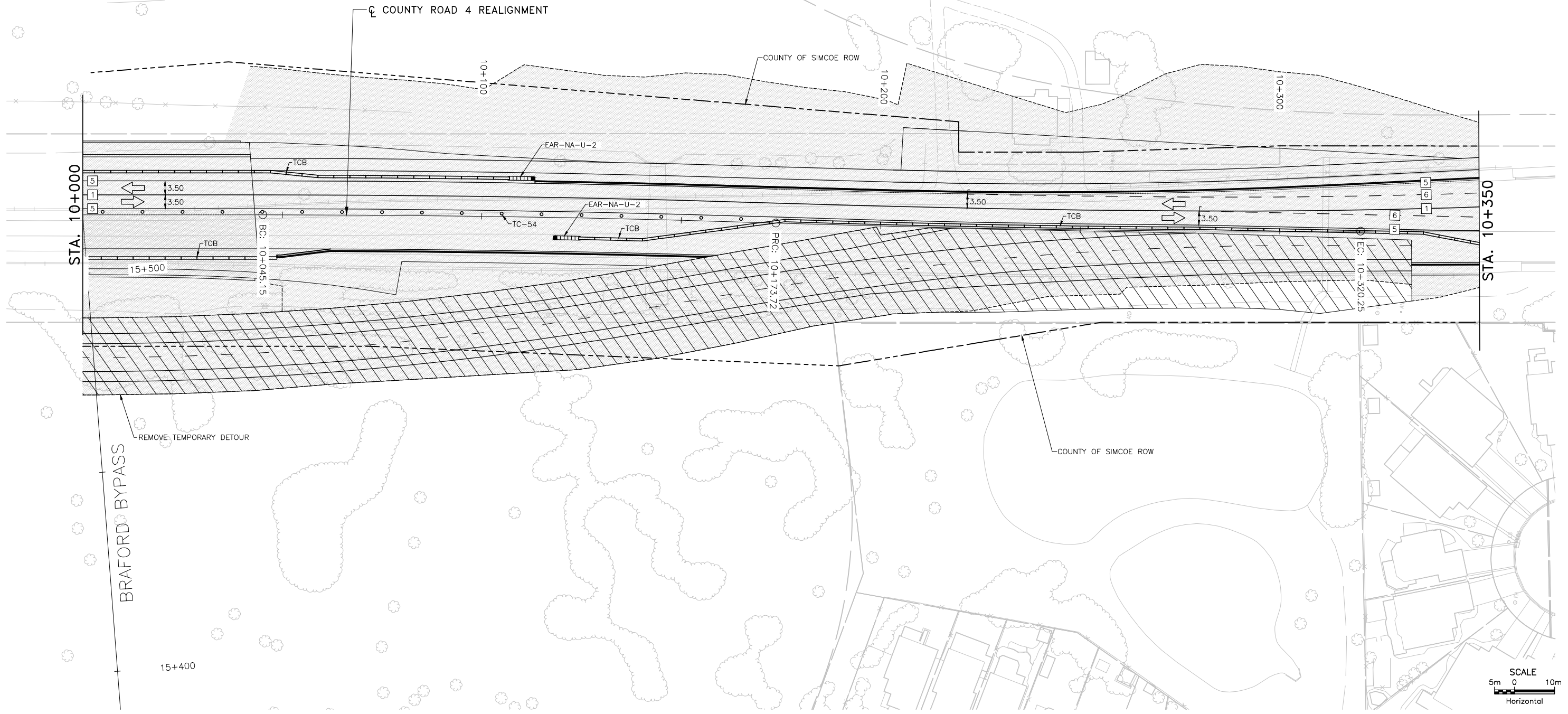
COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

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COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



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2016-10
ANS-D
MINISTRY OF TRANSPORTATION, ONTARIO

- NOTES:
 1. GRADING PLATFORMS FOR FUTURE COUNTY ROAD 4 INTERCHANGE RAMPS TO BE PROVIDED.
 2. DRAINAGE SYSTEM RECOMMENDATIONS TO BE PROVIDED.
 3. WORKS FOR CULVERTS AND EXTENSIONS ARE TO BE DETERMINED.



COUNTY OF SIMCOE

TOWN OF BRADFORD WEST GWILLIMBURY

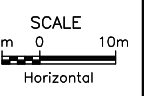
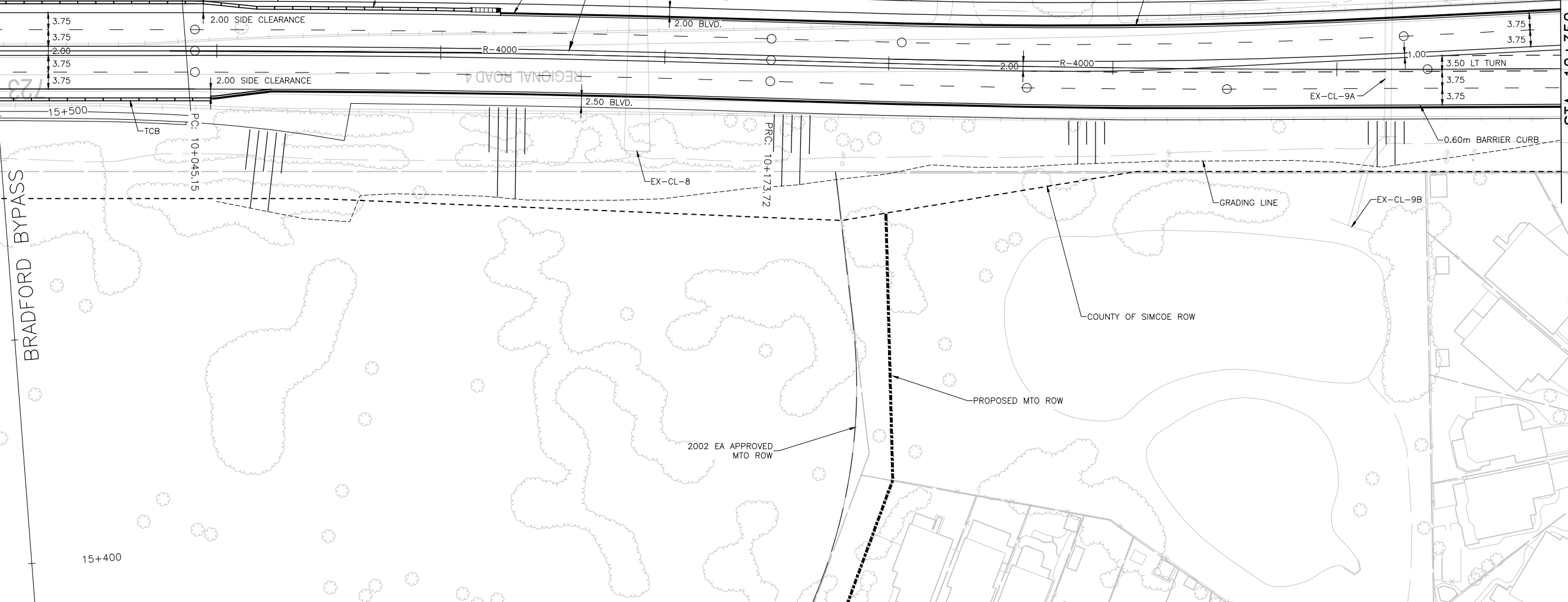
LIMIT OF MTO PROPOSED CAH
 STA. 10+350

STA. 10+000

STA. 10+350

BRADFORD BYPASS

COUNTY ROAD 4 REALIGNMENT



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