APPENDIX B

BACKGROUND REPORTS

APPENDIX B.1

Environmental Impact Study

Thorndale Bridge Improvements
Environmental Impact Study

FINAL DRAFT

May 8, 2020

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1.0 PROJECT OVERVIEW

1.1 INTRODUCTION

Stantec Consulting Ltd. (Stantec) has been retained by the County of Middlesex to complete a Municipal Class Schedule 'C' Environmental Assessment (EA) in accordance with the *Ontario Environmental Assessment Act* to identify improvements to the Thorndale Bridge on County Road 28 (the Project; **Figure 1**). The study area for the EA includes a bridge crossing a portion of the North Thames River corridor, which is designated as a Protection Area in the Municipality of Thames Centre Official Plan. Per the Official Plan, an Environmental Impact Study (EIS) is required which identifies potential impacts, mitigation and compensation for those areas beyond the road allowance, consistent with the Provincial Policy Statement (Ministry of Municipal Affairs and Housing (MMAH) 2014), The existing bridge is approximately 65 years old and has been identified for replacement within the next 10 years.

Figure 1: Study Area

The Study Area for this EIS includes the County Road 28 (Thorndale Road) right-of-way (ROW), plus an additional 120 metre (m) area of investigation (**Figure 2, Appendix A**). Methods for the background review, field investigations, and assessment of natural heritage features are provided in the sections below. This report will characterize the significance and sensitivity of the natural features in the Study Area, identify potential impacts of the project on these natural features, and recommend appropriate measures to avoid or minimize potential negative environmental impacts.

2.0 POLICY OVERVIEW

This report has been prepared to address policies and guidelines from federal and provincial legislation and municipal policy relevant to the Thorndale Bridge project. The policy documents discussed below were used to assess the natural heritage features and functions of the Study Area, scope the study methods, and determine natural heritage constraints or opportunities for the Project.

2.1 FEDERAL POLICY

2.1.1 Fisheries Act

The Government of Canada is responsible for the management of fisheries resources in Canada through the *Fisheries Act*, administered primarily by Fisheries and Oceans Canada (DFO). The *Fisheries Act* addresses national interests in marine and fresh waters. On June 21, 2019, changes to the Act (Bill C68) received royal assent and became law, restoring lost protections and incorporating modern safeguards into the *Fisheries Act*. On August 28, 2019 provisions of the new *Fisheries Act* came into force including new protections for fish and fish habitat in the form of standards, codes of practice, and guidelines for projects near water.

The *Fisheries Act* includes prohibitions against harmful alteration, disruption or destruction (HADD) of fish habitat. It extends protection to all fish and fish habitat. When a HADD cannot be avoided or mitigated, a subsection 35(2) authorization with appropriate offsetting of residual adverse effects is required. Section 6 of the Act lists the factors taken into account by the Minister when considering the approval of an authorization, which are:

- Fisheries management objectives;
- Whether there are measures and standards to avoid, mitigate or offset HADD to fish or fish habitat; and
- The public interest.

2.1.2 Species at Risk Act

Federal species at risk are identified and assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The federal *Species at Risk Act*, 2002 (SARA) protects wildlife species listed as extirpated, endangered or threatened under Schedule 1 of the Act from harm, harassment, killing or capture or collection. SARA also prohibits the damage or destruction of the residence of listed species, and the destruction of their critical habitat. SARA protections also extend to migratory birds and some aquatic species at risk (SAR) on non-federal land. The Ministry of Environment, now Ministry of the Environment, Conservation and Parks (MECP), may also make an order to protect species on non-federal lands if the species is not adequately protected under provincial laws. Permits for prohibited activities may be issued under Section 73 of SARA.

2.1.3 Migratory Birds Convention Act

The *Migratory Birds Convention Act* (MBCA) protects migratory birds and their nests (S.4). Section 6 of the Migratory Bird Regulations (Consolidated Regulations of Canada (CRC), c. 1035) prohibits the disturbance, destruction or taking of a nest, egg, or nest shelter of a migratory bird. Disturbance to nests of protected species during the course of vegetation clearing or bridge construction is a contravention of the MBCA.

2.2 PROVINCIAL POLICY

2.2.1 Planning Act

The Provincial Policy Statement (PPS; MMAH 2020) was issued under Section 3 of the *Planning Act* (PA) and came into effect in 1996, with the most recent revision in March 2020. The PA requires that decisions made by planning authorities are consistent with the policy statements, such as the PPS, which includes policies on development and land use patterns, resources and public health and safety. Municipal official plans are the most important vehicle for implementation of this Provincial Policy Statement (MMAH 2020). Section 2.1 of the PPS deals with natural heritage and requires that natural heritage systems are identified in certain ecoregions. This includes Ecoregion 6E, where the Study Area is located.

According to Section 2.1.5 of the PPS, development and site alteration are not permitted in the following features unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions:

a) Significant Wetlands

b) Significant Woodlands

c) Significant Valley lands

d) Significant Wildlife Habitat

e) Significant Areas of Natural and Scientific Interest

f) Coastal Wetlands

Development and site alterations are not permitted in the following features, except in accordance with provincial and federal requirements:

a) Significant portions of the habitat of endangered or threatened species

b) Fish Habitat

Development and site alteration are not permitted on lands that are adjacent to the natural heritage features and areas identified above unless the ecological function of the adjacent lands has been

evaluated and it has been demonstrated that there will be no negative impacts on the natural features or on their ecological functions.

2.2.2 Endangered Species Act

The *Endangered Species Act* (ESA) was created to identify species at risk based on the best available scientific information, to protect species that are at risk and their habitats, and to promote the recovery of species that are at risk. The ESA prohibits the killing, harming, harassing, capturing or taking of a living member of a species listed as threatened, endangered or extirpated by the Species at Risk in Ontario (SARO) list, and damage to habitat of protected species.

Species thought to be at risk in Ontario are assessed by the Committee on the Status of Species at Risk in Ontario (COSSARO), which is an independent body that reviews species based on the best available science, including community knowledge and Aboriginal traditional knowledge. Once species are classified at risk, they are added to the SARO list in one of four categories (extirpated, endangered, threatened and special concern). Extirpated, endangered and threatened species on this list automatically receive legal protection under the ESA.

The ESA also provides protection for the habitat of protected species. When a species is classified as endangered or threatened, the habitat of that species is protected under a general definition. The Lieutenant Governor in Council may make regulations prescribing an area as habitat of a species that is listed as extirpated, endangered or threatened on the SARO list. A habitat regulation can prescribe an area as the habitat of a species through the description of boundaries or features of an area, or by describing that area in any other manner. Habitat will be regulated with the goal of protecting habitat that promotes the survival and recovery of endangered or threatened species.

The ESA calls for the creation of recovery strategies for endangered or threatened species, and management plans for special concern species. These documents provide advice to the government on steps to take to protect and recover species at risk to healthy population levels.

2.2.3 Upper Thames River Conservation Authority

The Conservation Authorities Act (CAA), was created to provide for the organization and delivery of programs and services that further the conservation, restoration, development and management of natural resources in watersheds in Ontario. The CAA is administered by the Ministry of Natural Resources and Forestry (MNRF); however, it grants each of Ontario's 36 Conservation Authorities the authority to make regulations within the areas under their respective jurisdictions.

The Upper Thames River Conservation Authority (UTRCA) has the responsibility to regulate activities in wetlands, watercourses and hazard lands (e.g. areas in and near rivers, streams, floodplains, wetlands, slopes and shorelines) through the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation (Ontario Regulation (O. Reg.) 157/06). The UTRCA implements the regulation by issuing permits for works in or near watercourses, valleys, wetlands or shorelines when required.

Under the CAA of Ontario, the Authority has certain regulations whose objectives are:

- To prevent the loss of life and property due to flooding and erosion,
- To prevent pollution, and
- To conserve and enhance natural resources.

These policies apply to fill placement and removal or site grading in flood prone areas, erosion prone areas, dynamic beach areas, as well as alteration of watercourses, and interference with wetlands.

The Study Area falls within the Plover Mills Corridor sub-watershed, natural hazard, natural heritage areas and regulation limit of the UTRCA.

2.3 MUNICIPAL POLICY

2.3.1 Middlesex County Official Plan

The County of Middlesex Official Plan (MCOP; 2006) includes policies to protect and sustain the Natural System by limiting incompatible development and controlling the impact of permitted development in the natural heritage system. The Natural System described in the MCOP is based on features identified during the 2003 Middlesex Natural Heritage Study which primarily documented significant woodlands in the County. The more recent Middlesex Natural Heritage System Study (UTRCA 2014) expands the definition of significant features to include other natural vegetation communities, such as meadow and thicket. The Natural System mapped on Schedule C of the MCOP is not a land use designation and does not preclude development if no negative impact on the feature or its functions will result, however the MCOP notes that there are generally significant physical constraints to development within the Natural System which should be investigated prior to development. Middlesex County also has a Woodland Conservation By-law (#5738), however the regulations within the by-law do not apply to projects undertaken by the municipality.

Schedules A and C of the MCOP delineate land use, natural resources and natural heritage features within the County. The following are present in the Study Area:

- Natural Resources – Flood Regulated Watercourse and Associated Floodplain
- Natural Heritage Features – Watercourse (North Thames River), Significant Woodlands, Aggregate Resource Area

2.3.2 Municipality of Thames Centre Official Plan

The Municipality of Thames Centre Official Plan (TCOP; 2016) includes policies for the maintenance of existing natural areas. Three natural heritage feature designations are applied in the Plan: Natural Area, Protection Area or Environmental Area. Fish habitat and habitat of endangered or threatened species are designated Natural Areas, where development or site alteration is generally prohibited. Features such as significant woodlands, valleylands or wildlife habitat are designated Protection Areas, where development and site alteration may be permitted if environmental studies demonstrate no negative impacts on the

features or their ecological functions will result. Natural hazard lands, such as the floodplain, are designated Environmental Area, where development and site alteration may be permitted but where a conservation authority permit may also be required.

The Thames Centre Official Plan Schedule 'A' Land Use Plan identifies the Study Area as being within Protection Area (Significant Woodland) and Environmental Area (floodplain). Natural Area protections would also apply to fish habitat (Thames River) and any habitat of endangered or threatened species identified in the Study Area.

The Thames River, a Canadian Heritage River, is one of the municipality's most significant natural features, consequently policies prohibiting tree removal along the river are also incorporated into the TCOP. Tree removal along the Thames River may be permitted in some cases, such as when addressed in an EA and if suitable mitigation is in place.

3.0 NATURAL HERITAGE DATA REVIEW AND AGENCY CONSULTATION

Designated features and records of rare or protected species were identified through a review of background documents, online databases and agency consultation.

3.1 NATURAL HERITAGE DATA REVIEW

Background documents and other applicable sources of information were consulted during the preparation of this report, including the following data sources:

- The Ecosystems of Ontario, Part 1: Ecozones and Ecoregions (Crins et al. 2009)
- Land Information Ontario (LIO) database (MNRF 2019a)
- Species at Risk Public Registry. (Environment Canada, accessed July 2019)
- Species At Risk In Ontario (SARO) List (database) (MECP 2019a, accessed October 2019)
- Middlesex County Official Plan (MCOP; 2006)
- Significant Natural Areas of Middlesex County (McIlwraith et al. 1982)
- Middlesex Natural Heritage Study (MNHS; UTRCA 2003)
- Middlesex Natural Heritage System Study (MNHSS; UTRCA 2014)
- Thames Centre Official Plan (TCOP; 2016)
- Ortho-rectified satellite imagery (Middlesex County 2019)
- The Physiography of Southern Ontario (Chapman and Putnam 2007)

Data was compiled in a GIS database to support mapping and data query requirements of the natural heritage assessment.

For the potential occurrence of species at risk or provincially rare species, the following sources were consulted for recent (1990-present) records in the vicinity of the Study Area:

- Natural Heritage Information Centre (NHIC) Biodiversity Explorer database (MNRF 2019b)
- Atlas of the Mammals of Ontario (Dobbyn 1994)
- Ontario Reptile and Amphibian Atlas (Ontario Nature 2019)
- Ontario Breeding Bird Atlas (Cadman et al. 2007)
- Fisheries and Oceans Canada/Upper Thames Valley – Distribution of Fish and Mussel Species at Risk (DFO 2019)
- Upper Thames Region Conservation Authority data

Many of these resources do not note the exact locations of a species occurrence, with accuracy ranging from 1 square kilometre (km²) (NHIC) to 10 km² (wildlife atlases), to municipal boundaries or watersheds. As such they are used as an indicator of potential occurrence in the Study Area.

3.1.1 Species at Risk

For the purpose of this assessment, SAR are species classified as threatened (THR) or endangered (END) by COSSARO or aquatic species classified as THR or END on SARA Schedule 1. The ESA prohibits harm or harassment to threatened or endangered species, and damage or disturbance to their habitat. The ESA applies on all private and Crown owned lands in Ontario. Habitat protection under the ESA typically includes all habitats that directly or indirectly support SAR. SARA protects aquatic species on private and Crown owned lands in Ontario and Canada.

SAR occurrences were obtained from the NHIC (MNRF 2019a) and other online databases (Section 3.1).

3.1.2 Species of Conservation Concern

Species of Conservation Concern (SOCC) may be designated at the global, national, provincial or local level. For this report, SOCC includes species that are provincially rare (with a Provincial S-rank of S1 to S3), listed as Special Concern (SC) on the SARO list, or terrestrial species listed on Schedule 1 of SARA but not included on the SARO list.

Provincial ranks (S-ranks) are used by the NHIC to set protection priorities for rare species and vegetation communities. They are based on the number of factors such as abundance, distribution, population trends and threats in Ontario and are not legal designations. By comparing the global and provincial ranks, the status, rarity, and the urgency of conservation needs can be determined. Species with provincial ranks of S1 to S3, and those tracked by the MNRF, are considered SOCC. Provincial S-ranks are defined as follows:

S1: Critically imperiled; usually fewer than 5 occurrences
S2: Imperiled; usually fewer than 20 occurrences
S3: Vulnerable; usually fewer than 100 occurrences
S4: Apparently secure; uncommon but not rare, usually more than 100 occurrences
S5: Secure, common, widespread and abundant
S-rank followed by a “?” indicates the rank is still uncertain

3.2 AGENCY CONSULTATION

In addition to the background data described above, information requests were sent to the UTRCA on June 10, 2019 and to MNRF on October 15, 2019 for the following information:

- Natural Heritage Features
- Natural Hazards Features
- Drinking Water Source Protection Area Features
- Hydrology Data – HEC-RAS, Flow Files
- Fish/Mussel data
- Benthic Sampling Records
- Terrestrial SAR data
- Aquatic SAR data

- UTRCA Owned Lands data
- Watercourse thermal regime and flow regime
- Special habitat features (e.g. groundwater upwelling, spawning areas)
- In-water construction timing window
- MNRF fisheries management objectives, if applicable

UTRCA provided data for natural heritage features, natural hazard features, drinking water source protection areas, and property limits of UTRCA owned lands on June 18, 2019, and MNRF provided a response email noting natural heritage features and SOCC on October 16, 2019. The MNRF email appears in **Appendix C**.

Stantec also attended a meeting with the UTRCA on August 6, 2019 to review project intent, timelines, preliminary alternatives under consideration and staging of the structural improvements and the impact to the trail connection.

3.3 RESULTS OF RECORDS REVIEW AND AGENCY CONSULTATION

3.3.1 Physiography, Geology and Soils

The Thames River Valley is a spillway between till moraines (Chapman and Putnam 1984). Bedrock geology is limestone, dolostone and shale (Ontario Geological Survey 1991). Valley soils are undifferentiated mineral soils which are well-drained with intermediate water storage capacity (Government of Canada 1998).

The Study Area is located in the Niagara section of the Deciduous Forest Region (Rowe 1972), also known as the Carolinian Forest. Forests in this region are dominated by broadleaved trees including sugar maple, American beech, basswood, red maple, red oak, white oak, and bur oak. Species such as black cherry, black walnut, common hackberry, sycamore, swamp white oak, and shagbark hickory are also occasionally present. Coniferous trees such as hemlock, white pine, tamarack and eastern white cedar may be found in isolated patches where soil conditions are favorable.

3.3.2 Designated Natural Heritage Features

Natural heritage features identified in the Middlesex Natural Heritage System Study (MNHSS; UTRCA 2014), MCOP (2006), TCOP (2016) and Significant Natural Areas of Middlesex County (McIlwraith et al. 1982) are:

- Thames River
- Significant Woodland (significant vegetation patch)
- Significant Valleyland

The “Thorndale River Valley”, which is part of the Significant Woodland and Significant Valleyland noted above, was also described as a Significant Natural Area by McIlwraith et al. (1982) based on fieldwork completed in July, 1977. In this report Black Walnut is noted as a rare species for the county.

3.3.3 Terrestrial SAR and SOCC

A review of the background databases identified 11 SAR and 14 SOCC with records that overlap with the Study Area (**Table 1**).

Table 1: NHIC Review of Terrestrial SAR and SOCC in the Study Area

Common Name	Latin Name	Provincial S-rank	SARO Status	SARA Schedule 1
SAR				
Butternut	*Juglans cinerea*	S3?	END	END
Queensnake	*Regina septemvittata*	S2	END	END
Eastern Spiny Softshell[1]	*Apalone spinifera*	S3	END	END
Bank Swallow	*Riparia riparia*	S4B	THR	THR
Barn Swallow	*Hirundo rustica*	S4B	THR	THR
Bobolink	*Dolichonyx oryzivorus*	S4B	THR	THR
Eastern Meadowlark	*Sturnella magna*	S4B	THR	THR
Eastern Small-footed Myotis	*Myotis leibii*	S2S3	END	-
Little Brown Myotis	*Myotis lucifugus*	S4	END	END
Northern Myotis	*Myotis septentrionalis*	S3?	END	END
Tri-coloured Bat	*Perimyotis subflavus*	S3?	END	END
SOCC				
Lizard's-tail	*Saururus cernuus*	S3	-	-
Hairy-fruited Sedge	*Carex trichocarpa*	S3	-	-
Narrow-leaved Wild Leek	*Allium tricoccum*	S1?	-	-
Prairie Milkweed	*Asclepias sullivantii*	S2S3	-	-
Striped Cream Violet	*Viola striata*	S3	-	-
Spring Blue-eyed Mary	*Collinsia verna*	SX	EXP	EXP
Monarch	*Danaus plexippus*	S4B, S2N	SC	SC
Eastern Milksnake	*Lampropeltis triangulum*	S3	NAR	SC
Snapping Turtle	*Chelydra serpentina*	S3	SC	SC
Bald Eagle	*Haliaeetus leucocephalus*	S4B, S2N	SC	NAR
Eastern Wood-pewee	*Contopus virens*	S4B	SC	SC
Great Egret	*Ardea alba*	S2B	-	-
Red-headed Woodpecker	*Melanerpes erythrocephalus*	S4B	SC	THR
Wood Thrush	*Hylocichla mustelina*	S4B	SC	THR

1- Critical habitat for Eastern Spiny Softshell is present within a 10 km square overlapping the Study Area.

3.3.4 Aquatic SAR and SOCC

A review of the background databases identified five aquatic SAR, seven SOCC (**Table 2**) and an additional 26 fish and mussel species that were not at risk (NAR) with records that overlap with the Study Area (**Table B-3, Appendix B**). Background aquatic habitat and fish community data are shown on **Figure 2, Appendix A**. MNRF indicated in correspondence that the North Thames River has a thermal regime designated as warmwater. A restricted in-water work timing window based on fish species present falls between March 15 and July 15. The relocation timing window based on mussel species and habitat present restricts handling of mussels to a period when water temperatures are above 16°C, which typically occurs between June 15 and September 30.

Table 2: Aquatic SAR and SOCC recorded in the Study Area

Common Name	Scientific Name	Provincial S-rank	SARO Status	SARA Schedule 1	Source
SAR					
Black Redhorse	*Moxostoma duquesnei*	S2	THR	THR	DFO, 2019
Eastern Sand Darter	*Ammocrypta pellucida*	S2	END	THR	DFO, 2019
Rayed Bean	*Villosa fabale*	S1	END	END	NHIC, 2019
Silver Shiner	*Notropis photogenis*	S2/S3	THR	THR	DFO, 2019
Wavy-rayed Lampmussel	*Lampsilis fasciola*	S1	THR	SC	NHIC, 2019
SOCC					
Elktoe	*Alasmidonta marginata*	S3	NAR	NAR	MNRF, 2019
Greater Redhorse	*Moxostoma valenciennesi*	S3	NAR	NAR	MNRF, 2019
Greenside Darter	*Etheostoma blennioides*	S4	NAR	SC	LIO, 2019
Mucket	*Actinonaias ligamentina*	S3	NAR	NAR	MNRF, 2019
Northern Sunfish	*Lepomis peltastes*	S3	SC	SC	DFO, 2019
Purple Wartyback	*Cyclonaias tuberculata*	S3	NAR	NAR	MNRF, 2019
Rainbow	*Villosa iris*	S2/S3	SC	SC	DFO, 2019

4.0 FIELD INVESTIGATIONS

Background information was supplemented with field investigations undertaken by Stantec ecologists in 2019 to document existing conditions within the Study Area. Field investigations were conducted on five dates in 2019 and included surveys for vegetation and wetlands, wildlife and wildlife habitat, and to provide a general assessment of significance (**Table 3**). An aquatic habitat assessment was also completed for the North Thames River in the Study Area.

Surveys were completed from the road right-of-way and on private property (UTRCA) when permission was granted. Other private property was assessed from the edge of the property boundaries.

Table 3: Summary of Field Investigations

Type of Field Work	Date of Field Work	Surveyors
ELC, general wildlife habitat assessment, bat habitat assessment and snake emergence survey	April 17, 2019	B. Miller
Spring botanical	May 17, 2019	B. Miller
Summer botanical, bird nest survey	June 21, 2019	B. Miller
Snake habitat survey (within bridge deck)	August 20, 2019	M. Cameron
Fish and mussel habitat assessment	August 22, 2019	J. Keene

4.1 VEGETATION SURVEYS

Vegetation community assessments were conducted using the protocols outlined in the Ecological Land Classification (ELC) System for Southern Ontario (Lee et al. 1998), 2008 ELC code updates were used to classify vegetation communities that were not listed in the 1998 manual. Vegetation assessments included a general description of the community, lists of the dominant species in the canopy, sub-canopy, shrub and ground layers, a tree size class summary and a detailed plant species list.

Vegetation communities and botanical species observed were reviewed to determine whether any of the communities were rare in the province, contained any provincially significant plant species, or had the potential to provide significant habitat for wildlife. The nomenclature and provincial status of all plant species was based on a vascular plant species list provided by the Natural Heritage Information Centre (MNRF 2019b). Identification of potentially sensitive native plant species was based on their assigned coefficient of conservatism (CC) value, as determined by Oldham et al. (1995). This CC value, ranging from 0 (low) to 10 (high), is based on a species' tolerance of disturbance and fidelity to a specific natural habitat. Species with a CC value of 9 or 10 generally exhibit a high degree of fidelity to a narrow range of habitat parameters.

4.1.1 Vegetation Communities

Fifteen vegetation community types were identified in the Study Area, including 11 natural or naturalized types, one plantation type and three cultural types based on by ELC for Southern Ontario (Lee et al., 1998) and the updated 2008 ELC Catalogue. Narrow marsh communities were present along the North Thames River, woodland communities covered most of the valley and slopes, and meadow or cultural communities were common on the plateau above the river valley. One provincially rare vegetation community (Fresh-Moist Black Walnut Lowland Deciduous Forest, FODM7-4, S2S3) is present south of the bridge on the west side of the North Thames River. This floodplain woodland is dominated by the regionally-rare tree Black Walnut, however much of the ground layer is comprised of non-native or invasive species common to southern Ontario.

Table 4 includes a list of all vegetation communities encountered during this study. Vegetation communities are mapped on **Figure 3, Appendix A**.

Table 4: Vegetation communities in the Thorndale Bridge Study Area

Type	Code	Description	Dominant Species
Cultural	CVI_1	Transportation (Roads)	None
Cultural	CVR_4	Rural Property	Various. Lawns. Planted trees.
Cultural	CVC_1	Business Sector	None
Meadow	MEGM3	Dry – Fresh Graminoid Meadow	Kentucky bluegrass, smooth brome > common milkweed, smooth bedstraw, tall fescue, bird's-foot-trefoil, Invasive European swallow-wort (dog-strangling vine) is present next to road.
Meadow	MEFM1	Dry - Fresh Forb Meadow	Invasive European swallow-wort (dog-strangling vine) is abundant. Young black walnut, sugar maple and Manitoba maple. Riverbank grape, tall goldenrod.
Meadow	MEMM3/TAGM1a	Dry - Fresh Mixed Meadow	Kentucky bluegrass, smooth brome, tall goldenrod, common teasel with plantation of young white spruce, many dead or dying.
Thicket	THDM2-6/THDM2-11	Dry - Fresh Deciduous Shrub Thicket	Common buckthorn > hawthorn. Occasional young Scots pine. Orchard grass, smooth brome, smooth bedstraw, tall goldenrod, spiked sedge.
Forest	FODM4	Dry - Fresh Upland Deciduous Forest	Mature basswood, common hackberry, ash, red oak > bur oak. Choke cherry, false Solomon's seal, May-apple, Orange Daylily.
Forest	FODM4-3	Dry - Fresh Hackberry Deciduous Forest	Steep disturbed slope dominated by common hackberry. Common buckthorn, European swallow-wort, common burdock, Dame's rocket, garlic mustard.

Type	Code	Description	Dominant Species
Forest	FODM7-4	Fresh - Moist Black Walnut Lowland Deciduous Forest	Black walnut dominated floodplain woods. Dame's rocket, purple jewelweed, great ragweed, giant goldenrod, reed canary grass, garlic mustard. * This community is a provincially rare plant community based on NHIC rankings. The provincial rank of this community is S2S3.
Hedgerow	FODM11	Naturalized Deciduous Hedgerow	Roadside exotic willows on slope. Likely planted.
Plantation	TAGM1b	Coniferous Plantation	Young eastern white cedar, eastern white pine, white spruce and Scots pine. Occasional Freeman's maple.
Wetland	SWDO3	Organic Deciduous Swamp	Seepage area. Skunk cabbage, swamp aster, true forget-me-not, water horsetail, fowl mannagrass.
Wetland	MAMM1-3	Reed-canary Grass Graminoid Mineral Meadow Marsh	Floodplain marshes dominated by dense reed canary grass. Occasional to abundant purple jewelweed.
Aquatic	SA	Shallow Water	North Thames River waterway

4.1.2 Flora

The following is a floristic summary for the Study Area based on spring and summer surveys. A detailed list with all scientific plant names and species statuses is provided in **Appendix B**.

- A total of 139 species of vascular plants were recorded. This total includes taxa identified to species, subspecies (ssp.) and variation (var.) levels.
- 83 of the 139 recorded species are native to Ontario, while 56 are exotic species not native to Ontario.
- 75 native species have a provincial rank of S5, indicating they are common with a secure population in Ontario.
- Six native species have a provincial rank of S4, indicating they are uncommon to common, but not rare in the province and populations are apparently secure.
- Two provincially rare native species (Butternut and Hairy-fruited Sedge) with a provincial rank of S2? and S3, respectively, were observed in the Study Area south east of Thorndale Bridge. The Butternut (a single tree) was observed at the far west end of the Study Area south of Thorndale Road. The Hairy-fruited Sedge was observed in the floodplain woods next to the North Thames River.
- One potential regionally rare species was observed in the Black Walnut floodplain forest. Black Walnut was noted to be a rare species in Middlesex County in the Significant Natural Areas of Middlesex County (McIlwraith et al. 1982), however in the MCNHSS (UTRCA 2014) the species status is listed as unknown.
- One SAR plant (the above-mentioned Butternut) was observed in the Study Area. It is located along a hiking trail on an upland slope forest at the west end of the Study Area.
- Three sensitive native plant species with a high coefficient of conservatism value of 8 (Common Hackberry, Canada Garlic and Hairy-fruited Sedge) were observed in the Study Area. Common

Hackberry was observed throughout the Study Area, but is most abundant south east of the bridge. Canada Garlic and Hairy-fruited Sedge were observed south west of the bridge in the floodplain woods.

4.2 WILDLIFE AND WILDLIFE HABITAT

4.2.1 Migratory Bird Nesting Survey

Searches for nests of migratory birds protected under the MBCA, such as Cliff Swallows, or SAR birds protected by the ESA, such as Barn Swallows, on the bridge structure were conducted during habitat assessments. Species, activity and condition were documented for all nests observed.

On the south side of the bridge, 15 old Cliff Swallow nests were observed in April 2019, and two active nests in June 2019. On the north side of the bridge, five active Cliff Swallow nests were observed in June 2019. No nests of Barn Swallow or other migratory bird species were observed during field investigations. Locations of Cliff Swallow nests are shown on **Figure 4, Appendix A**.

4.2.2 Bat and Bat Habitat Surveys

Treed communities within the Study Area were assessed for their suitability to support bat maternity roost habitat as per *Species at Risk Bats within Treed Habitats Little Brown Myotis, Northern Myotis & Tri-Colored Bat* (MNRF 2017) and *Survey Methodology for the Use of Buildings and Isolated Trees by Species at Risk (SAR) Bats* (MNR 2014). Each tree with a diameter at breast height (DBH) larger than 10 centimetres (cm) was assessed, with details recorded for:

- Species
- DBH
- Height
- Presence of loose/peeling bark
- Cavity height (if present)
- Decay class
- Presence of other snags in proximity
- Open canopy

Suitable bat maternity roost trees were observed in ecosites FOD (four trees) and FODM4-3 (one tree) on the east side of the bridge, as well as in the naturalized hedgerows north (one tree) and south (one tree) of the road on the west side of the bridge. Per MNRF guidance (2017), there is no minimum threshold for number of maternity roost trees per hectare for an ELC ecosite to be considered suitable maternity roost habitat for SAR bats. All suitable bat maternity roost trees are shown on **Figure 4, Appendix A**.

4.2.3 Wildlife Observations

Wildlife (birds, reptiles, mammals, amphibians and insects) were noted incidentally during all site investigations. When areas where wildlife are likely to concentrate (i.e., along the riverbank, in woodlands

or thickets) were encountered, particular attention was paid to document wildlife use, as appropriate. Species, number, notes on habitat and behavior were recorded.

An Eastern Meadowlark (THR) was observed in the meadow (ecosite MEGM3) south of the road in the eastern end of the Study Area on June 21, 2019. A second observation of Eastern Meadowlark (dead on road) adjacent to this meadow was made on July 10, 2019, by a Stantec archaeologist. The Eastern Meadowlark typically occurs in meadows, hayfields and pastures, however, it will utilize a wider range of habitat than most grassland species, including mown lawn (e.g. golf course, parks), wooded city ravines, young conifer plantations and orchards (Peck and James 1987). These records of a SAR bird in or adjacent to suitable habitat and within the typical nesting period for the species suggest the meadow provides breeding habitat for this SAR. The locations of the Eastern Meadowlark observations are provided on **Figure 4, Appendix A**.

Two Eastern Gartersnakes were observed in the rip rap embankments north and south of the road west of Thorndale Bridge, as shown on **Figure 4, Appendix A**. Both snakes were observed in April, suggesting that the snakes may be using these embankments for overwintering. The locations of the Eastern Gartersnake observations are provided on **Figure 4, Appendix A**.

A groundhog was observed at the entrance to a burrow in the bridge embankment on the east bank of the river, where the concrete slabs have crumbled away exposing bare earth. The location of this burrow, and a second unidentified burrow, is shown on **Figure 4, Appendix A.**

4.2.4 Wildlife Habitat Assessment

General wildlife habitat assessments were completed at the Study Area. These assessments focused on the identification of wildlife habitat features, specifically Significant Wildlife Habitat (SWH) features as outlined in the MNRF's Criteria Schedules for Ecoregion 6E (MNRF 2015). When encountered, these features were identified, recorded and assessed for significance. All wildlife species were observed by sight, sound and/or through distinctive signs (e.g. tracks, scat).

Wildlife habitat suitability assessments were also completed for SARA and ESA protected species that may occur in the area, including species identified in the NHIC database and Ontario wildlife atlases during the literature review process.

4.3 AQUATIC HABITAT ASSESSMENT

A fish habitat assessment was conducted on August 22, 2019. The Study Area for the habitat assessment was 40m upstream and 40m downstream of the existing Thorndale Bridge.

Substrates within the Study Area were generally dominated by gravel and cobble with silt, sand and boulder present in lower proportion. Sand substrates were in higher proportion on the east side of the river. In-stream cover was provided by deep pools, cobble, boulder and aquatic macrophytes. Riparian vegetation within 5 m of the banks of the river included bull rushes, cut grass, reed canary grass, Joe Pye weed, giant ragweed, willow and jewelweed. Riffle and run morphologies dominated the area in the vicinity of Thorndale Bridge.

The section of the North Thames River that was assessed provides foraging, rearing, spawning and overwintering habitat for a number of unionid mussels and warmwater fish species. It is also categorized as critical habitat for Endangered Rayed Bean mussels (DFO 2019) and represents one of only two known areas of reproducing populations of this species in Canada.

During the habitat assessment shell evidence for the following mussel species was found within the Study Area:

- Rayed Bean (*Villosa fabale*) – recent shells
- Wavy-rayed Lampmussel (*Lampsilis fasciola*) – shells and live specimens
- Rainbow (*Villosa iris*)
- Fluted Shell (*Lasmigona costata*)
- Plain Pocketbook (*Lampsilis cardium*)
- Spike (*Elliptio dilatata*)
- Creeper (*Strophitus udulatus*)
- Elktoe (*Alasmidonta marginata*)
- Purple Wartyback (*Cyclonaias tuberculata*)

5.0 ASSESSMENT OF SIGNIFICANCE

5.1 SIGNIFICANT WOODLANDS

A significant woodland is present within the Study Area which is comprised of all contiguous woodland communities within the North Thames River valley in the municipality of Thames Centre. This feature was first designated as a Significant Natural Area (Thorndale River Valley) in the Significant Natural Areas of Middlesex County (McIlwraith et al. 1982) and was subsequently included in more natural heritage studies for the county (UTRCA 2003, UTRCA 2014).

5.2 SIGNIFICANT VALLEYLANDS

The North Thames River valley is a Significant Valleyland, per the MNHSS (UTRCA 2014).

5.3 SIGNIFICANT WETLANDS

There are no mapped significant wetlands in the Study Area. Unevaluated wetlands are present in the Study Area:

- An organic deciduous swamp community (SWDO3) is located within the Study Area, approximately 100 m north of the bridge, in an area of seepage along the valley wall.
- The east and west banks of the North Thames River in the ROW and larger Study Area consist of a band of reed-canary grass meadow marsh (MAMM1-3).

5.4 SIGNIFICANT WILDLIFE HABITAT

Wildlife habitat includes habitat for species listed as Special Concern under the ESA or ranked provincially rare (S1-S3) and the four categories of *Significant Wildlife Habitat*. The *Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E* (MNRF 2015) provide descriptions of wildlife habitats and guidance on criteria for determining the presence of candidate and confirmed wildlife habitats. Targeted wildlife surveys are typically required to confirm habitat use and significance.

This section discusses these categories of significant wildlife habitat relative to the Study Area. A full description of the evaluation of specific types of wildlife habitat is provided in **Table B-1**, **Appendix B**. Significant wildlife habitat (candidate and confirmed) is also shown on **Figure 4, Appendix A**.

5.4.1 Seasonal Concentration Areas

Seasonal concentration areas are sites where large numbers of a species gather together at one time of the year, or where several species congregate. Only the best examples of these concentration areas are typically designated as SWH. Review of the NHIC & LIO databases did not identify any confirmed seasonal concentration areas within the Study Area. The following candidate seasonal concentration areas were identified in the Study Area:

- Bat maternity colony (candidate)
- Reptile hibernaculum (candidate)

5.4.2 Rare Vegetation Communities or Specialized Habitats for Wildlife

Rare Vegetation Communities or Specialized Habitats for Wildlife are defined as separate components of SWH. Rare habitats are habitats with vegetation communities that are considered rare (S1-S3) in the province. These habitats are generally at risk and may support wildlife species that are considered significant. Specialized habitats are microhabitats that are critical to some wildlife species. No rare vegetation communities were identified in the Study Area. The following specialized habitats for wildlife were identified:

- Seeps and springs (confirmed)

5.4.3 Habitat for Species of Conservation Concern

Habitat for SOCC includes four types of species: those that are rare, those whose populations are significantly declining, those that have been identified as being at risk to certain common activities, and those with relatively large populations in Ontario compared to the remainder of the globe. An evaluation of candidate habitats for species of conservation concern, including provincially designated Special Concern species that were identified during the background review, is provided in **Table B-3, Appendix B**. The following habitat for species of conservation concern were identified in the Study Area:

- Hairy-fruited sedge (confirmed; see **Figure 4 Appendix A**)
- Monarch (candidate)
- Eastern Milksnake (candidate)
- Snapping Turtle (candidate)
- Eastern Wood-Pewee (candidate)
- Red-headed Woodpecker (candidate)
- Wood Thrush (candidate)

5.4.4 Animal Movement Corridors

Animal movement corridors are distinct passageways or defined natural features that are used by wildlife to move between habitats, usually in response to seasonal requirements. Movement corridors are identified once the following seasonal concentration areas or specialized habitats are confirmed as SWH: amphibian breeding habitat and deer wintering habitat. Candidate animal movement corridors are discussed in **Table B-1, Appendix B**. Riparian wetlands along the North Thames River in the Study Area likely provide a movement corridor for amphibians.

5.5 AREAS OF NATURAL AND SCIENTIFIC INTEREST

There are no ANSIs within the Study Area.

5.6 FISH HABITAT

The section of the North Thames River that was assessed provides foraging, rearing, spawning and overwintering habitat for a number of Unionid mussels and warmwater fish species, including several aquatic SAR (see Section 5.7). It is also categorized as critical habitat for Rayed Bean mussels (DFO 2019).

5.7 SPECIES AT RISK

Thirteen species and/or their habitat were identified as confirmed or potentially present in the Study Area based on a review of background documents as well as habitat assessments and targeted surveys undertaken in the field:

- Butternut (END) – confirmed in the sugar maple inclusion of the Black Walnut lowland (FODM7-4) in the southwest of the Study Area
- Eastern Spiny Softshell (END) – suitable habitat is present in the North Thames River and adjacent uplands
- Queensnake (END) – suitable habitat is present in the floodplain of the North Thames River
- Little Brown Myotis, Northern Myotis, Tri-coloured Myotis (END) – suitable habitat is present in the woodland community (FODM4) in the northeast of the Study Area
- Eastern Meadowlark (THR) – confirmed in grassland community (MEGM3) on the plateau in the southeast of the Study Area.
- Rayed Bean (END) – confirmed in the North Thames River
- Wavy-rayed Lampmussel (THR) – confirmed in the North Thames River
- Black Redhorse (THR) – confirmed in the North Thames River
- Eastern Sand Darter (END) – confirmed in the North Thames River
- Silver Shiner (THR) – confirmed in the North Thames River

An assessment of habitat presence and use for all 13 species is provided in **Table B-2, Appendix B**.

6.0 PROJECT DESCRIPTION

The purpose of this project is to identify improvements to the Thorndale Bridge on County Road 28/Thorndale Road. The existing bridge is approximately 67 years old and has been identified for replacement within the next 10 years. The study considers alternatives for replacement of the existing structure. The bridge will provide sufficient road capacity, while safely and efficiently accommodating active transportation.

The preferred solution is a new bridge and temporary detour. This involves replacing the whole bridge on the existing alignment, while rerouting traffic around the bridge construction on a detour. The preferred solution includes the following improvements:

- Replace the existing structure with a three-span (34.5 m – 46 m – 34.5 m) integral abutment bridge with a slab-on-steel I girder superstructure. 1700 millimetre (mm) deep steel I-girders, spaced at about 3.6 m, will be used to support the concrete deck. The bridge is designed for a 75-year lifespan.
- Each of the integral abutments consist of a concrete stem supported by a single row if steel H-piles. The new bridge abutments will be situated about 2.0 m beyond the existing abutments to avoid conflict with the existing abutment footing and piles.
- Three in-water piers (8 m length) will be removed to 300 mm below grade (stream bed) and replaced with two in-water piers (5.5 m length) on different footprints. The width of the new piers is approximately equal the width of the existing piers.
- Below the bridge deck, the slope on the west bank will be cut to a 2:1 slope whereas the slope on the east bank will be filled to achieve a 2:1 slope. No grading will take place within 5 m of the river's edge (estimate using a water level of 265 metres above sea level (MASL) recorded April 2019).
- The two-lane cross section will be maintained, with the ability to accommodate active transportation. The recommended bridge widening along Thorndale Road accommodates two 3.75 m lanes with 1.6 m paved shoulders at each side, and a 2.5 m raised multi-use trail on the south side.

7.0 IMPACT ASSESSMENT AND MITIGATION

The potential impacts to natural features that might reasonably be expected to occur as a result of the proposed bridge reconstruction are identified and discussed in this section. Both direct and indirect impacts associated with the Project are considered and appropriate mitigation measures recommended. An assessment of overall net environmental impacts is also provided based on the implementation of appropriate mitigation, restoration and enhancement measures to improve the overall integrity of the natural system in the area. Where direct impacts to SAR habitat or are expected to occur, recommended steps to consult with relevant agencies and/or obtain authorization are discussed.

7.1 IMPACTS TO NATURAL FEATURES

7.1.1 Vegetation Removal

The Project is located in semi-natural valley land, with some vegetation removal expected to occur in natural features within the existing ROW to accommodate road widening. Per the Thorndale Bridge Replacement Arborist Report (Stantec, 2020), a total of 117 trees will be removed by the project. The loss by natural vegetation community, based on proposed grading limits (Area of Impact), is provided in **Table 5** and shown on **Figure 3**. Limited vegetation removal will occur on the east side of the bridge where work is confined to the ROW or adjacent roadside meadow (MEFM1). Broader clearing, including tree removal, is required on the west side of the bridge to accommodate road widening and grading of the road embankment, however all vegetation removal is confined to the ROW.

Tree removal will occur in vegetation community FODM7-4, a provincially rare Black Walnut Lowland Deciduous Forest community located at the bottom of the road embankment south of Thorndale Rd and west of Thorndale Bridge. Black Walnut may be considered a rare species in Middlesex County. A total 49 trees, including 21 Black Walnuts, will be removed in this community, all within the existing road ROW. Clearing and site grading will affect less than 6 % of the Black Walnut lowland forest community within the Study Area (less if the contiguous forest located outside of the Study Area is considered) and encroach less than 20 m into the community at the widest point. The impact is also considered temporary as opportunities exist for planting Black Walnut trees along the base and slope of the embankment. Consequently, no negative long-term impacts to vegetation community FODM7-4 or its ecological functions are anticipated as a result of the project, if appropriate mitigation is applied.

Feature edges that correspond with the limit of work may experience indirect effects including inadvertent encroachment, sedimentation and erosion, and soil / root zone compaction. Indirect impacts on natural features will be mitigated through the implementation of standard environmental protection measures, which are discussed in **Section 7.2**, below.

Table 5: Anticipated Loss by Vegetation Community (in square metres)

Category	Code	Total Permanent Loss (m^2)	Total Temporary Loss (m^2)
Forest /Woodland	FODM4-3	36	28
	FODM7-4*	0	1,923
	Sub-total Woodland	**36**	**1,951**
Thicket /Hedgerow	THDM2-6/THDM2-11	0	1,216
	FODM11	625	4,780
	Sub-total Thicket / Hedgerow	**625**	**5,996**
Meadow	MEFM1	33	200
	MEGM3	11	676
	Sub-total Meadow	**44**	**876**
Wetland	MAMM1-3	93	168
	SA	203	0
	Sub-total Wetland	**296**	**168**
		Total (m^2)	**9,992**
		Total (ha)	**1.00**

* Provincially-rare vegetation community

7.1.2 Valleylands

The bridge replacement is designed within the ROW and along the same alignment as the existing bridge. No alteration to the valley morphology is proposed as part of the Project, consequently no impacts to the Significant Valleyland are anticipated.

7.1.3 Wetlands

Shoreline marsh community MAMM1-3 and the shallow aquatic environment may experience temporary disturbance during Project construction, due to grading and placement of a causeway to access pier locations. Temporary impacts to shoreline wetland communities can be addressed using Standard Sediment and Erosion Control measures (**Section 7.2.1**) by restoring these communities as soon as practicable following construction using methods described in **Section 7.2.2**. No permanent or long-term wetland impacts are anticipated as a result of the Project.

7.1.4 Significant Wildlife Habitat

Two significant wildlife habitat features (hairy-fruited sedge and seeps) were confirmed in the Study Area. The remaining SWH identified in the study area are candidate features, pending targeted field investigations to confirm use. Potential impacts to confirmed and candidate SWH noted for the Study Area are discussed by feature type:

- Seeps and Springs (confirmed) – The seepage area on the east valley wall, north of Thorndale Bridge is outside the proposed area of impact (~ 80 m); consequently, no direct impacts to this feature are anticipated.
  Hairy-fruited Sedge habitat (confirmed) – Hairy-fruited sedge was observed in the floodplain approximately 45 m south of Thorndale Bridge and west of the North Thames River. Direct impacts to the species and its habitat are not anticipated.
- Bat maternity colony (candidate) – The Project requires removal of two suitable maternity roost trees in the roadside hedgerows west of Thorndale Bridge, and a total of 0.7 ha of treed communities will be temporarily removed. Permanent removal in hedgerow community FODM11 is 0.06 ha. Forest and other suitable bat maternity habitat are well-represented in the Study Area, and negligible long-term implications to habitat availability are anticipated as a result of the proposed removals. Site-specific mitigation measures are recommended to address the risk of harm to roosting bats (**Section 7.2.6.3**).
- Reptile hibernaculum (candidate) – Based on observation of two Eastern Gartersnake in April within habitat suitable for overwintering, reptile hibernacula may be associated with the rocky embankments north and south of Thorndale Road on the west side of the North Thames River. Alterations to the embankments along Thorndale Road could result in the removal or temporary disturbance of this feature. Site-specific mitigation measures are recommended to address potential effects to snake hibernacula and risk of harm to snakes (**Section 7.2.6.1**).
- Monarch (candidate) – Monarch was observed during field investigations and the species may use roadside meadows for egg-laying and foraging. Small areas of roadside meadow habitat may be temporarily disturbed during construction; however, similar habitat will be available in the ROW post construction. Site-specific mitigation measures to address potential impacts to Monarch or its habitat are provided in **Section 7.2.6.2**.
- Eastern Milksnake habitat (candidate) – Eastern Milksnake may be present in candidate hibernacula features and in a variety of other habitats in the Study Area during the active season. As noted above, the Project could result in the removal or alteration of candidate hibernacula on the embankment of Thorndale Road if snakes are using it for that purpose. Site-specific mitigation measures are recommended to address potential effects to snake hibernacula and risk of harm to snakes (**Section 7.2.6.1**).
- Snapping Turtle habitat (candidate) – Suitable habitat for Snapping Turtle is present within the North Thames River and adjacent open communities, largely outside the proposed project footprint. Turtles may also use the gravel road shoulder or construction stockpiles for nesting and are vulnerable to vehicle mortality during construction. No long-term impacts to Snapping Turtle habitat are anticipated as a result of the Project. Site-specific mitigation measures to reduce potential for interaction with reptiles are provided in **Section 7.2.6.1**).
- Eastern Wood-Pewee, Wood Thrush and Red-headed Woodpecker (candidate) – The majority of suitable habitat for special concern species of woodland communities is located outside the Project grading limits, consequently direct project impacts to habitat for Eastern Wood-Pewee, Wood Thrush and Red-headed Woodpecker are anticipated to be limited. Recommendations to reduce the impacts of forested habitat removal on these three species will include mitigation for vegetation removal as described in **Section 7.2.2**.
- Animal movement corridors – Amphibian and deer movement corridors are associated with the river valley. This function will remain after completion of bridge construction. Construction has the potential

to interact with amphibians and deer during migration and dispersal; however, these effects can be mitigated with standard measures for wildlife (**Section 7.2.3**).

7.1.5 Habitat of Threatened and Endangered Species

7.1.5.1 Butternut

One Butternut tree was observed by Stantec on the edge of the Study Area during 2019 field investigations. This tree is located more than 30 m from the proposed limits of construction, which is beyond the extent of protected habitat for Butternut. Should construction limits be revised, a Butternut Health Assessment (BHA) by a certified assessor is recommended if any work (including equipment staging or stockpiling) will occur within 30 m of this tree.

7.1.5.2 Eastern Spiny Softshell

Critical habitat for Eastern Spiny Softshell, as defined by Environment Canada, is present in the Study Area and extends up to 50 m beyond the edge of the North Thames River (MECP 2019b) and any occupied wetlands. Critical nesting habitat extends 50 m from any confirmed nesting site, however no suitable nesting sites (sand or gravel beaches or bars) were identified in the Study Area. Consultation with MECP is recommended to determine the need for targeted surveys prior to construction and authorization requirements for work in critical habitat of Eastern Spiny Softshell.

7.1.5.3 Queensnake

Suitable habitat for Queensnake is present in the Study Area. Early consultation with MECP and UTRCA is recommended to determine: (1) if the species is present, (2) if surveys would be permitted (Queensnake is vulnerable to trampling as it basks under rocks), and (3) appropriate mitigation requirements. If Queensnake are confirmed in the Study Area, protected habitat extends 50 m from any confirmed hibernaculum and 30 m from the high water mark of an occupied wetland or reach of watercourse. Consultation with MECP is recommended to determine authorization requirements for work in habitat of Queensnake.

7.1.5.4 Endangered Bats

Seven snag trees providing suitable maternity roost habitat were identified within the Study Area, of which two are proposed for removal during Project construction. A total of 0.7 ha of treed communities will be removed, of which only 0.06 ha is permanent loss in hedgerow community FODM11. Forest and other suitable bat maternity habitat are well-represented in the Study Area, and negligible long-term implications to habitat availability are anticipated as a result of the proposed removals. Site-specific mitigation measures are recommended to address the risk of harm to roosting bats (**Section 7.2.6.3**).

7.1.5.5 Eastern Meadowlark

Although targeted surveys for breeding grassland birds were not conducted, the observation of Eastern Meadowlark in suitable breeding habitat (meadow; MEGM3) and during the nesting period suggests that Eastern Meadowlark is using this community for nesting. Nesting habitat of Eastern Meadowlark is protected under the ESA. Meadow community MEGM3 is outside the Project disturbance limits, consequently no impacts to the species or its habitat are anticipated as a result of Project construction. Should Project limits change and if nesting habitat will be disturbed by the Project, registration and conducting the work according to the rules in O. Reg. 242/08 Section 23.6 is recommended to avoid impacts to the species or its habitat.

7.1.5.6 Mussels: Rayed Bean and Wavy-rayed Lampmussel

A description of impacts to aquatic habitat, including habitat for mussel SAR, is provided in **Section 7.1.7**.

7.1.5.7 Fish: Silver Shiner, Eastern Sand Darter and Black Redhorse

Although regulated habitat for Silver Shiner has not been defined in the ESA, the species has been afforded similar additional protections under the ESA as Redside Dace (O. Reg. 242/08 Section 23.1), which includes protections of habitat within the meander belt width of the watercourse plus 30 metres. A description of impacts to aquatic habitat, including habitat for fish SAR, is provided in **Section 7.1.7**.

7.1.6 Fish Habitat

Potential impacts to fish habitat can include direct habitat loss or indirect impacts to habitat. Direct impacts may result from the placement of structures or fill below the high-water mark, including new bridge piers or abutments and any modifications to the river banks under the bridge.

The preferred solution is to replace the existing structure with a three-span bridge that has been designed within the footprint of the existing bridge. Portions of the bridge and road will be located within the 30 m buffer zone surrounding the meander belt width of the North Thames River, which is protected habitat for Silver Shiner. The defined meander belt width for the North Thames River at this location was not available at the time of writing this report. If unavailable, the meander belt width should be developed in consultation with UTRCA or MECP.

Construction of the new bridge will result in impacts to regulated Silver Shiner habitat. Permanently disturbed habitats include areas permanently covered by the new piers (two to replace three existing) and bridge abutments. Erosion protection may also be provided on the bank areas. Temporarily disturbed areas include construction access areas that will be restored to pre-construction conditions following construction and grading of the road embankment. Installation of the in-water piers may also require the construction of a causeway within the river channel.

Impacts related to loss of habitat from the footprint may be offset by creating or enhancing habitat conditions elsewhere, including substrate enhancements to promote spawning habitat. This may be partially achieved in the reduction from three existing piers to two piers, with restoration of habitat

occurring in the areas of pier removal. The area of habitat gained through the removal of these piers compared to that affected by new pier installation will need to be calculated at detail design.

Indirect impacts may result from the potential for sediment transport from exposed soil surfaces, potential entry of construction debris (e.g. concrete slurry, dust, etc.) into the water and spills associated with refueling of equipment. Suspended sediments increase turbidity of the water column, which can impair vision and subsequent feeding by fish that are sight-hunters. Suspended sediments can also abrade gill membranes leading to physical stress, and impact prey organisms' behavioral changes (i.e., avoidance, etc.). Heavier sediments can deposit on coarser substrates that may be used for spawning, incubation of juvenile fish, or food production, thereby impacting those habitat functions.

Indirect impacts are generally reduced through the implementation of standard mitigation measures to protect fish and fish habitat (**Section 7.2.5**).

7.2 MITIGATION

7.2.1 Erosion and Sediment Control

The potential indirect impacts associated with the Project are primarily from construction activities. Most of the potential impacts are common to various types of construction and can be controlled using standard mitigation measures for erosion and sediment control. The primary principles associated with sedimentation and erosion protection measures are to:

- Minimize the duration of soil exposure
- Retain existing vegetation, where feasible
- Encourage re-vegetation
- Divert runoff away from exposed soils
- Keep runoff velocities low
- Trap sediment as close to the source as possible

To address these principles, mitigation measures recommended for implementation during construction are described below.

- Reduce the access and temporary work space to the extent possible to limit destabilization of soils near the work area.
- Silt fencing and/or barriers such as sediment logs (i.e., SiltSoxx™) could be used along all work zones where there is potential for sedimentation of watercourses or wetlands, or inadvertent encroachment of construction vehicles into trees or natural areas.
- Dust could be controlled by using water instead of chemical suppressants in dust-sensitive areas such as the mapped natural heritage features.
- No equipment should be permitted to enter natural areas beyond the barrier fencing.
- All exposed soil areas should be stabilized (native seed mixes; sourced locally if possible) and re-vegetated, through the placement of seed and mulching or seed and an erosion control blanket, promptly upon completion of construction activities.

- Equipment should be re-fueled >30 m away from sensitive natural features (e.g. watercourses and wetlands) to avoid potential impacts if an accidental spill occurs.
- In addition to any specified requirements, additional silt fence and/or silt logs should be available on site, prior to grading operations, to provide a contingency supply in the event of an emergency.
- Sediment and erosion controls should be monitored regularly and properly maintained as required. Controls are to be removed only after the soils of the construction area have been stabilized and adequately protected or until cover is re-established.
- The limits of construction adjacent to natural features to be retained will be fenced prior to construction and monitored during construction (along with sediment and erosion control measures) to make sure that the limits are maintained with respect to vehicular traffic and soil or equipment stockpiling.
- The Contractor is required to restore disturbance to any natural features affected by construction to pre-construction conditions.

7.2.2 Vegetation Management

All proposed work will occur within the existing ROW or portions of roadside meadow. The removal of common herbaceous species is not expected to require mitigation. Mitigation measures for tree and shrub communities, including the Black Walnut Lowland Deciduous Forest, are:

- Clearly mark the limits of vegetation removal along sensitive features (rare vegetation community (FODM7-4) and wetland community (MAMM1-3)) to ensure no disturbance extends beyond the limits. A pre-clearing survey is recommended to avoid removal of regionally-rare Black Walnut to the extent possible. Barrier fencing used to delimit sensitive features may be coincident with silt fencing used to control erosion and sediment transport at the site.
- Preserve and stockpile existing native topsoil and seed banks from the riparian areas of the North Thames River for reuse in restoration. Seed banks should not be used from areas where invasive species are present.
- Supplement seed banks with native seed mixes to improve native species diversity. Seed mixes and other planting lists shall be designed to include only native species adapted to the site conditions, including soil type, moisture and sun exposure. Where possible, seed mixes and other plant material shall be sourced from within the Carolinian Zone (Deciduous Forest Region).
- Seed mixes shall include fast-growing, short-lived perennial cover crop to stabilize soil and reduce competition from weedy exotics. Native cover crops are preferred. A light (2 cm) layer of mulch (e.g. shredded bark) is recommended above the waterline to retain soil moisture and improve germination rates; however, the layer shall be sparse enough to retain approximately 20 to 40 % visible soil. An erosion mat may also be used to stabilize final grades where necessary and shall be applied post seeding and mulch application. Manufacturer specifications shall indicate the erosion mat is non-woven, made of biodegradable material, wildlife-friendly to avoid entanglement by snakes, and designed to allow sufficient light penetration for seed germination.
- Seeded areas shall receive water either through precipitation or irrigation after every seven successive days without rainfall for the first two months after planting.

- A clean equipment protocol will be used for machinery entering riparian areas to prevent the spread of invasive species into the feature.
- Develop a monitoring and adaptive management plan to control vegetation establishment.
- Refer to the tree protection and management plan for specific guidance on tree protection measures.

7.2.3 Avoidance of Wildlife

The following mitigation measures are recommended to avoid impacts to wildlife during Project construction.

- A visual search of the work area will be conducted by construction contractors before work commences each day, particularly for the period when most wildlife is active (generally April 1 to October 31). Visual inspections will locate and avoid snakes, turtles and other ground dwelling wildlife such as small mammals. Visual searches will include inspection of machinery and equipment left in the work area overnight prior to starting equipment.
- If wildlife is encountered, work at that location will stop, and the animal(s) will be permitted reasonable time to leave the work area on their own.
- Any observations of species at risk or species of conservation concern should be reported to MECP and MNRF within 48 hours. Species at risk should not be handled, harassed, or moved in any way, unless they are in immediate danger.

7.2.4 Protection of Migratory Bird Nests

The MBCA provides legal protection of migratory birds and their nests in Canada. Construction timing must consider restrictions imposed by the MBCA. To avoid damaging or disturbing bird nests and contravening the MBCA, the timing of any vegetation clearing should occur outside of the primary nesting period (i.e., the period when the percent of total nesting species is greater than 10% based on Environment Canada's Nesting Calendars and the period for which due diligence mitigation measures are generally recommended).

The primary nesting period (PNP) identified for the Study Area is April 9 – August 16, although nesting also infrequently occurs outside of this period (Environment Canada 2014). Vegetation removal during this core nesting period is not recommended; however, if required, a nest survey may be carried out by a qualified person in simple habitats such as an urban park, a vacant lot with few possible nest sites, a previously cleared area, or a structure (Government of Canada 2019). If a migratory bird nest is located within the work area at any time, a no-disturbance buffer will be delineated. This buffer will be maintained for the entire duration of the nest activity, which will be determined using periodic checks by the avian biologist. The radius of the buffer generally varies from 5 m – 60 m depending on the sensitivity of the nesting species. The Project will not resume within the nest buffer until the nest is confirmed to be no longer active.

7.2.5 Mitigation for Fish Habitat

In general, potential impacts to aquatic habitat can be mitigated through site control measures, such as previously mentioned sediment and erosion controls, and other measures to prevent the entry of substances and debris into the water. If in-water work or access is required, construction timing windows can be employed to reduce the risk of impacts occurring during sensitive life periods such as spawning and emergence of young fish. For works in the North Thames River, no in-water work or access should take place from March 15 to July 15. Harm to fish can be reduced through isolation of work areas using coffer dams or other work area isolation techniques, removal of fish and mussels from the isolated area and performing works in the dry work area to reduce resuspension of sediments during construction.

7.2.6 Site-specific Mitigation

7.2.6.1 Mitigation Recommendations for Reptiles

Because general mitigation measures may not provide sufficient protection, avoidance of sensitive wildlife periods and temporary wildlife exclusion are recommended for reptiles and amphibians. If habitat for Eastern Spiny Softshell or Queensnake is confirmed in the Study Area and a 17(c) permit under the ESA is required, mitigation will be determined by requirements for overall benefit. The peak active season for reptiles and amphibians, from approximately April 1 to October 31, cannot be avoided during construction. Installation of exclusion fencing (e.g. silt fence) to define Work Zones and restrict the movement of reptiles and amphibians into the working area is recommended to occur before May 15 or after September 15 (i.e., outside of key breeding period). If construction must be initiated during the turtle nesting or snake gestation season (approximately June 1 to September 1), a qualified biologist will visually inspect the site for evidence of nesting or individual reptiles and direct installation of construction barrier fencing to avoid nests. If it is not possible to isolate a nest from construction, work will be delayed until it is determined that the nest no longer includes viable eggs (hatchlings have emerged, or eggs were predated).

Potential snake hibernation sites (rock embankment of Thorndale Road west of Thorndale Bridge) will not be disturbed during the hibernation period (November 1 to March 31). Alternatively, pre-construction species use surveys could be conducted to determine if hibernacula are present or absent. If they are not confirmed, no further mitigation would be required. If removal of above-ground habitat features (rock slabs or piles, brush) is needed, these features will be retained outside the active work zone during construction and returned post-construction to the same or a nearby location.

Species listed as endangered or threatened on the SARO List or SARA Schedule 1 that are present in the Study Area must be protected from harm and harassment. Therefore, in addition to the mitigation described above, the following measures are recommended to reduce the likelihood of interactions with SAR/SOCC reptiles and amphibians:

- A thorough visual search will occur before work commences each day by construction contractors to avoid interaction with reptiles and amphibians. Visual searches will include inspection of machinery and equipment, prior to starting equipment, particularly during the peak activity.

- Inform on-site personnel of the potential presence of the SAR identified in the Study Area, obligations under the ESA (2007) and SARA, and recommended actions in the event of an encounter. Factsheets will be provided to all construction staff to assist with identification of Queensnake, Eastern Milksnake, and Eastern Spiny Softshell.
- Any SAR individual that is incidentally encountered in the Study Area must be allowed to leave of its own accord. Activities outside of the travelled road but within 20 m should cease until the individual disperses. Construction machinery/equipment outside of the travelled road must maintain a minimum operating distance of 20 m from the individual until it disperses from the project area of its own accord.
- Should on-site personnel be unable to allow an incidentally encountered SAR individual to disperse from the active construction area under its own ability, MECP (SAROntario@ontario.ca) must be contacted immediately for additional guidance.
- If an injured or deceased SAR is found, the specimen must be placed in a non-airtight container that is maintained at an appropriate temperature and MECP (SAROntario@ontario.ca) and a licensed wildlife rehabilitation centre must be contacted immediately for additional guidance.
- Areas cleared of vegetation must be re-established as soon as possible and prior to the next active season.
- The use of mesh or netting-type soil stabilization blankets must not be used for erosion-control measures to reduce the likelihood of snake entanglement.

7.2.6.2 Monarch

If vegetation clearing will proceed when Monarch larvae may be present (April 1 to September 30), milkweed plants must be inspected for Monarch larvae prior to their removal. If larvae are present, they may be moved to a location that is suitable and safe under the direction of a qualified professional. Monarch caterpillars may be moved to other milkweed plants; for other larval stages (i.e., eggs and chrysalis), entire milkweed plants should be transplanted.

Nectar producing plants will be included in the restoration seed mix(es) to provide habitat for Monarch.

7.2.6.3 Bats

Suitable maternity roost trees and habitat for SAR bats were identified in the Study Area. Removal of suitable bat maternity roost trees should occur outside the period when bats use trees for maternity roosts (i.e., May 1 to September 31) to reduce the likelihood of harm to bats.

7.2.6.4 SAR Mussels

Prior to in-water works associated with the Thorndale Bridge reconstruction, all mussels will need to be relocated from the prescribed search area likely to be affected by those activities. These include borehole test drilling locations and access routes, temporary causeways that may be needed to access boreholes, new bridge pier locations and to remove existing bridge pier locations and any areas where material, equipment or personnel may impact in-water areas of the North Thames River.

The relocation timing window based on mussel species and habitat present restricts handling of mussels to a period when water temperatures are above 16°C, which typically occurs between June 15 and September 30.

7.2.6.5 Fish SAR, including Silver Shiner

Mitigation measures to avoid harm to Silver Shiner and other fish SAR include:

- Maintaining the flow of the North Thames River without interruption during construction.
- Stabilize exposed soil, earth or substrates to prevent sediment or deleterious substances from entering the stream or watercourse within 5 days after the soil, earth or substrate becomes exposed.
- Any equipment, stockpiled material or construction material shall be stored outside the habitat of Silver Shiner and in a manner that prevents sediment or deleterious substances from entering the habitat of Silver Shiner
- A double row of sediment control fencing consisting of a non-woven material with staked straw bales shall be installed and maintained to prevent sediment from entering any part of the habitat of Silver Shiner.
- Any sediment-laden water that is proposed for discharge shall be filtered to remove the sediment before it enters any part of the habitat of silver shiner
- Native plants shall be planted in the area to restore wetland and upland habitat disturbed during construction.

7.3 FOREST EDGE MANAGEMENT AND RESTORATION PLANTING

Forest edges disturbed during construction provide an opportunity for naturalization using native plant species in order to mitigate the loss of vegetation and provide habitat for wildlife. These proposed naturalization areas will strengthen the natural heritage values of existing features and increase connectivity among woodlands, hedgerows, wetlands and meadows south of the ROW. Naturalization Areas will be designed with a self-sustaining seed mix of grass and forb species suitable for planting in the Upper Thames River watershed. Clusters of native trees and shrubs should be planted to buffer existing woodlands along the ROW or where the woodland edge has been disturbed by tree removal. Along forest edges trees and shrubs will be planted to provide a protective buffer, and plant species will be selected based on the adjacent vegetation community (e.g. THDM2-6, FODM7-4). Where possible, locally-sourced material, including species which provide habitat for butterflies and other pollinators, should be incorporated into the restoration plan.

Shredded bark mulch or wood chips should be applied in a ring around the base of all planted trees and shrubs to a depth no greater than 4 inches, avoiding contact with the plant stem. If wood chips from trees and brush chipped on site are used as mulch, do not use wood chips from Black Walnut as this may inhibit growth of desirable native plant species. Wood chips extending beyond the drip line of any planted trees or shrubs should be thinned to allow light penetration for groundcover regeneration or establishment.

Any seed mix should first be approved by UTRCA to ensure it contains regionally-appropriate species which are not considered nuisance species or of conservation concern. Control of Eurasian grasses or other weeds associated with agricultural production may be required prior to installation, either by mechanical or chemical means.

8.0 AUTHORIZATION REQUIREMENTS

8.1 FISHERIES ACT

The proposed bridge construction plan will be submitted to DFO as a Request for Review. If DFO determines that the proposed work will result in the Harmful Alteration, Disruption or Destruction (HADD) of fish habitat or the killing of fish through means other than fishing, an application for Authorization under the *Fisheries Act* will be submitted to DFO.

8.2 ENDANGERED SPECIES ACT

In order to proceed with the Project, authorizations under the ESA may be required for Eastern Spiny Softshell, Queensnake, Wavy-rayed Lampmussel, Rayed Bean, Black Redhorse, Eastern Sand Darter and Silver Shiner. A summary of requirements is presented below:

- **Eastern Spiny Softshell:** Suitable habitat for the species occurs within the Study Area. Consultation with MECP is recommended during or prior to the detailed design stage in order to determine authorization requirements, if any.
- **Queensnake:** As this species is extremely sensitive to trampling during targeted surveys, early consultation with MECP and UTRCA during or prior to the detailed design stage is recommended to determine presence / absence (including records of the species and if regulated habitat has been identified) and authorization requirements
- **Black Redhorse, Eastern Sand Darter, Silver Shiner, Wavy-rayed Lampmussel, Rayed Bean:** Consultation with the Ministry of the Environment, Conservation and Parks (MECP) is recommended to determine authorization requirements under the ESA. It is unlikely, due to the predicted area of in-water disturbance (i.e. greater than 100 m^2), that the project could qualify for an exemption under Ontario Regulation 23.4 of the ESA (Aquatic Species). The project will likely require an ESA 17(2)(c) Permit from the MECP for all in-water activities that could potentially affect Black Redhorse, Eastern Sand Darter, Silver Shiner, Rayed Bean and Wavy-rayed Lampmussel or their habitat. Habitat protection for Silver Shiner extends to the meander width of the watercourse plus 30 m. A 17(2)(c) net benefit permit may require additional offsetting measures for each of these species that will be negotiated with MECP as part of the authorization process.

8.3 SPECIES AT RISK ACT

The Project has the potential to harm or harass protected fish and mussel species and will, therefore, require a federal SARA Permit from the DFO for all in-water activities that could potentially affect Rayed Bean, Silver Shiner, Eastern Sand Darter and Black Redhorse or their habitat. Typical permit requirements involving mussel SAR require two years of post-relocation monitoring, so it is anticipated that the SARA Permit will need to cover at least three years of activity.

8.4 CONSERVATION AUTHORITY REGULATED AREAS

Under O. Reg. 157/06 permit is required for development or interference with wetlands and alterations to shorelines and watercourses. This may include the planned work within regulated areas associated with the North Thames River. A permit application package will need to be prepared and submitted to UTRCA that includes the following information:

- Maps and photographs showing the location of Project work relative to regulated features
- Environmental mitigation measures for sediment and erosion control, re-vegetation and seeding
- Other site-specific data as required

Consultation with UTRCA is recommended to confirm complete permit application requirements.

8.5 FISH AND WILDLIFE CONSERVATION ACT

If in-water work involving isolation techniques requires relocation of fish, turtles or other wildlife, a Wildlife Scientific Collectors Authorization may be required from the MNRF under the Fish and Wildlife Conservation Act.

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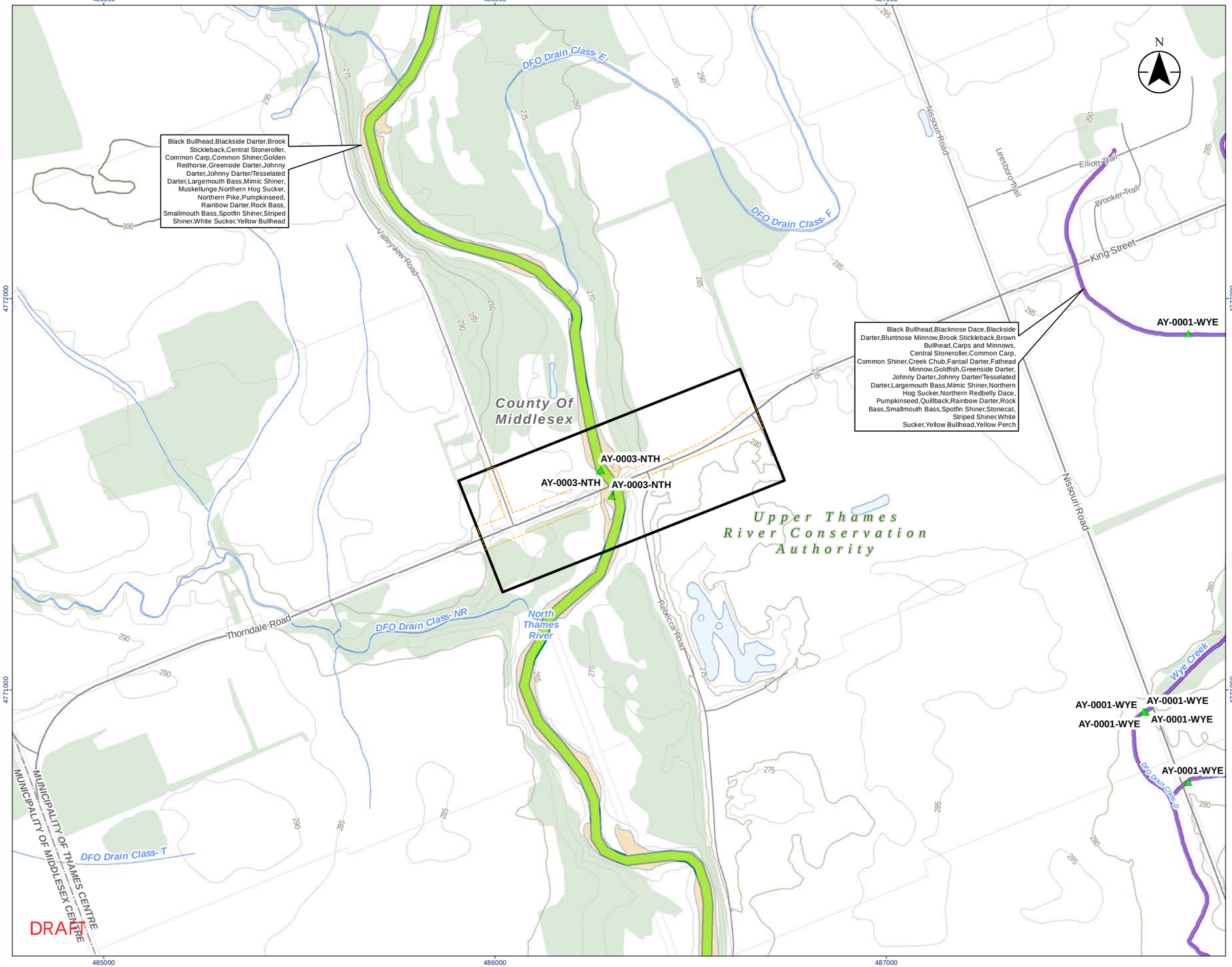
APPENDIX A
Figures



Stantec

Legend

- Study Area
- Fish Survey Point (ARA)
- Constructed Drain
- Thermal Regime, Cold
- Watercourse (Permanent)
- Conservation Area Administrative Boundary
- Thermal Regime, Warm
- Aquatic Species at Risk Distribution
- Aquatic Species at Risk Critical Habitat
- Waterbody
- Wooded Area
- Lot
- Municipal Boundary, Upper
- Municipal Boundary, Lower
- County of Middlesex Right-of-way

0 200 400 Meters

1:10,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2019.

Project Location
Municipality of Thames Centre

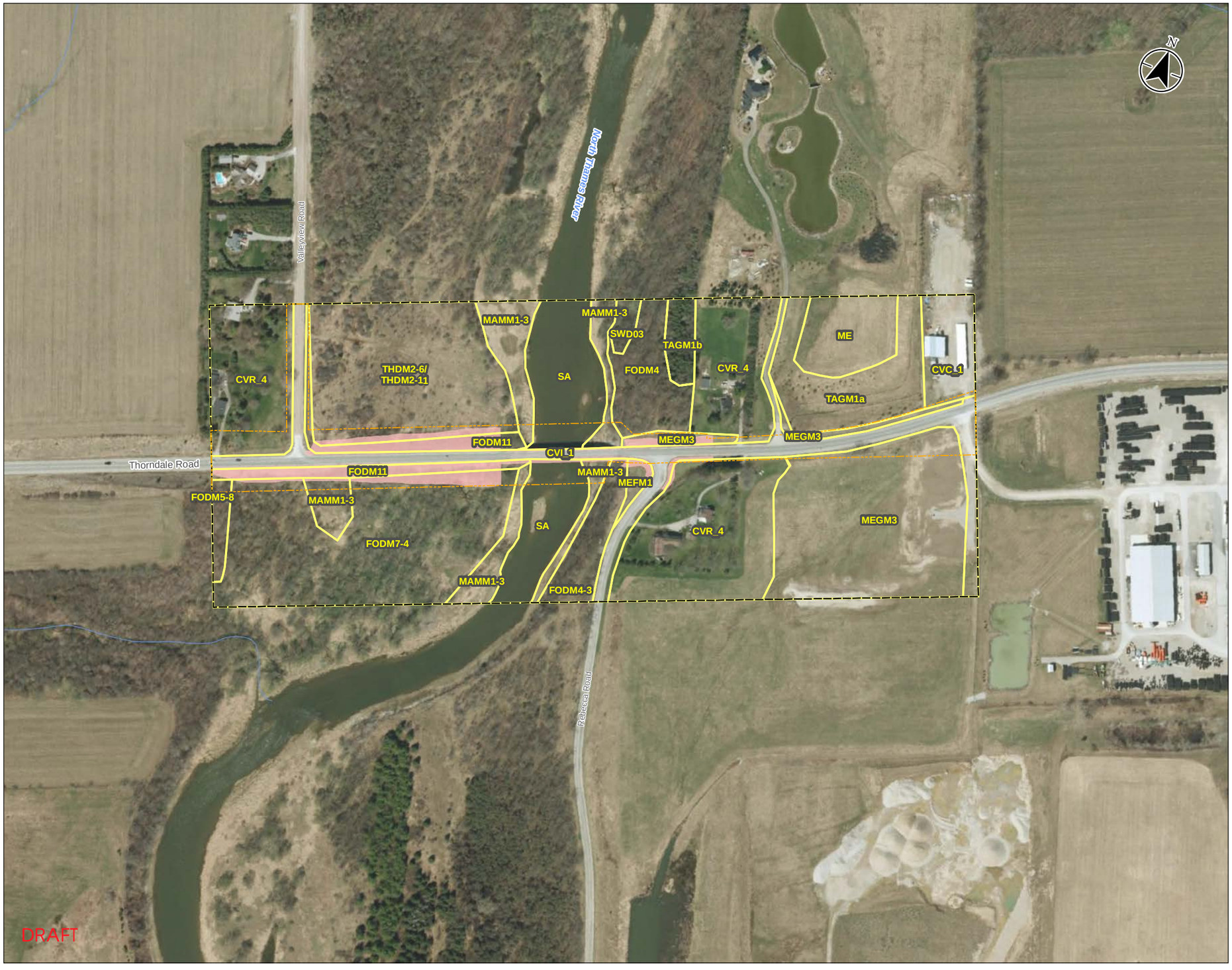
165001122 REVA
Prepared by JW on 2020-05-07
Technical Review by ABC on yyyy-mm-dd
Independent Review by ABC on yyyy-mm-dd

Client/Project
MIDDLESEX COUNTY
THORNDALE BRIDGE IMPROVEMENTS
COUNTY ROAD 28 (THORNDALE ROAD)

Figure No.
2

DRAFT

Title
Background Natural Features



Stantec

Legend

- Watercourse (Permanent)
- Area of Impact
- ELC
- Study Area
- County of Middlesex Right-of-way

ELC_LEGEND

- **CVC_1** Storage Facility
- **CVI_1** Transportation
- **CVR_4** Rural Property
- **FODM11** Naturalized Deciduous Hedge-row
- **FODM4** Dry - Fresh Upland Deciduous Forest
- **FODM4-3** Steep slope to river dominated by hackberry
- **FODM5-8** Sugar Maple-Ash forest on slope
- **FODM7-4** Black walnut floodplain forest / woodland
- **MAMM1-3** Floodplain Marsh
- **MAMM1-3** Frob Bedrock Meadow Marsh
- **MAMM1-3** Riverside marsh
- **MAMM1-3** Riverside marsh
- **ME** Meadow
- **MEFM1** Forb Meadow
- **MEGM3** Dry - Fresh Graminoid Meadow
- **SA** Shallow Water
- **SWDO3** Wetland
- **TAGM1a** Meadow and young planted conifers
- **TAGM1b** Coniferous Plantation
- **THDM2-6/ THDM2-11** Thicket

0 100 200 Meters

1:4,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
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Project Location
County of Middlesex

165001122 REVA
Prepared by JW on 2020-05-07
Technical Review by ABC on yyyy-mm-dd
Independent Review by ABC on yyyy-mm-dd

Client/Project
MIDDLESEX COUNTY
THORNDALE BRIDGE IMPROVEMENTS
COUNTY ROAD 28 (THORNDALE ROAD)

Figure No.
3

DRAFT

Title
ELC

Stantec

Legend

- Study Area

Notable Observations

- Animal Den
- Cliff Swallow Nest
- Eastern Gartersnake
- Eastern Meadowlark (Threatened)
- Hairy-Fruited Sedge (Rare)
- Potential Snake Overwintering Habitat
- Potential Bat Maternity Roost Tree
- Butternut Tree (Endangered)
- Area of Impact
- Area of Ground Water Seepage
- Species at Risk Habitat
- County of Middlesex Right-of-way

0 100 200 Meters

1:4,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
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Project Location
County of Middlesex

165001122 REVA
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Independent Review by ABC on yyyy-mm-dd

Client/Project
MIDDLESEX COUNTY
THORNDALE BRIDGE IMPROVEMENTS
COUNTY ROAD 28 (THORNDALE ROAD)

Figure No.
4

DRAFT

Title
Natural Heritage Features

APPENDIX B
Tables

Appendix B

Table B-1: Wildlife Habitat Assessment for the Thorndale Bridge Study Area (Ecoregion 6E)

Wildlife Habitat Type	Criteria	Methods	Results of Desktop Habitat Assessment	Results of Field Investigations
SEASONAL CONCENTRATION AREAS				
Waterfowl Stopover and Staging Area (Terrestrial and Aquatic)	Field with evidence of annual spring flooding from meltwater or runoff; aquatic habitats such as ponds, marshes, lakes, bays, and watercourses used during migration, including large marshy wetlands.	ELC surveys, wildlife habitat assessments, and air photo interpretation were used to assess features within the Study Area that may support waterfowl stopover and staging areas.	To be determined during 2019 field investigations.	**Absent**. No flooded fields were observed during spring 2019 field investigations. Wetlands in the Study Area are of insufficient size to support waterfowl concentrations. No concentrations of waterfowl were observed.
Shorebird Migratory Stopover Area	Beaches and un-vegetated shorelines of lakes, rivers, and wetlands.	ELC surveys and air photo interpretation were used to assess features within the Study Area that may support migratory shorebirds.	**Absent**. Natural unvegetated shoreline habitat was absent from the Study Area.	n/a
Raptor Wintering Area	Combination of fields and woodland (>20 ha).	ELC surveys and air photo interpretation were used to assess features within the Study Area that may support wintering raptors.	**Candidate**. The Study Area is within a larger landscape providing a combination of fields and woodland > 20 ha.	**Absent.** The Study Area is a mix of thicket and riparian woodland with small meadow communities on a plateau to the east. While winter raptor surveys were not undertaken, these features are of insufficient size to provide significant raptor wintering habitat.
Bat Hibernacula	Hibernacula may be found in caves, mine shafts, underground foundations and karsts.	ELC surveys, wildlife habitat assessments, and air photo interpretation were used to assess features within the Study Area that may support bat hibernacula.	**Absent**. Crevices, caves or abandoned mines Were absent from the Subject Property and Study Area.	n/a
Bat Maternity Colonies	Maternity colonies considered significant wildlife habitat are found in forested ecosites.	ELC surveys, wildlife habitat assessments, and air photo interpretation were used to assess features within the Study Area that may support bat maternity colonies.	To be determined during 2019 field investigations.	**Present.** Forest habitat was present in the Study Area which had suitable characteristics to support bat maternity colonies.
Turtle Wintering Areas	Over-wintering sites are permanent water bodies, large wetlands, and bogs or fens with adequate dissolved oxygen. Water has to be deep enough not to freeze and have soft mud substrate.	ELC surveys, wildlife habitat assessments and air photo interpretation were used to assess features within the Study Area that may support areas of permanent standing water but not deep enough to freeze.	**Candidate.** The Thames River may provide overwintering habitat for turtles.	**Candidate.** Suitable overwintering habitat for turtles may be present in the Thames River. Basking surveys were not undertaken in the Study Area.
Reptile Hibernaculum	Rock piles or slopes, stone fences, crumbling foundations.	ELC surveys and wildlife habitat assessments were used to document features that may support snake hibernacula.	To be determined during 2019 field investigations.	**Candidate.** Suitable hibernation sites for snakes (e.g. rock piles, riprap along culverts, tree stumps) were observed during field investigations in riprap embankments along the north and south side of Thorndale Road, west of the river. Gartersnakes (< 5 total) were observed among the riprap.
Colonial-Nesting Bird Breeding Habitat (Bank and Cliff)	Eroding banks, sandy hills, steep slopes, rock faces or piles.	ELC surveys, wildlife habitat assessments, and air photo interpretation were used to assess features within the Study Area that may support colonial bird breeding habitat.	To be determined during 2019 field investigations.	**Absent**. No eroding features, or exposed slopes were observed during field investigations. Cliff Swallow nests were observed on the bridge, however anthropogenic features are not significant wildlife habitat.
Colonial-Nesting Bird Breeding Habitat (Tree/Shrubs)	Dead trees in large marshes and lakes, flooded timber, and shrubs, with nests of colonially nesting heron species.	ELC surveys and wildlife habitat assessments were used to assess features within the Study Area that may support colonial bird breeding habitat (Trees/Shrubs).	**Absent**. Large marshes and lakes were absent from the Study Area.	n/a
Colonial-Nesting Bird Breeding Habitat (Ground)	Rock islands and peninsulas in a lake or large river.	ELC surveys and air photo interpretation were used to assess features within the Study Area that may support colonial bird breeding habitat (Ground).	**Absent**. Large islands or peninsulas were absent from the Study Area.	n/a
Migratory Butterfly Stopover Areas	Meadows and forests that are a minimum of 10 ha and are located within 5km of Lake Ontario.	GIS analysis was used to measure distance from the Lake Ontario shoreline.	**Absent**. The Study area is > 5 km from the Lake Ontario shoreline.	n/a
Landbird Migratory Stopover Areas	Woodlands of a minimum size located within 5km of Lake Ontario.	GIS analysis was used to measure distance from the Lake Ontario shoreline.	**Absent**. The Study area is > 5 km from the Lake Ontario shoreline.	n/a
Deer Yarding Areas	Deer yarding areas are mapped by MNRF and species use surveys are not required.	The LIO database and MNRF consultation were used to identify deer yarding areas.	**Absent**. Records of deer yarding areas were not identified by MNRF in the Study Area.	n/a
Deer Winter Congregation Areas	Deer winter congregation's areas are mapped by MNRF and species use surveys are not required.	The LIO database and MNRF consultation were used to identify deer winter congregation areas.	**Absent**. Records of deer winter congregation areas were not identified by MNRF in the Study Area.	n/a

Appendix B

Table B-1: Wildlife Habitat Assessment for the Thorndale Bridge Study Area (Ecoregion 6E)

Wildlife Habitat Type	Criteria	Methods	Results of Desktop Habitat Assessment	Results of Field Investigations
RARE VEGETATION COMMUNITIES				
Sand Barren, Alvar, Cliffs and Talus Slopes	Sand barren, Alvar, Cliff and Talus ELC Community Classes, and other areas of exposed bed rock and patchy soil development, near vertical exposed bedrock and slopes of rock rubble.	ELC surveys and air photo interpretation were used to assess vegetation communities in the Study Area.	**Absent**. These communities were absent from the Study Area.	n/a
Old-growth Forest	Relatively undisturbed, structurally complex; dominant trees > 100 years' old.	ELC surveys and air photo interpretation were used to assess vegetation communities in the Study Area.	To be determined during 2019 field investigations.	**Absent**. Old growth characteristics were not observed within woodlands in the Study Area.
Tallgrass Prairie and Savannah	Open canopy habitats (tree cover < 60%) dominated by prairie species.	ELC surveys and air photo interpretation were used to assess vegetation communities in the Study Area.	To be determined during 2019 field investigations.	**Absent**. Tallgrass Prairie and Savannah communities or indicator plants were not observed during field investigations.
Other Rare Vegetation Communities	Provincially Rare S1, S2 and S3 vegetation communities listed by the NHIC.	ELC surveys and air photo interpretation were used to assess vegetation communities in the Study Area.	To be determined during 2019 field investigations.	**Absent**. No rare vegetation communities Were observed during field investigations.
SPECIALIZED HABITAT FOR WILDLIFE				
Waterfowl Nesting Area	Upland habitats adjacent to wetlands (within 120m).	ELC surveys, wildlife habitat assessment, and airphoto interpretation were used to assess features within the Study Area that may support nesting waterfowl.	To be determined during 2019 field investigations.	**Absent**. Wetland communities and adjacent uplands are of insufficient size to provide significant waterfowl nesting habitat. No waterfowl were observed during field investigations.
Bald Eagle and Osprey nesting, Foraging, and Perching Habitat	Treed communities adjacent to rivers, lakes, ponds, and other wetlands with stick nests of Bald Eagle or Osprey.	ELC surveys, air photo interpretation and wildlife habitat assessment were used to assess features within the Study Area that may support nesting, foraging and perching habitat for large raptors.	To be determined during 2019 field investigations.	**Absent.** Stick nests of Bald Eagle or Osprey were not observed during field investigations.
Woodland Raptor Nesting Habitat	Forested ELC communities >30 ha with 10 ha of interior habitat.	ELC surveys, wildlife habitat assessment, and GIS analysis were used to assess features within the Study Area that may support nesting habitat for woodland raptors.	**Absent**. Woodland communities are of insufficient size to provide Interior forest habitat.	n/a
Turtle Nesting Areas	Exposed soil, including sand and gravel in open sunny areas near wetlands.	ELC surveys, wildlife habitat assessment and air photo interpretation were used to assess features within the Study Area that may support turtle nesting areas.	To be determined during 2019 field investigations.	**Absent.** No natural areas of exposed soil were observed in the Study Area. Suitable habitat for turtle nesting is present on the road shoulder and in agricultural fields, however anthropogenic features are not protected as significant wildlife habitat.
Seeps and Springs	Any forested area with groundwater at surface within the headwaters of a stream or river system.	Evidence of groundwater upwelling, including seeps and springs, was recorded during ELC surveys.	To be determined during 2019 field investigations.	**Present.** An area of groundwater seepage was observed along the east bank of the river, north of the bridge, during field investigations.
Amphibian Breeding Habitat (Woodland and Wetland)	Treed uplands with vernal pools, and wetland ecosites.	ELC surveys were used to assess features within the Study Area that may support breeding amphibians.	To be determined during 2019 field investigations.	**Absent.** No vernal pools or wetlands were observed within woodland communities. Wetland ecosites associated with the Thames River are unlikely to support significant amphibian breeding due to the presence of flowing water and fish predators.
Woodland Area-sensitive Bird Breeding Habitat	Large mature forest stands, woodlots >30ha and >200m from the forest edge.	ELC surveys, air photo interpretation, and GIS analysis were used to determine whether woodlots that occurred within the Study Area that Were >30 ha with interior habitat present (>200 m from edge).	**Absent**. No portion of the Study Area is > 200 m from a forest edge.	n/a
HABITAT FOR SPECIES OF CONSERVATION CONCERN				
Marsh Bird Breeding Habitat	Wetlands with shallow water and emergent aquatic vegetation.	ELC surveys and air photo interpretation were used to identify marshes with shallow water and emergent vegetation that may support marsh breeding birds.	To be determined during 2019 field investigations.	**Absent.** Narrow reed canary grass marsh communities are present along the Thames River, however these are of insufficient size to support concentrations of breeding marsh birds. No marsh indicator species were observed during field investigations.

Appendix B

Table B-1: Wildlife Habitat Assessment for the Thorndale Bridge Study Area (Ecoregion 6E)

Wildlife Habitat Type	Criteria	Methods	Results of Desktop Habitat Assessment	Results of Field Investigations
Open Country Bird Breeding Habitat	Large grasslands and fields (>30 ha).	ELC surveys, air photo interpretation, and GIS analysis were used to identify grassland communities within the Study Area that may support area-sensitive breeding birds.	**Absent**. Grassland habitat in and overlapping the Study Area is less than 30 ha.	n/a
Shrub/Early Successional Bird Breeding Habitat	Large shrub and thicket habitats (>10 ha).	ELC surveys, air photo interpretation and GIS analysis were used to identify large communities that may support shrub/early successional breeding birds.	**Absent**. Early successional communities > 10 ha are absent from Study Area.	n/a
Terrestrial Crayfish	Wet meadows and edges of shallow marshes.	ELC surveys were used to identify shallow marsh and meadow marsh communities that occurred within the Study Area; searches for crayfish chimneys were conducted during wildlife habitat assessments.	To be determined during 2019 field investigations.	**Absent.** No crayfish chimneys were observed in the Study Area.
SPECIES OF CONSERVATION CONCERN				
Lizard's Tail (S3)	Grows in moist deciduous woods often in swamp and marsh habitats (Dickenson, et.al., 2004; Argus, et.al., 1982-1987).	A two-season botanical inventory was used to identify plant species of conservation concern.	To be determined during 2019 field investigations.	**Absent.** The species was not observed in the Study Area during field investigations.
Hairy-fruited Sedge (S3)	Soggy thickets, wet prairies, fens, sedge meadows, calcareous seeps, and roadside ditches. This sedge prefers fertile wetlands where there is seepage of mineral-rich ground water or floodplains where nutrients are deposited from running water (Illinois Wildflowers 2019).	A two-season botanical inventory was used to identify plant species of conservation concern.	To be determined during 2019 field investigations.	**Confirmed.** The species was observed in ELC community FODM7-4 in the Study Area.
Narrow-leaved Wild Leek (S1?)	Rich deciduous forests, often on floodplains, but occasionally also in upland oak-hickory forests (Reznicek et al. 2011).	A two-season botanical inventory was used to identify plant species of conservation concern.	To be determined during 2019 field investigations.	**Absent.** The species was not observed in the Study Area during field investigations.
Prairie Milkweed (S2S3)	Dry to moist, open, sandy soils including meadows, prairie remnants and forest edges (Reznicek et al, 2011).	A two-season botanical inventory was used to identify plant species of conservation concern.	To be determined during 2019 field investigations.	**Absent.** The species was not observed in the Study Area during field investigations.
Striped Cream Violet (S3)	Found in low woods and moist meadow, particularly along floodplains (Newcomb, 1977, Argus, et.al., 1982-1987)	A two-season botanical inventory was used to identify plant species of conservation concern.	To be determined during 2019 field investigations.	**Absent.** The species was not observed in the Study Area during field investigations.
Spring Blue-eyed Mary (SARO Extirpated)	Open woodland within floodplains. It prefers moist rich soils and is often associated with Sugar Maple and White Oak trees.	A two-season botanical inventory was used to identify plant species of conservation concern.	**Absent.** The species has not been observed in Ontario since 1954.	n/a
Monarch (SARO Special Concern)	Forage and nest in open habitat (i.e., meadows, grasslands and pastures) with various milkweed species (Asclepias spp.) and/or wildflowers such as goldenrods (Solidago spp.), asters (Aster spp.) and yarrow (Achillea millefolium) (COSEWIC 2016).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during 2019 field investigations.	**Candidate.** Suitable habitat for Monarch is present in the Study Area in meadow and meadow marsh communities as well as along the edges of agricultural fields and natural vegetation communities where milkweed and nectar-producing wildflowers may be present. However, the species was not observed during 2019 field investigations.
Elktoe (S3)	Small streams to medium-sized rivers in gravel or mixed sand and gravel in riffles, often deeply buried in substrate (Metcalfe-Smith et. al. 2005).	DFO SAR mapping was used to determine ranges of SAR mussels in the vicinity of the bridge with similar habitat preferences to Elktoe.	To be determined during 2019 field investigations.	**Confirmed.** Shell evidence for Elktoe was observed by Stantec during 2019 field investigations.
Mucket (S3)	Medium-sized to large rivers in substrates ranging from cobble and gravel in riffles with strong currents to quiet water with coarse gravel, sand or mud (Metcalfe-Smith et. al. 2005).	DFO SAR mapping was used to determine ranges of SAR mussels in the vicinity of the bridge with similar habitat preferences to Mucket.	To be determined during 2019 field investigations.	**Habitat Present.** While no shell evidence for Mucket was observed by Stantec during 2019 field investigations, habitat conditions were suitable.
Purple Wartyback (S3)	Small to large rivers in gravel or mixed sand and gravel in areas with moderate to swift current (Metcalfe-Smith et. al. 2005).	DFO SAR mapping was used to determine ranges of SAR mussels in the vicinity of the bridge with similar habitat preferences to Purple Wartyback.	To be determined during 2019 field investigations.	**Confirmed.** Shell evidence for Purple Wartyback was observed by Stantec during 2019 field investigations.
Rainbow (SARO Special Concern)	Mainly small streams to small rivers in coarse sand or gravel substrates in or near riffles and along the edges of emergent vegetation in moderate to strong current (Metcalfe-Smith et. al. 2005).	DFO SAR mapping was used to determine ranges of SAR mussels in the vicinity of the bridge with similar habitat preferences to Rainbow.	To be determined during 2019 field investigations.	**Confirmed.** Shell evidence for Rainbow was observed by Stantec during 2019 field investigations.

Appendix B

Table B-1: Wildlife Habitat Assessment for the Thorndale Bridge Study Area (Ecoregion 6E)

Wildlife Habitat Type	Criteria	Methods	Results of Desktop Habitat Assessment	Results of Field Investigations
Greater Redhorse (S3)	Cool bottom waters of large streams with substantial flows (Holm et. al. 2009).	DFO SAR mapping was used to determine ranges of SAR fish in the vicinity of the bridge with similar habitat preferences to Greater Redhorse.	To be determined during 2019 field investigations.	**Absent.** No Greater Redhorse were observed by Stantec during 2019 field investigations, nor were suitable habitat conditions of cool, deeper waters in areas of substantial flows within the immediate vicinity of the bridge.
Greenside Darter (SARO Special Concern)	Heavily vegetated waters of streams or, rarely, lakes (Holm et. al. 2009).	DFO SAR mapping was used to determine ranges of SAR fish in the vicinity of the bridge with similar habitat preferences to Greenside Darter.	To be determined during 2019 field investigations.	**Absent.** No Greenside Darter were observed by Stantec during 2019 field investigations, nor were suitable habitat conditions of heavy aquatic vegetation in areas of fast flow observed within the immediate vicinity of the bridge.
Northern Sunfish (SARA Special Concern)	Warm waters of slow-moving streams and lakes with aquatic vegetation (Holm et. al. 2009).	DFO SAR mapping was used to determine ranges of SAR fish in the vicinity of the bridge with similar habitat preferences to Northern Sunfish.	To be determined during 2019 field investigations.	**Candidate.** While no Northern Sunfish were observed by Stantec during 2019 field investigations, habitat conditions were suitable in backwater areas of slack water at the near-shore bridge piers.
Eastern Milksnake (SARA Special Concern)	Frequently reported in and around buildings, especially old structures, however, it is found in a variety of habitats, including prairies, pastures, hayfields, rocky hillsides and a wide variety of forest types. Two important features of ideal habitat are proximity to water, and suitable locations for basking and egg-laying, nesting sites may include compost or manure piles, stumps, under boards, or in loose soil (COSEWIC, 2002a).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during 2019 field investigations.	**Candidate.** Suitable habitat for Milksnake is present, however the species was not observed during field investigations.
Snapping Turtle (SARO Special Concern)	Ponds, sloughs, streams, rivers, and shallow bays that are characterized by slow moving water, aquatic vegetation, and soft bottoms. Females show strong nest site fidelity and nest in sand or gravel banks at waterway edges in late May or early June.	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during 2019 field investigations.	**Candidate.** Suitable habitat is present in the Study Area within the Thames River, however the species was not observed during field investigations.
Bald Eagle (SARO Special Concern)	Almost always nests near water. Large stick nests are placed in trees located within mature woodlots. They usually prefer 250 ha of mature forest for breeding, however, along Lake Erie, where the lake provides a valuable food source, the eagles will nest in smaller woodlots or even single trees (Sandilands, 2005).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during 2019 field investigations.	**Absent.** Bald Eagle and its nest(s) were not observed during field investigations.
Eastern Wood-Pewee (SARO Special Concern)	Eastern Wood-pewee is found in the mid-canopy layer of deciduous and mixedwood forests with open understories and is commonly associated with edges and clearings (MNRF 2017).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during 2019 field investigations.	**Candidate.** Suitable habitat for Eastern Wood-Pewee is present, however the species was not observed during field investigations.
Great Egret (S2B)	Nesting colonies on lakes, ponds, marshes, estuaries, impoundments, and islands (Cadman et al. 2007).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during 2019 field investigations.	**Absent.** Great Egret and its nest(s) were not observed during field investigations.
Red-headed Woodpecker (SARO Special Concern)	Occupies a wide range of habitats characterized by open areas for feeding, snags for roosting, and a secure food supply: Open deciduous and riparian woodlands, orchards, parks, and oak savannah (Cadman et al. 2007).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during 2019 field investigations.	**Candidate.** Suitable riparian woodland is present from the Study Area, however the species was not observed during field investigations.
Wood Thrush (SARO Special Concern)	Prefers deciduous and mixed forests in southern Ontario, ranging from small and isolated to large and contiguous woodlots. The presence of tall trees and a thick understory are preferred (Cadman et al., 2007).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during 2019 field investigations.	**Candidate.** Suitable habitat for Wood Thrush is present, however the species was not observed during field investigations.

Appendix B

Table B-1: Wildlife Habitat Assessment for the Thorndale Bridge Study Area (Ecoregion 6E)

Wildlife Habitat Type	Criteria	Methods	Results of Desktop Habitat Assessment	Results of Field Investigations
ANIMAL MOVEMENT CORRIDORS				
Amphibian Movement Corridor	Corridors may be found in all ecosites associated with water. Determined based on identifying significant amphibian breeding habitat (wetland).	Identified after Amphibian Breeding Habitat - Wetland is confirmed. Movement corridors should be considered when amphibian breeding habitat is confirmed as SWH from Amphibian Breeding Habitat (Wetland).	To be determined during 2019 field investigations.	**Candidate.** The Thames River valley provides a corridor for amphibian movement.
Deer Movement Corridor	Corridors may be found in all forest ecosites. Determined based on identifying significant deer wintering habitat.	Identified after deer wintering habitat is confirmed. Movement corridors should be considered when deer wintering habitat is confirmed as SWH based on MNRF data.	**Absent.** No deer wintering areas were identified in the Study Area.	n/a

Appendix B

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APPENDIX B

Appendix B-2: Habitat Potential in the Thorndale Bridge Study Area for Threatened or Endangered Species

Species	Habitat Preference	Habitat Potential
PLANTS		
Butternut	Found in a variety of habitats throughout Southern Ontario, including woodlands and hedgerows (Farrar, 1995).	**Habitat Present.** One Butternut tree was recorded by Stantec on the edge of the Study Area during 2019 field investigations. Suitable habitat exists for this species within any deciduous or mixed woodlands and hedgerows.
MOLLUSCS		
Rayed Bean	Typically found in sand or gravel in shallow, clear headwaters and riffle areas of small tributaries, but can also be found buried among the roots of aquatic plants.	**Critical Habitat Present.** Critical habitat for Rayed Bean is present in the study reach of the Thames River. Shell evidence for Rayed Bean was observed by Stantec during 2019 field investigations.
Wavy-rayed Lampmussel	Lives mainly in gravel or sand bottoms of riffle areas in clear, medium-sized streams, and can be particularly sensitive to siltation.	**Habitat Present.** Shell evidence for Wavy-rayed Lampmussel was observed by Stantec during 2019 field investigations.
FISH		
Black Redhorse	Black Redhorse are found in moderate to fast-flowing areas in large warmwater streams, 25 – 130 m wide. They prefer well-developed riffles and pools adjacent to riffles. They are associated with clean, coarse substrate consisting of gravel and cobble but have also been found in areas with sand, silt and boulders. Adults are rarely associated with submerged aquatic vegetation. They have been known to migrate and spawn at the edge of riffles, avoiding the highest velocity areas, over substrates ranging in size from fine gravel to large cobble. Juveniles and young-of-the-year are found in low-gradient habitat, with reduced flow. They use shallow pools with heterogeneous substrate composed of clean pebble and cobble with a mixture of sand and silt. Both adult and juvenile Black Redhorse have been found in areas influenced by groundwater (COSEWIC 2015)	**Habitat Present.** The study reach provides suitable foraging, rearing, spawning and overwintering habitat for Black Redhorse.

Appendix B-2: Habitat Potential in the Thorndale Bridge Study Area for Threatened or Endangered Species

Species	Habitat Preference	Habitat Potential
Eastern Sand Darter	Eastern Sand Darter prefer sand-bottomed areas in streams, rivers and sandy shoals in lakes. They spawn on mixed sand and gravel substrates (COSEWIC 2009).	**Habitat Present.** The study reach provides suitable foraging, rearing, spawning and overwintering habitat for Eastern Sand Darter. Ontario Reg. 242/08 indicates that specific habitat regulations apply to the geographic areas of Brant, Chatham-Kent, Essex, Elgin, Haldimand, Middlesex, Norfolk and Prince Edward, including the water bodies of Lake Erie, Lake St. Clair and the Detroit River that are adjacent to those geographic areas. Habitat protections include any area adjacent to the part of a river, stream or other watercourse that is Eastern Sand Darter habitat where the adjacent area (riparian) consists primarily of vegetation that occurs naturally or with minimal human intervention, such as a forest, woodland, thicket, wetland, old field, pasture or meadow, within 30 metres of the high water mark.
Silver Shiner	Silver shiners prefer moderate to large size streams with swift currents that are free of weeds and have clean gravel or boulder bottoms. They live in schools and feed on crustaceans and adult flies that fall in the water or fly just above the surface (MECP, 2019).	**Habitat Present.** The study reach provides suitable foraging, rearing, spawning and overwintering habitat for Silver Shiner. General Habitat Protections under the ESA apply, however habitat definition includes not only the watercourse and habitat elements therein, but also the riparian and floodplain areas adjacent to occupied reaches.
REPTILES		
Queensnake	Rocky, gravelly, or slate stream-bed substrates, with a swift to moderate current and woodland surroundings (COSEWIC, 2010). Restricted to relatively small sections of a few rivers and wetlands in southwestern Ontario; highly specialized and rarely found more than 3 m from water.	**Suitable Habitat Present.** Suitable habitat for Queensnake is present in the Study Area. Targeted surveys should be undertaken at or prior to the detailed design stage. If Queensnake are confirmed in the Study Area, protected habitat extends 50 m from any confirmed hibernaculum and 30 m from the high water mark of an occupied wetland or reach of watercourse.
Eastern Spiny Softshell	Found along lakes and large rivers. Requires sandy beaches or riverbanks for nesting, shallow soft-bottomed water bodies to function as nurseries or refugia, basking areas and deep pools for thermoregulation, and riffle areas for foraging (COSEWIC 2002).	**Habitat Present.** Habitat for Eastern Spiny Softshell is present in the Study Area and protections may extend up to 50 m beyond the edge of the Thames River (MECP 2019) and any occupied wetlands. Protected nesting habitat extends 50 m from any confirmed nesting site, however no suitable nesting sites were identified in the Study Area.
BIRDS		
Bank Swallow	Bank Swallows excavate nests in exposed earth banks along watercourses and lakeshores, roadsides, stockpiles of soil, and the sides of sand and gravel pits (Falconer et al., 2016). Any suitable habitat may be present if stockpiles of soil are present or in areas of sand/gravel extraction.	**Habitat Absent.** No suitable nesting habitat for Bank Swallow was identified in the Study Area during field investigations.

Appendix B-2: Habitat Potential in the Thorndale Bridge Study Area for Threatened or Endangered Species

Species	Habitat Preference	Habitat Potential
Barn Swallow	Nest on walls or ledges of barns and other human-made structures such as bridges, culverts or other buildings; forages in open areas for flying insects (COSEWIC 2011).	**Habitat Absent.** Barn Swallow nests were not observed on the bridge structure; however, the structure has characteristics which could permit nesting and pre-construction surveys are recommended.
Bobolink	Nests primarily in forage crops with a mixture of grasses and broad-leaved forbs, predominantly hayfields and pastures (COSEWIC 2010b).	**Habitat Absent.** Suitable large grassland habitat is absent from the Study Area. No Bobolink were observed during field investigations (habitat assessments) in June or July 2019.
Eastern Meadowlark	Meadows, hayfields and pastures; also, other open habitat types including mown lawn (COSEWIC 2011b). Prefers large (~5 ha), low-lying wet grasslands with abundant litter (COSEWIC 2011b).	**Habitat Present.** Eastern Meadowlark was observed in the meadow community (MEGM3) in the east of the Study Area in June and July 2019.
MAMMALS		
Small-footed Myotis	Small-footed myotis hibernate in caves and abandoned mines in winter, and roost under rocks, in rock outcrops, buildings, under bridges, or in caves, mines, or hollow trees in the spring and summer (MNRF 2017).	**Suitable Habitat Present.** Suitable roosting habitat is available on the bridge structure.
Little Brown Myotis	Trees, buildings and bridges for roosting; trees for nesting; caves and mines for hibernation (COSEWIC 2013).	**Suitable Habitat Present.** Candidate maternity roost trees were identified within suitable ELC communities.
Northern Myotis	Caves provide overwintering habitat (COSEWIC 2013). Rarely uses human-made structures for roosting (COSEWIC 2013).	**Suitable Habitat Present.** Candidate maternity roost trees were identified within suitable ELC communities.
Tri-colored Bat	Found in a variety of habitats; caves provide overwintering habitat (COSEWIC 2013).	**Suitable Habitat Present.** Candidate maternity roost trees were identified within suitable ELC communities.

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APPENDIX B

Table B-3 Aquatic Species Recorded in the Thorndale Bridge Study Area

Common Name	Scientific Name	Provincial S-rank	SARO Status	SARA Schedule 1	Source
SAR					
Black Redhorse	*Moxostoma duquesnei*	S2	THR	THR	DFO, 2019
Eastern Sand Darter	*Ammocrypta pellucida*	S2	END	THR	DFO, 2019
Rayed Bean	*Villosa fabale*	S1	END	END	NHIC, 2019; Stantec, 2020
Silver Shiner	*Notropis photogenis*	S2/S3	THR	THR	DFO, 2019
Wavy-rayed Lampmussel	*Lampsilis fasciola*	S1	THR	SC	NHIC, 2019; Stantec, 2020
SOCC					
Elktoe	*Alasmidonta marginata*	S3	NAR	NAR	MNRF, 2019; Stantec, 2020
Greater Redhorse	*Moxostoma valenciennesi*	S3	NAR	NAR	MNRF, 2019
Greenside Darter	*Etheostoma blennioides*	S4	NAR	SC	LIO, 2019
Mucket	*Actinonaias ligamentina*	S3	NAR	NAR	MNRF, 2019
Northern Sunfish	*Lepomis peltastes*	S3	SC	SC	DFO, 2019
Purple Wartyback	*Cyclonaias tuberculata*	S3	NAR	NAR	MNRF, 2019; Stantec, 2020
Rainbow	*Villosa iris*	S2/S3	SC	SC	DFO, 2019; Stantec, 2020
NAR					
Black Bullhead	*Ameiurus melas*	S4	NAR	NAR	LIO, 2019
Blackside Darter	*Percina maculata*	S4	NAR	NAR	LIO, 2019
Bluntnose Minnow	*Pimephales notatus*	S5	NAR	NAR	MNRF, 2019
Brook Stickleback	*Culaea inconstans*	S5	NAR	NAR	LIO, 2019
Central Stoneroller	*Campostoma anomalum*	S4	NAR	NAR	LIO, 2019
Common Carp	*Cyprinus carpio*	SNA	NAR	NAR	LIO, 2019
Common Shiner	*Luxilus cornutus*	S5	NAR	NAR	LIO, 2019
Fantail Darter	*Etheostoma flabellare*	S4	NAR	NAR	MNRF, 2019
Golden Redhorse	*Moxostoma erythrurum*	S4	NAR	NAR	LIO, 2019
Johnny Darter	*Etheostoma nigrum*	S5	NAR	NAR	LIO, 2019
Johnny Darter/Tessellated Darter	*Etheostoma nigrum/Etheostoma olmstedi*	S5/S4	NAR	NAR	LIO, 2019
Largemouth Bass	*Micropterus salmoides*	S5	NAR	NAR	LIO, 2019

APPENDIX B

Common Name	Scientific Name	Provincial S-rank	SARO Status	SARA Schedule 1	Source
Mimic Shiner	*Notropis volucellus*	S5	NAR	NAR	LIO, 2019
Muskellunge	*Esox masquinongy*	S4	NAR	NAR	LIO, 2019
Northern Hog Sucker	*Hypentelium nigricans*	S4	NAR	NAR	LIO, 2019
Northern Pike	*Esox lucius*	S5	NAR	NAR	LIO, 2019
Pumpkinseed	*Lepomis gibbosus*	S5	NAR	NAR	LIO, 2019
Rainbow Darter	*Etheostoma caeruleum*	S4	NAR	NAR	LIO, 2019
Rock Bass	*Ambloplites rupestris*	S5	NAR	NAR	LIO, 2019
Rosyface Shiner	*Notropis rubellus*	S4	NAR	NAR	MNRF, 2019
Smallmouth Bass	*Micropterus dolomieu*	S5	NAR	NAR	LIO, 2019
Spotfin Shiner	*Cyprinella spiloptera*	S4	NAR	NAR	LIO, 2019
Striped Shiner	*Luxilus chrysocephalus*	S4	NAR	NAR	LIO, 2019
Stonecat	*Noturus flavus*	S4	NAR	NAR	MNRF, 2019
White Sucker	*Catostomus commersonii*	S5	NAR	NAR	LIO, 2019
Yellow Bullhead	*Ameiurus natalis*	S4	NAR	NAR	LIO, 2019
Fluted Shell	*Lasmigona costata*	S5	NAR	NAR	Stantec, 2020
Plain Pocketbook	*Lampsilis cardium*	S4	NAR	NAR	Stantec, 2020
Spike	*Elliptio dilatata*	S5	NAR	NAR	Stantec, 2020
Creeper	*Strophitus udulatus*	S5	NAR	NAR	Stantec, 2020

VASCULAR PLANT LIST - Thorndale Rd. Bridge Replacement, Middlesex County, ON

Plant Species Observed next to the Thames River by B. Miller on June 21, 2019

NORTH-WEST OF BRIDGE	NORTH-EAST OF BRIDGE	SOUTH-WEST OF BRIDGE	SOUTH-EAST OF BRIDGE	SCIENTIFIC NAME	COMMON NAME	PROVINCIAL STATUS (S-RANK)	COSEWIC / SARO STATUS	COEFFICIENT OF CONSERVATISM	COEFFICIENT OF WETNESS
				PTERIDOPHYTES (Ferns & Fern Allies)					
	x	x		Equisetum arvense	Field Horsetail	S5		0	0
	x			Equisetum fluviatile	Water Horsetail	S5		7	-5
				GYMNOSPERMS (Conifers)					
	x			Picea glauca	White Spruce (PLANTED)	S5		6	3
	x			Pinus strobus	Eastern White Pine (PLANTED)	S5		4	3
x	x			Pinus sylvestris	Scots Pine	SE5			3
	x			Thuja occidentalis	Eastern White Cedar (PLANTED)	S5		4	-3
				ANGIOSPERMS (Dicots)					
x		x	x	Acer negundo	Manitoba Maple	S5		0	0
	x		x	Acer saccharum	Sugar Maple	S5		4	3
	x			Acer x freemanii	Freeman's (Swamp) Maple	S5		6	-5
x				Achillea millefolium	Common Yarrow	SE			3
	x	x		Agrimonia sp.	Agrimony Species				
x	x	x	x	Alliaria petiolata	Garlic Mustard	SE5			0
x	x	x	x	Ambrosia trifida	Great Ragweed	S5		0	0
x		x		Anemonastrum canadense	Canada Anemone	S5		3	-3
x				Anemone virginiana	Tall Anemone	S5		4	3
		x		Angelica atropurpurea	Purple-stemmed Angelica	S5		6	-5
x	x	x	x	Arctium minus	Common Burdock	SE5			3
x	x			Asclepias syriaca	Common Milkweed	S5		0	5
			x	Berberis thunbergii	Japanese Barberry	SE5			3
	x	x	x	Calystegia sepium	Hedge False Bindweed	S5		2	0
	x			Cardamine pensylvanica	Pennsylvania Bittercress	S5		6	-3
x	x		x	Celtis occidentalis	Common Hackberry	S4		8	0
x				Cerastium fontanum	Mouse-ear Chickweed	SE5			3
	x	x		Chelone glabra	White Turtlehead	S5		7	-5
x	x	x	x	Circaea canadensis	Enchanter's Nightshade	S5		2	3
	x	x		Clematis virginiana	Virginia Virgin's-bower	S5		3	0
x				Clinopodium vulgare	Field Basil	S5		4	5
	x	x		Cornus alternifolia	Alternate-leaved Dogwood	S5		6	3
x	x			Cornus racemosa	Gray Dogwood	S5		2	0

VASCULAR PLANT LIST - Thorndale Rd. Bridge Replacement, Middlesex County, ON

Plant Species Observed next to the Thames River by B. Miller on June 21, 2019

NORTH-WEST OF BRIDGE	NORTH-EAST OF BRIDGE	SOUTH-WEST OF BRIDGE	SOUTH-EAST OF BRIDGE	SCIENTIFIC NAME	COMMON NAME	PROVINCIAL STATUS (S-RANK)	COSEWIC / SARO STATUS	COEFFICIENT OF CONSERVATISM	COEFFICIENT OF WETNESS
x	x			Crataegus monogyna	English Hawthorn	SE4			3
x				Crataegus cf. punctata	Dotted Hawthorn	S5		4	5
		x		Crataegus sp.	Hawthorn				
x				Daucus carota	Wild Carrot	SE5			5
	x			Echium vulgare	Common Viper's Bugloss	SE5			5
x				Erigeron annuus	Annual Fleabane	S5		0	3
		x		Erigeron philadelphicus	Philadelphia Fleabane	S5		1	-3
x				Erysimum cheiranthoides	Wormseed Wallflower	S5			3
			x	Euonymus obovatus	Running Strawberry Bush	S4		6	5
	x	x		Eutrochium maculatum	Spotted Joe Pye Weed	S5		3	-5
	x			Fragaria vesca	Woodland Strawberry	S5		4	3
x				Fragaria virginiana	Wild Strawberry	S5		2	3
		x		Fraxinus americana	White Ash	S4		4	3
	x	x	x	Fraxinus pennsylvanica	Green Ash	S4		3	-3
		x	x	Galium aparine	Cleavers	S5		4	3
x	x		x	Galium mollugo	Smooth Bedstraw	SE5			5
	x			Geranium maculatum	Spotted Geranium	S5		6	3
	x			Geranium robertianum	Herb-Robert	S5		2	3
x	x	x	x	Geum canadense	White Avens	S5		3	0
x	x	x		Glechoma hederacea	Ground Ivy	SE5			3
	x			Heracleum mantegazzianum	Giant Hogweed	SE2			0
		x		Heracleum maximum	Cow-parsnip	S5		3	-3
x	x	x	x	Hesperis matronalis	Dame's Rocket	SE5			3
x				Hypericum perforatum	Common St. John's-wort	SE5			5
	x	x		Impatiens capensis	Spotted Jewelweed	S5		4	-3
x	x	x	x	Impatiens glandulifera	Purple Jewelweed	SE4			-3
		x		**Juglans cinerea**	**Butternut**	**S2?**	**END**	**6**	**3**
x	x	x	x	Juglans nigra	Black Walnut	S4?		5	3
x			x	Lapsana cf. communis	Common Nipplewort	SE5			3
	x			Leonurus cardiaca	Common Motherwort	SE5			5
x				Leucanthemum vulgare	Oxeye Daisy	SE5			5
x	x			Lonicera morrowii	Morrow's Honeysuckle	SE3			3
x				Lotus corniculatus	Garden Bird's-foot Trefoil	SE5			3
x	x			Lysimachia ciliata	Fringed Loosestrife	S5		4	-3

VASCULAR PLANT LIST - Thorndale Rd. Bridge Replacement, Middlesex County, ON

Plant Species Observed next to the Thames River by B. Miller on June 21, 2019

NORTH-WEST OF BRIDGE	NORTH-EAST OF BRIDGE	SOUTH-WEST OF BRIDGE	SOUTH-EAST OF BRIDGE	SCIENTIFIC NAME	COMMON NAME	PROVINCIAL STATUS (S-RANK)	COSEWIC / SARO STATUS	COEFFICIENT OF CONSERVATISM	COEFFICIENT OF WETNESS
	x	x		Lysimachia nummularia	Creeping Jennie	SE5			-3
x	x			Lythrum salicaria	Purple Loosestrife	SE5			-5
x			x	Medicago lupulina	Black Medic	SE5			3
x				Melilotus sp.	Sweet-clover	SE5			
	x			Mentha canadensis	Canada Mint	S5		3	-3
			x	Morus alba	White Mulberry	SE5			0
	x			Myosotis scorpioides	True Forget-me-not	SE5			-5
x	x	x	x	Parthenocissus vitacea	Thicket Creeper	S5		4	3
x	x			Physocarpus opulifolius	Eastern Ninebark	S5		5	-3
x				Plantago lanceolata	English Plantain	SE5			3
x				Plantago rugelii	Rugel's Plantain	S5		1	0
	x			Podophyllum peltatum	May-apple	S5		5	3
			x	Populus alba	White Poplar	SE5			5
x				Populus deltoides ssp. deltoides	Eastern Cottonwood	S5		4	0
	x		x	Potentilla recta	Sulphur Cinquefoil	SE5			5
x				Potentilla sp.	Cinquefoil Species				
	x			Prunus avium	Sweet Cherry	SE4			5
x	x	x	x	Prunus virginiana	Choke Cherry	S5		2	3
	x			Quercus macrocarpa	Bur Oak	S5		5	3
	x			Quercus rubra	Northern Red Oak	S5		6	3
x	x	x	x	Ranunculus acris	Tall Buttercup	SE5			0
		x	x	Ranunculus repens	Creeping Buttercup	SE5			0
x	x	x	x	Rhamnus cathartica	Common Buckthorn	SE5			0
x				Ribes sp.	Currant Species (Exotic)	SE			
x				Robinia pseudoacacia	Black Locust	SE5			3
	x			Rosa multiflora	Multiflora Rose	SE5			3
x	x	x	x	Rubus occidentalis	Black Raspberry	S5		2	5
	x			Rudbeckia laciniata	Cut-leaved Coneflower	S5		7	-3
	x	x	x	Rumex obtusifolius	Bitter Dock	SE5			-3
		x		Salix amygdaloides	Peach-leaved Willow	S5		6	-3
x		x	x	Salix sp.	Willow (Exotic)	SE			
	x			Sanguinaria canadensis	Bloodroot	S5		5	3
x				Scrophularia marilandica	Carpenter's Square Figwort	S4		7	3
x				Sinapis cf. arvensis	Corn Mustard	SE5			5

VASCULAR PLANT LIST - Thorndale Rd. Bridge Replacement, Middlesex County, ON

Plant Species Observed next to the Thames River by B. Miller on June 21, 2019

NORTH-WEST OF BRIDGE	NORTH-EAST OF BRIDGE	SOUTH-WEST OF BRIDGE	SOUTH-EAST OF BRIDGE	SCIENTIFIC NAME	COMMON NAME	PROVINCIAL STATUS (S-RANK)	COSEWIC / SARO STATUS	COEFFICIENT OF CONSERVATISM	COEFFICIENT OF WETNESS
		x		Solanum dulcamara	Bittersweet Nightshade	SE5			0
x				Solidago altissima	Tall Goldenrod	S5		1	3
			x	Solidago flexicaulis	Zigzag Goldenrod	S5		6	3
x	x	x	x	Solidago gigantea	Giant Goldenrod	S5		4	-3
x				Symphyotrichum novae-angliae	New England Aster	S5		2	-3
	x			Symphyotrichum puniceum	Swamp Aster	S5		6	-5
x		x		Taraxacum officinale	Common Dandelion	SE5			3
	x		x	Thalictrum dioicum	Early Meadow-rue	S5		6	3
x	x		x	Tilia americana	American Basswood	S5		4	3
x				Toxicodendron radicans	Poison Ivy	S5		2	0
x				Tragopogon pratensis	Meadow Goat's-beard	SE5			5
x				Trifolium pratense	Red Clover	SE5			3
			x	Trifolium repens	White Clover	SE5			3
			x	Ulmus americana	American Elm	S5		3	-3
	x			Ulmus rubra	Slippery Elm	S5		6	0
x		x		Urtica dioica ssp. gracilis	Slender Stinging Nettle	S5		2	0
	x	x	x	Verbena urticifolia	White Vervain	S5		4	0
	x		x	Viburnum opulus ssp. opulus	Cranberry Viburnum	SE3?			-3
x				Vicia cracca	Tufted Vetch	SE5			5
x	x	x	x	Vincetoxicum rossicum	European Swallow-wort (Dog-strangling Vine)	SE5			5
		x		Viola sp.	Violet Species				
x	x	x	x	Vitis riparia	Riverbank Grape	S5		0	0
				ANGIOSPERMS (Monocots)					
		x		Allium canadense	Canada Garlic	S5		8	3
		x		Arisaema triphyllum	Jack-in-the-pulpit	S5		5	-3
x				Asparagus officinalis	Garden Asparagus	SE5			3
x				Bromus inermis	Smooth Brome	SE5			5
	x			Carex blanda	Woodland Sedge	S5		3	0
x				Carex hirta	Hammer Sedge	SE2			0
	x			Carex hystericina	Porcupine Sedge	S5		5	-5
x		x		Carex pellita	Woolly Sedge	S5		2	-5
	x			Carex rosea	Rosy Sedge	S5		2	5
x				Carex spicata	Spiked Sedge	SE5			3

VASCULAR PLANT LIST - Thorndale Rd. Bridge Replacement, Middlesex County, ON

Plant Species Observed next to the Thames River by B. Miller on June 21, 2019

NORTH-WEST OF BRIDGE	NORTH-EAST OF BRIDGE	SOUTH-WEST OF BRIDGE	SOUTH-EAST OF BRIDGE	SCIENTIFIC NAME	COMMON NAME	PROVINCIAL STATUS (S-RANK)	COSEWIC / SARO STATUS	COEFFICIENT OF CONSERVATISM	COEFFICIENT OF WETNESS
	x			Carex stipata	Awl-fruited Sedge	S5		3	-5
		x		Carex trichocarpa	Hairy-fruited Sedge	S3		8	-5
x	x	x	x	Dactylis glomerata	Orchard Grass	SE5			3
	x			Eleocharis sp.	Sprikerush Species				
	x			Glyceria striata	Fowl Mannagrass	S5		3	-5
	x			Hemerocallis fulva	Orange Daylily	SE5			5
		x		Iris versicolor	Harlequin Blue Flag	S5		5	-5
x				Lolium arundinaceum	Tall Fescue	SE5			3
	x			Maianthemum racemosum	False Solomon's Seal	S5		4	3
x	x	x	x	Phalaris arundinacea	Reed Canary Grass	S5		0	-3
x				Phleum pratense	Common Timothy	SE5			3
x		x		Poa pratensis	Kentucky Bluegrass	S5		0	3
			x	Poa sp.	Bluegrass Species				
		x		Scilla siberica	Siberian Squill	SE2			5
	x	x		Symplocarpus foetidus	Skunk Cabbage	S5		7	-5
	x			Trillium grandiflorum	White Trillium	S5		5	3

FLORISTIC SUMMARY	TOTAL
Total Species	139
Native Species	83
Introduced (exotic) species	56
Species at Risk in Ontario (END, THR or SC)	1
Rare in Ontario (S1, S2 or S3)	2
Uncommon to common in Ontario (S4)	6
Common to very common in Ontario (S5)	75
Highly sensitive plant species with C value of 8, 9 or 10	3
Wetland Plant Species (-5, -4 or -3)	36

APPENDIX C
Relevant Correspondence

Stantec Consulting Ltd.
600-171 Queens Avenue, London ON N6A 5J7

October 15, 2019
File: 165001122

Attention: **Karina Černiavskaja, District Planner**
Ministry of Natural Resources and Forestry, Aylmer District
615 John St. N. Aylmer, ON N5H 2S8
Tel: 519-773-4757 | Fax: 519-773-9014 | Email: karina.cerniavskaja@ontario.ca

Dear Karina,

Reference: Natural Heritage Information Request for Middlesex County Thorndale Bridge Improvements

Middlesex County is undertaking a Municipal Class Environmental Assessment (EA) study for improvements to the Thorndale Bridge on County Road 28 (Thorndale Road; Figure 1). The existing bridge is approximately 65 years old and has been identified for replacement within the next 10 years. To establish the most appropriate solution to this need, the study will consider alternative solutions, including: do nothing (retain the existing bridge as is), rehabilitation or replacement of the Thorndale Bridge. Alternatives will be evaluated based on a range of factors and criteria. The study is being undertaken in accordance with the requirements for Schedule 'C' projects within the Municipal Class EA document (October 2000, as amended in 2007, 2011 & 2015), under the Ontario Environmental Assessment Act.

The purpose of this letter is to request your input with respect to existing conditions within the Study Area, and to identify issues, concerns, or approval requirements that the Ministry of Natural Resources and Forestry (MNRF) may have. Stantec has conducted a search of the Natural Heritage Information Center (NHIC) Database, natural heritage data on MNRF's Land Information Ontario (LIO) mapping website and the Ontario Reptile and Amphibian Atlas (ORAA), but we would like to request updates and/or corrections to the information, as available. This information is required to complete our natural heritage review for the project.

FISH AND FISH HABITAT

A background review was completed to identify fish and fish habitat, and aquatic species at risk (SAR) or rare species in the vicinity of the Study Area. The North Thames River within the Study Area (Figure 1; UTM coordinates 17T 486292.00 m E and 4771516.00 m N) is a permanent, warm-water, fish-bearing river. The LIO database includes fish species lists for the North Thames River in the Study Area (Table 1). Fish and mussel SAR recorded in the NHIC database and Fisheries and Oceans Canada (DFO) Aquatic Species at Risk mapping are also included in Table 1, below.

Table 1: Aquatic species recorded in the Study Area

Common Name	Scientific Name	Provincial S-rank	SARO Status	Source (2019)
Black Bullhead	*Ameiurus melas*	S4		LIO

Black Redhorse	*Moxostoma duquesnei*	S2	THR	DFO
Blackside Darter	*Percina maculata*	S4		LIO
Brook Stickleback	*Culaea inconstans*	S5		LIO
Central Stoneroller	*Campostoma anomalum*	S4	NAR	LIO
Common Carp	*Cyprinus carpio*	SNA		LIO
Common Shiner	*Luxilus cornutus*	S5		LIO
Eastern Sand Darter	*Ammocrypta pellucida*	S2	END	DFO
Golden Redhorse	*Moxostoma erythrurum*	S4	NAR	LIO
Greenside Darter	*Etheostoma blennioides*	S4		LIO
Johnny Darter	*Etheostoma nigrum*	S5		LIO
Johnny Darter/Tesselated Darter	*Etheostoma nigrum/Etheostoma olmstedi*			LIO
Largemouth Bass	*Micropterus salmoides*	S5		LIO
Mimic Shiner	*Notropis volucellus*	S5		LIO
Muskellunge	*Esox masquinongy*	S4		LIO
Northern Hog Sucker	*Hypentelium nigricans*	S4		LIO
Northern Pike	*Esox lucius*	S5		LIO
Northern Sunfish	*Lepomis peltastes*	S3	SC	DFO
Pumpkinseed	*Lepomis gibbosus*	S5		LIO
Rayed Bean	*Villosa fabale*	S1	END	NHIC
Wavy-rayed Lampmussel	*Lampsilis fasciola*	S1	THR	NHIC
Rainbow	*Villosa iris*	S2/S3	SC	DFO
Rainbow Darter	*Etheostoma caeruleum*	S4		LIO
Rock Bass	*Ambloplites rupestris*	S5		LIO
Silver Shiner	*Notropis photogenis*	S2/S3	THR	DFO
Smallmouth Bass	*Micropterus dolomieu*	S5		LIO
Spotfin Shiner	*Cyprinella spiloptera*	S4		LIO

Striped Shiner	*Luxilus chrysocephalus*	S4	NAR	LIO
White Sucker	*Catostomus commersonii*	S5		LIO
Yellow Bullhead	*Ameiurus natalis*	S4		LIO

Field assessment

A fish habitat assessment, conducted on August 22, 2019, found shell evidence for the following mussel species within the Study Area:

- Rayed Bean (*Villosa fabale*)
- Wavy-rayed Lampmussel (*Lampsilis fasciola*)
- Rainbow (*Villosa iris*)
- Fluted Shell (*Lasmigona costata*)
- Plain Pocketbook (*Lampsilis cardium*)
- Spike (*Elliptio dilatata*)
- Creeper (*Strophitus udulatus*)
- Elktoe (*Alasmidonta marginata*)
- Purple Wartyback (*Cyclonaias tuberculata*)

Substrates within the Study Area were generally dominated by gravel and cobble with silt, sand and boulder present in lower proportion. Sand substrates were in higher proportion on the east side of the river. In-stream cover was provided by deep pools, cobble, boulder and aquatic macrophytes. Riparian vegetation within 5m of the banks of the river included bull rushes, cut grass, reed canary grass, Joe Pye weed, giant ragweed, willow and jewel weed. Riffle and run morphologies dominated the area in the vicinity of Thorndale Bridge.

We are requesting confirmation or updates to the following information related to fish and fish habitat in the Study Area:

- Species/community information from locations within the Study Area (Figure 1)
- Watercourse thermal regime(s) and flow regime(s)
- Special habitat features (e.g. groundwater upwelling, spawning areas, refugia, migratory routes)
- In-water construction timing window(s)
- MNRF fisheries management objectives, if applicable

TERRESTRIAL RESOURCES

A background review was completed to identify species at risk or rare species and natural areas in the vicinity of the Study Area. The NHIC database, eBird database and the Ontario Reptile and Amphibian Atlas had records of six provincially rare or at-risk species within the vicinity of the Study Area (Table 2).

Table 2: Recent records of rare terrestrial species or terrestrial Species at Risk (1980 – present).

Common Name	Latin Name	Provincial S-rank	SARO Status	Source (2019)
Hairy-fruited Sedge	*Carex trichocarpa*	S3		NHIC
Spring Blue-eyed Mary	*Collinsia verna*	SX	EXP	NHIC
Snapping Turtle	*Chelydra serpentina*	S3	SC	ORAA
Milksnake	*Lampropeltis triangulum*	S3		ORAA
Eastern Wood-pewee	*Contopus virens*	S4B	SC	eBird
Barn Swallow	*Hirundo rustica*	S4B	THR	eBird

Other species which may be present based on range overlap and general habitat availability include: Butternut, Queensnake, Eastern Spiny Softshell, Eastern Meadowlark, Bobolink, Bank Swallow and Wood Thrush.

No natural features were identified in the vicinity of the Study Area.

CLOSING

We respectfully request confirmation of the above findings and the identification of any additional natural heritage resources information you may have for the Study Area. We have also contacted the MECP with respect to provincially protected species at risk that may occur in the Study Area.

Please contact the undersigned if you have any questions regarding this information request.

Regards,

Stantec Consulting Ltd.

Joe Keene, M.Sc.
Senior Benthic Ecologist
Phone: 519 780-8152
Fax: 519 836-2493
joe.keene@stantec.com

Melissa Cameron M.Sc., M.LA.
Ecologist / Landscape Architect
Phone: 519 645 3351

melissa.cameron@stantec.com

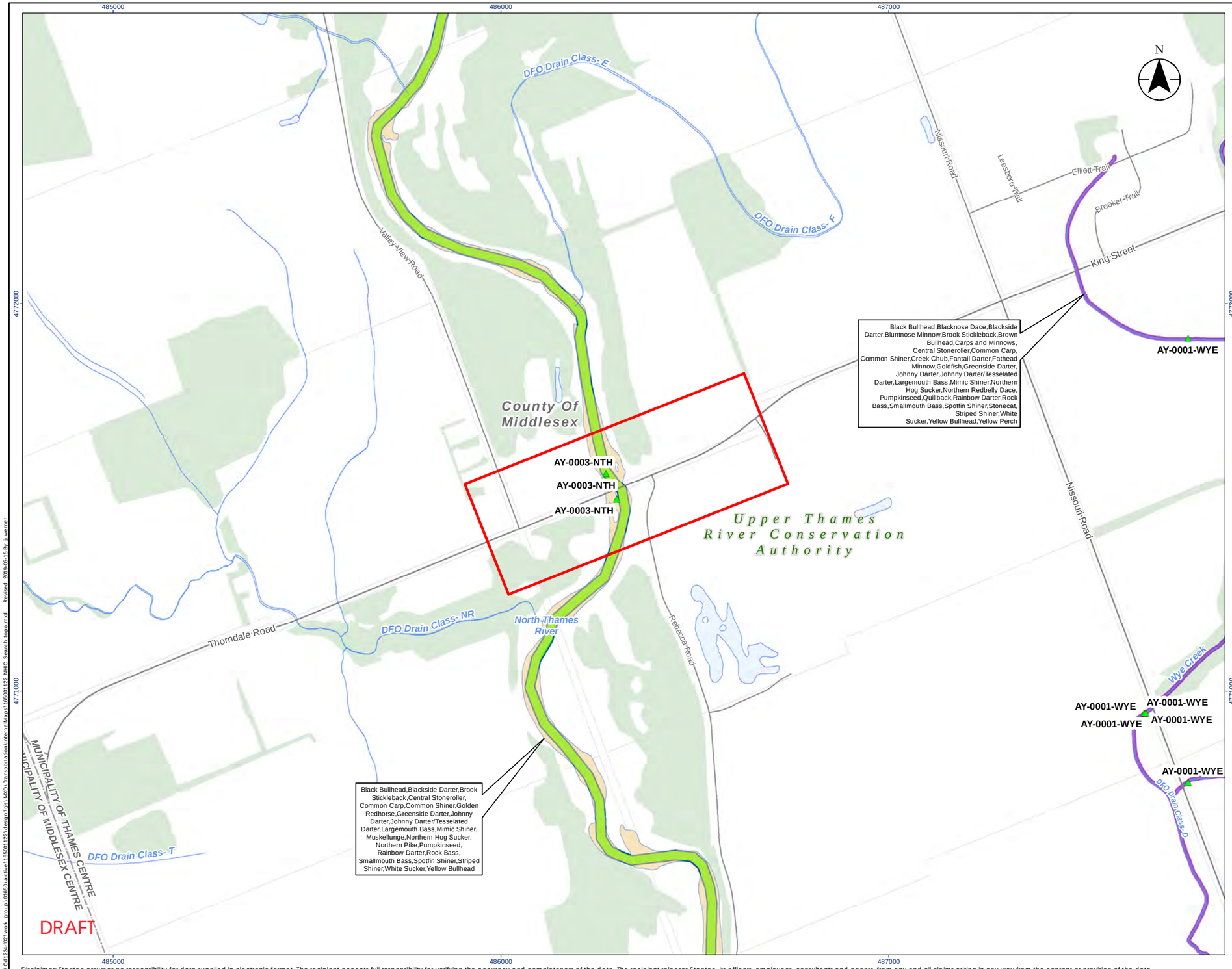
Reference: **Natural Heritage Information Request for Middlesex County Thorndale Bridge Improvements**

Attachment 1: Figure 1

c. Isaac Bartlett, Paula Burnard, Julie Werner – Stantec Consulting Ltd.
SAROntario@ontario.ca

em \\ca0217-ppfss01\work_group\01650\active\165001122\design\environmental\consultation\info request\let_nat_her_ir_20191011.docx

ATTACHMENT 1:
Figure 1



Stantec

Legend

- Study Area
- Fish Survey Point (ARA)
- Constructed Drain
- Thermal Regime, Cold
- Watercourse (Permanent)
- Conservation Area Administrative Boundary
- Thermal Regime, Warm
- Aquatic Species at Risk Distribution
- Aquatic Species at Risk Critical Habitat
- Waterbody
- Wooded Area
- Lot
- Municipal Boundary, Upper
- Municipal Boundary, Lower

0 100 200 Meters

1:10,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2019.

Project Location
Municipality of Thames Centre

165001122 REVA
Prepared by JW on 2019-05-15
Technical Review by ABC on yyyy-mm-dd
Independent Review by ABC on yyyy-mm-dd

Client/Project
MIDDLESEX COUNTY
THORNDALE BRIDGE IMPROVEMENTS
COUNTY ROAD 28 (THORNDALE ROAD)

Figure No.
1

DRAFT

Title
Background Data

Cameron, Melissa

From: Philip Simm <SimmP@thamesriver.on.ca>
Sent: Monday, June 17, 2019 3:11 PM
To: Werner, Julie
Subject: RE: Thorndale Bridge Improvements - EA

Follow Up Flag: Follow up
Flag Status: Completed

Hi Julie,
I have uploaded some data to our ftp site:

- Natural Heritage Features
- Natural Hazards Features
- Drinking Water Source Protection Area Features
- UTRCA Owned Lands data

https://ftp.thamesriver.on.ca/?u=J8pL3sB5&p=3K0zSR8O

These layers:

- Hydrology Data – HEC-RAS, Flow Files
- Fish/Mussel data
- Benthic Sampling Records
- Terrestrial Species At Risk data
- Aquatic Species At Risk data

Have to come from other staff and I will pass them on as I get them.

I didn't start at UTRCA until Feb 2004 so I think I just missed you (you might have been thinking of Terry Chapman - he's still here).
I was recently updating our trails layer and some of your GPS work is still there (and the last time it was done...yikes!).

phil.

UPPER THAMES RIVER
CONSERVATION AUTHORITY

Philip Simm
GIS Specialist
1424 Clarke Road London, Ontario, N5V 5B9#
519.451.2800 Ext. 247 | Fax: 519.451.1188
simmp@thamesriver.on.ca | www.thamesriver.on.ca

>>> "Werner, Julie" <Julie.Werner@stantec.com> 6/10/2019 9:32 AM >>>
Good morning Phil,

Thank you for your email, I have attached our study area (NAD83 UTM 17) along with the email from Karen Winfield for context to this request. The layers we are interested in include:

- Natural Heritage Features
- Natural Hazards Features
- Drinking Water Source Protection Area Features
- Hydrology Data – HEC-RAS, Flow Files
- Fish/Mussel data
- Benthic Sampling Records
- Terrestrial Species At Risk data
- Aquatic Species At Risk data
- UTRCA Owned Lands data

Please let me know if you have any questions or require any clarifications. Also, I am not sure if you remember me but I used to work with you and Chris Harrington when I was a student at Western finishing up my Geography degree back in 2002. I am friends with Julie Welker still and ended up marrying Jeff Hill who was the marketing person at UTRCA while I was there.

Thanks again for your help.

Julie Werner B.A., GISP
Environmental Planner, GIS Analyst

Direct: 905 381-3245
Mobile: 905 928-9240
Julie.Werner@stantec.com

Stantec
200-835 Paramount Drive
Stoney Creek ON L8J 0B4

From: Philip Simm <SimmP@thamesriver.on.ca>
Sent: Monday, June 10, 2019 8:20 AM
To: Werner, Julie <Julie.Werner@stantec.com>
Subject: Thorndale Bridge Improvements - EA

Hi Julie,
Please forward a polygon of the extent required and a list of layers you think you might need.

Regards,
phil.

Philip Simm
GIS Specialist
1424 Clarke Road London, Ontario, N5V 5B9#
519.451.2800 Ext. 247 | Fax: 519.451.1188
simmp@thamesriver.on.ca | www.thamesriver.on.ca

recipient immediately notify the sender and permanently delete this message without reviewing, copying, forwarding, disclosing or otherwise using it or any part of it in any form whatsoever.>

<The contents of this e-mail and any attachments are intended for the named recipient(s). This e-mail may contain information that is privileged, confidential and/or exempt from disclosure under applicable law. If you have received this message in error, are not the named recipient(s), or believe that you are not the intended recipient immediately notify the sender and permanently delete this message without reviewing, copying, forwarding, disclosing or otherwise using it or any part of it in any form whatsoever.>

Cameron, Melissa

From: Cerniavskaja, Karina (MNRF) <Karina.Cerniavskaja@ontario.ca>
Sent: Wednesday, October 16, 2019 8:28 AM
To: Cameron, Melissa
Cc: Werner, Julie; Hohner, Paula; Harttrup, Nancy; Bartlett, Isaac; Keene, Joe; Species at Risk (MECP)
Subject: RE: Natural Heritage Information Request - Thorndale Bridge

Good morning Melissa,

Thank you for your email and letter.

I have circulated your email and letter with appropriate Ministry of Natural Resources and Forestry, Aylmer District staff for review and comment.

Please let me know if you have any questions.

Thanks again,
Karina

Karina Černiavskaja, District Planner
Ministry of Natural Resources and Forestry, Aylmer District
615 John St. N. Aylmer, ON N5H 2S8
Tel: 519-773-4757 | Fax: 519-773-9014 | Email: karina.cerniavskaja@ontario.ca

As part of providing accessible customer service, please let me know if you have any accommodation needs or require communication supports or alternate formats.

From: Cameron, Melissa <Melissa.Cameron@stantec.com>
Sent: October-15-19 4:19 PM
To: Cerniavskaja, Karina (MNRF) <Karina.Cerniavskaja@ontario.ca>
Cc: Werner, Julie <Julie.Werner@stantec.com>; Hohner, Paula <Paula.Hohner@stantec.com>; Harttrup, Nancy <nancy.harttrup@stantec.com>; Bartlett, Isaac <isaac.bartlett@stantec.com>; Keene, Joe <Joe.Keene@stantec.com>; Species at Risk (MECP) <SAROntario@ontario.ca>
Subject: Natural Heritage Information Request - Thorndale Bridge

Good afternoon Karina,

Thank you for providing comments on the Notice of Public Information Centre 1. Please find attached a letter requesting natural heritage data relevant to the Middlesex County Thorndale Bridge improvements (Municipal Class EA Study). We have completed a preliminary screening based on publicly-available data sources and request your confirmation of our findings or any additional natural heritage data you may have. A copy is also being provided to MECP for their information. Based on our interpretation of MECP's Draft Proponent's Guide to Preliminary Screening for Species at Risk, consultation with an MECP biologist is initiated once results of field investigations are available and potential project impacts are understood.

Thank you again, and best regards,

Melissa

Melissa Cameron M.Sc, M.LA, OALA
Ecologist / Landscape Architect

Direct: 519 645-3351
Mobile: 226 971-0042
melissa.cameron@stantec.com

Stantec

From:	Buck, Kathleen (MNRF)
To:	Cameron, Melissa
Cc:	MNRF Ayl Planners (MNRF); Werner, Julie; Hohner, Paula; Harttrup, Nancy; Bartlett, Isaac; Keene, Joe
Subject:	RE: Natural Heritage Information Request - Thorndale Bridge
Date:	Thursday, October 31, 2019 2:57:20 PM
Attachments:	image001.png let_nat_her_ir_20191015.pdf NHGuide_MNRF_2019-04-01.pdf

Good afternoon Melissa,

I've reviewed the attached preliminary screening of available background data for Middlesex County's Municipal Class Environmental Assessment study for improvements to the Thorndale Bridge on County Road 28 (Thorndale Road) in the Municipality of Thames Centre, Middlesex County. Please see the additional information that we have available for the Study Area:

Fish and Fish Habitat

- Fish Species Summary: Blackside Darter, Black Bullhead, Blackside Darter, Bluntnose Minnow, Brook Stickleback, Common Shiner, Central Stoneroller, Common Carp, Elktoe, Fantail Darter, Golden Redhorse, Greater Redhorse, Greenside Darter, Johnny Darter, Johnny Darter/Tesselated Darter, Largemouth Bass, Mimic Shiner, Muskellunge, Mucket, Northern Hog Sucker, Northern Pike, Pumpkinseed, Purple Wartyback, Rainbow Darter, Rock Bass, Smallmouth Bass, Rosyface Shiner, Smallmouth Bass, Stonecat, Spotfin Shiner, Striped Shiner, White Sucker, Yellow Bullhead
- Thermal Regime: Warm
- Restricted In-Water Work Timing Window: March 15-July 15

Terrestrial Resources

There are no Areas of Natural and Scientific Interest (ANSIs) or Provincially Significant Wetlands (PSWs) within or adjacent to the project area.

Species of Conservation Concern

The habitat of provincially rare (S1-S3, SH) and Special Concern species is considered Significant Wildlife Habitat under the category of 'Special Concern and Rare Wildlife Species' in the Significant Wildlife Habitat Technical Guide Ecoregion Criteria Schedules. Therefore, consideration should be given to these species and whether their habitat occurs on or within 120 m of the Study Area. The following Species of Conservation Concern (provincially tracked species) are located in the vicinity of the Study Area. Please note, this does not include species that are listed on the Species at Risk in Ontario (SARO) List. To ensure access to reliable and up to date information, please contact SAROntario@ontario.ca.

- Hairy-fruited Sedge (S3)
- Lizard's-tail (S3)
- Narrow-leaved Wild Leek (S1?)
- Striped Cream Violet (S3)
- Elktoe (S3)
- Great Egret (S2B)
- Greater Redhorse (S3)

Mucket (S3)
- Prairie Milkweed (S2S3)
- Purple Wartyback (S3)

The attached *Natural Heritage Information Request Guide* has been developed to assist you with accessing additional natural heritage data and values from convenient online sources.

It remains the proponent's responsibility to complete a preliminary screening for each project, to obtain available information from multiple sources, to conduct any necessary field studies, and to consider any potential environmental impacts that may result from an activity. We wish to emphasize the need for the proponents of development activities to complete screenings prior to contacting the Ministry or other agencies for more detailed technical information and advice.

The Ministry continues to work on updating data housed by Lands Information Ontario and the Natural Heritage Information Centre, and ensuring this information is accessible through online resources. Species at risk data is regularly being updated. To ensure access to reliable and up to date information, please contact SAROntario@ontario.ca.

This information will assist in scoping the necessary field assessments for an area if development or site alteration is proposed. This information is not meant to circumvent the responsibility of the proponent to undertake species and / or habitat surveys. Surveys or additional site level assessment are often required to confirm presence or absence of natural heritage features and values. Environmental consulting firms have the professional and technical expertise to assess sites for natural heritage features and can gauge the potential for such features to exist.

Absence or lack of information for a given geographic area does not necessarily mean the absence of natural heritage features. Many areas in Ontario have never been surveyed and new plant and animal species records are still being discovered for many localities. In addition, new species may be listed and new natural heritage features may be defined over time. For these reasons, the Ministry cannot provide a definitive statement on the presence, absence or condition of natural heritage features in all parts of Ontario.

Thank you for your inquiry.

Kathleen Buck, Management Biologist
Ministry of Natural Resources and Forestry, Aylmer District
615 John St. N. Aylmer, ON N5H 2S8
519-773-4785
kathleen.buck@ontario.ca

Ontario

From: Cameron, Melissa <Melissa.Cameron@stantec.com>
Sent: October-15-19 4:19 PM
To: Cerniavskaja, Karina (MNRF) <Karina.Cerniavskaja@ontario.ca>

Cc: Werner, Julie <Julie.Werner@stantec.com>; Hohner, Paula <Paula.Hohner@stantec.com>; Harttrup, Nancy <nancy.harttrup@stantec.com>; Bartlett, Isaac <isaac.bartlett@stantec.com>; Keene, Joe <Joe.Keene@stantec.com>; Species at Risk (MECP) <SAROntario@ontario.ca>
Subject: Natural Heritage Information Request - Thorndale Bridge

Good afternoon Karina,

Thank you for providing comments on the Notice of Public Information Centre 1. Please find attached a letter requesting natural heritage data relevant to the Middlesex County Thorndale Bridge improvements (Municipal Class EA Study). We have completed a preliminary screening based on publicly-available data sources and request your confirmation of our findings or any additional natural heritage data you may have. A copy is also being provided to MECP for their information. Based on our interpretation of MECP's Draft Proponent's Guide to Preliminary Screening for Species at Risk, consultation with an MECP biologist is initiated once results of field investigations are available and potential project impacts are understood.

Thank you again, and best regards,

Melissa

Melissa Cameron M.Sc, M.LA, OALA
Ecologist / Landscape Architect

Direct: 519 645-3351
Mobile: 226 971-0042
melissa.cameron@stantec.com

Stantec

From: Species at Risk (MECP) <SAROntario@ontario.ca>
Sent: Wednesday, January 15, 2020 1:40 PM
To: Cameron, Melissa <Melissa.Cameron@stantec.com>
Subject: RE: NH Information Request - Thorndale Bridge, Middlesex

Hello Melissa,

RE: Thorndale Bridge over North Thames River, Municipality of Thames Centre, Middlesex County and the *Endangered Species Act, 2007*

The Ministry of Environment, Conservation and Parks (MECP) understands that Middlesex County is conducting a Municipal Class EA for bridge improvements along Thorndale Road, as identified in the information provided.

As requested, an initial species at risk (SAR) information screening has been completed under the *Endangered Species Act, 2007* (ESA 2007) by MECP's Species at Risk Branch (SARB) for the above-noted project location with respect to endangered and threated species in Ontario. There are known occurrences of the following endangered or threatened SAR in the general area with potential to occur at the project location:

- Silver Shiner (threatened, species and general habitat protection)
- Barn Swallow (threatened, species and general habitat protection)

Please note that this is an initial screening for endangered and threatened SAR and the absence of an element occurrence does not indicate the absence of species. The province has not been surveyed comprehensively for the presence or absence of SAR and Ontario's data relies on observers to report sightings of SAR. Field assessments by a qualified professional are recommended as there is a high likelihood for SAR species and/or habitat to occur within the project location. Also, attached are some documents that my be helpful to you.

The position of SARB is based on the information that has been provided by you on behalf of the County. Should information not have been made available and considered in our review, or new information comes to light, or if on-site conditions and circumstances

change, please contact SARB as soon as possible (SAROntario@ontario.ca) to discuss next steps.

Regards,

Catherine Stewart
Management Biologist
Permissions and Compliance, Species at Risk Branch
Ministry of Environment, Conservation and Parks

From: Cameron, Melissa <Melissa.Cameron@stantec.com>
Sent: October-15-19 4:19 PM
To: Cerniavskaja, Karina (MNRF) <Karina.Cerniavskaja@ontario.ca>
Cc: Werner, Julie <Julie.Werner@stantec.com>; Hohner, Paula <Paula.Hohner@stantec.com>; Harttrup, Nancy <nancy.harttrup@stantec.com>; Bartlett, Isaac <isaac.bartlett@stantec.com>; Keene, Joe <Joe.Keene@stantec.com>; Species at Risk (MECP) <SAROntario@ontario.ca>
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Thank you again, and best regards,

Melissa

Melissa Cameron M.Sc, M.LA, OALA
Ecologist / Landscape Architect

Direct: 519 645-3351
Mobile: 226 971-0042
melissa.cameron@stantec.com

Stantec

APPENDIX B.2

Tree Inventory

Thorndale Bride Replacement
Arborist Report

April 23, 2020

Prepared for:

Middlesex County
Administration Offices
399 Ridout Street North
London ON N6A 2P1

Prepared by:

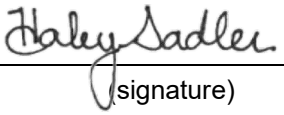
Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4

165001122

This document entitled Thorndale Bride Replacement Arborist Report was prepared by Stantec Consulting Ltd. (“Stantec”) for the account of Middlesex County (the “Client”) to support the permitting process for the Thorndale Bridge Replacement (the “Project”). In connection thereto, this document may be reviewed and used by the provincial and municipal government agencies participating in the permitting process in the normal course of their duties. Except as set forth in the previous sentence, any reliance on this document by any third party for any other purpose is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by 
(signature)

Landon Black, OALA, ISA Certified Arborist ON-1876A
Landscape Architect
Tel.: (519) 585-7263
landon.black@stantec.com

Reviewed by 
(signature)

Haley Sadler, OALA, CSLA, LEED AP
Senior Landscape Architect
Tel.: (519) 675-6615
haley.sadler@stantec.com

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LIST OF APPENDICES

1.0 INTRODUCTION

Middlesex County retained Stantec Consulting Ltd. (Stantec) to undertake a Municipal Class Environmental Assessment (Class EA) Study for improvements to the Thorndale Bridge on County Road 28 (Thorndale Road), within the Municipality of Thames Centre, in Middlesex County. The Class EA will determine the preferred alternative for Thorndale Bridge is to replace the existing bridge with a new bridge on the existing alignment with traffic being rerouted around bridge construction on detour.

2.0 METHODOLOGY

2.1 SITE REVIEW

Brian Miller, Tech. Dipl. Botanist, completed a tree inventory and assessment of the project site on April 1, 2020. The site assessment included a review of trees located within the disturbance limits for trees greater than 10 cm diameter at breast height (DBH). The area was also reviewed for the presence of any rare or endangered tree species that would require additional protection and review.

Trees, included in the detailed tree inventory, were tagged with a numbered metal tree tag. The tree inventory data collected included tree species, DBH in centimetres, health condition, and dripline radius in metres. Trees included in the inventory, that were located on private property, or trees that could not be physically tagged, were identified with an identification key (i.e., 'C1', 'C2', 'C3'), etc. Tree canopies that encroach on construction zones and require pre-construction pruning in order to mitigate damage were also identified during the assessment. The data for the project is included on Table 1 located in Appendix A.

2.2 REPORT

The tree inventory data was reviewed in conjunction with the project design. Tree locations, driplines, and tree protection zones (TPZ) were integrated into the project design drawing to determine impacts, and location of Tree Protection Fencing (TPF). Trees that will be impacted by the proposed construction have been recommended for removal and these recommendations have been identified in Table A. Sections 3.0 and 4.0 of this report include a summary of the Detailed Tree Inventory, site observations, and mitigation recommendations.

2.3 TREE ASSESSMENT CRITERIA

2.3.1 Definitions of Measurements

Tree assessment includes specific measurements as part of the field review. Outlined below are measurements taken as part of the tree review:

DBH – Measurement of the trunk at 1.4 m above grade. Expressed as diameter in centimetres.

Dripline – Measurement of the approximate extents of the branches as measured from the trunk of the tree. This also represents the general root zone of the tree. Expressed as a radius in metres.

2.3.2 Tree Condition Assessment

The condition of inventoried trees was assessed using the following three categories which were weighted to produce an overall rating:

Trunk Integrity (TI) - Assessment of the trunk for any defects

Canopy Structure (CS) - Assessment of the scaffold branches and canopy of the tree

Canopy Vigour (CV) - Assessment of the amount of deadwood versus live growth in the tree crown, also considers size, color and amount of foliage

Outlined below are the detailed guidelines utilized for the condition classification:

Good: Defects, if present, are minor (e.g. twig dieback, small wounds); defective tree part is small (e.g. 5-8 cm diameter limb) providing little if any risk.

Fair: Defects are numerous or significant (e.g. dead scaffold limbs); defective parts are moderate in size (e.g. limb greater than 5-8 cm in diameter).

Poor: Defects are severe (trunk cavity in excess of 50%); defective parts are large (e.g. majority of crown).

Dead: Tree exhibits no signs of life

3.0 OBSERVATIONS

The road on both sides of the existing bridge is situated atop an earth embankment with significant fall in elevation to the surrounding valley lands. A utility line corridor runs parallel to the bridge, south of County Road 28. A limited number of immature trees are growing from the sides of the embankment. The majority of mature trees are limited to the base of the embankment. The species observed on the site are a mix of locally common, native species and non-native species. A total of 200 trees have been included in the inventory, including the following tree species:

Table 1: Observed Species

Family	Genus species (common name)
Cannabaceae (hemp family)	*Celtis occidentalis* (hackberry)
Cupressaceae (cypress family)	*Thuja occidentalis* (eastern white cedar)
Juglandaceae (walnut family)	*Juglans nigra* (black walnut)
Malvaceae (mallow family)	*Tilia americana* (basswood)
Moraceae (mulberry family)	*Morus alba* (mulberry)
Oleaeceae (olive family)	*Fraxinus pennsylvanica* (green ash) *Fraxinus sp.* (ash sp.)
Pinaceae (pine family)	*Pinus nigra* (Austrian pine) *Pinus sylvestris* (Scots pine)
Rosaceae (rose family)	*Crataegus monogyna* (common hawthorn) *Crataegus sp.* (hawthorn species) *Malus pumila* (common apple) *Malus sp.* (apple sp.) *Prunus avium* (sweet cherry) *Prunus serotina* (black cherry)
Salicaceae (willow family)	*Populus alba* (white poplar) *Populus deltoides ssp. deltoides* (eastern cottonwood) *Populus tremuloides* (trembling aspen) *Salix sp.* (willow sp.)
Sapindaceae (soapberry family)	*Acer platanoides* (Norway maple) *Acer rubrum* (red maple) *Acer saccharum* (sugar maple)
Ulmaceae (elm family)	*Ulmus americana* (white elm)

3.1 RARE AND ENDANGERED TREES

The site was reviewed for threatened, rare or endangered trees. A 30 metre buffer from the limit of construction was used to delineate the potential presence of threatened, rare or endangered trees. This additional buffer area was not always accessible for survey due to private property boundaries. No threatened, rare, or endangered tree species were observed.

4.0 ANALYSIS

The following is a summary of the preservation and removal recommendations.

4.1 TREES RECOMMENDED FOR PRESERVATION

There are 83 trees identified in the inventory that are recommended to be retained within the project area. This figure does not include the trees that will be retained in the wooded areas of the valley that were not surveyed. The trees recommended for preservation have been identified and these recommendations are identified in Table A under 'Action' for each tree.

- ***Protect - No Hoarding***: Preservation on private property/outside limits of work with limited to no anticipated impacts within the dripline of the trees. Trees will be preserved and will not have protection fencing installed at the limits of the dripline. A total of 24 trees are recommended for inclusion within this preservation category.

- ***Protect - Hoarding***: Trees will be preserved, and hoarding will be installed at the limits of construction or the dripline of the tree, whichever is greater. A total of 59 trees are recommended for inclusion within this preservation category.

Tree protection will be provided as per the Drawings L-900 to L-903 located in Appendix B.

4.2 TREES IDENTIFIED FOR REMOVAL OR INJURY

There were 117 trees recommended for removal within the project area. These recommendations are identified in Table A under 'Action' for each tree.

- ***Remove - Construction***: Trees are recommended for removal because the tree will either be destroyed, or it is anticipated that the tree will be injured to the point where it is not retainable. A total of 117 trees are recommended for inclusion within this category.

4.3 PRUNING

No trees have been identified for pruning as a part of the field observations for this project. If required, branches interfering with construction activities shall be pruned by a Certified Arborist using proper arboricultural techniques prior to the start of construction.

If there are additional branches that interfere with equipment access during construction, a Certified Arborist shall be contacted, and they will determine the next steps.

4.3.1 Root Pruning

There may be tree roots encountered through the excavation process. All pruning, root pruning and removal should be completed by or under the direct supervision of a Certified Arborist to mitigate damage to the tree. Refer to Section 5.0 for construction mitigation measures recommended for implementation where applicable.

4.4 PERMIT TO INJURE OR DESTORY TREES, AND COMPENSATION

4.4.1 COMPENSATION

Compensation recommendations have been prepared using two industry standard methods. The intent of these compensation recommendations is to present a range of compensation options consistent with similar projects in southern Ontario. Ultimately the ability to compensate is based partly upon the availability of suitable space.

Cumulative Stem Diameter – The DBH of each stem being removed (each tree may have more than one stem) is summed and the total divided by the caliper diameter of the replacement trees (typically assumed to be 50 or 60 mm). In this case 4,904 cm of DBH is recommended for removal and 817- 60 mm caliper compensation trees would be recommended.

Ratio Compensation – The number of trees removed (or a multiple of the number) is the same as the number of trees replanted as compensation. Typically a multiplier of three is used (3 trees compensated : 1 tree removed) and in this case would yield 351 trees. Size of replacement trees is not a consideration under this compensation scheme.

5.0 CONSTRUCTION AND TREE IMPACT MITIGATION AND MANAGEMENT INFORMATION

5.1 POTENTIAL CONSTRUCTION IMPACTS TO TREES

Trees are living organisms that react to changes in their environment. Trees can be damaged during construction without showing signs of injury until some years later. Most construction-related impacts can be attributed to the removal or impacts to the roots that result in the slow death of the tree. This occurs due to the tree's inability to absorb sufficient water and nutrients. Contained within this section are descriptions of the potential impacts this project may have on the trees and impact mitigation methods that are intended to aid in the design and construction process.

5.2 SOIL COMPACTION AND ROOT DAMAGE

The leading cause of construction damage to trees is compaction of the soil around the roots or within the TPZ. The TPZ is the area around the tree or group of trees in which no grading or construction activity may occur. Equipment entering into a TPZ compresses the air pockets around the roots inhibiting the tree from absorbing nutrients and water. This damage ultimately degrades the health of the tree. Accordingly, during the removal stage, equipment use within the preservation zones should be restricted to ensure that the trees' roots are not disturbed, thereby assisting in maintaining their continued health.

The success of tree preservation is dependent not only on protecting the root zone from compaction and damage; it is also contingent upon the ability to ensure that the structural roots within the root plate are not disturbed. Root damage can take various forms. The most common is compaction. Compaction can occur when vehicles, equipment or storage occur within on the soil under the canopy of the tree. Compaction reduces the voids within the soil structure and limits the tree's ability to grow new roots and uptake water and nutrients. Compaction is a slow killer and the effects can often take several years to be observed within the tree. Root damage can also occur when the roots of the trees are physically damaged through cutting, excavation or other site servicing work. The removal of roots negatively impacts the health of the trees by reducing its ability to uptake nutrients but in severe cases the impacts can result in damage to the structural roots and tree failures can result.

5.3 MECHANICAL DAMAGE

Equipment can physically damage the trees through striking the trunk, limbs and/or roots. Felled trees can also cause damage during the tree removal stage of construction. The Contractor should be held responsible for all damage to the trees during all stages of construction. Removal trees shall always be felled away from adjacent trees to be retained.

Tree canopy damage can occur through physical damage to the branches, limbs and even the foliage. When working adjacent to the canopy of trees care must be taken when operating equipment to not strike any overhanging limbs. Idling machines can also cause damage to foliage and small branches by

burning them with the heat from the exhaust and pollution. The work zones and types of equipment that will be operating adjacent to the trees must be considered and discussed with the contractor onsite to ensure that proper mitigation occurs through the construction process.

5.4 PRUNING

Pruning a tree results in a wound that a tree must respond to. Trees' ability to respond to wounds changes as they age. Pruning in mature trees should be selective and calculated. Deadwood removal is essential to personal safety and should be completed regularly. Corrective pruning in mature trees may be required. This may include crown reduction, large limb removal or removal of defective structural form. Further corrective actions may be required to stabilize and protect mature trees from failure. These may include cabling systems, bracing and/or retrenchment pruning. All pruning must be completed by an ISA Certified Arborist.

Excavation requires the removal of roots. Root pruning must clean cut the roots to promote continued health and discourage rot. Ideally the roots will be exposed using an air spade or hydro-vacuum excavation and then pruned at the limits of excavation. Pruning cuts shall be made at a maximum of 150 mm inside the limits of excavation and backfilled immediately to protect the roots from drying out. Root pruning must be completed by or under the direct supervision of a Certified Arborist.

6.0 DISCLAIMER

The assessment of the trees presented within this report has been made using accepted arboricultural techniques. These include a visual examination of the above-ground parts of each tree for structural defects, scars, external indications of decay, evidence of insect presence, discoloured foliage, the general condition of the trees and the surrounding site, as well as the proximity of property and people. None of the trees examined were dissected, cored, probed, or climbed, and detailed root crown examinations involving excavation were not undertaken.

Notwithstanding the recommendations and conclusions made in this report, it must be realized that trees are living organisms and their health and vigour is constantly changing. They are not immune to changes in site conditions or seasonal variations in the weather.

While reasonable efforts have been made to ensure the trees recommended for retention are healthy, no guarantees are offered or implied, that these trees or any part of them will remain standing. It is both professionally and practically impossible to predict with absolute certainty the behavior of any single tree or group of trees in all circumstances. Inevitably a standing tree will always pose some risk. Most trees have the potential for failure if provided with the necessary combinations of stresses and elements. This risk can only be eliminated if the tree is removed.

Although every effort has been made to ensure that this assessment is reasonably accurate the trees should be re-assessed periodically. The assessment presented in this report is valid at the time of inspection.

APPENDIX A

Table A Detailed Tree Inventory

TABLE A. Detailed Tree Inventory: Thorndale Bridge
County of Middlesex, Ontario
Data collected: April 2, 2020

Tree ID	Botanical Name	Common Name	DBH (cm)					Dripline Radius (m)	Condition	Comments	Species Sensitive to Disturbance	Action
			Stem 1	Stem 2	Stem 3	Stem 4	Stem 5		Overall Condition			
1	*Malus pumila*	Common Apple	25	18				3	Fair		No	Protect - No Hoarding
2	Fraxinus pennsylvanica	Green Ash	11					1.5	Poor		No	Protect - No Hoarding
3	*Fraxinus pennsylvanica*	Green Ash	12					2	Fair		No	Protect - No Hoarding
4	*Crataegus monogyna*	Common Hawthorn	18	13				3	Good	Lower stem covered in English ivy	No	Protect - No Hoarding
5	*Pinus nigra*	Austrian Pine	48					4	Fair	Moderate to severe browning of needles	No	Protect - No Hoarding
6	*Acer platanoides*	Norway Maple	38					5	Good		No	Protect - No Hoarding
7	*Acer negundo*	Manitoba Maple	75					6	Fair	One large broken branch.	No	Protect - No Hoarding
8	*Populus deltoides ssp. deltoides*	Eastern Cottonwood	80					6	Good		No	Protect - No Hoarding
9	Pinus sylvestris	Scots Pine	19					0.5	Poor	Nearly dead	No	Protect - No Hoarding
10	*Pinus sylvestris*	Scots Pine	21					1	Poor	Nearly dead	No	Protect - No Hoarding
11	*Pinus sylvestris*	Scots Pine	13					1.5	Fair		No	Protect - No Hoarding
12	*Pinus sylvestris*	Scots Pine	22					2.5	Good		No	Protect - No Hoarding
13	*Malus sp.*	Apple sp.	10					1.5	Fair		No	Protect - No Hoarding
14	*Pinus sylvestris*	Scots Pine	15					2	Good		No	Protect - No Hoarding
15	*Fraxinus pennsylvanica*	Green Ash	15					2	Good		No	Protect - No Hoarding
16	*Fraxinus pennsylvanica*	Green Ash	21					1.5	Poor		No	Protect - No Hoarding
17	*Acer platanoides*	Norway Maple	12					1.5	Good		No	Protect - No Hoarding
18	*Acer platanoides*	Norway Maple	11					2	Good		No	Protect - No Hoarding
19	*Acer platanoides*	Norway Maple	38					6	Good		No	Protect - No Hoarding
20	*Acer platanoides*	Norway Maple	20					3.5	Good		No	Protect - No Hoarding
21	*Acer negundo*	Manitoba Maple	28					3.5	Good		No	Protect - No Hoarding
22	*Salix sp.*	Willow sp.	72					6	Fair	Several dead branches in lower crown likely due to shading	No	Protect - No Hoarding
23	*Acer platanoides*	Norway Maple	30					4	Good		No	Protect - No Hoarding
24	*Celtis occidentalis*	Hackberry	15					2	Good	Covered in riverbank grape vine	No	Protect - No Hoarding
25	*Salix sp.*	Willow sp.	33	29				5	Fair		No	Remove - Construction
26	Juglans nigra	Black Walnut	13					2	Good		No	Remove - Construction
27	*Salix sp.*	Willow sp.	35	35	32			5	Good		No	Protect - Hoarding
28	*Salix sp.*	Willow sp.	26					3	Good		No	Protect - Hoarding
29	*Salix sp.*	Willow sp.	55	35				5	Fair		No	Remove - Construction
30	*Salix sp.*	Willow sp.	39	32	28	22		6	Fair		No	Remove - Construction
31	*Salix sp.*	Willow sp.	34					3	Fair		No	Remove - Construction
32	Salix sp.	Willow sp.	38	38	38	35		6	Fair		No	Remove - Construction
33	Salix sp.	Willow sp.	42	40	35			5	Fair		No	Remove - Construction
34	Salix sp.	Willow sp.	16					2	Fair		No	Protect - Hoarding
35	Salix sp.	Willow sp.	21	17				3	Good		No	Protect - Hoarding
36	Acer negundo	Manitoba Maple	24					2.5	Fair		No	Remove - Construction
37	*Salix sp.*	Willow sp.	48	44	42	23		6	Fair		No	Remove - Construction
38	Acer negundo	Manitoba Maple	13					2	Poor		No	Remove - Construction
39	*Salix sp.*	Willow sp.	62					5	Fair		No	Remove - Construction
40	*Acer negundo*	Manitoba Maple	34					4	Fair		No	Remove - Construction
41	*Salix sp.*	Willow sp.	31					2.5	Fair		No	Protect - Hoarding
42	*Salix sp.*	Willow sp.	18					1.5	Poor		No	Protect - Hoarding
43	*Salix sp.*	Willow sp.	44					3.5	Fair		No	Remove - Construction
44	*Salix sp.*	Willow sp.	28	27				4	Fair		No	Protect - Hoarding
45	*Salix sp.*	Willow sp.	35					3	Fair		No	Protect - Hoarding
46	*Acer negundo*	Manitoba Maple	15	15				3	Good		No	Remove - Construction
47	*Acer negundo*	Manitoba Maple	26					3	Fair		No	Remove - Construction

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			Stem 1	Stem 2	Stem 3	Stem 4	Stem 5		Overall Condition			
48	*Salix sp.*	Willow sp.	58	28				6	Poor		No	Remove - Construction
49	Acer negundo	Manitoba Maple	24					3	Fair		No	Remove - Construction
50	*Juglans nigra*	Black Walnut	39					4	Good		No	Remove - Construction
51	*Populus tremuloides*	Trembling Aspen	13					2	Good		No	Remove - Construction
52	*Populus tremuloides*	Trembling Aspen	14					1.5	Good		No	Remove - Construction
53	*Malus pumila*	Common Apple	26	23				3.5	Good		No	Protect - Hoarding
54	*Acer negundo*	Manitoba Maple	17					2	Good		No	Remove - Construction
55	*Fraxinus pennsylvanica*	Green Ash	14					2	Good		No	Remove - Construction
56	*Populus tremuloides*	Trembling Aspen	11					1	Fair		No	Remove - Construction
57	*Juglans nigra*	Black Walnut	15					2	Good		No	Remove - Construction
58	*Populus tremuloides*	Trembling Aspen	15					1	Fair		No	Remove - Construction
59	*Populus tremuloides*	Trembling Aspen	15					1.5	Fair		No	Remove - Construction
60	*Populus tremuloides*	Trembling Aspen	18					2	Poor		No	Remove - Construction
61	*Fraxinus pennsylvanica*	Green Ash	17					2.5	Good		No	Remove - Construction
62	*Juglans nigra*	Black Walnut	19					3	Good		No	Remove - Construction
63	*Juglans nigra*	Black Walnut	22					3	Good		No	Remove - Construction
64	*Fraxinus pennsylvanica*	Green Ash	23					2.5	Fair		No	Remove - Construction
65	*Salix sp.*	Willow sp.	23	21				2.5	Poor		No	Protect - Hoarding
66	*Populus tremuloides*	Trembling Aspen	19					2	Good		No	Protect - Hoarding
67	*Acer negundo*	Manitoba Maple	25					2.5	Fair		No	Remove - Construction
68	*Acer negundo*	Manitoba Maple	18					2.5	Fair		No	Remove - Construction
69	*Acer negundo*	Manitoba Maple	26					3	Fair		No	Remove - Construction
70	*Salix sp.*	Willow sp.	36	28	27	21		6	Good	Four widely spaced stems	No	Remove - Construction
71	*Acer negundo*	Manitoba Maple	25					3	Fair		No	Remove - Construction
72	*Acer negundo*	Manitoba Maple	23					2	Poor		No	Protect - Hoarding
73	*Acer negundo*	Manitoba Maple	21					2.5	Fair		No	Remove - Construction
74	*Malus sp.*	Apple sp.	26	22	20	18	12	4	Fair		No	Remove - Construction
75	*Acer negundo*	Manitoba Maple	13					2	Good		No	Remove - Construction
76	*Acer negundo*	Manitoba Maple	32					3	Poor		No	Remove - Construction
77	*Acer negundo*	Manitoba Maple	45					4	Fair		No	Remove - Construction
78	*Acer negundo*	Manitoba Maple	28	28				2.5	Poor		No	Remove - Construction
79	Salix sp.	Willow sp.	100					7.5	Poor		No	Remove - Construction
80	Acer negundo	Manitoba Maple	65					3	Poor		No	Remove - Construction
81	*Acer saccharum*	Sugar Maple	19					1.5	Good		Yes	Remove - Construction
82	*Salix sp.*	Willow sp.	95					6	Fair		No	Remove - Construction
83	*Acer saccharum*	Sugar Maple	22					2.5	Good		Yes	Remove - Construction
84	Salix sp.	Willow sp.	65					5	Fair		No	Remove - Construction
85	Juglans nigra	Black Walnut	26					3.5	Good		No	Protect - Hoarding
86	*Juglans nigra*	Black Walnut	28					2.5	Good		No	Protect - Hoarding
87	*Juglans nigra*	Black Walnut	39					3.5	Good		No	Protect - Hoarding
88	*Populus deltoides ssp. deltoides*	Eastern Cottonwood	58					4	Good		No	Remove - Construction
89	*Acer negundo*	Manitoba Maple	16					2	Good		No	Remove - Construction
90	*Juglans nigra*	Black Walnut	19					2	Fair		No	Remove - Construction
91	*Salix sp.*	Willow sp.	45	42	33	33		5	Poor	Two smaller stems are growing horizontally. Other stems cut for hydro wires	No	Protect - Hoarding
92	*Juglans nigra*	Black Walnut	20					2.5	Fair		No	Remove - Construction
93	*Acer negundo*	Manitoba Maple	17					1.5	Fair		No	Remove - Construction

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			Stem 1	Stem 2	Stem 3	Stem 4	Stem 5		Overall Condition			
94	*Juglans nigra*	Black Walnut	25					3.5	Good		No	Remove - Construction
95	*Acer negundo*	Manitoba Maple	21					2.5	Fair		No	Remove - Construction
96	*Juglans nigra*	Black Walnut	17					3	Good		No	Remove - Construction
97	Crataegus sp.	Hawthorn sp.	12					1.5	Fair		No	Protect - Hoarding
98	Crataegus sp.	Hawthorn sp.	11	11				2.5	Good		No	Protect - Hoarding
99	Juglans nigra	Black Walnut	24					3	Good		No	Remove - Construction
100	Salix sp.	Willow sp.	48	46				4	Poor		No	Remove - Construction
101	*Juglans nigra*	Black Walnut	24					3	Good		No	Remove - Construction
102	*Salix sp.*	Willow sp.	33					2	Poor		No	Remove - Construction
103	*Salix sp.*	Willow sp.	33	28				4	Poor	Three other main stems broken off	No	Remove - Construction
104	*Salix sp.*	Willow sp.	45					3	Fair		No	Remove - Construction
105	*Crataegus sp.*	Hawthorn sp.	18	15				2	Poor		No	Remove - Construction
106	*Crataegus sp.*	Hawthorn sp.	15					2	Good		No	Remove - Construction
107	*Juglans nigra*	Black Walnut	18					3	Good		No	Remove - Construction
108	*Crataegus sp.*	Hawthorn sp.	20	12				2.5	Fair		No	Protect - Hoarding
109	*Salix sp.*	Willow sp.	42	40	39			5	Poor	Dieback plus broken stems	No	Remove - Construction
110	*Acer negundo*	Manitoba Maple	50	30				2.5	Poor	Larger stem is dead	No	Remove - Construction
111	*Fraxinus pennsylvanica*	Green Ash	12					1.5	Good		No	Remove - Construction
112	*Crataegus sp.*	Hawthorn sp.	16	15	14	13	12	3.5	Fair		No	Remove - Construction
113	*Crataegus sp.*	Hawthorn sp.	16	15				2.5	Fair		No	Remove - Construction
114	*Juglans nigra*	Black Walnut	31					4	Good		No	Remove - Construction
115	*Prunus serotina*	Black Cherry	20					2.5	Good		Yes	Remove - Construction
116	*Salix sp.*	Willow sp.	44	35	35	30		5	Poor		No	Remove - Construction
117	*Crataegus sp.*	Hawthorn sp.	27					3	Good		No	Protect - Hoarding
118	*Crataegus sp.*	Hawthorn sp.	14	12	11			2.5	Good		No	Remove - Construction
119	*Juglans nigra*	Black Walnut	36					3.5	Good		No	Remove - Construction
120	*Juglans nigra*	Black Walnut	20					2	Good		No	Remove - Construction
121	*Juglans nigra*	Black Walnut	30					3.5	Good		No	Remove - Construction
122	*Juglans nigra*	Black Walnut	17					2	Good		No	Remove - Construction
123	*Juglans nigra*	Black Walnut	12					1.5	Good		No	Remove - Construction
124	*Juglans nigra*	Black Walnut	18					2.5	Good		No	Remove - Construction
125	*Salix sp.*	Willow sp.	40	40	35	30		5	Poor		No	Remove - Construction
126	*Juglans nigra*	Black Walnut	34					4	Good		No	Remove - Construction
127	*Juglans nigra*	Black Walnut	43					4	Good		No	Remove - Construction
128	*Acer negundo*	Manitoba Maple	17					2	Fair		No	Remove - Construction
129	*Juglans nigra*	Black Walnut	22					2.5	Good		No	Remove - Construction
130	*Juglans nigra*	Black Walnut	30					4	Good		No	Remove - Construction
131	*Acer negundo*	Manitoba Maple	16					2	Poor		No	Remove - Construction
132	*Juglans nigra*	Black Walnut	18					2	Fair		No	Remove - Construction
133	*Salix sp.*	Willow sp.	60	58				4.5	Poor	Smaller stem is dead	No	Remove - Construction
134	*Acer negundo*	Manitoba Maple	40					2.5	Poor		No	Remove - Construction
135	*Juglans nigra*	Black Walnut	43					4.5	Good		No	Remove - Construction
136	*Crataegus sp.*	Hawthorn sp.	17	15				2.5	Good		No	Remove - Construction
137	*Crataegus sp.*	Hawthorn sp.	17					2	Fair		No	Protect - Hoarding
138	*Juglans nigra*	Black Walnut	50					4.5	Good		No	Remove - Construction
139	*Acer negundo*	Manitoba Maple	12					1.5	Poor		No	Remove - Construction
140	*Celtis occidentalis*	Hackberry	34					3	Good		No	Remove - Construction
141	*Acer negundo*	Manitoba Maple	18					1.5	Poor		No	Remove - Construction

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			Stem 1	Stem 2	Stem 3	Stem 4	Stem 5		Overall Condition			
142	*Juglans nigra*	Black Walnut	21					2	Fair		No	Remove - Construction
143	*Juglans nigra*	Black Walnut	32					3	Good		No	Remove - Construction
144	*Acer negundo*	Manitoba Maple	26					2.5	Poor		No	Remove - Construction
145	*Acer negundo*	Manitoba Maple	65	50				5	Poor		No	Remove - Construction
146	*Juglans nigra*	Black Walnut	41					3.5	Good		No	Remove - Construction
147	*Acer negundo*	Manitoba Maple	25	18				2.5	Fair		No	Remove - Construction
148	*Acer negundo*	Manitoba Maple	21					2	Poor		No	Remove - Construction
149	*Acer negundo*	Manitoba Maple	29					3.5	Fair		No	Remove - Construction
150	*Juglans nigra*	Black Walnut	30					3	Good		No	Remove - Construction
151	*Acer negundo*	Manitoba Maple	25					2.5	Good		No	Remove - Construction
152	*Salix sp.*	Willow sp.	65					3.5	Poor		No	Remove - Construction
153	*Juglans nigra*	Black Walnut	44	40				4	Good		No	Remove - Construction
154	*Thuja occidentalis*	Eastern White Cedar	20	15	15	14	12	3	Fair		No	Remove - Construction
155	*Acer negundo*	Manitoba Maple	24					1.5	Poor		No	Remove - Construction
156	*Acer negundo*	Manitoba Maple	26					2.5	Poor		No	Remove - Construction
157	*Acer negundo*	Manitoba Maple	24	20	20	18		3.5	Poor		No	Remove - Construction
158	*Acer negundo*	Manitoba Maple	27					2.5	Poor	Horizontal stem	No	Remove - Construction
159	*Ulmus americana*	White Elm	10					1.5	Good		No	Remove - Construction
160	*Acer negundo*	Manitoba Maple	34	18				3	Poor		No	Protect - Hoarding
161	*Celtis occidentalis*	Hackberry	23					2	Good		No	Protect - Hoarding
162	*Celtis occidentalis*	Hackberry	19					2	Good		No	Protect - Hoarding
163	*Prunus avium*	Sweet Cherry	28	16				2.5	Fair		No	Protect - Hoarding
164	*Prunus avium*	Sweet Cherry	23					1.5	Good		No	Protect - Hoarding
165	*Prunus avium*	Sweet Cherry	29					3	Good		No	Protect - Hoarding
166	*Celtis occidentalis*	Hackberry	15					2	Good		No	Protect - Hoarding
167	*Celtis occidentalis*	Hackberry	19					2	Good		No	Protect - Hoarding
168	*Celtis occidentalis*	Hackberry	19					2	Good		No	Protect - Hoarding
169	*Prunus avium*	Sweet Cherry	24					2.5	Good		No	Protect - Hoarding
170	*Celtis occidentalis*	Hackberry	12					1.5	Good		No	Protect - Hoarding
171	*Celtis occidentalis*	Hackberry	24					2.5	Good		No	Protect - Hoarding
172	*Celtis occidentalis*	Hackberry	14					1.5	Good		No	Protect - Hoarding
173	*Juglans nigra*	Black Walnut	16					2	Good		No	Protect - Hoarding
174	*Celtis occidentalis*	Hackberry	10					1.5	Good		No	Protect - Hoarding
175	*Celtis occidentalis*	Hackberry	10					1	Good		No	Remove - Construction
176	*Morus alba*	White Mulberry	18					3	Good		No	Remove - Construction
177	*Tilia americana*	Basswood	15					1.5	Good		Yes	Protect - Hoarding
178	*Populus alba*	White Poplar	13					1	Poor	Horizontal stem	No	Protect - Hoarding
179	*Celtis occidentalis*	Hackberry	10					1.5	Good		No	Protect - Hoarding
180	*Tilia americana*	Basswood	18					1.5	Good		Yes	Protect - Hoarding
181	*Salix sp.*	Willow sp.	45					2	Poor	Horizontal stem	No	Protect - Hoarding
182	*Celtis occidentalis*	Hackberry	21					2	Good		No	Protect - Hoarding
183	*Celtis occidentalis*	Hackberry	13					1.5	Fair		No	Protect - Hoarding
184	*Celtis occidentalis*	Hackberry	20					2	Fair		No	Protect - Hoarding
185	*Celtis occidentalis*	Hackberry	58	42				4.5	Good		No	Protect - Hoarding
186	*Celtis occidentalis*	Hackberry	51					3.5	Good		No	Protect - Hoarding
187	*Malus sp.*	Apple sp.	28	22				3	Fair		No	Protect - Hoarding
188	*Acer negundo*	Manitoba Maple	30	25				3.5	Fair		No	Protect - Hoarding

TABLE A. Detailed Tree Inventory: Thorndale Bridge
County of Middlesex, Ontario
Data collected: April 2, 2020

Tree ID	Botanical Name	Common Name	DBH (cm)					Dripline Radius (m)	Condition	Comments	Species Sensitive to Disturbance	Action
			Stem 1	Stem 2	Stem 3	Stem 4	Stem 5		Overall Condition			
189	*Acer saccharum*	Sugar Maple	14					2	Good		Yes	Protect - Hoarding
190	*Acer saccharum*	Sugar Maple	15					2	Good		Yes	Protect - Hoarding
191	*Acer saccharum*	Sugar Maple	63					5	Good		Yes	Protect - Hoarding
192	*Juglans nigra*	Black Walnut	23	20				3	Good		No	Protect - Hoarding
193	*Juglans nigra*	Black Walnut	35					3.5	Good		No	Protect - Hoarding
194	*Acer saccharum*	Sugar Maple	15	11	7			2	Good		Yes	Remove - Construction
195	*Juglans nigra*	Black Walnut	23	20				3	Good		No	Protect - Hoarding
196	*Juglans nigra*	Black Walnut	59					5	Good		No	Protect - Hoarding
197	*Juglans nigra*	Black Walnut	20					2.5	Good		No	Protect - Hoarding
198	*Juglans nigra*	Black Walnut	19					1.5	Poor		No	Protect - Hoarding
199	*Celtis occidentalis*	Hackberry	15					2	Good		No	Protect - Hoarding
A	*Celtis occidentalis*	Hackberry	59					4.5	Good		No	Protect - Hoarding

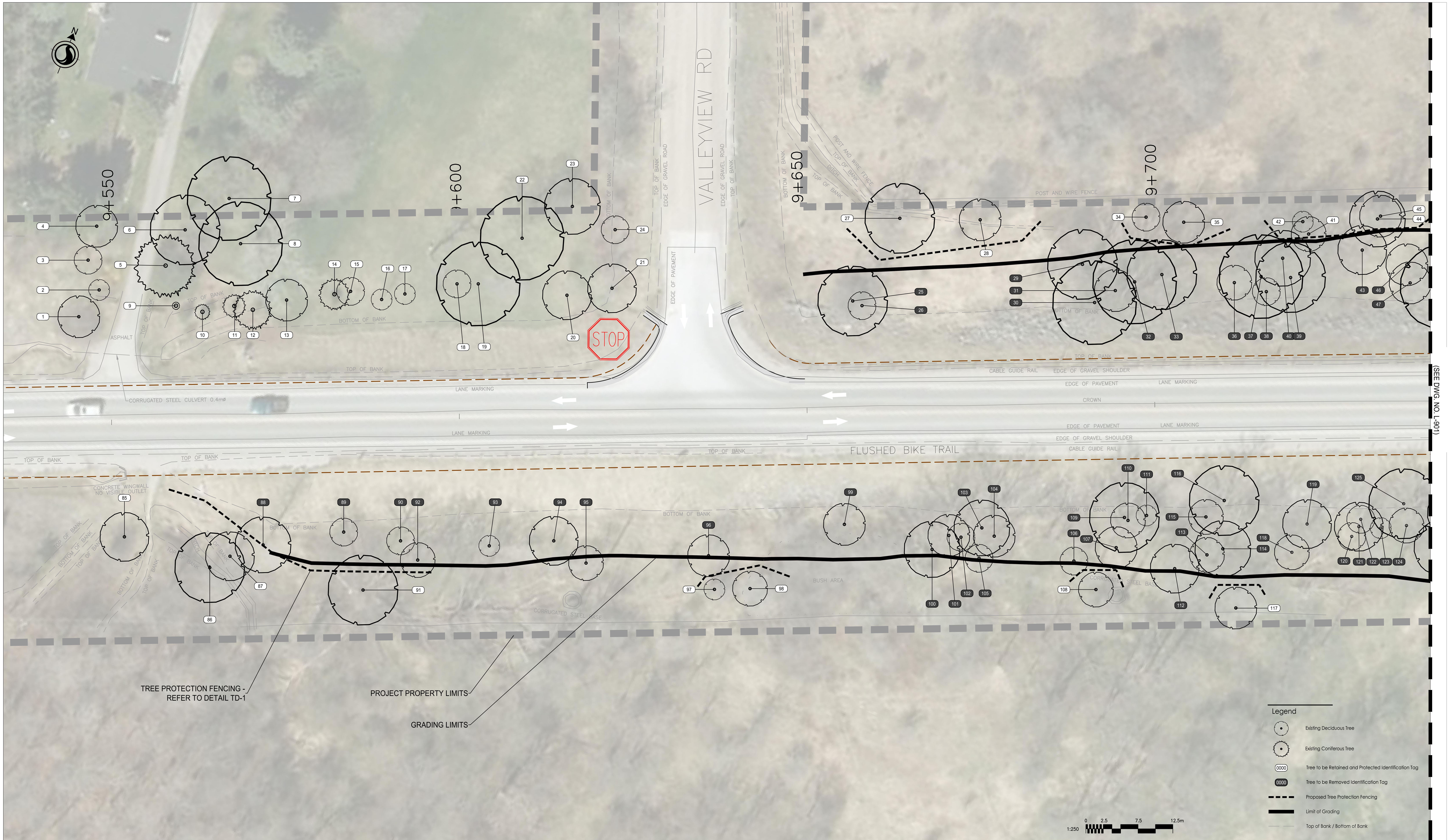
Table A Summary

1. 'Total 'Action' Trees

Protect - Hoarding:	59
Protect- No Hoarding:	24
Protect- Reduced TPZ:	0
Remove - Construction:	117
Remove - Condition:	0
Remove - Hazard:	0
Total:	**200**

APPENDIX B

TMP Drawings L-900 to L-903



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					DESIGN	LB	0	ISSUED FOR APPROVAL	2020/04/22	STANTEC CONSULTING LTD
					DRAWN BY	LB				
					CHECKED	HS				
					APPROVED	LB				
					DATE	2020/04/14				

CONSULTANT OR DIVISION

Stantec

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ON-1876A

middlesex county

SCALE: 1:250

TITLE: THORNDALE BRIDGE
COUNTY ROAD 28

TREE MANAGMENT PLAN

PROJECT No. 165001122

SHEET No. L-900

PLAN FILE No.

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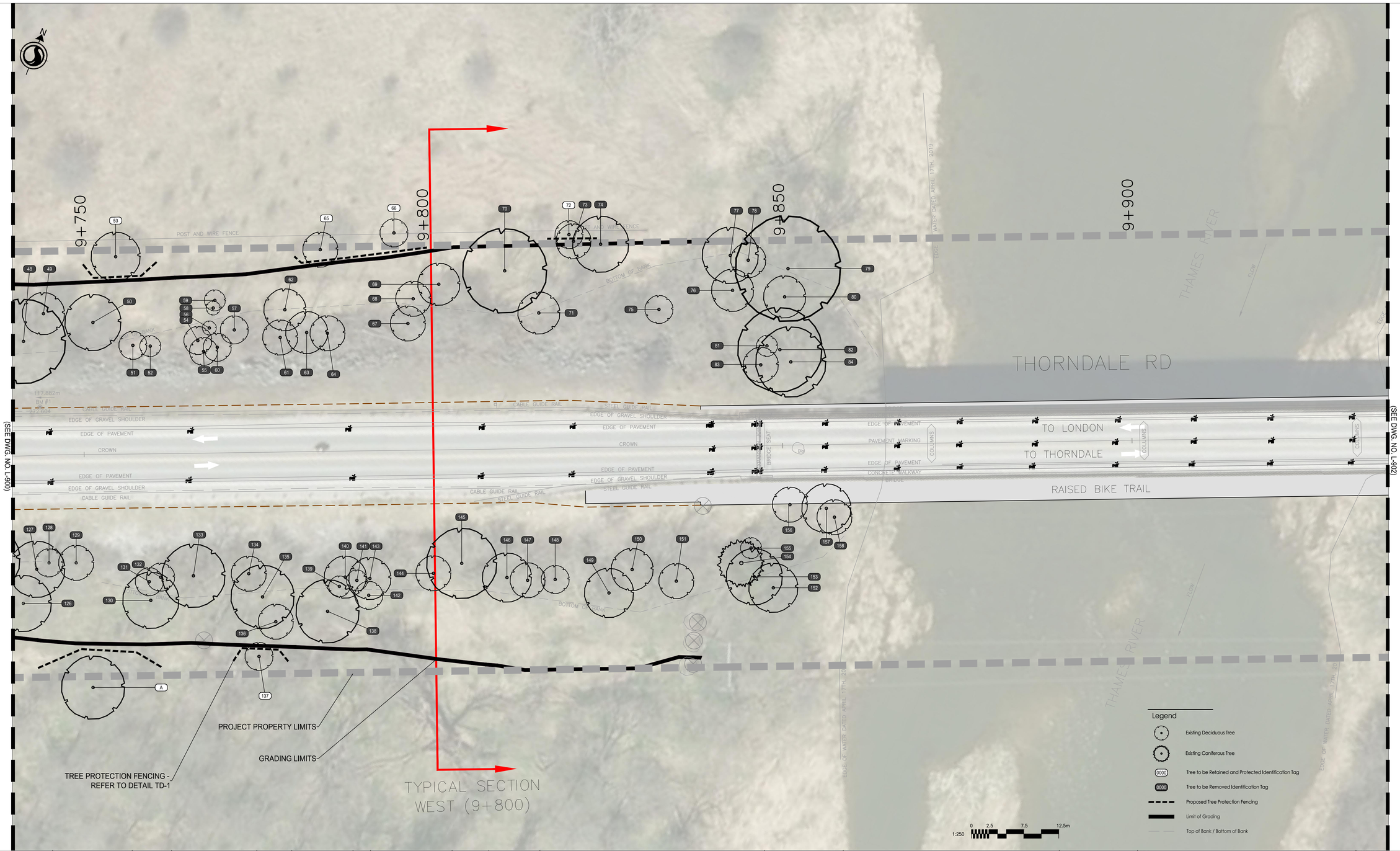

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DETAILS		No.	REVISIONS	DATE	CONSULTANT
DESIGN	LB	0	ISSUED FOR APPROVAL	2020/04/22	STANTEC CONSULTING LTD.
DRAWN BY	LB				
CHECKED	HS				
APPROVED	LB				
DATE	2020/04/14				

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TITLE

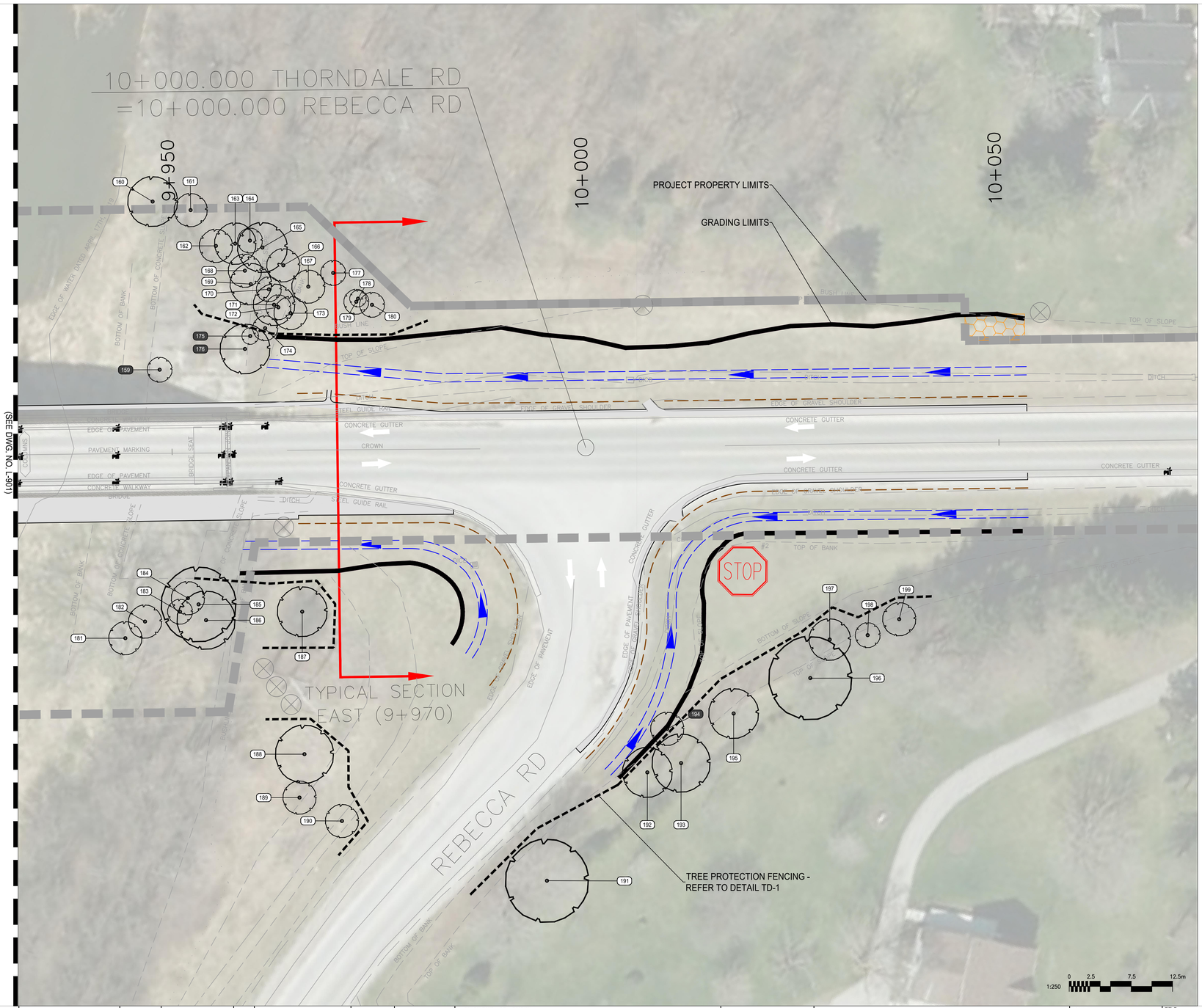
THORNDALE BRIDGE
COUNTY ROAD 28

TREE MANAGMENT PLAN

PROJECT No. 165001122

SHEET No. L-901

PLAN FILE No.



Legend

- Existing Deciduous Tree
- Existing Coniferous Tree
- 0000 — Tree to be Retained and Protected Identification Tag
- 0000 — Tree to be Removed Identification Tag
- Proposed Tree Protection Fencing
- Limit of Grading
- Top of Bank / Bottom of Bank

EXISTING SERVICES	DRAWING #, SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION

DETAILS	
DESIGN	LB
DRAWN BY	LB
CHECKED	HS
APPROVED	LB
DATE	2020/04/14

No.	REVISIONS	DATE	CONSULTANT
0	ISSUED FOR APPROVAL	2020/04/22	STANTEC CONSULTING LTD

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SCALE
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TITLE
THORNDALE BRIDGE
COUNTY ROAD 28
TREE MANAGMENT PLAN

PROJECT No.
165001122

SHEET No.
L-902

PLAN FILE No.

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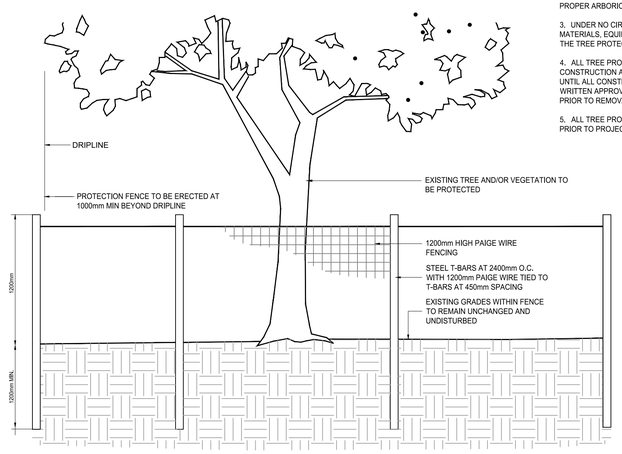

NOTES:

1. ATTACHMENT OF FENCE TO TREES WILL NOT BE PERMITTED.

2. ANY EXPOSED ROOTS ARE TO BE HAND PRUNED USING PROPER ARBORICULTURAL PRACTICES.

3. UNDER NO CIRCUMSTANCES SHALL ANY CONSTRUCTION MATERIALS, EQUIPMENT OR VEHICLES BE PLACED WITHIN THE TREE PROTECTION ZONE.

4. ALL TREE PROTECTION TO BE ERECTED PRIOR TO ANY CONSTRUCTION ACTIVITY AND IS TO REMAIN IN PLACE UNTIL ALL CONSTRUCTION HAS BEEN COMPLETED. OBTAIN WRITTEN APPROVAL FROM CONTRACT ADMINISTRATOR PRIOR TO REMOVAL OF FENCING.

5. ALL TREE PROTECTION FENCING SHALL BE REMOVED PRIOR TO PROJECT FINAL ACCEPTANCE.

TD 1

PROPOSED TREE PROTECTION FENCING
N.T.S.

GENERAL

1. The Tree Management/Preservation Plan is to be read in conjunction with the associated Arborist Report and shall not be utilized as a standalone document.

TREE PROTECTION FENCING

1. The Contractor shall install Tree Protection Fencing (TPF) to protect trees identified for preservation.
2. All TPF will conform with the Arborist Report and detail(s) included on these plans. Where current governing Municipal/City standards differ, contact Project Arborist or Contract Administrator for direction.
3. No substitutions of materials, products or quantities will be accepted without the prior written permission of the Project Arborist.
4. Upon installation of the TPF, the Contractor shall contact the Project Arborist to review and approve the fencing and location(s) in writing prior to commencement of any site work.
5. The TPF shall remain in the approved locations throughout the duration of the site works and shall not be moved at any time to accommodate construction or site work.
6. The Contractor shall inspect TPF weekly and maintain as required through all stages of development/construction. The TPF shall be removed at the completion of all site works and disturbed areas shall be restored to original condition.

TREE PRESERVATION

1. The Tree Protection Zone (TPZ) is protected and delineated by the TPF or as otherwise defined in the approved Arborist Report. The Contractor is not to proceed in uncertainty.
2. Any potential or incurred injury/damage to adjacent tree(s) identified to be preserved shall be immediately reported to the Project Arborist and reviewed on site. Injury/damage includes any required arboricultural treatment including but not limited to: limb pruning, trunk damage, root exposure or required cutting/removal or any other activity that has the potential to harm the tree.
3. The TPZ is not to be used for any type of storage including materials, equipment or stockpiles.
4. No trenching or tunneling for underground services shall occur within the TPZ.
5. Any equipment use within the TPZ will be restricted throughout all stages of development. This applies to TPZs within or outside of the project limit line.
6. Absolutely no alteration of grades or construction activity is permitted within the TPF and TPZ. Absolutely no flushing of contaminant shall be permitted towards or within the TPZ.
7. When working adjacent to trees to be preserved site preparation measures such as pruning for overhead clearance may be required. Preparatory pruning shall only be performed when completed by or under the direct supervision of an ISA Certified Arborist (or approved qualified person as approved by the Project Arborist).
8. All pruning work shall be performed by a qualified individual and shall be in accordance with current horticultural practices including but not limited to:
   a. Pruning cuts shall be made just beyond the branch collar and should be limited to thinning cuts. Heading cuts will only be accepted in specific cases as directed by an arborist and should be avoided where possible.
   b. Pruning of all stems greater than 50 mm in diameter should be made with a three-cut method to avoid tearing living bark tissue.
   c. No wound dressings shall be applied.
16. Where soil excavation/grading work is required within the rooting zone of a tree to be preserved (the rooting zone often extends beyond the identified TPZ and can be 3 times the dripline radius or more):
   a. Roots shall be cleanly severed before stripping and removing soil to avoid damage to the tree and the root system. Roots to be cut using appropriate equipment (i.e. trencher adapted to this specific use/chainsaw/root pruning machine). Roots may be severed using the clean edge of a straight excavator bucket under supervision of an ISA Certified Arborist.
   b. No attempts to cut existing roots with the digging bucket of any heavy machinery will be permitted as it can cause the roots to tear and pull and be harmful to root regeneration and recovery.
   c. Any exposed roots of a tree to be preserved with a diameter greater than 2.5cm (1 inch) shall be pruned back to the soil face.
   d. An excavation area within the TPZ shall be backfilled immediately and/or roots shall be kept constantly moist with burlap covered with white plastic and checked a minimum of 2 times a day, for a maximum of 48 hours. If roots are to be exposed for a period greater than 48 hours, the exposed area shall be covered with a minimum of 150 mm (6 inches) of mulch and maintained in a moist condition during construction until the area can be properly backfilled.
17. Trees shall not have any rigging cables, fencing, signage or hardware of any sort attached or wrapped around them.
18. No contaminants or toxic materials shall be dumped or flushed where they may come into contact with the feeder roots of trees to be preserved.
19. The Contractor will be held responsible for all avoidable damage to preserved trees during all stages of construction.
20. Watering or other maintenance of trees to be preserved may be required if construction activities are observed to be causing stress or impacting health as determined by the Project Arborist.

TREE REMOVALS

1. Prior to the commencement of tree removals, all trees designated for removal must be clearly identified in the field.
2. Where possible, removals, chipping, and/or brush removal is to be completed outside of migratory bird nesting season from April 1 to August 31. If removals are to occur within the restricted activity period, due diligence measures, including pre-clearing nest sweeps will be employed to reduce risk to nesting birds protected under the Migratory Birds Convention Act, 1994 and Migratory Birds Regulations. These surveys must be completed by a qualified biologist or ornithologist.
3. Trees shall always be felled away from adjacent preserved trees to prevent avoidable damage to the crowns and stems

EXISTING SERVICES	DRAWING #, SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION

DETAILS		No.	REVISIONS	DATE	CONSULTANT
DESIGN	LB	0	ISSUED FOR APPROVAL	2020/04/22	STANTEC CONSULTING LTD.
DRAWN BY	LB				
CHECKED	HS				
APPROVED	LB				
DATE	2020/04/14				

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Stantec

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SCALE

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TITLE

THORNDALE BRIDGE
COUNTY ROAD 28

TREE MANAGMENT PLAN

PROJECT No.
165001122

SHEET No.
L-903

PLAN FILE No.

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APPENDIX B.3

Stage 1 Archaeological Assessment

Ministry of Heritage, Sport, Tourism, and Culture Industries

Archaeology Program Unit
Programs and Services Branch
Heritage, Tourism and Culture Division
401 Bay Street, Suite 1700
Toronto ON M7A 0A7
Tel.: (416) 314-2120
Email: Andrea.Williams@ontario.ca

Ministère des Industries du patrimoine, du sport, du tourisme et de la culture

Unité des programme d'archéologie
Direction des programmes et des services
Division du patrimoine, du tourisme et de la culture
401, rue Bay, bureau 1700
Toronto ON M7A 0A7
Tél. : (416) 314-2120
Email: Andrea.Williams@ontario.ca

Ontario

Oct 13, 2020

Parker S. Dickson (P256)
Stantec Consulting
171 Queens London ON N6A 5J7

RE: Review and Entry into the Ontario Public Register of Archaeological Reports: Archaeological Assessment Report Entitled, "Stage 1 Archaeological Assessment: Municipal Class Environmental Assessment, Thorndale Bridge Improvements, County Road 28 (Thorndale Road), Parts of Lots 15 and 16, Concessions 1 and 2, Geographic Township of Nissouri, former Oxford County, now Municipality of Thames Centre, Middlesex County, Ontario ", Dated Sep 17, 2019, Filed with MHSTCI Toronto Office on Oct 9, 2020, MHSTCI Project Information Form Number P256-0577-2019, MHSTCI File Number 0010529

Dear Mr. Dickson:

This office has reviewed the above-mentioned report, which has been submitted to this ministry as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18.[1] This review has been carried out in order to determine whether the licensed professional consultant archaeologist has met the terms and conditions of their licence, that the licensee assessed the property and documented archaeological resources using a process that accords with the 2011 *Standards and Guidelines for Consultant Archaeologists* set by the ministry, and that the archaeological fieldwork and report recommendations are consistent with the conservation, protection and preservation of the cultural heritage of Ontario.

The report documents the assessment of the study area as depicted in Figures 1 and 4 of the above titled report and recommends the following:

The Stage 1 archaeological assessment of the study area for the Project, involving background research and a property inspection, determined that much of the study area retains potential for the identification and documentation of archaeological resources. In accordance with Section 1.3.1 and Section 7.7.4 of the MHSTCI's 2011 Standards and Guidelines for Consultant Archaeologists (Government of Ontario 2011), Stage 2 archaeological assessment is required for any portion of the Project's anticipated construction which impacts an area of archaeological potential. Further, the portion of the study area containing the Thames River retains potential for the identification of marine archaeological resources, it is also recommended that potential for marine archaeological resources be evaluated using the MHSTCI's Criteria for Evaluating Marine Archaeological Potential Checklist.

The Stage 1 archaeological assessment also determined that there are portions of the study area which

retain low to no archaeological potential for the identification or recovery of archaeological resources. In accordance with Section 1.3.2 and Section 7.7.4 of the MHSTCI's 2011 Standards and Guidelines for Consultant Archaeologists (Government of Ontario 2011), Stage 2 archaeological assessment is not required for any portion of the Project's anticipated construction which impacts an area of low to no archaeological potential.

Full and detailed recommendations are provided in the body of the report.

Based on the information contained in the report, the ministry is satisfied that the fieldwork and reporting for the archaeological assessment are consistent with the ministry's 2011 *Standards and Guidelines for Consultant Archaeologists* and the terms and conditions for archaeological licences. This report has been entered into the Ontario Public Register of Archaeological Reports. Please note that the ministry makes no representation or warranty as to the completeness, accuracy or quality of reports in the register.

Should you require any further information regarding this matter, please feel free to contact me.

Sincerely,

Andrea Williams
Archaeology Review Officer

cc. Archaeology Licensing Officer
Chris Traini,Middlesex County
Chris Traini,Middlesex County

[1] *In no way will the ministry be liable for any harm, damages, costs, expenses, losses, claims or actions that may result: (a) if the Report(s) or its recommendations are discovered to be inaccurate, incomplete, misleading or fraudulent; or (b) from the issuance of this letter. Further measures may need to be taken in the event that additional artifacts or archaeological sites are identified or the Report(s) is otherwise found to be inaccurate, incomplete, misleading or fraudulent.*

Stage 1 Archaeological Assessment: Municipal Class Environmental Assessment, Thorndale Bridge Improvements, County Road 28 (Thorndale Road)

Parts of Lots 15 and 16, Concessions 1 and 2,
Geographic Township of Nissouri,
former Oxford County,
now Municipality of Thames Centre,
Middlesex County, Ontario

September 29, 2020

Prepared for:

Chris Traini, P.Eng.
Middlesex County
399 Ridout Street North
London, Ontario N6A 2P1
Tel: 519-434-7321, ext. 2264
Email: ctraini@middlesex.ca

Prepared by:

Stantec Consulting Ltd.
600 – 171 Queens Ave.
London, Ontario N6A 5J7

Licensee: Parker Dickson, MA
License Number: P256
PIF Number: P256-0577-2019
Project Number: 165001122

REVISED REPORT

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Executive Summary

Stantec Consulting Ltd. (Stantec) was retained by Middlesex County to complete a Stage 1 archaeological assessment as part of Municipal Class Environmental Assessment (Class EA) for improvements to the Thorndale Bridge on County Road 28 (Thorndale Road) (the Project). The Stage 1 assessment conducted by Stantec was undertaken in the preliminary planning and design process for the Class EA requirements for a Schedule 'C' project under the *Ontario Environmental Assessment Act* (Government of Ontario 1990d). The Stage 1 assessment was further triggered by the Provincial Policy Statement (PPS) which has been issued under section 3 of the *Planning Act* (Government of Ontario 1990a). The PPS states that decisions affecting planning matters may be affected by other legislation; for archaeological work that would include the *Ontario Heritage Act* (1990b). According to Section 2.6.2 of the PPS, "*development* and *site alteration* shall not be permitted on lands containing *archaeological resources* or *areas of archaeological potential* unless *significant archaeological resources* have been *conserved*" (Government of Ontario 2014).

The Stage 1 study area for the Project includes permanent and temporary work spaces on either side of the Thames River at the Thorndale Bridge. The final detailed design and the construction easement/footprint for the Project will be determined at a later date. Thus, the current study area for the Stage 1 archaeological assessment is large and serves to capture a broad and generalized geographic area associated with the Project. The study area is approximately 775 metres long and 315 metres wide and comprises approximately 23.7 hectares, located within Lots 15 and 16, Concessions 1 and 2, Geographic Township of Nissouri, former Oxford County, now Municipality of Thames Centre, Middlesex County, Ontario.

The Stage 1 archaeological assessment was conducted in accordance with the Ministry of Heritage, Sport, Tourism and Culture Industries' (MHSTCI) 2011 *Standards and Guidelines for Consultant Archaeologists* under archaeological consulting license P265 issued to Parker Dickson by the MHSTCI. A property inspection was undertaken on July 10, 2019 and September 15, 2020, under Project Information Form number P256-0577-2019.

The Stage 1 archaeological assessment of the study area for the Project, involving background research and a property inspection, determined that much of the study area retains potential for the identification and documentation of archaeological resources. In accordance with Section 1.3.1 and Section 7.7.4 of the MHSTCI's 2011 *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011), Stage 2 archaeological assessment is required for any portion of the Project's anticipated construction which impacts an area of archaeological potential. Further, the portion of the study area containing the Thames River retains potential for the identification of marine archaeological resources, it is also recommended that potential for marine archaeological resources be evaluated using the MHSTCI's *Criteria for Evaluating Marine Archaeological Potential Checklist*.

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Full and detailed recommendations are provided in the body of the report.

The MHSTIC is asked to review the results presented and to accept this report into the *Ontario Public Register of Archaeological Reports*. Archaeological sites recommended for further archaeological fieldwork or protection remain subject to Section 48 (1) of the *Ontario Heritage Act* (Government of Ontario 1990b) and may not be altered, or have artifacts removed from them, except by a person holding an archaeological license.

The Executive Summary highlights key points from the report only; for complete information and findings, the reader should examine the complete report.

Project Personnel

Licensed Archaeologist:	Parker Dickson, MA (P256)
Project Manager:	Isaac Bartlett, P.Eng.
Licensed Field Director:	Ruth Dickau, Ph.D. (R1171), Parker Dickson, MA (P256)
GIS Specialist:	Julie Werner
Report Writer:	Ruth Dickau, Ph.D. (R1171)
Historian:	Frank Smith, MA
Quality Review:	Parker Dickson, MA (P256)
Independent Review:	Colin Varley, MA, RPA (P002)

Acknowledgements

Middlesex County:	Chris Traini, P.Eng. – County Engineer
Ministry of Heritage, Sport, Tourism and Culture Industries:	Robert von Bitter – Archaeological Sites Database Coordinator Andrea Williams – Archaeology Review Officer

1.0 PROJECT CONTEXT

1.1 DEVELOPMENT CONTEXT

Stantec Consulting Ltd. (Stantec) was retained by Middlesex County to complete a Stage 1 archaeological assessment as part of Municipal Class Environmental Assessment (Class EA) for improvements to the Thorndale Bridge on County Road 28 (Thorndale Road) (the Project). The Stage 1 assessment conducted by Stantec was undertaken in the preliminary planning and design process for the Class EA requirements for a Schedule 'C' project under the *Ontario Environmental Assessment Act* (Government of Ontario 1990d). The Stage 1 assessment was further triggered by the Provincial Policy Statement (PPS) which has been issued under section 3 of the *Planning Act* (Government of Ontario 1990a). The PPS states that decisions affecting planning matters may be affected by other legislation; for archaeological work that would include the *Ontario Heritage Act* (1990b). According to Section 2.6.2 of the PPS, "*development* and *site alteration* shall not be permitted on lands containing *archaeological resources* or *areas of archaeological potential* unless *significant archaeological resources* have been *conserved*" (Government of Ontario 2014).

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Table 1: Lots and Concessions Related to the Study Area

Lot	Concession	Geographic Township	Former County	Current Municipality
15	1	Nissouri	Oxford	Municipality of Thames Centre, Middlesex County
16	1	Nissouri	Oxford	Municipality of Thames Centre, Middlesex County
15	2	Nissouri	Oxford	Municipality of Thames Centre, Middlesex County
16	2	Nissouri	Oxford	Municipality of Thames Centre, Middlesex County

1.1.1 Objectives

In compliance with the provincial standards and guidelines set out in the Ministry of Heritage, Sport, Tourism and Culture Industries' (MHSTCI) 2011 *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011), the objectives of the Stage 1 archaeological assessment are as follows:

- To provide information about the study area's geography, history, previous archaeological fieldwork, and current land conditions;
- To evaluate the study area's archaeological potential, which will support recommendations for Stage 2 survey for all or parts of the property; and
- To recommend appropriate strategies for Stage 2 survey.

To meet these objectives, Stantec archaeologists employed the following research strategies:

- A review of relevant archaeological, historic, and environmental literature pertaining to the study area;
- A review of the land use history, including pertinent historic maps; and
- An examination of the *Ontario Archaeological Sites Database* to determine the presence of known archaeological sites in and around the study area.

Permission for Stantec staff to enter private lands associated with the study area could not be obtained by Middlesex County to facilitate a full property inspection. As a result, the property inspection was limited to municipal road rights-of-way (ROWs) and public property.

1.2 HISTORICAL CONTEXT

1.2.1 Post-contact Indigenous Resources

"Contact" is typically used as a chronological benchmark when discussing Indigenous archaeology in Canada and describes the contact between Indigenous and European cultures. The precise moment of contact is a constant matter of discussion. Contact in what is now the province of Ontario is broadly assigned to the 16th century (Loewen and Chapdelaine 2016).

The post-contact Indigenous occupation of southern Ontario was heavily influenced by the dispersal of various Iroquoian-speaking communities by the New York State Iroquois and the subsequent arrival of Algonkian-speaking groups from northern Ontario at the end of the 17th century and beginning of the 18th century (Konrad 1981; Schmalz 1991). By 1690, Algonkian speakers from the north appear to have begun to repopulate Bruce County (Rogers 1978:761). This is the period in which the Mississaugas are known to have moved into southern Ontario and the lower Great Lakes watersheds (Konrad 1981). In southwestern Ontario, however, members of the Three Fires Confederacy (Chippewa, Ottawa, and Potawatomi) were immigrating from Ohio and Michigan in the late 1700s (Feest and Feest 1978:778-779). Together with the Potawatomi, the Ojibwa and Ottawa constituted a political confederacy known as the Three Fires. At approximately 1790, the study area was occupied by populations of Ottawa, Chippewa, Potawatomi, and Wyandot (Feest and Feest 1978:777, 779).

From the mid-16th century until the turn of the 17th century, the region of the study area was within the extended political territory of Iroquoian populations who were probably ancestral to those historically described as the *Neutre* Nations (by the French) or the *Attiwandaron* (by the Huron-Wendat); their autonym is not conclusively known (Birch 2015). Following the turn of the 17th century, the region of the study area seems to have been abandoned by permanent settlement and constituted a liminal territory between the historic Attiwandaron (Neutral) and the historic Fire Nation, an Algonquian group occupying

the western end of Lake Erie. It is argued, however, that at this time the Attiwandaron (Neutral) expanded extensively westward, displacing the Fire Nation and occupying the region of modern Chatham-Kent (Lennox and Fitzgerald 1990:418-419).

It is debated whether the Fire Nation descended from the archaeologically described Western Basin Tradition (which is documented throughout the Thames River Valley from approximately 700 CE), or if they migrated into the western part of Lake Erie, displacing a previous Indigenous culture (Murphy and Ferris 1990:193-194). In 1649, the Seneca, with the Mohawk, led a campaign into southern Ontario and dispersed the Huron-Wendat, Tionontate (Petun), and Attiwandaron (Neutral) Nations and the Seneca established dominance over the region, using it as a hinterland for beaver hunting (Heidenreich 1978; Trigger 1978:345). By 1690, Ojibwa speaking people had begun moving south into the lower Great Lakes basin. The Indigenous economy since the turn of the 18th century had focused on fishing and the fur trade, supplemented by agriculture and hunting (Konrad 1981; Rogers 1978). Generally, the study area falls within the traditional territory of the Bkejwanong (Walpole Island) First Nation, the Aamjiwnaang (Sarnia) First Nation (Aamjiwnaang First Nation), the Wiiwkwedong and Aazhoodena (Kettle Point and Stony Point) First Nation (Lytwyn 2009) and the Deshkaan Ziibing Anishnaabeg (Chippewas of the Thames First Nation).

The expansion of the fur trade led to increased interaction between European and Indigenous people, and ultimately intermarriage between European men and Indigenous women. During the 18th century the progeny of these marriages began to no longer identify with either their paternal or maternal cultures, but instead as Métis. The ethnogenesis of the Métis progressed with the establishment of distinct Métis communities along the major waterways in the Great Lakes of Ontario. Métis communities were primarily focused around the upper Great Lakes and along Georgian Bay, however, Métis people have historically lived throughout Ontario (Métis Nation of Ontario 2016; Stone and Chaput 1978:607-608).

The nature of Indigenous settlement size, population distribution, and material culture shifted as European settlers encroached upon their territory. Despite this shift, “written accounts of material life and livelihood, the correlation of historically recorded villages to their archaeological manifestations, and the similarities of those sites to more ancient sites have revealed an antiquity to documented cultural expressions that confirms a deep historical continuity to…systems of ideology and thought” (Ferris 2009:114). As a result, Indigenous peoples have left behind archaeologically significant resources throughout southern Ontario which show continuity with past peoples, even if they have not been recorded in Euro-Canadian documentation.

Since contact with European explorers and immigrants, and, later, with the establishment of provincial and federal governments (the Crown), the lands within Ontario and the Geographic Township of Nissouri have been included in various treaties, land claims, and land cessations. Though not an exhaustive list, Morris (1943) provides a general outline of some of the treaties within the Province of Ontario from 1783 to 1923. Based on Morris (1943), the study area is situated within Treaty Number 6. Treaty Number 6 was established on September 7th, 1796, between the Crown and the Chippewa Nation (Indigenous and Northern Affairs Canada 2016). Treaty Number 6 *“...conveyed by the Principal Chiefs, Warriors and People of the Chippewa Nation of Indians to the Crown, of that tract of land situate lying and being on the*

north side of the River Thames or River La Tranche and known by the Indian name Escunnisabe, on the 7th of September, 1796…" (Morris 1943:26-27). While it is difficult to exactly delineate treaty boundaries today, Figure 2 provides an approximate outline of Treaty Number 6 (identified by the letter "I").

1.2.2 Euro-Canadian Resources

In 1791, the Provinces of Upper Canada and Lower Canada were created from the former Province of Quebec by an act of British Parliament. At this time, Colonel John Graves Simcoe was appointed as the Lieutenant Governor of Upper Canada and was tasked with governing the new province, directing its settlement, and establishing a constitutional government modelled after that of Britain. In 1792, Simcoe divided Upper Canada into 19 counties consisting of previously settled lands, new lands opened for settlement, and lands not yet acquired by Crown. These new counties stretched from Essex in the west to Glengarry in the east.

Initially, Nissouri Township was a part of Oxford County. Following municipal restructuring in 2001, the western portion of Nissouri Township, along with the Township of North Dorchester, were amalgamated to form the Municipality of Thames Centre as a part of reorganized Middlesex County. The population of Oxford County increased dramatically in the early 19th century and vast tracts of land north of Governor's Road, present day Dundas Street, were opened to accommodate the influx of settlers. The survey of Nissouri was originally initiated in 1811 but was delayed by the outbreak of the War of 1812. Later, the Township of Nissouri was surveyed by Shubal Park, the Deputy Surveyor of Ontario, and annexed by Oxford County in 1821. The name of the Nissouri township is believed to be in reference to an Indigenous word meaning "running waters," for the many watercourses that cross the township (Logan 1967:6). The surveyed township extended thirteen and a half miles north to south, from the Perth Line to the Governor's Road, and eleven and thirteen sixteenths miles west to east from London Township to Zorra.

The first European settlers in Nissouri township were Clauson Burges, George Logan, John Dunsmore, John and Thomas Scatcherd, the Vining family, and the McGaffin family (Page & Co. 1878:12). By 1822, the population of Nissouri Township was large enough to warrant its own town meeting. In the years following, Charles Ingersoll, a prominent business owner in Oxford Township, built a grist and sawmill, expanding on his previously existing ashery and distillery (Dawe 1980:31-33). Ingersoll played an important role in the development of Nissouri Township, even offering to pay the first tax assessments for the township as a whole in return for a set quantity of ash from each taxpayer. Around this time a number of new roads were opened up from the Detroit path (known as the 'Main Road') joining up with Governor's Road which formed the southern boundary of Nissouri Township. These new roads coincided with a number of new mill sites that were under development (Dawe 1980:31-33).

The settlement of Nissouri Township was supplemented by an influx of British settlers throughout the second half of the 1820s. In addition, there were representatives of several minorities, such as the Pennsylvania Dutch, who had immigrated after the American Revolutionary War. By 1842, the population of the township had grown to 1,460 (Smith 1846:131).

In 1858, the Grand Trunk Railway (GTR) line was completed through the village of Thorndale, including a station and rail freight sheds. The coming of the GTR through the village of Thorndale significantly influenced its mid-to late 19th century development. The railway line opened up new markets for timber, farm products and other goods produced in the village and surrounding area (Abra 2019).

The *Illustrated Historical Atlas of Middlesex County* (Page & Co. 1878) notes that Nissouri Township was densely occupied by 1878, with landowners listed for most lots (Figure 3). Table 2 provides a summary of the landowners associated with Lots 15 and 16, Concessions 1 and 2.

Table 2: Applicable Landowner Information from the 1876 Map of Nissouri Township

Lot	Concession	Landowner	Comment
15 (west of Thames)	1	William R. Harding	A structure and orchard are depicted in the north central part of the lot, fronting County Road 28.
15 (small parcel east of the Thames)	1	Robert Walker	No structures depicted.
15 (east of Thames)	2	Robert Walker	A structure and orchard are depicted on the east bank of the Thames River, fronting County Road 28. A second orchard is depicted to the south, east of the Thames River.
15 (small parcel west of Thames)	2	William R. Harding	No structures depicted.
16 east half	1	Patrick De Wan	A structure and orchard are depicted in the southwest corner of the half lot, fronting County Road 28.
16 (west of Thames)	2	Patrick De Wan	No structures depicted.
16 west half (east of Thames)	2	John Holland	A structure and orchard are depicted on the east bank of the Thames Rivers, front County Road 28.

Historical county atlases were produced primarily to identify factories, offices, residences and landholdings of subscribers, and were funded by subscription fees. Landowners who did not subscribe were not always listed on the maps (Caston 1997:100). As such, all structures were not necessarily depicted or placed accurately (Gentilcore and Head 1984). Further, review of historic mapping, including treaty maps, also has inherent accuracy difficulties due to potential error in geo-referencing. Geo-referencing is conducted by assigning spatial coordinates to fixed locations and using these points to spatially reference the remainder of the map. Due to changes in “fixed” locations over time (e.g., road intersections), errors/difficulties of scale and the relative idealism of the historic cartography, historic maps may not translate accurately into real space points. This may provide obvious inconsistencies during the historic map review. Nonetheless, the majority of the region surrounding the study area has been subject to European-style agricultural practices for over 100 years, having been settled by Euro-Canadian farmers by the late 19th century. Much of the region today continues to be used for agricultural purposes.

1.3 ARCHAEOLOGICAL CONTEXT

1.3.1 The Natural Environment

The study area is situated within the Stratford Till Plain physiographic region of southern Ontario (Chapman and Putnam 1984:133). The Stratford Till Plain is described as:

> *…broad clay plain of 1,370 square miles, extending from London in the south to Blyth and Listowel in the north with a projection toward Arthur and Grand Valley. It is an area of ground moraine interrupted by several terminal moraines. The moraines are more closely spaced in the southwestern portion of the region; consequently that part resembles the Mount Elgin Ridges…. Throughout this area the till is fairly uniform, being a brown calcareous silty clay whether on the ridges or the more level ground moraine. It is a product of the Huron ice lobe. Some of the silt and clay is calcareous rock flour, probably a good deal of it coming from previously deposited varved clays of the Lake Huron Basin.*
>
> (Chapman and Putnam 1984:133)

The study area is dominated by the Thames River valley, which lies within a former glacial spillway, and is surrounded by undrumlinized till plains. Soil on the terrace above the river valley to the west is classified as Bryanston loam (Hagerty and Kingston 1992:39-41). Although these soils contain some rock and boulders, they are considered good for agriculture. They are highly erodible due to their loamy nature (Hagerty and Kingston 1992:41). Soil on the terrace above the river valley to the east is classified as Brant silt loam (Hagerty and Kingston 1992:33-35). These soils are considered excellent for agriculture and among the most productive in the county. Like the Bryanston loam, Brant silt loam can be susceptible to erosion in sloped topography (Hagerty and Kingston 1992:35).

Maize was the most important subsistence crop for pre-contact Indigenous agriculture. Soil variability can account for significant difference in bushel yield per acre for corn agriculture (Government of Ontario 2016). The ideal soil texture and drainage for corn cultivation is well-drained silty. Both Bryanston loam and Brant silt loam would be suitable for Indigenous maize cultivation.

Potable water is the single most important resource for any extended human occupation or settlement and since water sources in southwestern Ontario have remained relatively stable over time, proximity to drinkable water is regarded as a useful index for the evaluation of archaeological site potential. In fact, distance to water is one of the most commonly used variables for predictive modeling of archaeological site location in Ontario.

The closest potable water source is the north branch of the Thames River, which bisects the study area. Use of the Thames River has evolved over time from being a transportation route used by early Indigenous inhabitants and Euro-Canadian explorers and settlers, to an industrial power source to support the early mills of the area, and finally to a water course used for recreational purposes throughout the 20th and 21st centuries. The Thames River drains an area of approximately 5,700 square kilometres and is approximately 200 kilometres in length. The Thames River is designated as a Canadian Heritage

River on the merit of its over 11,000 years of Indigenous occupation and its importance in Canada's post-contact history (Canadian Heritage Rivers System 2017).

1.3.2 Pre-contact Indigenous Resources

This portion of southwestern Ontario has been occupied by Indigenous peoples since the retreat of the Wisconsin glacier approximately 11,000 years ago. Much of what is understood about the lifeways of these Indigenous peoples is derived from archaeological evidence and ethnographic analogy. In Ontario, Indigenous culture prior to the period of contact with European peoples has been distinguished into cultural periods based on observed changes in material culture. These cultural periods are largely based on observed changes in formal lithic tools, and separated into the Early Paleo-Indian, Late Paleo-Indian, Early Archaic, Middle Archaic, and Late Archaic periods. Following the advent of ceramic technology in the Indigenous archaeological record, cultural periods are separated into the Early Woodland, Middle Woodland, and Late Woodland periods, based primarily on observed changes in formal ceramic decoration. It should be noted that these cultural periods do not necessarily represent specific cultural identities but are a useful paradigm for understanding changes in Indigenous culture through time. Table 3 provides a general outline of the cultural chronology of the study area, summarized from Ellis and Ferris (1990). The provided time periods are based on the "Common Era" calendar notation system: Before Common Era (BCE) and Common Era (CE).

Table 3: Generalized Cultural Chronology of the Study Area

Period	Characteristics	Time	Comments
Early Paleo-Indian	Fluted Projectiles	9000 – 8400 BCE	spruce parkland/caribou hunters
Late Paleo-Indian	Hi-Lo Projectiles	8400 – 8000 BCE	smaller but more numerous sites
Early Archaic	Kirk and Bifurcate Base Points	8000 – 6000 BCE	slow population growth
Middle Archaic	Brewerton-like Points	6000 – 2500 BCE	environment similar to present
Late Archaic	Narrow Point	2000 – 1800 BCE	increasing site size
	Broad Point	1800 – 1500 BCE	large chipped lithic tools
	Small Point	1500 – 1100 BCE	introduction of bow hunting
Terminal Archaic	Hind Points	1100 – 950 BCE	emergence of true cemeteries
Early Woodland	Meadowood Points	950 – 400 BCE	introduction of pottery
Middle Woodland	Dentate/Pseudo-Scallop Pottery	400 BCE – CE 500	increased sedentism
	Princess Point	CE 550 – 900	seasonal hunting and gathering
Late Woodland	Early Ontario Iroquoian	CE 900 – 1300	incipient agriculture
	Middle Ontario Iroquoian	CE 1300 – 1400	agricultural villages
	Late Ontario Iroquoian	CE 1400 – 1650	earth worked villages, warfare
Contact Indigenous	Various Algonkian and Iroquoian Groups	1600 – 1875 CE	early written records and treaties
Historic	French/Euro-Canadian	1749 CE – present	European settlement

Local environmental conditions during the Paleo-Indian period were significantly different from what they are today. Ontario's first peoples would have crossed the landscape in small groups in search of food, particularly migratory game species. In this area, caribou may have been a Paleo-Indian diet staple, supplemented by wild plants, small game, birds, and fish. Given the low density of populations on the landscape at this time and their mobile nature, Paleo-Indian sites are small and ephemeral. They are sometimes identified by the presence of fluted points. Sites are frequently located adjacent to the shorelines of large glacial lakes. Between 9000 and 8000 BCE, Indigenous populations were sustained by hunting, fishing and foraging and lived a relatively mobile existence across an extensive geographic territory. Despite these wide territories, social ties were maintained between groups. One method to maintain social ties between distant groups was through gift exchange, evident through exotic lithic material documented on many sites (Ellis 2013:35-40).

Archaeological records indicate subsistence changes around 8000 BCE at the start of the Archaic Period in southwestern Ontario. Since the large mammal species that formed the basis of the Paleo-Indian diet became extinct or moved north with the warming of the climate, Archaic populations had a more varied diet, exploiting a range of plants and bird, mammal, and fish species. Reliance on specific food resources like fish, deer, and several nut species became more noticeable through the Archaic Period and the presence of warmer, more hospitable environs led to expansion of group and family sizes. In the archaeological record, this is evident in the presence of larger sites.

By approximately 8000 BCE, evidence exists and becomes more common for the production of ground-stone tools such as axes, chisels and adzes. These tools themselves are believed to be indicative specifically of woodworking. This evidence can be extended to indicate an increase in craft production and arguably craft specialization. This latter statement is also supported by evidence, dating to approximately 7000 BCE of ornately carved stone objects which would be laborious to produce and have explicit aesthetic qualities (Ellis 2013:41). This is indirectly indicative of changes in social organization which permitted individuals to devote time and effort to craft specialization. Since 8000 BCE, the Great Lakes basin experienced a low-water phase, with shorelines significantly below modern lake levels (Stewart 2013: Figure1.1.C). It is presumed that the majority of human settlements would have been focused along these former shorelines. At approximately 6500 BCE the climate had warmed considerably since the recession of the glaciers and the environment had grown more similar to the present day. By approximately 4500 BCE, evidence exists from southern Ontario for the utilization of native copper (naturally occurring pure copper metal) (Ellis 2013:42). The known origin of this material along the north shore of Lake Superior indicates the existence of extensive exchange networks across the Great Lakes basin.

The coniferous forests of earlier times were replaced by stands of mixed coniferous and deciduous trees by about 4000 BCE. The transition to more productive environmental circumstances led to a rise in population density. As a result, Archaic sites become more abundant over time. Artifacts typical of these occupations include a variety of stemmed and notched projectile points; chipped stone scrapers; ground stone tools (e.g., celts, adzes) and ornaments (e.g., bannerstones, gorgets); bifaces or tool blanks; animal bone; and chert waste flakes, a byproduct of the tool making process (Ellis *et al*. 1990).

At approximately 3500 BCE, the isostatic rebound of the North American plate following the melt of the Laurentide glacier had reached a point which significantly affected the watershed of the Great Lakes basin. Prior to this, the Upper Great Lakes had drained down the Ottawa Valley via the French-Mattawa river valleys. Following this shift in the watershed, the drainage course of the Great Lakes basin had changed to its present course. This also prompted a significant increase in water-level to approximately modern levels (with a brief high-water period); this change in water levels is believed to have occurred catastrophically (Stewart 2013:28-30). This change in geography coincides with the earliest evidence for cemeteries (Ellis 2013:46). By 2500 BCE, the earliest evidence exists for the construction of fishing weirs (Ellis *et al.* 1990: Figure 4.1). Construction of these weirs would have required a large amount of communal labour and are indicative of the continued development of social organization and communal identity. The large-scale procurement of food at a single location also has significant implications for permanence of settlement within the landscape. This period is also marked by further population increase and by 1500 BCE evidence exists for substantial permanent structures (Ellis 2013:45-46).

By approximately 950 BCE, the earliest evidence exists for populations using ceramics. Populations are understood to have continued to seasonally exploit natural resources. This advent of ceramic technology correlated, however, with the intensive exploitation of seed foods such as goosefoot and knotweed as well as mast such as nuts (Williamson 2013:48). The use of ceramics implies changes in the social organization of food storage as well as in the cooking of food and changes in diet. Fish also continued to be an important facet of the economy at this time. Evidence continues to exist for the expansion of social organization (including hierarchy), group identity, ceremonialism (particularly in burial), interregional exchange throughout the Great Lakes basin and beyond, and craft production (Williamson 2013:48-54).

By approximately 550 CE, evidence emerges for the introduction of maize into southern Ontario. This crop would have initially only supplemented Indigenous peoples' diet and economy (Birch and Williamson 2013:13-14). Maize-based agriculture gradually became more important to societies and by approximately 900 CE permanent communities emerge which are primarily focused on agriculture and the storage of crops, with satellite locations oriented toward the procurement of other resources via hunting, fishing and foraging. By approximately 1250 CE, evidence exists for the common cultivation of historic Indigenous cultigens, including maize, beans, squash, sunflower and tobacco. The cultural affiliation of populations within the region of the study area at this time period is debated, whether they may have spoken a form of Iroquoian language or Algonquian (Murphy and Ferris 1990). The extent archaeological record demonstrates many cultural traits similar to historic Indigenous nations (Williamson 2013:55).

1.3.3 Registered Archaeological Sites and Known Surveys

In Canada, archaeological sites are registered within the Borden system, a national grid system designed by Charles Borden in 1952 (Borden 1952). The grid covers the entire surface area of Canada and is divided into major units containing an area that is two degrees in latitude by four degrees in longitude. Major units are designated by upper case letters. Each major unit is subdivided into 288 basic unit areas, each containing an area of 10 minutes in latitude by 10 minutes in longitude. The width of basic units reduces as one moves north due to the curvature of the earth. In southern Ontario, each basic unit

measures approximately 13.5 kilometres east-west by 18.5 kilometres north-south. In northern Ontario, adjacent to Hudson Bay, each basic unit measures approximately 10.2 kilometres east-west by 18.5 kilometres north-south. Basic units are designated by lower case letters. Individual sites are assigned a unique, sequential number as they are registered. These sequential numbers are issued by the MHSTCI who maintain the *Ontario Archaeological Sites Database*. The study area under review is located within Borden Blocks AgHh and AgHg.

Information concerning specific site locations is protected by provincial policy and is not fully subject to the *Freedom of Information and Protection of Privacy Act* (Government of Ontario 1990c). The release of such information in the past has led to looting or various forms of illegally conducted site destruction. Confidentiality extends to media capable of conveying location, including maps, drawings, or textual descriptions of a site location. The MHSTCI will provide information concerning site location to the party or an agent of the party holding title to a property, or to a licensed archaeologist with relevant cultural resource management interests.

An examination of the *Ontario Archaeological Sites Database* has shown that there are 12 registered archaeological sites located within a one-kilometre radius of the study area (Government Ontario 2019a). Table 4 summarizes the registered archaeological sites within one-kilometre of the study area. None of the registered archaeological sites are located within 50 metres of the study area.

Table 4: Registered Archaeological Sites within One-Kilometre of the Study Area

Borden #	Site Name	Site Type	Cultural Affiliation
AgHh-196	Not applicable (n/a)	Indigenous findspot	Early Archaic
AgHh-197	n/a	Indigenous findspot	Late Archaic
AgHh-198	n/a	Indigenous findspot	Middle Archaic
AgHh-199	n/a	Euro-Canadian homestead	19th century Euro-Canadian
AgHh-248	n/a	Indigenous findspot	Late Woodland
AgHh-249	n/a	Indigenous findspot	Middle Woodland
AgHh-250	n/a	Indigenous findspot	Middle Woodland
AgHh-251	n/a	Indigenous findspot	Early Woodland
AgHh-252	n/a	Indigenous findspot	Middle Archaic
AgHh-253	n/a	Indigenous findspot	Late Archaic
AgHh-254	Findspot 11, Location 12	Indigenous findspot	Indeterminate Indigenous
AgHh-255	n/a	Indigenous findspot	Late Archaic

A query of the *Ontario Public Register of Archaeological Reports* was completed to identify any previous archeological assessment completed within, or adjacent to, the study area. Based on the query, no previous archaeological assessments have been completed within the study area or within 50 metres of the current study area (Government of Ontario 2019b).

1.3.4 Existing Conditions

The study area for the Stage 1 assessment of the Project comprises approximately 23.7 hectares of municipal road ROW and adjacent lands within Lots 15 and 16, Concessions 1 and 2, Geographic Township of Nissouri, former Oxford County, now Municipality of Thames Centre, Middlesex County, Ontario. The study area involves a stretch of Thorndale Road that crosses the Thames River west of the town of Thorndale, extending approximately 400 metres on either side of the river. The Stage 1 archaeological study area also includes the lands approximately 150 metres on either side of the road. Generally, the study area is a mix of woodlot and scrubland, fallow agricultural field, manicured lawns, steeply sloped areas, and previously disturbed lands including existing municipal road ROWs, gravel and paved laneways, and buildings. The north branch of the Thames River crosses the study area.

2.0 FIELD METHODS

Initial background research compiled the available information concerning potential and registered archaeological resources within the study area. A property inspection was conducted under archaeological consulting license P256 issued to Parker Dickson, MA, of Stantec by the MHSTCI. The property inspection was completed on July 10, 2019 and September 15, 2020, under Project Information Form (PIF) number P256-0577-2019 in accordance with Section 1.2 of the MHSTCI's 2011 *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011). The property inspection involved spot checking of the study area to identify the presence or absence of any features of archaeological potential. Table 5 provides a summary of the weather conditions during the property inspection. Overall, the lighting, weather, and field conditions were not detrimental to the identification of features of archaeological potential.

Table 5: Weather Conditions during Property Inspection

Date	Field Director	Activity	Weather Conditions
July 10, 2019	Ruth Dickau (R1171)	Photo documentation	Sunny and warm
September 15, 2020	Parker Dickson (P256)	Photo documentation	Sunny and warm

The final construction easement/footprint for the Project will be determined at a later date. Thus, the overall study area for the Stage 1 archaeological assessment is large and serves to capture a broad and generalized geographic area associated with the Project. However, since the proposed construction will be focused on the Thorndale Bridge and municipal road ROW, the property inspection was largely limited to the road ROW, and the lands immediately adjacent to it, to identify the presence or absence of any features of archaeological potential. Further, permission for Stantec staff to enter private lands associated with the study area could not be obtained to facilitate a full property inspection. As a result, the property inspection was limited to municipal road ROWs and public property.

The photography from the property inspection is presented in Section 7.1 and confirms that the requirements for a Stage 1 property inspection were met, as per Section 1.2 and Section 7.7.2 Standard 1 of the MHSTCI'S 2011 *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011). Figure 4 provides an illustration of the study area depicted photo locations.

Photo 1 illustrates a fallow agricultural field within the study area which retains archaeological potential. Photos 2 to 5 illustrate typical woodlot and scrubland within the study area which retain archaeological potential. Photos 6 and 7 illustrate manicured lawns within the study area which retain archaeological potential.

Numerous modern disturbances were noted throughout the study area, including municipal road ROWs along with adjacent ditches and steep foreslopes (Photos 8 to 12), and gravel and paved laneways (Photos 13 and 14). Disturbance associated with the construction of the existing Thorndale Bridge, specifically beneath the bridge itself at the river's edge, is illustrated in Photos 17 and 18. Other modern

disturbances are noted throughout the study area, including residences and commercial buildings, but were not photo documented as part of the property inspection due to land access restrictions.

Lastly, the north branch of the Thames River crosses the study area (Photos 15 and 16) and is low and permanently wet. While the river is low and permanently wet, the area retains potential for marine archaeological resources.

3.0 ANALYSIS AND CONCLUSIONS

Archaeological potential is established by determining the likelihood that archaeological resources may be present on a subject property. Stantec applied archaeological potential criteria commonly used by the MHSTCI (Government of Ontario 2011) to determine areas of archaeological potential within the region under study. These variables include proximity to previously identified archaeological sites, distance to various types of water sources, soil texture and drainage, glacial geomorphology, elevated topography, and the general topographic variability of the area. However, it is worth noting that extensive land disturbance can eradicate archaeological potential (Government of Ontario 2011).

Potable water is the single most important resource for any extended human occupation or settlement and since water sources in Ontario have remained relatively stable over time, proximity to drinkable water is regarded as a useful index for the evaluation of archaeological site potential. In fact, distance to water is one of the most commonly used variables for predictive modeling of archaeological site locations. Distance to modern or ancient water sources is generally accepted as the most important determinant of past human settlement patterns and, considered alone, may result in a determination of archaeological potential. However, any combination of two or more other criteria, such as well-drained soils or topographic variability, may also indicate archaeological potential.

As discussed above, distance to water is an essential factor in archaeological potential modeling. When evaluating distance to water it is important to distinguish between water and shoreline, as well as natural and artificial water sources, as these features affect site location and type to varying degrees. The MHSTCI categorizes water sources in the following manner:

- Primary water sources: lakes, rivers, streams, creeks;
- Secondary water sources: intermittent streams and creeks, springs, marshes and swamps;
- Past water sources: glacial lake shorelines, relic river or stream channels, cobble beaches, shorelines of drained lakes or marshes; and
- Accessible or inaccessible shorelines: high bluffs, swamp or marshy lake edges, sandbars stretching into marsh.

A major primary water source, the north branch of the Thames River, crosses the study area. The Thames River was a significant transportation route in the past and the focus of both Indigenous and Euro-Canadian settlement and activity. The entire length of the Thames River was designated as Canadian Heritage River in 2000, by the governments of Ontario and Canada under the Canadian Heritage Rivers System (Canadian Heritage Rivers System 2017). Additional ancient and/or relic tributaries of water sources may have existed but are not identifiable today and are not indicated on historic mapping.

Further examination of the study area's natural environment identified soil conditions suitable for Indigenous and Euro-Canadian agriculture. Both Bryanston loam and Brant silt loam are well drained and could support Indigenous maize cultivation. The study area also contains areas of elevated topography. Storck (1982) notes that archaeological sites, particularly Paleo-Indian sites, tend to be situated in areas

of elevated topography as these areas would possess better drainage and would provide a broad view of the surrounding terrain for game watching.

An examination of the *Ontario Archaeological Sites Database* identified 11 Indigenous archaeological findspots within one kilometre of the study area, dating from the Early Archaic (8000 – 6000 BCE) to the Late Woodland (CE 1400 – 1650), demonstrating that the Thames River valley was an important focus of Indigenous activity for thousands of years.

For Euro-Canadian sites, archaeological potential can be extended to areas of early Euro-Canadian settlement, including places of military or pioneer settlements; early transportation routes; and properties listed on the municipal register or designated under the *Ontario Heritage Act* (Government of Ontario 1990b) or property that local histories or informants have identified with possible historical events, activities, or occupations. There are no protected heritage properties within or adjacent to the study area for the Project, although two mid-to-late 19th century residences are located east of the Thorndale bridge, fronting Thorndale Road. Both residences are depicted on the 1878 map of the Township of West Nissouri in the *Illustrated Historical Atlas of Middlesex County* (Page & Co. 1878). Full details pertaining to potential heritage properties and the anticipated impacts of the Project are provided in the Cultural Heritage Evaluation Report (CHER) for the Project (Stantec n.d.).

Historical mapping demonstrates that the study area follows early interior roads and concessions with structures illustrated as fronting these roads, particularly Thorndale Road. Much of the established road and rail networks, as well as structures and the associated agricultural settlements from the 19th century are still visible today.

Background and archival research have determined that the study area for the Project retains potential for the identification of Indigenous and Euro-Canadian archaeological resources. However, the Stage 1 property inspection has determined that portions of the study area, particularly along municipal road ROWs and beneath the existing Thorndale Bridge, have been subject to extensive land disturbance which has removed archaeological potential. Further, the Thames River itself represents a low and permanently wet area and is considered to retain low to no archaeological potential for land-based archaeological resources. However, the Thames River retains potential for the identification of marine archaeological resources.

The majority of the study area comprises woodlot and scrubland, fallow agricultural field, and manicured lawn. These areas are determined to retain archaeological potential. Photography from the property inspection also suggests that the study area retains areas of steep slope or other extensive disturbances. However, such areas were not specifically examined as part of the property inspection due to land access restrictions. As such, these areas have been included as part of the determination that the majority of the study area exhibits potential for the identification and recovery of archaeological resources.

In summary, the Stage 1 archaeological assessment of the Project, involving background research and a property inspection, determined that much of the study area retains potential for the identification and documentation of archaeological resources.

4.0 RECOMMENDATIONS

The Stage 1 archaeological assessment of the study area for the Project, involving background research and a property inspection, determined that much of the study area retains potential for the identification and documentation of archaeological resources. In accordance with Section 1.3.1 and Section 7.7.4 of the MHSTCI'S 2011 *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011), **Stage 2 archaeological assessment is required for any portion of the Project's anticipated construction which impacts an area of archaeological potential (Figure 4).**

The objective of the Stage 2 archaeological assessment will be to document archaeological resources within the portions of the study area still retaining archaeological potential and to determine whether these archaeological resources require further assessment. The Stage 2 archaeological assessment will include the systematic walking of open ploughed fields at five metre intervals as outlined in Section 2.1.1 of the MHSTCI'S 2011 *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011). The MHSTCI standards further require that all agricultural land, both active and inactive, be recently ploughed and sufficiently weathered to improve the visibility of archaeological resources. Ploughing must be deep enough to provide total topsoil exposure, but not deeper than previous ploughing, and must provide at least 80% ground surface visibility.

Moreover, for areas inaccessible for ploughing, the Stage 2 archaeological assessment will include a test pit survey at five metre intervals as outlined in Section 2.1.2 of the MHSTCI'S 2011 *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011). The MHSTCI standards require that each test pit be approximately 30 centimetres in diameter, excavated to at least five centimetres into subsoil, and have all soil screened through six millimetre hardware cloth to facilitate the recovery of any cultural material that may be present. Prior to backfilling, each test pit will be examined for stratigraphy, cultural features, or evidence of fill.

If the archaeological field team determines any lands to be low and permanently wet, steeply sloped, or disturbed during the course of the Stage 2 field work, those areas will not require survey, but will be photographically documented in accordance with Section 2.1 of the MHSTCI'S 2011 *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011).

In addition to the above, the portion of the study area containing the Thames River retains potential for the identification of marine archaeological resources (Figure 4). It is anticipated that impacts to the Thames River will occur and will be finalized as part of the Project's detailed design phase. Thus, **it is further recommended that potential for marine archaeological resources be evaluated using the MHSTCI's *Criteria for Evaluating Marine Archaeological Potential Checklist*.** A copy of the checklist is provided in Appendix A.

The Stage 1 archaeological assessment also determined that there are portions of the study area which retain low to no archaeological potential due to extensive disturbance. These portions of the study area retain low to no potential for the identification or recovery of archaeological resources. In accordance with

Section 1.3.2 and Section 7.7.4 of the MHSTCI'S 2011 *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011), **Stage 2 archaeological assessment is not required for any portion of the Project's anticipated construction which impacts an area of low to no archaeological potential (Figure 4).**

The MHSTCI is asked to review the results presented and to accept this report into the *Ontario Public Register of Archaeological Reports*.

5.0 ADVICE ON COMPLIANCE WITH LEGISLATION

This report is submitted to the Minister of Tourism, Culture and Sport as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18 (Government of Ontario 1990b). The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Tourism, Culture and Sport, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.

It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* (Government of Ontario 1990b) for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the *Ontario Public Register of Archaeological Reports* referred to in Section 65.1 of the *Ontario Heritage Act* (Government of Ontario 1990b).

Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48(1) of the *Ontario Heritage Act* (Government of Ontario 1990b).

The *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 (Government of Ontario 2002) requires that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Government and Consumer Services.

Archaeological sites recommended for further archaeological fieldwork or protection remain subject to Section 48 (1) of the *Ontario Heritage Act* (Government of Ontario 1990b) and may not be altered, or have artifacts removed from them, except by a person holding an archaeological license.

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7.0 IMAGES

7.1 PHOTOGRAPHS

Photo 1: General view of agricultural field, facing southeast

Photo 2: General view of scrubland, facing northwest

Photo 3: General view of woodlot, facing northwest

Photo 4: General view of scrubland, facing northeast

Photo 5: General view of woodlot, facing southeast

Photo 6: General view of manicured lawn, facing northeast

Photo 7: General view of manicured lawn, facing northwest

Photo 8: General view of disturbed road ROW, facing northeast

Images
September 29, 2020

Photo 9: General view of disturbed road ROW, facing southwest

Photo 10: General view of disturbed road ROW, facing northwest

Photo 11: General view of disturbed road ROW, facing southwest

Photo 12: General view of disturbed road ROW, facing southwest

Photo 13: General view of disturbed road ROW, facing south

Photo 14: General view of manicured lawn and existing residence, facing east

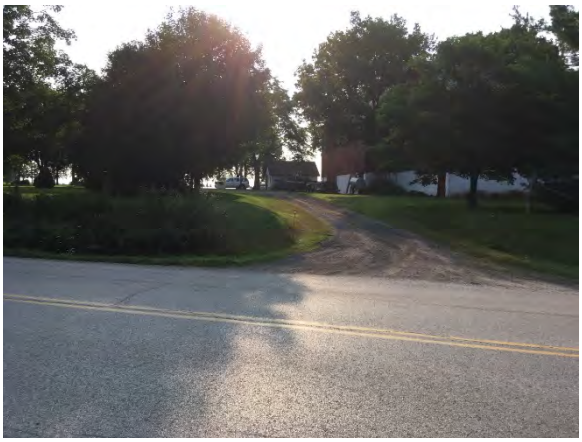


Photo 15: General view of the Thames River, facing northwest

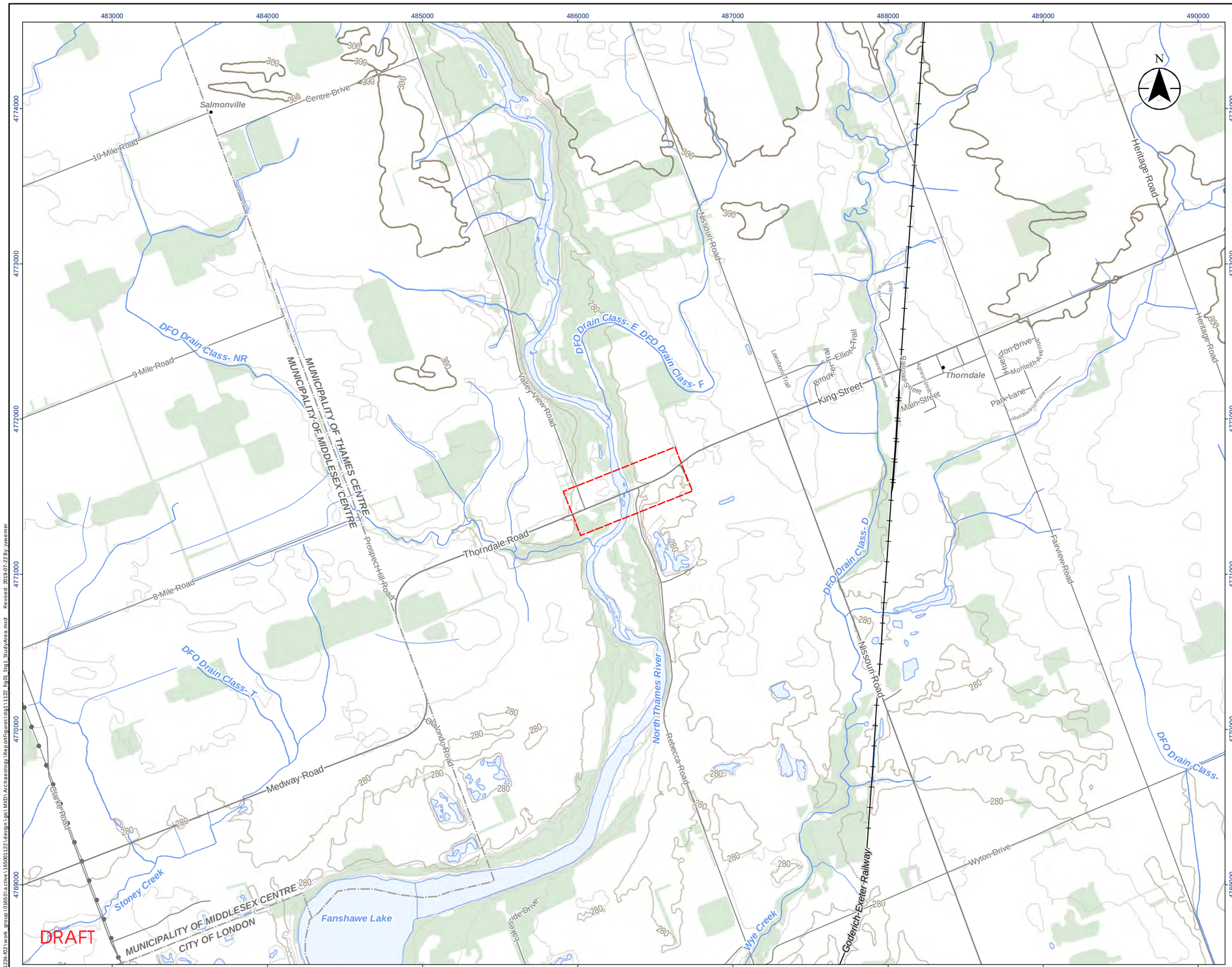
Photo 16: General view of the Thames River, facing south

Photo 17: Existing disturbance beneath Thorndale Bridge, facing southwest

Photo 18: Existing disturbance beneath Thorndale Bridge, facing southeast

8.0 MAPS

General maps of the study area will follow on succeeding pages.



Stantec

Legend

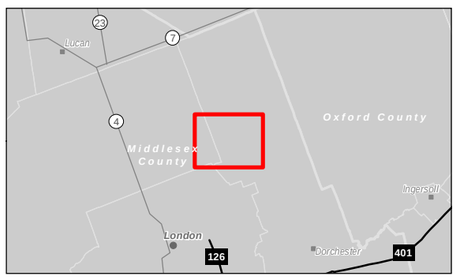
- Study Area
- Constructed Drain
- Railway
- Hydro Line
- Watercourse (Permanent)
- Waterbody
- Wooded Area
- Municipal Boundary, Lower

0 250 500 Meters

1:25,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018.
3. Orthoimagery obtained from © First Base Solutions, Middlesex County, imagery date 2010.



Project Location
County of Middlesex

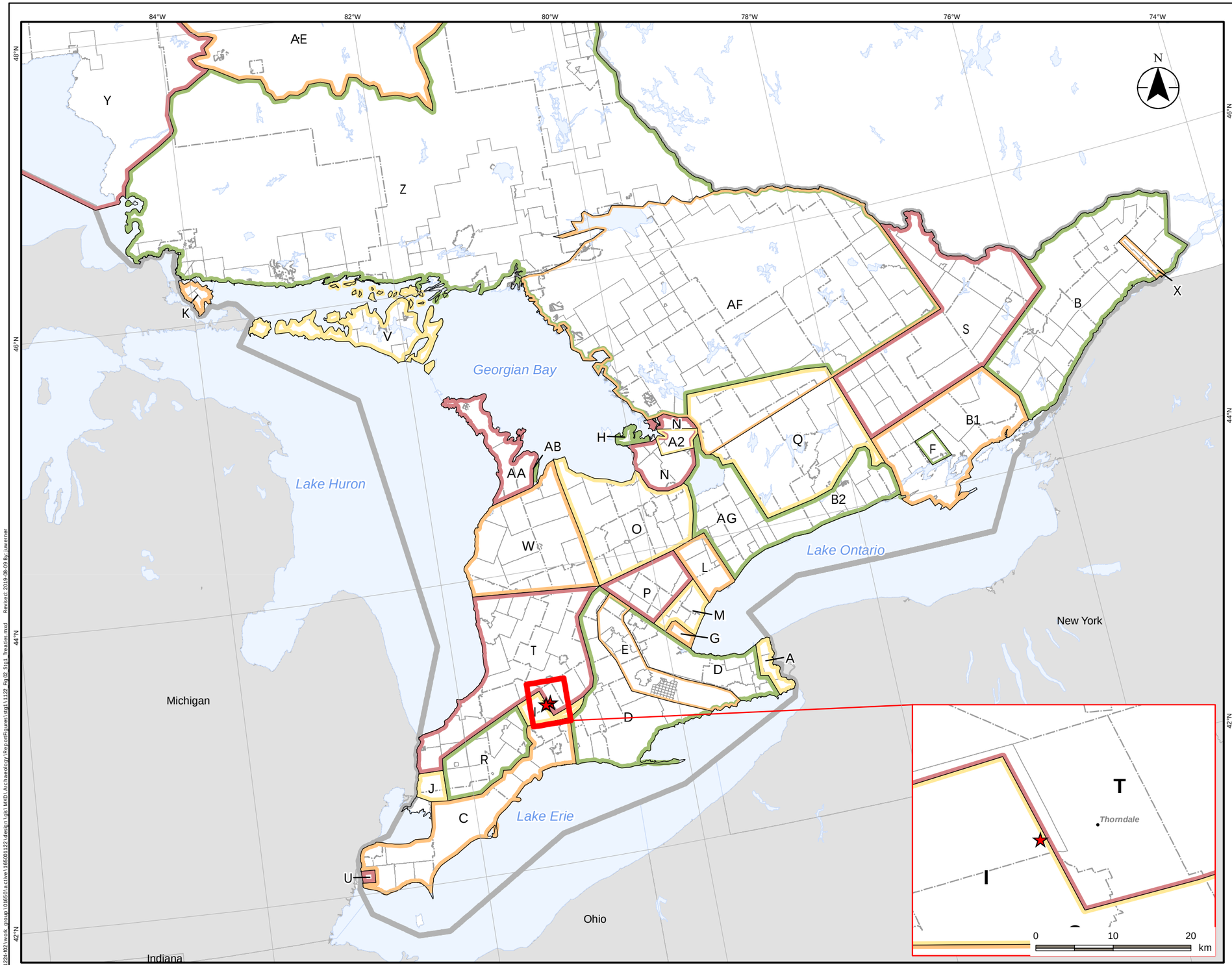
165001122 REVA
Prepared by JW on 2019-07-22
Technical Review by ABC on yyyy-mm-dd
Independent Review by ABC on yyyy-mm-dd

Client/Project
MIDDLESEX COUNTY
THORNDALE BRIDGE IMPROVEMENTS
COUNTY ROAD 28 (THORNDALE ROAD)

Figure No.
1

DRAFT

Title
Study Area Location



Stantec

Legend

- Study Area
- Municipal Boundary - Upper Tier
- Municipal Boundary - Lower or Single Tier
- Waterbody

Ontario Treaties (from Morris 1943)

A	Treaty No. 381, May 9th, 1781 (Mississauga and Chippewa)
B	Crawford's Purchase, October 9th, 1783 (Algonquin and Iroquois)
B1	Crawford's Purchase, October 9th, 1783 (Mississauga)
B2	Crawford's Purchases, 1784, 1787 And 1788 (Mississauga)
A2	John Collins' Purchase, 1785 (Chippewa)
C	Treaty No. 2, May 19th, 1790 (Odawa, Chippewa, Pottawatomi, and Huron)
D	Treaty No. 3, December 2nd, 1792 (Mississauga)
E	Haldimand Tract:from the Crown to the Mohawk, 1793
F	Tyendinaga:from the Crown to the Mohawk, 1793
G	Treaty No. 3 3/4:from the Crown to Joseph Brant, October 24th, 1795
H	Treaty No. 5, May 22nd, 1798 (Chippewa)
I	Treaty No. 6, September 7th, 1796 (Chippewa)
J	Treaty No. 7, September 7th, 1796 (Chippewa)
L	Treaty No. 13, August 1st, 1805 (Mississauga)
M	Treaty No. 13A, August 2nd, 1805 (Mississauga)
N	Treaty No.16, November 18th, 1815 (Chippewa)
O	Treaty No. 18, October 17th, 1818 (Chippewa)
P	Treaty No. 19, October 28th 1818 (Chippewa)
Q	Treaty No. 20, November 5th, 1818 (Chippewa)
R	Treaty No. 21, March 9th, 1819 (Chippewa)
S	Treaty No. 27, May 31st, 1819 (Mississauga)
T	Treaty No. 27½, April 25th, 1825 (Ojibwa and Chippewa)
U	Treaty No. 35, August 13th, 1833 (Wyandot or Huron)
V	Treaty No. 45, August 9th, 1836 (Chippewa and Odawa, "For All Indians To Reside Thereon")
W	Treaty No. 45½, August 9th, 1836 (Saugeen)
X	Treaty No. 57, June 1st, 1847 (Iroquois of St. Regis)
Z	Treaty No. 61, September 9th, 1850 (Robinson Treaty:Ojibwa)
AA	Treaty No. 72, October 30th, 1854 (Chippewa)
AB	Treaty No. 82, February 9th, 1857 (Chippewa)
AF	Williams Treaty, October 31st and November 15th, 1923 (Chippewa and Mississauga)
AG	Williams Treaty, October 31st, 1923 (Chippewa)

0 75 150 km

1:3,000,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 Statistics Canada Lambert
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2016.
3. Treaty boundaries adapted from Morris 1943 (1964 reprint).

Project Location
Province of Ontario

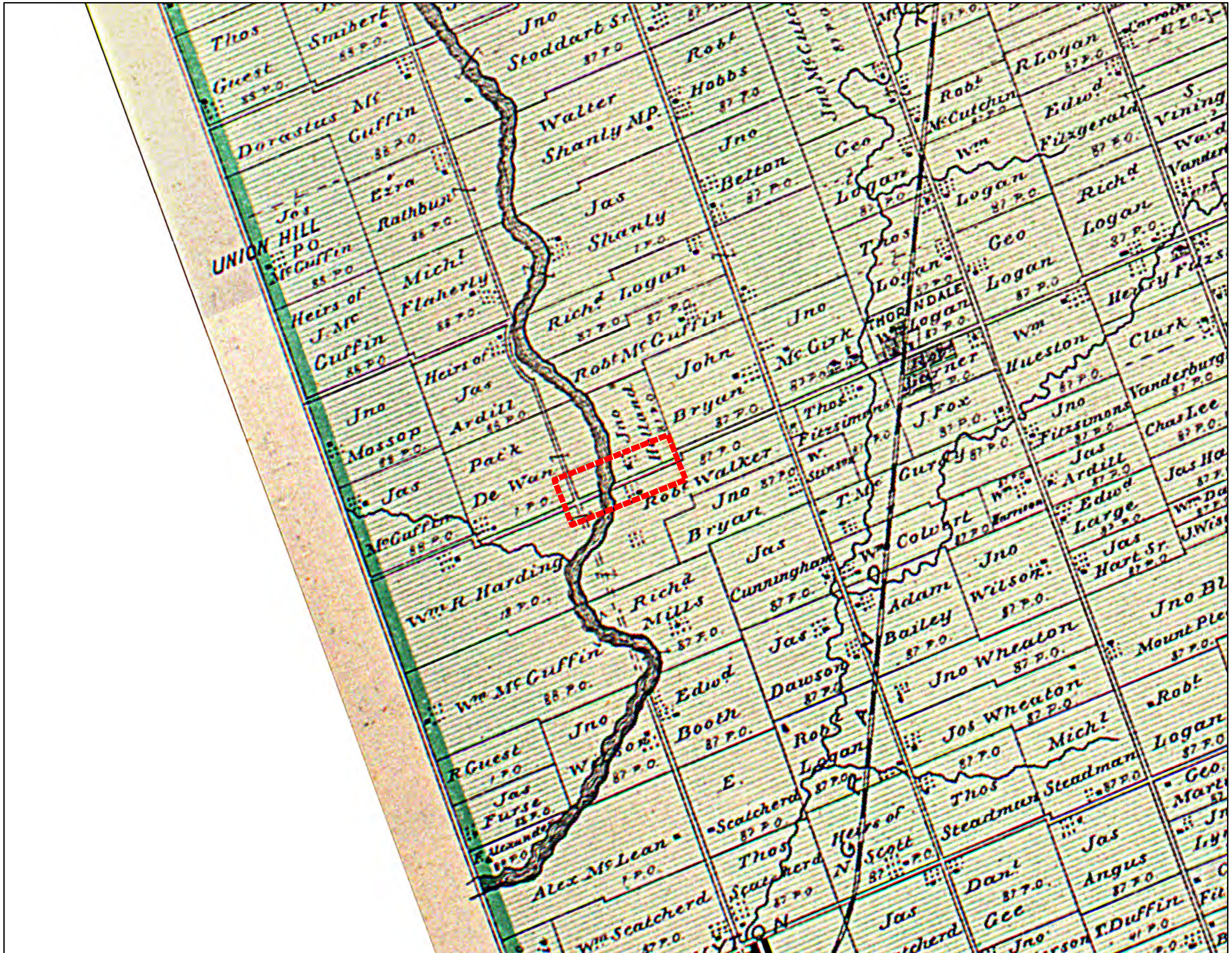
165001122 REVA
Prepared by JW on 2019-08-09
Technical Review by ABC on yyyy-mm-dd
Independent Review by ABC on yyyy-mm-dd

Client/Project
MIDDLESEX COUNTY
THORNDALE BRIDGE IMPROVEMENTS
COUNTY ROAD 28 (THORNDALE ROAD)

Figure No.
2

DRAFT

Title
Treaties and Purchases
(Adapted from Morris 1943)



Stantec

Legend

Study Area (Approximate)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Historic map sources: Page, H.R. and Co. 1878.<ita> Illustrated Historical Atlas of the County of Middlesex, Ontario.</ita> Toronto: Correll, Craig & Co. Lith. Toronto.
3. Not to scale

Project Location	165001122 REVA
County of Middlesex	Prepared by JW on 2019-07-22 Technical Review by ABC on yyyy-mm-dd Independent Review by ABC on yyyy-mm-dd

Client/Project

MIDDLESEX COUNTY
THORNDALE BRIDGE IMPROVEMENTS
COUNTY ROAD 28 (THORNDALE ROAD)

Figure No.

3 DRAFT

Title

Portion of the 1878 Map of Nissouri Township

\\Cd1224-f02\work_group\01650\active\165001122\design\gis\MXD\Archaeology\ReportFigures\stg1\1122_fig03_Stg1_1878.mxd Revised: 2019-07-22 By: jwerner

Stantec

Legend

- Study Area
- Photo Location and Direction
- Disturbed, Low to No Archaeological Potential No Further Work Required
- Thames River - Retains Potential for Marine Archaeological Resource
- Archaeological Potential - Stage 2 Required

0 100 200 Meters

1:4,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018.
3. Orthoimagery obtained from © First Base Solutions, Middlesex County, imagery date 2010.

Project Location	165001122 REVA
County of Middlesex	Prepared by JW on 2020-09-16
	Technical Review by PD on 2019-09-17

Client/Project

MIDDLESEX COUNTY
THORNDALE BRIDGE IMPROVEMENTS
COUNTY ROAD 28 (THORNDALE ROAD)

Figure No.

4

Title

Archaeological Potential of the Study Area

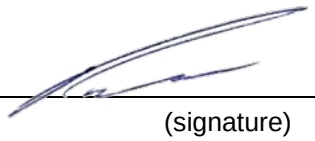
9.0 CLOSURE

This report documents work that was performed in accordance with generally accepted professional standards at the time and location in which the services were provided. No other representations, warranties or guarantees are made concerning the accuracy or completeness of the data or conclusions contained within this report, including no assurance that this work has uncovered all potential archaeological resources associated with the identified property.

All information received from the client or third parties in the preparation of this report has been assumed by Stantec to be correct. Stantec assumes no responsibility for any deficiency or inaccuracy in information received from others.

Conclusions made within this report consist of Stantec's professional opinion as of the time of the writing of this report and are based solely on the scope of work described in the report, the limited data available and the results of the work. The conclusions are based on the conditions encountered by Stantec at the time the work was performed. Due to the nature of archaeological assessment, which consists of systematic sampling, Stantec does not warrant against undiscovered environmental liabilities nor that the sampling results are indicative of the condition of the entire property.

This report has been prepared for the exclusive use of the client identified herein and any use by any third party is prohibited. Stantec assumes no responsibility for losses, damages, liabilities, or claims, howsoever arising, from third party use of this report. We trust this report meets your current requirements. Please do not hesitate to contact us should you require further information or have additional questions about any facet of this report.

Quality Review 
(signature)

Parker Dickson, Associate, Senior Archaeologist

Independent Review 
(signature)

Colin Varley, Senior Associate, Senior Archaeologist

APPENDIX A

Appendix A MHSTCI'S MARINE ARCHAEOLOGICAL POTENTIAL CHECKLIST

A copy of the MHSTCI's (formerly, Ministry of Tourism, Culture and Sport) *Criteria for Evaluating Marine Archaeological Potential Checklist* is provided on the following pages.

Ontario

Ministry of Tourism, Culture and Sport

Programs & Services Branch
401 Bay Street, Suite 1700
Toronto ON M7A 0A7

Criteria for Evaluating Marine Archaeological Potential

A Checklist for Non-Marine Archaeologists

Purpose

The **purpose of this checklist** is to help proponents determine:

- if a property or project area may contain marine archaeological resources or have marine archaeological potential

A marine archaeological site is fully or partially submerged, or lies below or partially below the high-water mark of any body of water.

The property or project area includes all submerged areas that may be impacted by project activities, including, but not limited to:

- the main project area
- temporary storage and stockpiling locations
- staging and work areas, such as docking platforms and dredging locations
- temporary features such as access routes, anchors, moorings and cofferdams.

Please refer to the **instructions** on pages 4 through 9 when completing this checklist

Processes covered

- *Planning Act*
- *Environmental Assessment Act*
- *Aggregate Resources Act*
- *Ontario Heritage Act*
  - Standards & Guidelines for Conservation of Provincial Heritage Properties
- *Canadian Environmental Assessment Act*
- *Canada Shipping Act*

Marine archaeological assessment

The assessment will help you:

- identify, evaluate and protect marine archaeological resources on your property or project area
- reduce potential delays and risks to your project

If you are not sure how to answer one or more of the questions on the checklist, you may want to hire a licensed marine archaeologist (defined on page 5) to undertake a marine archaeological assessment.

Note: Under Part VI of the *Ontario Heritage Act*, all marine archaeological assessments **must** be done by a licensed marine archaeologist. Only a licensed marine archaeologist can assess – or alter – a marine archaeological site.

Have you found a site?

If you find something you think may be of marine archaeological value during project work, you **must** – by law – stop all activities immediately and contact a licensed marine archaeologist. The marine archaeologist will carry out the fieldwork in compliance with the *Ontario Heritage Act*.

Have you found human remains?

If you find remains (e.g., bones) that could be of human origin, you **must** – by law - immediately notify the appropriate authorities (police, coroner's office, or Registrar of Cemeteries) and comply with the *Funeral, Burial and Cremation Services Act*.

Other Checklists

Please use a separate checklist for your project if:

- your Parent Class EA document has approved screening criteria
- your ministry's or prescribed public body's approved Identification and Evaluation Process includes approved screening criteria

Project or Property Name

Project or Property Location (upper and lower or single tier municipality)

Proponent Name

Proponent Contact Information

Telephone Number	Fax Number	Email Address

Screening Questions

1. Is there a government-authorized, pre-approved screening checklist, methodology or process in place?

☐ Yes ☐ No

If **Yes**, please follow the pre-approved screening checklist, methodology or process. Do not complete the rest of this checklist.
If **No**, continue to Question 2.

2. Has a marine archaeological assessment been prepared for the property or project area and been entered by MTCS into the Ontario Public Register of Archaeological Reports?

☐ Yes ☐ No

If **Yes**, do **not** complete the rest of the checklist. You are expected to follow the recommendations in the marine archaeological assessment report(s).

The proponent and/or approval authority will:

- summarize the previous marine archaeological assessment
- follow any recommendations for further marine archaeological assessment work, as applicable
- add this checklist to the project file, with the appropriate documents that demonstrate a marine archaeological assessment was undertaken (e.g. MTCS letter that states that the report has been entered into the Ontario Public Register of Archaeological Reports)

The summary and appropriate documentation may be:

- submitted as part of a report requirement, e.g. environmental assessment document
- maintained by the proponent or approval authority

If **No**, continue to Question 3.

3. Are there known marine or land-based archaeological sites on or within 500 metres of the property or project area?

☐ Yes ☐ No

4. Is there Aboriginal or local knowledge of marine or land-based archaeological sites on or within 500 metres of the property or project area?

☐ Yes ☐ No

5. Is there Aboriginal knowledge or historically documented evidence of past Aboriginal use on or within 500 metres of the property or project area?

☐ Yes ☐ No

6. Is there a known burial site or cemetery on the property or adjacent to the property or project area?

☐ Yes ☐ No

7. Has the property or project area been recognized for its cultural heritage value?

☐ Yes ☐ No

If **Yes** to any of questions 3 to 7, do **not** complete the checklist. Your property or project area could contain marine archaeological resources: please hire a licensed marine archaeologist to conduct a marine archaeological assessment.
If **No**, continue to Question 8.

8. Has the entire property or project area been subjected to recent, extensive and intensive disturbance?

☐ Yes ☐ No

If **Yes**, do **not** complete the checklist. Instead, please keep and maintain a summary of documentation that provides evidence of the recent disturbance. A marine archaeological assessment is not required.
If **No**, continue to Question 9.

9. Are there two or more reported or registered ship wreck sites or reports of lost ships within a five kilometre radius of the property or project area?

☐ Yes ☐ No

If **Yes**, a marine archaeological assessment is required.

If **No**, continue to Question 10.

10. Is the property or project area within one kilometre of an active or historic harbour, seaplane or floatplane base, tunnel, ferry route, marine terminal, or winter road?

☐ Yes ☐ No

If **Yes**, a marine archaeological assessment is required.

If **No**, continue to Question 11.

11. Where the project impacts fourth order or higher watercourses, are there existing narrows, rapids, waterfalls or does the watercourse enter or leave a body of water within 300 metres of the property or project area?

☐ Yes ☐ No

If **Yes**, a marine archaeological assessment is required.

If **No**, continue to Question 12.

12. Are there potential built heritage or cultural heritage landscape resources that may be of cultural heritage value or interest adjacent to the watercourse or water body?

☐ Yes ☐ No

If **Yes**, a marine archaeological assessment is required.

If **No**, continue to Question 13.

13. Are there inundated beaches, bluffs, lakeshores, streams or river banks within 300 metres of the property or project area?

☐ Yes ☐ No

If **Yes**, a marine archaeological assessment is required.

If **No**, continue to Question 14.

14. Are there inundated beaches, lakeshores or river/creek banks beyond 300 metres and at greater depth than the project area with evidence of two or more of the following in the project area?

- elevated bathymetric features such as drumlins, eskers, kames, ridges, etc.
- pockets of sandy lakebed
- distinctive bathymetric formations such as escarpments, shoals, promontories, reefs, etc.
- inundated resource extraction areas (quarry, fishery)
- inundated historical settlement including built heritage resources or cultural heritage landscapes
- inundated historical transportation routes

☐ Yes ☐ No

If **Yes**, a marine archaeological assessment is required.

If **No**, there is low potential for marine archaeological resources at the property (or project area).

The proponent, property owner and/or approval authority will:

- summarize the conclusion
- add this checklist with the appropriate documentation to the project report or file

The summary and appropriate documentation may be:

- submitted as part of a report requirement, e.g. under the *Environmental Assessment Act*, *Planning Act* processes
- maintained and retained by the property owner, proponent or approval authority

Instructions

Please have the following available, when requesting information related to the screening questions:

- a clear map or chart showing the location and boundary of the property or project area
  - large scale and small scale maps/charts showing nearby islands or township names for context
- the municipal addresses of all properties or water lots within or adjacent to the project area, if any
- the lot, concession, parcel number or mining claims of any properties within the project area

In this context, the following definitions apply:

- **licensed marine archaeologist** means an archaeologist who has a valid marine archaeology licence issued by the Ministry of Tourism, Culture and Sport to practice in Ontario. As a consultant, a licensed marine archaeologist enters into an agreement with a client to carry out or supervise marine archaeological work on behalf of the client, produce reports for or on behalf of the client and provide technical advice to the client.
- **proponent** means a person, agency, group or organization that carries out or proposes to carry out an undertaking or is the owner or person having charge, management or control of an undertaking.

1. Is there a pre-approved screening checklist, methodology or process in place?

An existing checklist, methodology or process may be already in place to identify marine archaeological potential, including:

- one prepared and adopted by the municipality, such as an archaeological management plan
- an environmental assessment process, such as a screening checklist for municipal bridges
- projects being reviewed under the Canadian *Environmental Assessment Act*.
- one that is approved by the Ministry of Tourism, Culture and Sport under the Ontario government's Standards & Guidelines for Conservation of Provincial Heritage Properties [s. B.2.]

2. Has a marine archaeological assessment been prepared for the property or project area and been entered into the Ontario Public register of Archaeological Reports?

Respond 'yes' to this question, if all of the following are true:

- a marine archaeological assessment report has been prepared and complies with MTCS requirements
  - a letter has been sent by MTCS to the licensed marine archaeologist confirming that MTCS has entered the report into to the Ontario Public Register of Archaeological Reports (Register)
- the report contains a recommendation stating that there are no further concerns regarding impacts to marine archaeological sites

If a marine archaeological assessment report has been completed and deemed compliant by MTCS, and the report contains a recommendation that further marine archaeological assessment work be undertaken, this work will need to be completed.

For more information about previously conducted marine archaeological assessments, contact:

- approval authority (such as a municipality or conservation authority)
- proponent for whom the marine archaeological assessment was carried out
- consultant archaeologist qualified to hold a marine archaeology licence in Ontario
- Ministry of Tourism, Culture and Sport at archaeology@ontario.ca

3. Are there known marine or land-based archaeological sites on or within 500 metres of the property or project area?

MTCS maintains a database of marine and land-based archaeological sites reported to the ministry. Land-based archaeological sites may extend into adjacent waterbodies.

For more information, contact MTCS Archaeological Data Coordinator at archaeology@ontario.ca.

4. Is there Aboriginal or local knowledge of marine or land-based archaeological sites on or within 500 metres of the property or project area?

Check with:

- Aboriginal communities in your area
- local municipal staff

Aboriginal communities may have knowledge that can contribute to the identification of cultural heritage resources, and we suggest that any engagement with Aboriginal communities includes a discussion about known or potential cultural heritage resources that are of value to these communities. Aboriginal communities and local municipal staff may have information about marine archaeological sites that are not included in the MTCS database or reported to the ministry.

Other sources of local knowledge include the following:

- property owner
- local heritage organizations and historical societies, Association for Great Lakes Maritime History
- local and provincial dive organizations (Save Ontario Shipwrecks, Ontario Underwater Council), Preserve Our Wrecks, Ontario Marine Heritage Committee)
- local dive shops
- local amateur divers and diving associations
- local museums
- municipal heritage committees
- published local histories

5. Is there Aboriginal knowledge or historically documented evidence of past Aboriginal use on or within 500 metres of the property or project area?

Check with:

- Aboriginal communities in your area
- local municipal staff

Other sources of local knowledge include the following:

- property owner
- local heritage organizations and historical societies
- local museums
- municipal heritage committees
- published local histories

6. Is there a known burial site or cemetery on the property or adjacent to the property or project area?

For more information on known cemeteries or burial sites contact the following:

- Cemeteries Regulation Unit, Ontario Ministry of Consumer Services – for database of registered cemeteries
- Ontario Genealogical Society (OGS) – to locate records of Ontario cemeteries, both currently and no longer in existence; cairns, family plots and burial registers
- Canadian County Atlas Digital Project – to locate early cemeteries

In this context, 'adjacent' means 'contiguous', or as otherwise defined in a municipal official plan.

When wrecks are associated with a loss of life, the area in the vicinity of the wreck may be established as a cemetery.

7. Has the property or project area been recognized for its cultural heritage value?

There is a strong chance there may be marine archaeological resources on the property or project area if it has been listed, designated or otherwise identified as being of cultural heritage value by:

- Municipal government
- Ontario government
- Canadian government

This includes a property that is:

- designated under *Ontario Heritage Act* (the OHA), including:
  - individual designation (Part IV)
  - part of a heritage conservation district (Part V)
  - a land or marine archaeological site (Part VI)
- subject to:
  - an agreement, covenant or easement entered into under the OHA (Parts II or IV)
  - a notice of intention to designate (Part IV)
  - a heritage conservation district study area by-law (Part V) of the OHA
- included on:
  - a municipal register or inventory of heritage properties
  - Ontario government's list of provincial heritage properties
  - Federal government's list of federal heritage buildings
- part of a:
  - National Historic Site
  - UNESCO World Heritage Site
- designated under:
  - *Heritage Railway Station Protection Act*
  - *Heritage Lighthouse Protection Act*
- subject of a municipal, provincial or federal commemorative or interpretive plaque.

To determine if your property or project area is covered by any of the above, see:

- Part A of the MTCS Criteria for Evaluating Potential for Built Heritage and Cultural Heritage Landscapes

Part VI – Archaeological Sites
Includes three marine archaeological sites prescribed under Ontario Regulation 11/06 and five terrestrial archaeological sites designated by the Minister under Regulation 875 of the Revised Regulation of Ontario, 1990.

For more information, refer to Regulation 875 and Ontario Regulation 11/06.

8. Has the entire property or project area been subjected to recent, extensive and intensive disturbance?

Recent: after-1960

Extensive: over all or most of the area

Intensive: thorough or complete disturbance

Examples of ground disturbance include:

- quarrying
- dredging
- structural footprints and associated construction areas
  - where the structure has deep foundations or footings
- infrastructure development such as:
  - dams
  - pipelines, hydro lines or other utility trenches
  - causeways
  - bridges

Note: this applies only to the excavated part of the right-of-way or corridor as the remainder may not be impacted

A ground disturbance does not include:

- aqua-cultural activities, such as a fish farm
- areas of traditional or commercial harvesting of fish, shellfish or water-based vegetation
- traditional agricultural areas that have been inundated

Property (Project Area) Inspection

Some documentation may provide evidence of prior disturbance, such as:

- photographs
- maps
- detailed descriptions and blueprints of prior projects

If complete disturbance isn't clear from documents available, an archaeologist licensed for marine archaeology can be hired to undertake an underwater and/or remote-sensing inspection of the study area to determine whether there is any remaining marine archaeological potential.

9. Are there two or more reported or registered ship wreck sites or reports of lost ships within a five kilometre radius of the property or project area?

The presence of two or more ship wreck sites or reports of lost ships in the vicinity may indicate increased marine archaeological potential for additional marine wrecks.

10. Is the property or project area within one kilometre of an active or historic harbour, seaplane or floatplane base, tunnel, ferry route, marine terminal, or winter road?

Focussed areas of marine activity on- and off-shore are indicators for potential marine archaeology due to:

- deliberate structures built in or on the water, such as:
  - mooring and anchoring structures
  - weirs, piers, docks, cribwork
  - groynes, breakwaters, artificial reefs
  - vessels scuttled for utilitarian or other purposes
  - infrastructure related to the construction or operation of a facility like marine railways
- incidental features, such as:
  - beached or sunken vessels or aircraft
  - dropped objects

As a result, there is potential for marine archaeological features or artifacts.

11. Where the project impacts fourth order or higher watercourses, are there existing narrows, rapids, waterfalls or does the watercourse enter or leave a body of water within 300 metres of the property or project area?

Fourth order and higher watercourses (on the Strahler scale) have potential association with human activity around narrows, rapids, waterfalls and proximity to waterbodies such as lakes due to:

- fish harvesting and related dams or weirs
- portage locations for navigable waterways
- early historical fording locations
- early historical water power sources for mills

These activities may result in marine archaeological features or artifacts.

12. Are there potential built heritage or cultural heritage landscape resources that may be of cultural heritage value or interest adjacent to the watercourse or water body?

Euro-Canadian settlement immediately adjacent to water bodies or watercourses may be focussed on the water for specific industrial, commercial or residential uses resulting in marine archaeological features or artifacts. For guidance, see the MTCS Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes

13. Are there inundated beaches, bluffs, lakeshores, streams or river banks within 300 metres of the property or project area?

The margins of water bodies are associated with past human occupations and use of the land. About 80-90% of archaeological sites are found within 300 metres of water bodies.

- water body types:
  - primary - lakes, rivers, streams, creeks
  - secondary - springs, marshes, swamps and intermittent streams and creeks
- water bodies can include constructed water bodies or watercourses, such as:
  - temporary channels for surface drainage
  - rock chutes and spillways
- Accessible or inaccessible shorelines can also have archaeological potential, for example:
  - high bluffs or cliffs
  - sandbars

You can get information about inundated shoreline features through:

- a site visit
- aerial photographs
- bathymetric data
- geological and physiographic studies

14. Are there inundated beaches, lakeshores or river/creek banks beyond 300 metres and at greater depth than the project area with evidence of two or more of the following in the project area?

- elevated bathymetric features such as drumlins, eskers, kames, ridges, etc.
- pockets of sandy lakebed
- distinctive bathymetric formations such as escarpments, shoals, promontories, reefs, etc.
- inundated resource extraction areas (quarry, fishery)
- inundated historical settlement including built heritage resources or cultural heritage landscapes
- inundated historical transportation routes

Landforms associated with past human occupations that have later been inundated, as historically documented or demonstrated through water-level chronologies, retain their archaeological potential.

- **Elevated bathymetric features**
  Higher ground and elevated positions, surrounded by low or level topography, often indicate past settlement and land use. Features such as eskers, drumlins, sizeable knolls, plateaus next to lowlands or other such features are a strong indication of archaeological potential.
  Find out if your property or project area had elevated topography prior to inundation through:
  - nautical charts
  - bathymetric data

- **Pockets of sandy lakebed**

  Areas of sandy soil, prior to being inundated, that would be well-drained and in areas characterized by heavy soil or rocky ground may indicate archaeological potential

  Find out if your property or project area had sandy soil through:

  - site visits
  - lakebed studies and sediment borehole data

- **Distinctive bathymetric formations**

  Distinctive land formations include – but are not limited to:

  - waterfalls
  - rock outcrops or faces
  - caverns
  - mounds

  Prior to inundation such features were often important to past inhabitants as special or sacred places. The following sites may be present at – or close to – these formations:

  - burials
  - structures
  - offerings
  - rock paintings or carvings

  Find out if your property or project area has a distinctive land formation through:

  - site visits
  - aerial photographs
  - bathymetric data

- **Inundated resource extraction areas**

  Prior to inundation, the following resources were collected in these extraction areas:

  - food or medicinal plants e.g. migratory routes, spawning areas, prairie
  - scarce raw materials e.g. quartz, copper, ochre or outcrops of chert
  - resources associated with early historic industry e.g. fur trade, logging, prospecting, mining

  Aboriginal communities may hold traditional knowledge about their past use or resources in the area.

- **Inundated early historic settlement**

  Early Euro-Canadian settlements include – but are not limited to:

  - early military or pioneer settlement, e.g. pioneer homesteads, isolated cabins, farmstead complexes
  - early wharf or dock complexes
  - pioneers churches and early cemeteries

- **Inundated early historic transportation routes** - such as trails, passes, roads, railways, portage routes, canals.

  For more information, see:

  - historical maps or atlases
    - for information on early settlement patterns such as trails (including Aboriginal trails), monuments, structures, fences, mills, historic roads, rail corridors, canals, etc.
    - Archives of Ontario holds a large collection of historical maps and atlases
    - digital versions of historical atlases are available on the Canadian County Atlas Digital Project
  - commemorative markers or plaques such as those posted by local, provincial or federal agencies
  - municipal heritage committees or other local heritage organizations
    - for information on early historic settlements or landscape features (e.g. fences, mill races)
    - for information on commemorative markers or plaques

Print Clear

APPENDIX B.4

Cultural Heritage Assessment Report

Cultural Heritage Evaluation Report and Heritage Impact Assessment: Thorndale Bridge

DRAFT

July 23, 2020

Prepared for:

Middlesex County
399 Ridout Street North
London, ON N6A 2P1

Prepared by:

Stantec Consulting Ltd
600-171 Queens Avenue
London, ON N6A 5J7

File: 165001122

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Executive Summary

Middlesex County retained Stantec Consulting Ltd. (Stantec) to undertake a Municipal Class Environmental Assessment (Class EA) Study for improvements to the Thorndale Bridge on County Road 28 (Thorndale Road), within the Municipality of Thames Centre, in Middlesex County. The study is being undertaken in accordance with the requirements for Schedule 'C' projects within the Class EA document, under the *Ontario Environmental Assessment Act.* The Class EA will include an analysis of existing and future travel needs, and development and evaluation or alternative solutions and alternative designs for the Thorndale Bridge.

As part of this study, a Cultural Heritage Evaluation Report (CHER) was completed for structures within the Study Area that are 40 years old or older. A CHER is completed where a potential built heritage resource or cultural heritage landscape requires evaluation to determine its cultural heritage value or interest. Where cultural heritage value or interest is identified, the CHER includes a description of heritage attributes and a Statement of Cultural Heritage Value. The CHER represents the foundation upon which future work is based, including a heritage impact assessment or a Strategic Conservation Plan. This CHER includes the evaluation of Thorndale Bridge.

Thorndale Bridge is located in the Municipality of Thames Centre, within Middlesex County. The bridge forms part of Thorndale Road spanning the North Thames River. The bridge was constructed in 1953, as part of mid-20th century flood control measures on the Thames River system. The bridge is a four-span cast-in-place concrete two-cell box girder bridge. It carries two lanes of traffic on Thorndale Road over the North Thames River.

Thorndale Bridge met criteria (1.i) of *Ontario Regulation* (O. Reg.) 9/06 and scored 40 points per the Ontario Heritage Bridge Guidelines. The conclusion that the bridge has CHVI is supported by the evaluation carried out against O. Reg. 9/06, which is the only criteria required for establishing CHVI in the Municipal Class Environmental Assessment document. Accordingly, Thorndale Bridge was found to have CHVI as it met one criteria (1.i) under O. Reg. 9/06, for its design/physical value as a representative example of a mid-20th century box girder bridge, a type that is becoming increasingly rare in the province.

The Class EA determined the preferred alternative for Thorndale Bridge is to replace the existing bridge with a new bridge on the existing alignment with traffic being rerouted around bridge construction on detour. The retention of the current bridge is not feasible as the County of Middlesex has identified that the Thorndale Bridge will reach the end of its lifespan in the next 10 years and has capacity concerns related to pedestrian and cyclist traffic. As per Step 3 of the Class EA process, an impact

assessment was completed to assess the impacts of the proposed change/impact and identify mitigation measures.

The impact assessment determined that there are direct impacts anticipated to the Thorndale Bridge through its removal. Based on the presence of cultural heritage resources which have the potential to be affected by the proposed undertaking, mitigation measures in the form of documentation are recommended.

Documentation should be undertaken during the detailed design work program prior to any change in site conditions and include:

- Documentation in the form of detailed photography should be completed under the direction of a heritage professional in good standing with the Canadian Association of Heritage Professionals
- The results of the documentation activities should be made available at local libraries for public use

To assist in the retention of historic information, copies of this report should be deposited with local libraries and municipalities. It is recommended that this report be deposited at the Middlesex County Library Thorndale Branch and provided to the Municipality of Thames Centre Municipal Heritage Committee.

The Executive Summary highlights key points from the report only; for complete information and findings the reader should examine the complete report.

Project Personnel

Project Manager:	Paula Hohner, MScPl, MCIP, RPP
Heritage Task Manager:	Laura Walter, MA
Heritage Consultant:	Meaghan Rivard, MA, CAHP
Report Writer:	Laura Walter, MA Frank Smith, MA
GIS Specialist:	Julie Werner
Administrative Assistant:	Carol Naylor
Quality Reviewer:	Meaghan Rivard, MA, CAHP
Independent Reviewer:	Colin Varley, MA, RPA

Abbreviations

CHER	Cultural Heritage Evaluation Report
CHVI	Cultural Heritage Value or Interest
Class EA	Class Environmental Assessment
CN	Canadian National Railway
GTR	Grand Trunk Railway
HIA	Heritage Impact Assessment
km	Kilometres
m	Metres
MCEA	Municipal Class Environmental Assessment
MEA	Municipal Engineers Association
MHSTCI	Ministry of Heritage, Sport, Tourism, Culture Industries
MTO	Ministry of Transportation Ontario
O. Reg.	*Ontario Regulation*
OHBG	Ontario Heritage Bridge Guidelines
PPS	Provincial Policy Statement
UTRCA	Upper Thames River Conservation Authority
WNTHS	The West Nissouri Township Historical Society

1.0 Introduction

1.1 Study Purpose

Middlesex County retained Stantec Consulting Ltd. (Stantec) to undertake a Municipal Class Environmental Assessment (Class EA) Study for improvements to the Thorndale Bridge on County Road 28 (Thorndale Road), within the Municipality of Thames Centre, in Middlesex County. The study is being undertaken in accordance with the requirements for Schedule 'C' projects within the Class EA document, under the *Ontario Environmental Assessment Act.* The Class EA will include an analysis of existing and future travel needs, and development and evaluation of alternative solutions and alternative designs for the Thorndale Bridge.

As part of the Class EA, a Cultural Heritage Evaluation Report (CHER) has been completed for structures within the Study Area that are 40 years old or older. This includes the subject of this CHER, Thorndale Bridge (Figure 1 and Figure 2). A CHER is completed where a potential built heritage resource or cultural heritage landscape requires evaluation to determine its cultural heritage value or interest (CHVI). Where CHVI is identified, the CHER includes a description of heritage attributes and a Statement of Cultural Heritage Value. The CHER also represents the foundation upon which recommendations for a Heritage Impact Assessment (HIA) are made, if necessary.

To meet these objectives, the CHER will:

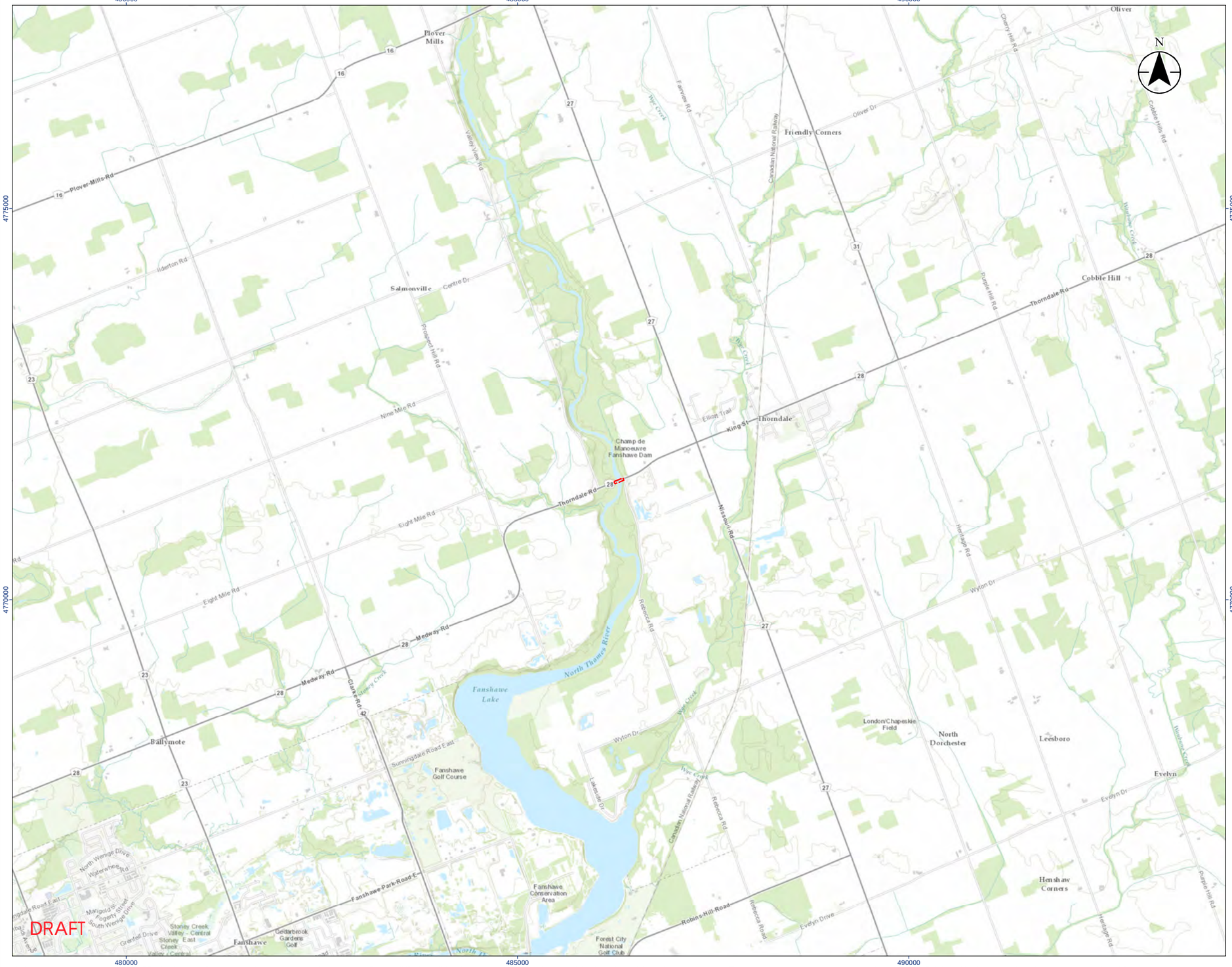
- Review the historical context of the area surrounding the Study Area
- Summarize the results of the field investigation and provide photographic documentation of current conditions
- Describe the Study Area based on an understanding of the historical and current conditions
- Evaluate the CHVI of the bridges and surrounding landscape per Ministry of Heritage, Sport, Tourism, Culture Industries (MHSTCI) requirements and relevant heritage frameworks
- Include a statement of cultural heritage value and description of heritage attributes where CHVI is identified
- Identify potential impacts that may be anticipated on future projects

- Provide recommendations on mitigation measures or HIA reporting processes

Thorndale Bridge spans the Thames River as part of Thorndale Road and is situated 30 metres (m) west of Rebecca Road, and 210 m east of Valley View Road, in the Municipality of Thames Centre, within Middlesex County (Figure 1). The bridge was constructed in 1953 and is a four span concrete box girder bridge. The Study Area boundary for the bridge was defined by the bridge structure itself, and includes the embankments approaching the bridge structure (Figure 2).

Figure 1: Project Location

Figure 2: Study Area



Stantec

Legend

Study Area

0 1,000 2,000 Meters

1:50,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Project Location
County of Middlesex

165001122 REVA
Prepared by JW on 2019-07-02
Technical Review by ABC on yyyy-mm-dd
Independent Review by ABC on yyyy-mm-dd

Client/Project
MIDDLESEX COUNTY
THORNDALE BRIDGE IMPROVEMENTS
COUNTY ROAD 28 (THORNDALE ROAD)

Figure No.
1

DRAFT

Title
Project Location

V:\165\01\active\165001122\design\gis\MXD\CulturalHeritage\ReportFigures\cher1122_fig01_ProjectLoc.mxd Revised: 2019-07-02 By: juwerner

Stantec

Legend

- Study Area
- Municipal Boundary, Lower

0 250 500 Meters

1:10,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018.
3. Orthoimagery obtained from © First Base Solutions, Middlesex County, imagery date 2010.

Project Location	165001122 REVA
County of Middlesex	Prepared by JW on 2019-07-02
	Technical Review by ABC on yyyy-mm-dd
	Independent Review by ABC on yyyy-mm-dd

Client/Project

MIDDLESEX COUNTY
THORNDALE BRIDGE IMPROVEMENTS
COUNTY ROAD 28 (THORNDALE ROAD)

Figure No.

2

DRAFT

Title

Study Area

2.0 Environmental Assessment Framework

2.1 Requirements

The requirement to consider cultural heritage in Class EAs is discussed in the *Municipal Class Environmental Assessment* (MCEA) document (Municipal Engineers Association 2015) and the revised 2020 *Provincial Policy Statement* (PPS) (Government of Ontario 2020). The MCEA document considers the cultural environment, including built heritage resources and cultural heritage landscapes, as well as archaeological resources, as one in a series of environmental factors to be considered when undertaking a Class EA, particularly when describing existing and future conditions, development alternatives, and determination of the preferred alternative.

The MCEA document further suggests that cultural heritage resources that retain heritage attributes should be identified early in the EA process and that these resources should be avoided where possible. Where avoidance is not possible, potential impacts to these attributes should be identified and minimized. Adverse impacts should be mitigated in keeping with provincial and municipal guidelines, as available.

2.2 Municipal Class Environmental Assessment Process

In 2000, the Minister of the Environment and Climate Change approved the MCEA process proposed by the Municipal Engineers Association (MEA). The MEA is an association of public sector Professional Engineers in the province. This included a provision to complete a heritage assessment for any bridge over the age of 40 years. Since this time, a series of amendments and clarifications have been made to the MCEA process. One of these clarifications was released in 2003 by the MEA regarding the inclusion of a 40-year threshold for schedule determination. The intent of the MEA was to provide for the protection of potentially significant bridges throughout the province; the 40-year threshold is generally accepted by both the federal and provincial authorities as a preliminary screening measure for CHVI. The MCEA document was most recently updated in 2015.

To provide clarity regarding the 40-year threshold for schedule determination, the MEA released guidelines in the form of a series of questions contained within a Checklist. This Checklist assists the proponent in the determination of future study requirements and a copy is provided in Appendix A. The MCEA requirements for bridges are addressed in Part B of the Checklist. In this section, there are 19 “Descriptions” to which answers of “Yes” or “No” are required. Requirements for additional studies are determined based on the responses to each question. There are three basic steps to carrying out the requirements of the Checklist as outlined in Section 2.2.1.

2.2.1 The Process

Step 1: Undertake Municipal Heritage Bridges Cultural, Heritage and Archaeological Resources Assessment Checklist (Part B) to determine if the bridge may have CHVI.

1. If no potential for CHVI is identified, then the proposed work can be a considered a Schedule A or A+ Class EA and no further investigation regarding cultural heritage is required.

- Schedule A:

  - These projects are limited in scale, have minimal adverse environmental effects, and include a number of municipal maintenance and operational activities. These projects are pre-approved and may proceed to implementation without following the full Class EA planning process. Schedule A projects generally include normal or emergency operational and maintenance activities (Municipal Engineers Association 2015: A-3).

- Schedule A+:

  - These projects are similar to Schedule A projects in that they are pre-approved. Where they differ is in notice issued to the public. Schedule A+ projects include municipal infrastructure projects where, although the public has no ability to change the outcome, they are notified of planned work. These EAs are typically approved by municipal councils through budget or special project funding. There is also more flexibility in the ways in which the public is notified of this work and varies greatly from one municipality to the next (Municipal Engineers Association 2015: A-4).

2. If potential for CHVI is identified, then proceed to Step 2.

Step 2: Undertake a cultural heritage evaluation of the bridge against *Ontario Regulation* (O. Reg.) *9/06* of the *Ontario Heritage Act* and prepare a CHER.

1. If the bridge is determined not to contain CHVI as per O. Reg. 9/06 then the CHER should be submitted to the proponent for review and approval. No further work is required and an EA is not triggered from a cultural heritage perspective.

2. If the bridge is determined to contain CHVI as per O. Reg. 9/06, prior to schedule determination, further work will be required in the form of an HIA. Once the proponent understands the proposed (or potential) scope of work, proceed to Step 3.

A draft version of the CHER was provided to the client in 2019 to inform the determination of the EA schedule for the Thorndale Bridge EA. Given the identification of CHVI alongside the project expense, the EA study was determined to be a Schedule 'C' project. The draft version of the CHER was amended in May 2020 to include an impact assessment as described below to satisfy MCEA requirements and inform the project decisions.

Step 3: Undertake an HIA to assess the impacts of the proposed change/impact, identify mitigation measures, and establish a conservation strategy, if needed.

1. If no impacts to the heritage attributes identified in the CHER will result from the proposed work, then the HIA should be submitted to the proponent for review and approval. No further work is required and the proposed work can be considered a Schedule A or A+ EA, from a cultural heritage perspective.

If the HIA determines that the project has the potential to impact the resource, proceed to Schedule B or C to consider alternative solutions. As part of the HIA, mitigation measures to lessen the impacts of the proposed undertaking and a conservation strategy should be prepared. The HIA should be submitted to the proponent for review and approval and to the MHSTCI for review and comment.

- Schedule B:
  - These projects have the potential for some adverse environmental impacts. The proponent is required to undertake a screening process involving mandatory contact with directly affected public and relevant review agencies (i.e., MHSTCI), to confirm that they are aware of the project and that their concerns are addressed. If there are no outstanding concerns, then the proponent may proceed to implementation. Schedule B projects general include improvements and minor expansions to existing facilities (Municipal Engineers Association 2015: A-4).

- Schedule C:
  - These projects have the potential for significant environmental effects and must proceed under the full planning and documentation procedures specified in the MCEA document. Schedule C projects require the preparation and filing of an Environmental Study Report (ESR) for review by the public and relevant agencies. Schedule C projects generally include the construction of new facilities and major expansions to existing facilities (Municipal Engineers Association 2015: A-4).

This report represents a combination of "Step 2" and "Step 3" of the MCEA process.

2.2.2 Determining Project Schedule

Generally, the MCEA Project Schedule is determined by the magnitude of the environmental impacts resulting from the project. As such, projects with minimal impacts are carried out under Schedules A or A+, projects with moderate adverse impacts are carried out under Schedule B, and projects with the potential for significant environmental effects are carried out under Schedule C.

In the case of bridges found to have CHVI, all reconstruction and/or alteration activities to the structure, or grading activities adjacent to the structure, should be carried out under Schedules B or C. As indicted in Appendix 1 of the MCEA document, projects involving a bridge with CHVI that cost less than $2.4 million should be carried out under Schedule B and projects with a cost greater than $2.4 million should be carried out under Schedule C (Municipal Engineers Association 2015).

While the magnitude of the impact to the bridge and the cost of the project can be used to determine the whether to proceed under Schedule B or C, the MCEA document notes that the divisions among project Schedules is often not distinct and proponents are encouraged to document their rationale for the selection (Municipal Engineers Association 2015: Appendix 1).

3.0 Methodology

3.1 Field Program

A site assessment was undertaken on June 6, 2019, by Cultural Heritage Specialists Laura Walter and Frank Smith of Stantec. The weather conditions were warm and partly cloudy. Historical research was conducted at the London Public Library, the Archives and Special Collections at Western University, and supplemented by material available through online resources.

3.2 Reporting

The CHER was composed of a program of archival research focused on the Study Area (Figure 2). To familiarise the study team with the Study Area, local historical resources were consulted, archival documents were reviewed, and a summary of the historical background of the local area was prepared. Specifically, mapping from 1862, 1878, 1915, 1930, 1961, and 1962 was reviewed.

The metric system was adopted in Canada between 1971 and 1984. Given the construction date of the bridge, measurements would have been prepared according to Imperial standards. Converting measurements that are often standardized into metric may obscure patterns and relationships between features. Therefore, when discussing dimensions of historic structures Imperial units may be used. In all other areas, measurement of distance for example, metric units are applied.

3.3 Evaluation of Cultural Heritage Value or Interest

The criteria for determining CHVI is defined by O. Reg. 9/06 of the *Ontario Heritage Act*. These criteria are considered in the EA process, as no other formal criteria for identifying CHVI is identified in the MCEA document. This regulation considers three main indicators of cultural heritage value: design or physical value, historic or associative value, and contextual value. Each indicator contains three additional sub-criteria. A property may be considered to have CHVI if it meets one or more of the criteria in O. Reg. 9/06. These criteria are provided below, as they appear in O. Reg. 9/06 of the *Ontario Heritage Act*:

1. *The property has design value or physical value because it:*
    - i. *is a rare, unique, representative, or early example of a style, type, expression, material or construction method;*
    - ii. *displays a high degree of craftsmanship or artistic merit; or*

iii. *demonstrates a high degree of technical or scientific achievement.*

2. *The property has historical value or associative value because it:*

   i. *has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community;*

   ii. *yields, or has the potential to yield, information that contributes to an understanding of a community or culture; or*

   iii. *demonstrates or reflects the work or ideas of an architect, artist, builder, designer or theorist who is significant to a community.*

3. *The property has contextual value because it:*

   i. *is important in defining, maintaining or supporting the character of an area;*

   ii. *is physically, functionally, visually or historically linked to its surroundings; or*

   iii. *is a landmark.*

(Government of Ontario 2006a)

3.3.1 Ontario Heritage Bridge Guidelines

This report also evaluates the bridge using criteria identified in the *Ontario Heritage Bridge Guidelines for Provincially Owned Bridges* (OHBG) to supplement O. Reg. 9/06 evaluation (Ontario Ministry of Transportation 2008). The OHBG, similar to O. Reg. 9/06, are divided into three categories: Design/Physical Value, Historic/Associative Value, and Contextual Value, but provide a rating system more specific to bridge structures. The OHBG evaluation criteria include a numerical scoring for the separate categories and a total score.

It must be noted that the OHBG are intended to apply to provincially owned (Ministry of Transportation) bridges and are not required to determine the CHVI of a non-provincially owned bridge. However, the OHBG are useful in evaluating bridges as they have been designed and weighted specifically for this resource type, unlike O. Reg. 9/06, which is more general in nature. As such, the OHBG have been used in this report as a supplementary evaluation tool in addition to O. Reg. 9/06, which is the official tool for recognizing CHVI at the local/municipal level. In addition, the OHBG provide guidance on mitigating negative effects related to proposed changes to bridges. Again, these are intended for bridges under MTO ownership where the evaluation threshold is met. In this case they provide an appropriate structure for considering mitigation options. The

OHBG evaluation criteria are included in Appendix B and further discussion for the impact assessment in Section 7.2.

4.0 Historical Summary

4.1 Introduction

Thorndale Bridge spans the North Thames River as part of Thorndale Road between Valleyview Road and Rebecca Road, in the Municipality of Thames Centre, within Middlesex County. The Study Area is situated in the road allowance between lots 15 and 16 in Concession 2, in the former Township of West Nissouri, within Middlesex County, now the Municipality of Thames Centre. The Study Area boundary for the bridge was defined by the bridge structure itself, and includes the embankments approaching the bridge structure.

4.2 Physiography

The Study Area is situated within the Stratford Till Plain physiographic region within southwestern Ontario (Chapman and Putnam 1984: 113). The broad clay plain covers 3,548 square kilometres (km) and extends from London north to Blyth and Listowel. The plain contains ground moraines that are more closely spaced in the southwestern portion of the region. The overall slope of the region is to the southwest, from approximately 457 m to 274 m above sea level. Throughout the region the till is fairly uniform and is composed of brown calcareous silty clay. Gravel for road construction is plentiful in the region (Chapman and Putnam 1984: 133). Soils in the region are naturally fertile with a good supply of lime in the subsoil, making it one of the most productive agricultural areas in Ontario (Chapman and Putnam 1984: 134).

The Study Area is located in the Upper Thames River Watershed within the Plover Mills Corridor. The Plover Mills Corridor extends along the banks of the North Thames River roughly between Huron Street on the east side of the City of London north to Perth County Line, in the Township of Perth South northwest of the Town of St. Marys. The land use in the watershed is 71% agriculture, 17% natural vegetation, 5% urban, 4% water, and 3% aggregates (Upper Thames River Conservation Authority [UTRCA] 2017).

The entire length of the Thames River was designated a Canadian Heritage River in 2000, by the governments of Ontario and Canada under the Canadian Heritage Rivers System. The river is 273 km long and drains 5,825 square km of land (Quinlan 2013: 2). The river is divided into three distinct branches, with the Study Area spanning the North Thames River. The North Thames River starts north of the community of Mitchell, in the Municipality of North Perth, and extends southwest through St. Marys and the Study Area to London, where the north meets the south branch at the Forks of the Thames (Thames River Background Study Research Team 1998: 2).

The Thames River was designated for its natural, cultural, and recreational heritage values. The Thames is the only major river in Canada with the majority of its watershed within the Carolinian Life Zone. This region is recognized as one of the most biologically significant and diverse regions in Canada. The river has provided the setting for 11,000 years of Aboriginal and European settlement, exploration, transportation, and economic development (Thames River Background Study Research Team 1998: 1).

4.3 Survey and Settlement

The Study Area is located in the former Township of Nissouri, in the road allowance between lots 15 and 16 in Concession 2. The area was surveyed in 1818 by Shubael Park. The township was surveyed using the double-front survey system, which divided the 200 acre lots into two parcels with concession roads running north-south, and sideroads established east-west (Plate 1) (The West Nissouri Township Historical Society [WNTHS]2005: 6). The name of the township is believed to be in reference to an Aboriginal word meaning “running waters,” for the many watercourses that cross the township (Logan 1967: 6).

Plate 1: Double-Front System (Dean 1969)

Early land grants in the township prior to 1820 were issued to the Canada Company, United Empire Loyalists (UEL), and War of 1812 military personnel. The first land grant, Lot 14, Concession 2, was issued to Deborah Relyea, the daughter of a UEL. A total of 61 grants were issued to 61 sons and daughters of UEL, which encompassed 11,200 acres in the township (WNTHS 2005: 8). Following the War of 1812, discharged soldiers were offered land grants in the Township of Nissouri that totaled 13,400 acres. Very few UEL descendants and military personnel settled in the township due the lack of decision in the selection of their lots and the undeveloped remote location (WNTHS 2005: 17). As such, early settlers were mostly from the British Isles, with a few UEL. The first settlers in the township were Clauson Burges, George Logan, John Dunsmore, John and Thomas Scatcherd, the Vining family, and the McGaffin family (Page & Co. 1878:

12). The first land cleared in the township was a portion of Lot 14, Concession 2, south of the Study Area, where the surveyor party camped in 1818 (Godspeed 1889: 561).

4.4 19th Century Development

The Township of Nissouri was established by an act of Government on April 14, 1821 and was initially within Oxford County (Logan 1967: 6). The first township meeting was held on January 17, 1821 at the residence of James Howard on Lot 13, Concession 6 (WNTHS 2005: 48). Development in the Township of Nissouri was slow in the early 19th century due to its lack of accessibility and forest cover. By 1829, only 29 acres of the township had been cleared by settlers (WNTHS 2005: 32).

The Governor's Road (Dundas Street) spanned the southern boundary of the Township of West Nissouri. The roadway had been opened between 1793 to 1795, by a part of Queen's Rangers, under the direction of Lieutenant-Governor John Graves Simcoe. The roadway was to serve as a military connection between the Great Lakes and the St. Clair River (Magel 1998: 30). The first roadways within the township were blazed trails that followed Aboriginal pathways (WNTHS 2005: 437). The poor condition of these roadways made travel slow and difficult in the township and remained as such for most of the early 19th century (WNTHS 2005: 17).

East of the Study Area, the first settlers were the Logan family and James Shanly. The Logan family arrived in the 1820s, and the first residence constructed in present-day Thorndale was built by William and William H. Logan. Thorndale was originally known as the Logan Settlement (WNTHS 2005: 124). In 1837, James Shanly purchased and settled on 600-acres in Concession 2. Shanly built a residence on the property and he named the estate Thorndale in reference to a previous home in Ireland (Logan 1967: 24). Thorndale served as the meeting place for the area, with Shanley acting as the legal counsellor for the area (WNTHS 2005: 124). Shanly established a large distillery on the Wye Creek, which attracted people to the area (WNTHS 2005: 125).

By 1842, the population of the township had grown to 1,460 (Smith 1849: 131). In 1849, 27,784 acres in the township had been taken up, with 5,918 acres under cultivation (Smith 1849: 130). With the *Municipal Corporations Act* in 1850, the township was divided into west and east sections. The new township of West Nissouri included concessions west of the border of lots in Concession 8. The Township of West Nissouri became part of Middlesex County, while the Township of East Nissouri remained in Oxford County. The first meeting of the Township of West Nissouri was held at the residence of Robert Logan on January 19, 1852, with John Scatcherd as the first reeve (WNTHS 2005: 49).

In 1857, following Shanly's death, the Logan family subdivided the village of Thorndale. The following year, the Grand Trunk Railway (GTR) line was completed through the village, including a station and rail freight sheds. The coming of the GTR accelerated development in Thorndale and significantly influenced its mid-to late 19th century growth. The railway line opened up new markets for timber, farm products, and other goods produced in the village and surrounding area (Abra 2019). A post office was established in the village in 1859, with John M. Read as the first postmaster (Library and Archives Canada 2014).

The GTR line and the village of Thorndale are depicted east of the Study Area on *Tremaine's Map of the County of Middlesex, Canada West* in 1862 (Figure 3). In 1875, Thorndale was a small community with a population of about 100 (McAlpine, Everett & Co. 1875: 370). Thorndale is depicted east of the Study Area on the 1878 map in the *Illustrated Historical Atlas Map of the County of Middlesex* (Figure 3). In 1878, Thorndale was a growing community with a population of 300 (Page & Co. 1878: 12). In 1888, Thorndale had a population of 350, with a sawmill, flour mill, and a cheese box factory as the principal industries (Godspeed 1889: 564).

Outside of Thorndale, the Township of Nissouri remained primarily agricultural and by the late 19th century was focused on cattle and dairy farming (WNTHS 2005: 76).

4.5 20th Century Development

Thorndale remained a small community in the Township of West Nissouri in the early 20th century, with a population in 1901 of 350 (1901: 413). Outside of Thorndale, other 19th century villages in the township that were not on the GTR line declined or disappeared (WNTHS 2005: 435). Agriculture remained the primary industry in the Township of West Nissouri, with over half the villages in the early 20th century serving the farms (WNTHS 2005: 75). In 1918, the GTR became part of the Canadian National Railway (CN). Expenses for road building increased throughout the 20th century, with the first road paving completed through Thorndale in 1927 (WNTHS 2005: 439).

Southwest of the Study Area, in 1939, the Department of Transport purchased 600 acres for the construction of an airport in the community of Crumlin (WNTHS 2005: 449). The Township of West Nissouri was one of the few townships to have an airport. By the mid-20th century annexation became a major concern in the township, and in the 1960s the City of London attempted to annex several thousand acres from adjoining townships, including the Township of West Nissouri (WNTHS 2005: 61). The topic of annexation remained an issue throughout the late 20th century. In 1991, the airport was annexed by the City of London (WNTHS 2005: 450). A second annexation followed in 1993 with 890 hectares (2,199 acres) of the Township of West Nissouri annexed by the City of London (WNTHS 2005: 61).

By the late 20th century the township remained primarily agriculture based, with 256 farms in operation in the mid-1990s (WNTHS 2005: 75). In 2001, the Township of West Nissouri amalgamated with the Township of North Dorchester to form the new Municipality of Thames Centre (WNTHS 2005: 64). The municipality has a stable population with a small growth rate, with a population of 13,000 in 2011 and 13,191 in 2016 (Statistics Canada 2017).

4.6 Site History

The current Thorndale Bridge was constructed in 1953. Two previous structures existed prior to its construction. A bridge was constructed through the Study Area in the mid-19th century as depicted on Tremaine's Map of the County of Middlesex in 1862 (Figure 3). Local history sources date the first bridge west of Thorndale across the Thames River to 1869, for a price of $400 (WNTHS 2005: 443). It should be noted, however, that a bridge is not depicted through the Study Area on the 1878 map of the Township of West Nissouri in the *Illustrated Historical Atlas of the County of Middlesex* (Figure 3).

By the late 19th century, flooding became an issue on the Thames River and Wye Creek through Thorndale. In 1902, a new bridge was constructed for $3,340 (WNTHS 2005: 443). As determined through historic negatives and photographs, the 1902 bridge was a four-span metal pin-connected truss bridge with wood deck and stone piers (Plate 2 to Plate 4). Between 1880 and 1910, the pin-connected truss bridge was the most common bridge type in Canada (Holth n.d.). A postcard from 1910 depicts the bridge through the Study Area (Plate 5). The postcard shows the sloping topography of the Study Area, which remains today within the river valley. A bridge structure is also depicted through the Study Area on the 1915 topographic map (Figure 4).

Plate 2: Thorndale Bridge 1910 (WNTHS 2005: 444)

Plate 3: Irene Mills on Thorndale Bridge in 1945 (WNTHS 2005: 436)

Plate 4: Thorndale Bridge 1951 (Archives and Special Collections, Western Libraries, Western University 1951)

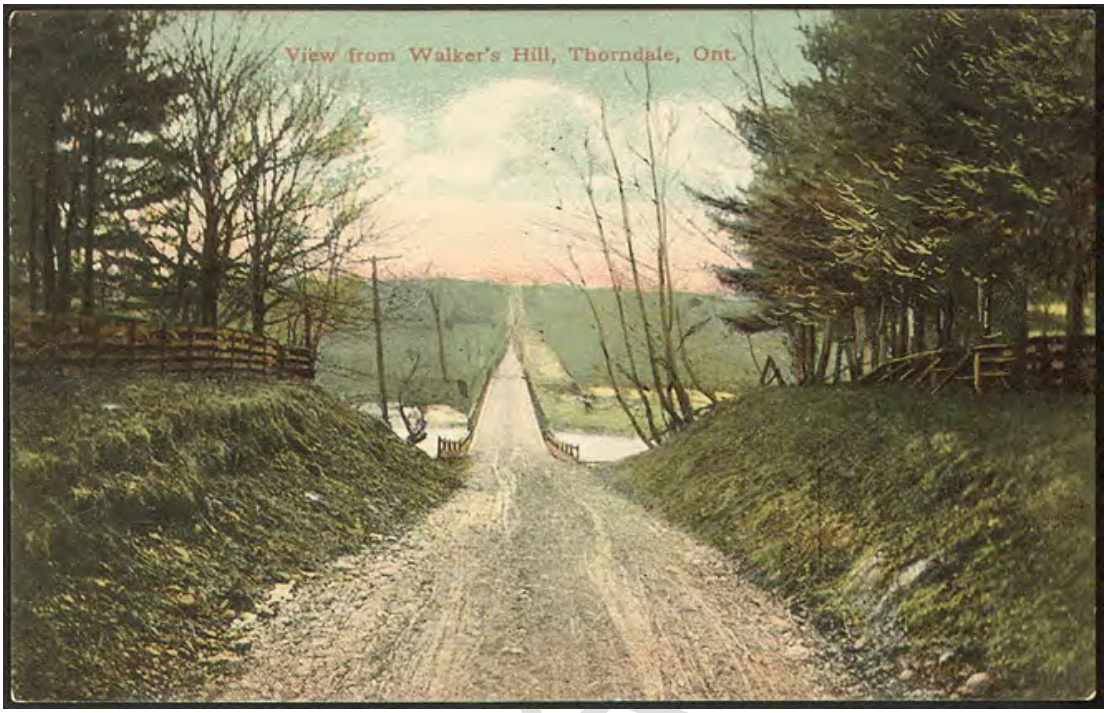


Plate 5: View from Walker's Hill towards bridge 1910 (Lee 1910)

Flooding issues continued in the early 20th century with two serious floods in 1920 and 1937. The flood of 1937 was the highest ever recorded on the Thames River and was the most destructive of life and property (UTRCA n.d. [a]). After the flood of 1937, representatives from five counties met to discuss solutions to address the flooding. This meeting led to the establishment of a conservation authority. In 1946, the provincial government passed the *Conservation Authorities Act.* The Upper Thames River Conservation Authority (UTRCA) was the sixth conservation authority formed in Ontario, by an Order in Council on September 18, 1947 (UTRCA n.d. [b]).

The first major project of the UTRCA was the construction of a flood control dam on the North Thames River. The Fanshawe Dam was one in a series of eight dams recommended by the 1952 Upper Thames Valley Report for the flood control of the Thames River system. The Fanshawe Dam and reservoir were constructed between 1950 and 1952 and began operation in 1953 (UTRCA n.d. [b]). During the construction of the dam, discussions began between the UTCRA and Middlesex County for the replacement of the Thorndale Bridge. An agreement was made in 1952, with the cost for the new bridge spilt between Middlesex County and UTCRA (WNTHS 2005: 436).

The bridge was designed in 1952 by M.M. Dillon & Co. using the Standard Specifications for Highway Bridges (Craig and Bartlett 2005: 7). The original drawings for the bridge show the structure had the standard Department of Highways two-cable guide rail (Appendix B). In May 1953, the 1902 bridge was demolished and removed and construction began on the new bridge, which included, as depicted in a construction photograph from August 1953, the damming of the river for the erection of the bridge (Plate 6). The Thorndale Bridge was completed that year and is depicted in a 1954 photograph (Plate 7). This structure is depicted through the Study Area on the 1962 topographic map (Figure 4).

Plate 6: Thorndale Bridge under construction August 28, 1953 (Archives and Special Collections, Western Libraries, Western University 1953)

Plate 7: Thorndale Bridge June 19, 1954 (Archives and Special Collections, Western Libraries, Western University 1954)

By 1984, a deck condition report completed by M.M. Dillon Limited determined that the Thorndale Bridge had some deterioration of its deck slab and concrete curbs due to salt damage (Dillon Limited 1984). In 1986, repairs were carried out to the bridge deck including the removal of the existing asphalt, chipping areas of the deck and sidewalks, placing new concrete end dams at expansion joints, and waterproofing and repaving of the deck and approaches (Middlesex County 1986).

An Inspection Report of the bridge was completed in 1999 by Dillon Consulting Limited. The report recommended the installation of a supplementary steel flexbeam guiderail and the completion of a corrosion survey to estimate the extent of deterioration of the deck (Dillon Consulting Limited 1999). Photographs from the 1999 report show the condition of the bridge that year (Plate 8 to Plate 11).

Plate 8: Curb and railing on south side looking west in 1999 (Dillon Consulting Limited 1999)

Plate 9: Thorndale Bridge looking east in 1999 (Dillon Consulting Limited 1999)

Plate 10: Close-up of railing on south side in 1999 (Dillon Consulting Limited 1999)

Plate 11: South soffit and fascia in 1999 (Dillon Consulting Limited 1999)

In 2000, a Detailed Bridge Deck Condition Survey was completed by Dillon Consulting Limited. The report determined the asphalt surface to be in fair condition and the concrete deck in fair to good condition (Dillon Consulting 2000). Following the bridge survey, in 2002, under contract M-C-02, rehabilitation was undertaken on Thorndale Bridge, that included:

- Removal of the existing asphalt pavement and waterproofing system
- Removal of the existing steel railing system and concrete end posts
- Scarifying concrete deck and partial depth removal of concrete from deck
- Removal of the existing concrete curbs
- Placing of new silica fume concrete overlay
- Placing new parapet wall and railing
- Modifying existing abutment ballast wall and placing new approach slabs
- Installation of new expansion joints
- Epoxy injecting cracks in webs of box girder superstructure
- Installation and stressing of post tensioning bars
- Mill and pave approaches

(Dillon Consulting Limited 2002)

A bridge inspection completed in 2010 by Dillon Consulting Limited determined the need for rehabilitation work to the structure due to the presence of cracks in the webs of the box girders (Dillon Consulting Limited 2010).

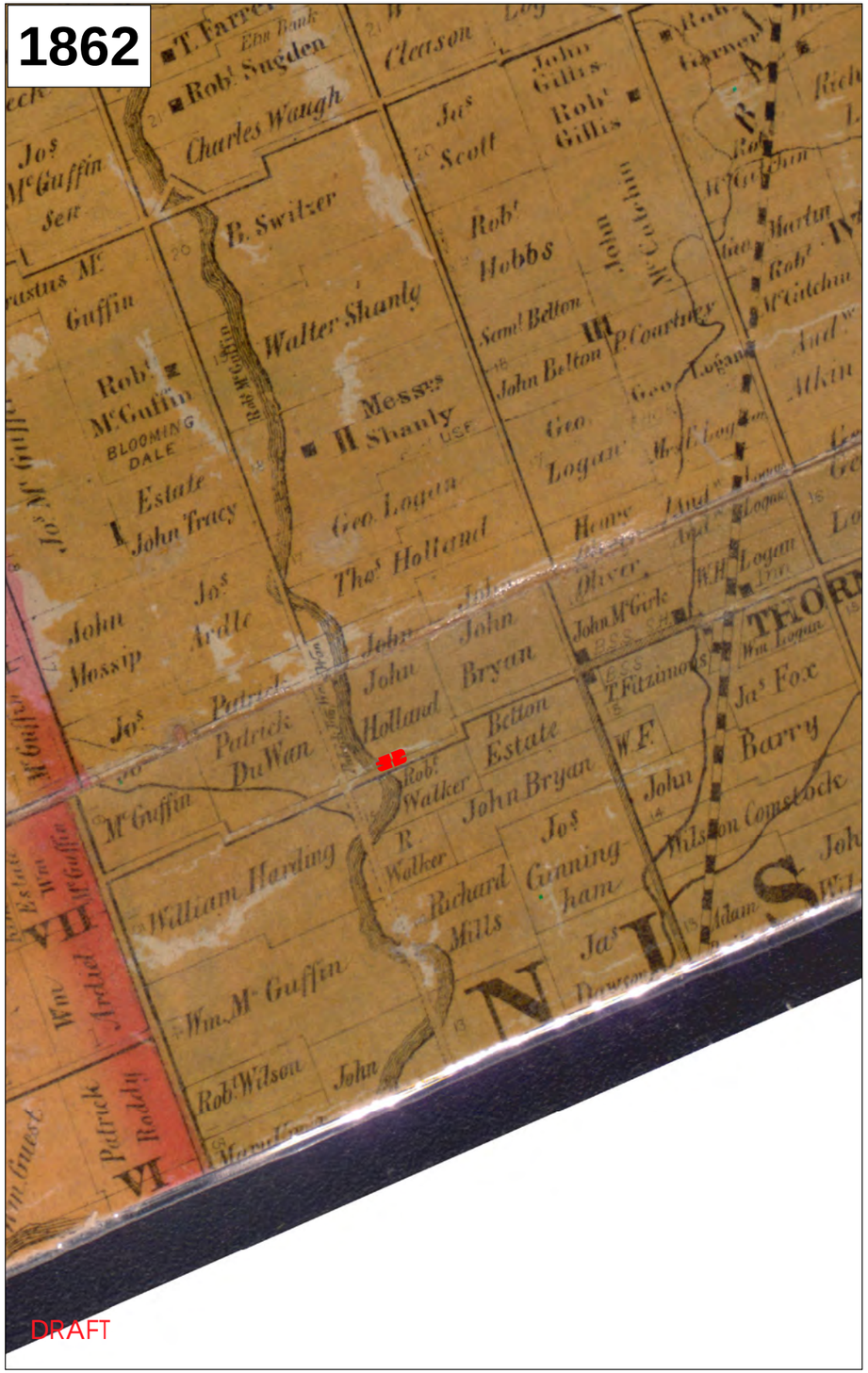
4.7 Structure and Bridge Construction

Thorndale Bridge is a box girder bridge that was constructed in 1953. Beam and girder is one of the most common styles of bridge construction. Beam and girder construction consists of a series of solid members running longitudinally the length of the span, often with bracing between the parallel members. Each beam or girder is fastened to the abutments or piers and the deck is laid down on top. These bridges are more complex than a simple slab bridge but use less material than slab bridges. Typically, beam and girder bridges are used for long spans of greater than 10 m. There are a variety of beam and girder styles, which include I-Beams, Box-style, Rectangular, and T-shape. Beams and girder bridges are usually made of concrete or steel (Heritage Resources Centre n.d.:31).

The box girder form is a post-Second World War development (Mead & Hunt 1999: 28). These structures began to appear in North America in the early 1950s and were common by the 1960s (Parsons Brinckerhoff and Engineering and Industrial Heritage 2005: 3-104). The Thorndale Bridge represents a relatively early example of the prolific bridge type.

4.8 Bridge Designer

Thorndale Bridge was designed and engineered by M.M. Dillon & Co., Consulting Engineers from London, Ontario. M.M. Dillon & Co. was founded by Marmaduke Murray Dillon and George Humphries in 1946 in London, Ontario (Dillon Consulting 2019). The original bridge drawings are stamped by Registered Professional Engineer W.K. Clawson and R.M. Dillon (Appendix B).



Stantec

Legend
Study Area (Approximate)

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Historic map sources: Tremaine, George. 1862. *Tremaine's Map of the County of Middlesex, Canada West*. Toronto: Tremaine.
Page, H.R. and Co. 1878. *Illustrated Historical Atlas of the County of Middlesex, Ontario*. Toronto: H.R. Page and Co.
3. Not to scale

Project Location
County of Middlesex

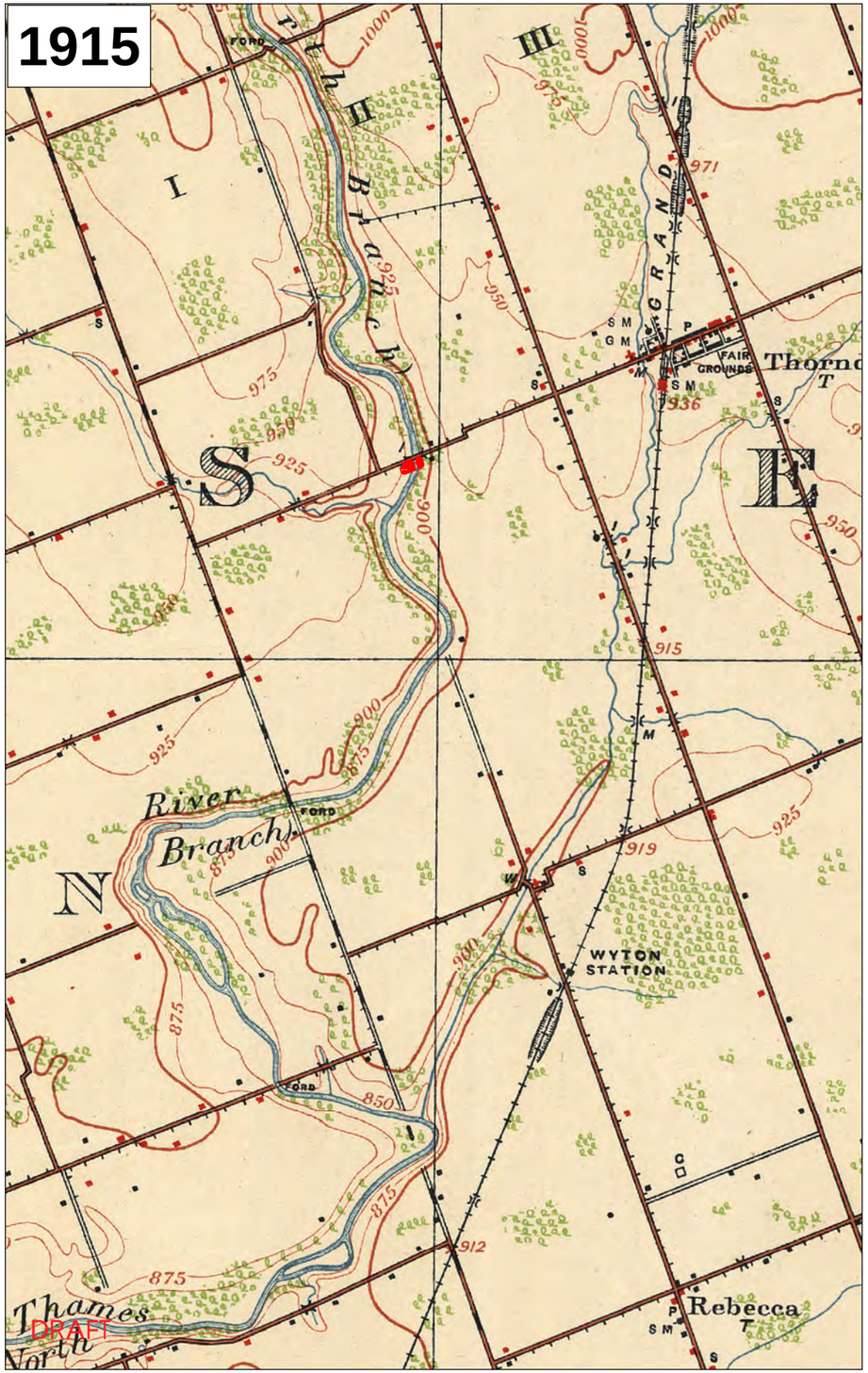
165001122 REVA
Prepared by JW on 2019-07-02
Technical Review by ABC on yyyy-mm-dd
Independent Review by ABC on yyyy-mm-dd

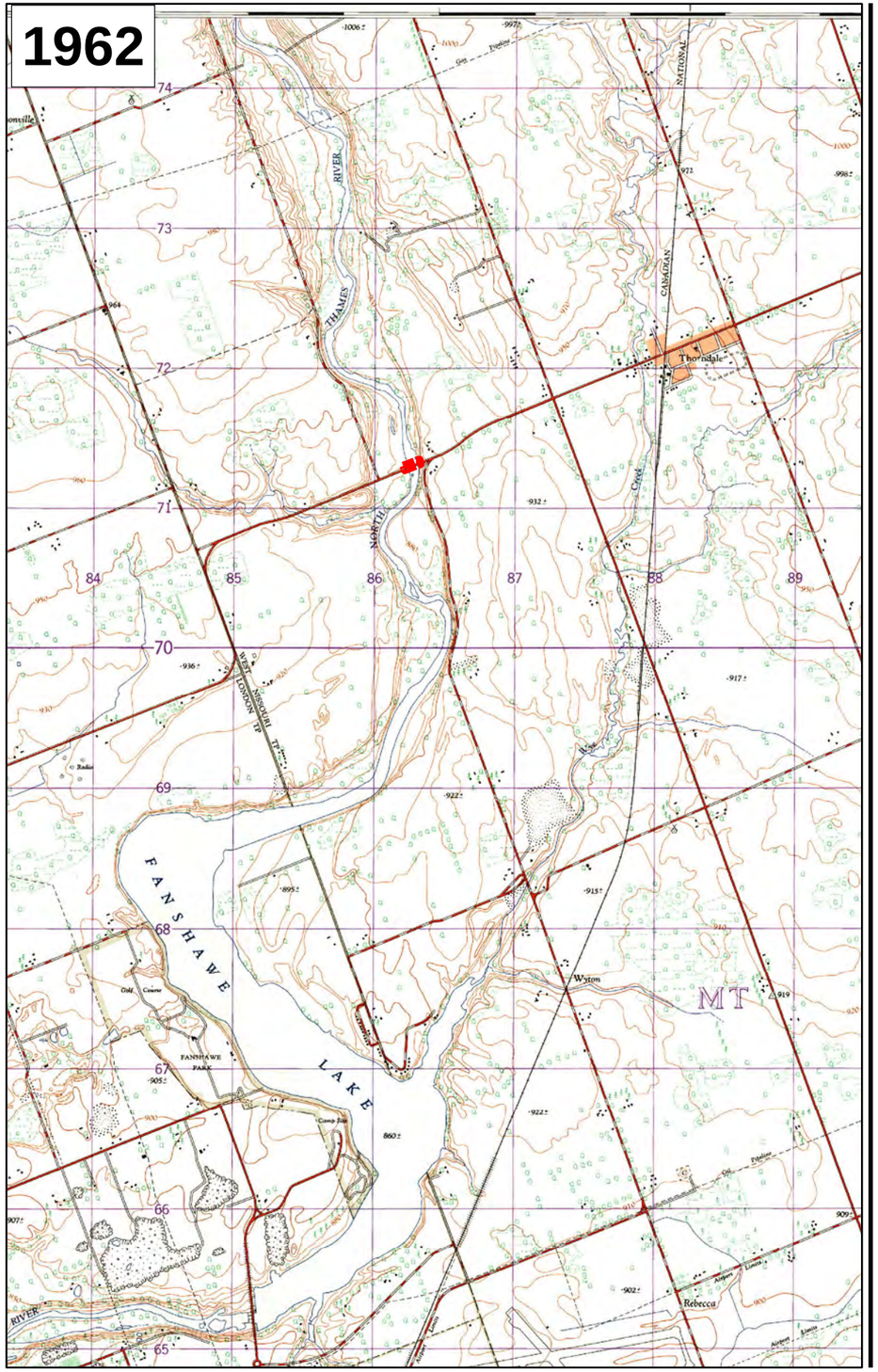
Client/Project
MIDDLESEX COUNTY
THORNDALE BRIDGE IMPROVEMENTS
COUNTY ROAD 28 (THORNDALE ROAD)

Figure No.
3

DRAFT

Title
19th Century Mapping





Stantec

Legend
Study Area (Approximate)

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Historic map sources: Department of Militia and Defence. 1915. *Topographic Map, Ontario, Lucan Sheet.*
Army Survey Establishment, R.C.E. 1962. Crumlin, *Middlesex County, Ontario.*
3. Not to scale

Project Location
County of Middlesex

165001122 REVA
Prepared by JW on 2019-07-02
Technical Review by ABC on yyyy-mm-dd
Independent Review by ABC on yyyy-mm-dd

Client/Project
MIDDLESEX COUNTY
THORNDALE BRIDGE IMPROVEMENTS
COUNTY ROAD 28 (THORNDALE ROAD)

Figure No.
4

DRAFT

Title
20th Century Mapping

5.0 Bridge Description

5.1 Thorndale Bridge

5.1.1 Landscape Context

Thorndale Bridge spans the North Thames River as part of Thorndale Road between Valleyview Road and Rebecca Road, in the Municipality of Thames Centre, within Middlesex County. The bridge is situated west of the small rural community of Thorndale and is set within a rural and natural area of the municipality. The bridge spans the North Thames River over UTRCA lands that are composed of the naturalized river valley (Plate 12 and Plate 13). West of the bridge is naturalized area that is mostly forested (Plate 14). East of the bridge are two residences that front on Thorndale Road.

The residence at 16614 Thorndale Road is a mid- to late 19th century one and one half storey residence (Plate 15). It is depicted on the 1878 Township of West Nissouri map in the *Illustrated Historical Atlas of Middlesex County* (Figure 3). The residence at 16615 Thorndale Road is also a mid- to late 19th century one and one half storey residence (Plate 16 and Plate 17). Adjacent to the residence is a timber frame barn with a gambrel roof and stone foundation. The residence is also depicted on the 1878 map (Figure 3). East of the two residences are commercial and industrial properties and to the south are sand and gravel pits.

Thorndale Bridge is oriented in a general west-east direction and carries two lanes of traffic over the North Thames River. West and east of the bridge Thorndale Road declines in slope as the roadway approaches the bridge in the river valley (Plate 18 to Plate 20). Thorndale Road over the bridge has a double centre line with narrow shoulders and raised concrete curbs (Plate 21). The west and east bridge abutments are set on the gradual to steep slopes of the North Thames River valley (Plate 22 and Plate 23). Concrete slope protection is present adjacent to both abutments. Beyond that, the east slope is covered with grass and the west slope is covered with trees and rocks associated with the 1902 bridge (Plate 24).

Plate 12: North Thames River looking northeast from bridge

Plate 13: North Thames River looking southwest

Plate 14: Thorndale Road looking west from west bridge approach

Plate 15: 16614 Thorndale Road looking northwest

Plate 16: 16615 Thorndale Road looking southwest

Plate 17: 16615 Thorndale Road looking southeast

Plate 18: East approach looking west

Plate 19: East approach looking east

Plate 20: West approach looking west

Plate 21: Thorndale Bridge deck looking northeast

Plate 22: East slope and abutment looking north

Plate 23: West slope south side looking east

Plate 24: Rock protection and vegetation on southwest side of bridge

5.1.2 Bridge Description

Detailed information regarding the Thorndale Bridge was taken from the 1984, 1999, 2000, and 2010 Bridge and Deck Inspections completed by Dillon Consulting Limited.

Thorndale Bridge is a four-span cast-in-place concrete two-cell box girder bridge (Plate 25). The four continuous spans are 24.4 m, 30.5 m, 30.5 m, and 24.4 m in length. The bridge has no skew. The current roadway width is 7.5 m and the current structure width is 9.5 m (Plate 26 to Plate 28). The wearing surface is asphalt (Plate 29). There is a concrete parapet wall with a single rail and curb on each side of the bridge (Plate 30). A steel beam guide rail is attached to all four parapet wall ends (Plate 31). Each side of the deck has eighteen deck drains spaced at 6 m (Plate 32 to Plate 34). There is an expansion joint at each abutment (Plate 35 and Plate 36).

At each abutment, there are three steel pipe rollers filled with concrete bearings and two thick steel beds anchored to the deck and keyed into the abutment seat. Similar treatment is located at the piers with two long steel pipe rollers and one thick steel bed. The west abutment consists of an abutment seat supported by three rectangular columns. The east abutment consists of a typical abutment stem (Plate 37). All piers consist of concrete shafts with triangular ice breaker heads on the sides (Plate 38). All abutments and piers are founded on steel piles.

Plate 25: Thorndale Bridge looking northwest

Plate 26: East approach to the bridge looking southwest

Plate 27: East approach to bridge looking west

Plate 28: West approach to the bridge looking east

Plate 29: Thorndale Bridge deck looking northwest

Plate 30: South concrete parapet wall and steel rails looking northeast

Plate 31: Steel guardrails attached to bridge parapet wall on northeast side of bridge

Plate 32: Top of metal deck drain

Plate 33: Detail of top of metal deck drain

Plate 34: Metal deck drains along bridge

Plate 35: Expansion joint on west side of the bridge

Plate 36: Expansion joint on east side of the bridge

Plate 37: East abutment looking north

Plate 38: Bridge piers looking west

5.2 Modifications

As discussed in Section 4.6, modifications were made to the bridge in 1986 and 2002.

5.3 Comparative Analysis

Stantec reviewed the listing of bridges in the Middlesex County, *County-Wide Bridge Study* from February 2017, to complete a comparative analysis for Thorndale Bridge with other bridges in the County. This analysis was completed to measure the rarity or unique attributes of the bridge. In addition, the dates of construction and the bridge types were compared to determine if Thorndale Bridge is an early example or unique style of bridge.

Thorndale Bridge is a four-span cast-in-place concrete two-cell box girder bridge. The *County-Wide Bridge Study* identified Thorndale Bridge as Bridge Study ID CM-B-063, County Structure ID 19-174, a cast-in-place concrete box girder structure that was constructed in 1952 (Dillon Consulting 2017: A-2). The report reviewed 686 bridges and culverts within Middlesex County, and 65 bridges and culverts within the Municipality of Thames Centre. The Thorndale Bridge is the only box girder structure within the County of Middlesex (Dillon Consulting 2017: 9). It is one of 57 structures constructed in the County between 1950 to 1959, and one of four constructed in the Municipality of Thames Centre between 1950 to 1959 (Dillon Consulting 2017: A-33).

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Although Thorndale Bridge is the only box girder bridge in the Municipality of Thames Centre and the County of Middlesex, it is a common bridge type across the province. By comparison, examining that type of bridge on the Ministry of Transportation Ontario (MTO) bridge list that includes 2801 structures, there are 148 provincially owned beam/girder structures in the province with box beams constructed between 1952 and 2013. Of these bridges, 15 are specifically located in the West Region of Ontario, the region within which the Thorndale Bridge is situated. While the box girder structure was a common bridge type in the 1950s and 1960s, not many of this bridge type remain in the province.

6.0 Cultural Heritage Value or Interest

6.1 Evaluation Overview

Two separate evaluation criteria were considered in the evaluation of Thorndale Bridge, as outlined in Section 3.3. Within the EA process, O. Reg. 9/06 is typically used to identify CHVI (see Section 6.2.1). For this project, the OHBG evaluation framework was also considered as it contains bridge-specific evaluation criteria and is part of a process recognized by the province for assessing the heritage value of bridges (see Section 6.2.2).

It must be noted that the OHBG are intended to apply to provincially owned bridges and are not required to determine the CHVI of a non-provincially owned bridge. However, the OHBG are useful in evaluating bridges as they have been designed and weighted specifically for this resource type, unlike O. Reg 9/06 which is more general in nature. An overall summary of cultural heritage value identified in the two evaluation frameworks is provided in Section 6.3 and a Statement of CHVI is provided in Section 6.4.

6.2 Evaluation

6.2.1 Ontario Regulation 9/06

Design/Physical Value

Thorndale Bridge is a box girder bridge that was constructed in 1953. It is the only box girder structure in the Municipality of Thames Centre and Middlesex County. As comparative data in the County is limited, its type was examined through additional sources, which determined that beam/girder bridges are one of the most common styles of bridge construction in the province. However, the Thorndale Bridge as a box girder structure is an increasingly rare type of beam/girder bridge in the province. Once a common type during the 1950s and 1960s, few remain in the province, especially over watercourses, and none from Middlesex County date to this period, making the Thorndale Bridge the oldest remaining box girder bridge. Thus, the Thorndale Bridge is a representative example of a mid-20th century box girder structure that is becoming increasingly rare in the province.

Based on the above discussion, Thorndale Bridge meets one criterion (1.i) of O. Reg. 9/06.

Historic/Associative Value

Thorndale Bridge was constructed in 1953, as part of mid-20th century flood control measures on the Thames River System. The bridge was constructed following the establishment of the UTRCA in 1947 and the construction of Fanshawe Dam to the southwest in 1950 to 1953. Thorndale Bridge was designed by M.M. Dillon & Co. in 1952, using Standard Specifications for Highway Bridges in the province. The bridge was constructed the following year. Its mid-20th century construction serves a functional purpose, and thus the bridge has no direct historical connection with the early development of the former Township of West Nissouri or the nearby community of Thorndale. The bridge does not yield information that contributes to an understanding of a community or culture. The bridge demonstrates the work of M.M. Dillon & Co. (now Dillon Consulting), who are prolific bridge engineers in the province and Canada, but not significant to the community.

Based on the above discussion, the bridge does not meet criteria of Section 2 of O. Reg. 9/06.

Contextual Value

The visible sections of the Thorndale Bridge including the concrete parapet and steel beam guide rail are of common design and are not important in defining, maintaining, or supporting the character of the area. The bridge is functionally linked to its surroundings as it carries Thorndale Road over the North Thames River. However, this functional relationship is standard to all water crossings and does not confer a high degree of contextual value. The superstructure of the Thorndale Bridge is not visible while travelling along Thorndale Road. The bridge is within the viewscape of travelers along the North Thames River or those on the UTRCA lands, but the bridge is not a historic landmark, but rather a familiar structure in the context of the area. Notably, the replacement of the original steel railings resulted in a disruption to the contextual relationship between the bridge and the Thames River. The concrete barriers obstruct views to the river valley and thus remove the relationship between the road crossing and waterway.

Based on the above discussion, the bridge does not meet criteria of Section 3 of O. Reg. 9/06.

Table 1: Evaluation of Thorndale Bridge According to *Ontario Regulation* 9/06 of the *Ontario Heritage Act*

Criteria of O. Reg. 9.06	Y/N	Comments
Is a rare, unique, representative or early example of a style, type, expression, material or construction method	Y	Thorndale Bridge is a box girder bridge. It is the only structure of its type in the Municipality of Thames Centre and the County of Middlesex. Although, this was a relatively common bridge type in the province during the 1950s and 1960s, not many of this bridge type remain in the province, especially over watercourses. Thus, the Thorndale Bridge is a representative example of a mid-20th century box girder bridge over a water crossing that is becoming increasingly rare in the province.
Displays a high degree of craftsmanship or artistic merit	N	The bridge does not contain decorative features or other elements that demonstrate a high degree of craftsmanship or artistic merit. Accordingly, the bridge does not meet this criterion.
Demonstrates a high degree of technical or scientific achievement	N	The bridge is a common girder design that uses steel beams and concrete, common bridge materials at the time of construction. As such, it does not demonstrate a high degree of technical or scientific achievement. Accordingly, the bridge does not meet this criterion.
Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community	N	The bridge was constructed in 1953 as part of mid-20th century flood control measures following the creation of the UTRCA in 1947 and the construction of the Fanshawe Dam between 1950 and 1953. The bridge is the third constructed in the Study Area across the North Thames River and is preceded by 1902 and circa 1869 structures. Its construction serves a functional purpose, and thus the bridge has no direct connection with the early development of the former Township of West Nissouri or the nearby community of Thorndale. Accordingly, the bridge does not meet this criterion.
Yields, or has the potential to yield, information that contributes to an understanding of a community or culture	N	The bridge is a box girder structure that does not contribute significantly to an understanding of a community or culture. Accordingly, the bridge does not meet this criterion.
Demonstrates or reflects the work or ideas of an architect, artist, builder, designer or theorist who is significant to a community	N	The bridge was designed by M.M. Dillon & Co., consulting engineers from London, Ontario. The bridge was designed using the Standard Specifications for Highway Bridges in the province at that time. The original structure has been modified through the replacement of its original railings, bridge deck, and expansion joints. M.M. Dillon & Co. (now Dillon Consulting) is a prolific bridge engineer in the province and Canada. Accordingly, the bridge does not meet this criterion.

Criteria of O. Reg. 9.06	Y/N	Comments
Is important in defining, maintaining or supporting the character of an area	N	The visible sections of the bridge are of common design and are not important in defining, maintaining, or supporting the character of the area. Accordingly, the bridge does not meet this criterion.
Is physically, functionally, visually or historically linked to its surroundings	N	The bridge is functionally linked to its surroundings as it carries Thorndale Road over the North Thames River. However, this functional relationship is standard to all water crossings and does not confer a high degree of contextual value. Accordingly, the bridge does not meet this criterion.
Is a landmark	N	The superstructure of the bridge is not visible along Thorndale Road. Within the viewscape along the roadway are the simple concrete barriers with steel railings. The bridge is within the viewscape from the North Thames River or UTRCA lands. The structure is not a historic landmark but rather a familiar structure within the context of the area. Accordingly, the bridge does not meet this criterion.

6.2.2 Ontario Heritage Bridge Guidelines

Following evaluation against the OHBG, Thorndale Bridge was determined to have design/physical value as mid-20th century box girder structure, that is becoming increasingly rare in the province. The majority of its score was attributed to its functional design, visual appeal, and its bridge designers (Table 2).

Table 2: Ontario Heritage Bridge Guidelines

	Criteria	Details	Maximum Score	Assigned Score	Comments
Design/Physical Value (Total marks 50)	Functional Design	Excellent	20	16	Thorndale Bridge is a four span concrete girder bridge with box beams and is a common type in the West Region. The MTO bridge list indicates that there 148 beam/girder bridges with concrete box beams in the province, and 15 of this type specifically within the West Region. While the bridge was relatively common bridge type in the 1950s and 1960s they are becoming increasingly rare across the province, especially over watercourses.
		Very Good	16		
		Fair	12		
		Common	0		

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	Criteria	Details	Maximum Score	Assigned Score	Comments
	Visual Appeal	Excellent	20	12	Thorndale bridge is a well-proportioned structure that is appropriate to its landscape within the North Thames River valley.
		Good	12		
		Fair	4		
		None	0		
	Materials	Excellent	10	0	The major components of Thorndale Bridge are cast-in-place concrete and steel. Both are considered to be common materials in bridge construction, and typical of the 1953 date.
		Very Good	8		
		Good	5		
		Common	0		
Contextual Value (Total marks 25)	Landmark	Excellent	15	3	With the exception of the concrete barriers with steel railings, Thorndale Bridge is not visible while travelling along Thorndale Road and views of the Thames River while travelling across the bridge are largely obstructed. However, the bridge is visible from the North Thames River and UTCRA lands and is a familiar structure in the context of the area.
		Good	9		
		Fair	3		
		Common	0		
	Character Contribution	Excellent	10	0	The bridge is set within a rural and natural landscape. The common construction and design elements of the bridge are in keeping with the character of the area but do not significantly contribute to it.
		Good	6		
		Common	0		
Historical Association (Maximum Score 25)	Designer/ Construction Firm	Excellent	15	9	Thorndale Bridge was designed by M.M. Dillon & Co., consulting engineers from London, Ontario. The bridge was constructed under Middlesex County and UTRCA. M.M. Dillon & Co. (now Dillon Consulting) have been a prolific bridge engineer firm since 1946 in the London area and Canada.
		Good	9		
		Fair	3		
		Unknown	0		

	Criteria	Details	Maximum Score	Assigned Score	Comments
	Association with a Historical theme, person or event	Excellent	10	0	Thorndale Bridge was constructed in 1953 and is associated with mid-20th century flood control measures of the Thames River system following the creation of the UTRCA and the construction of the Fanshawe Dam. For its mid-20th century construction date and common connection as part of flood measures on the Thames River, the bridge does not merit historic value.
		Good	6		
		Common	0		
	Total Score			**40**	

6.3 Summary of Evaluation

Following evaluation against O. Reg. 9/06 and the OHBG, Thorndale Bridge was determined to be a representative example of a mid-20th century box girder structure, a type that is becoming increasingly rare in the province. Thorndale Bridge met one criterion under O. Reg. 9/06 (1.i), for its design/physical value (Table 1). Thorndale Bridge scored 40 points according to the OHBG and therefore does not meet the threshold of 60 points to be considered provincially important (Table 2). Based on these findings, Thorndale Bridge does not meet the threshold to be considered provincially important and worthy of inclusion on the *Ontario Heritage Bridge List*.

6.4 Statement of Cultural Heritage Value or Interest

Thorndale Bridge spans the North Thames River as part of Thorndale Road between Valleyview Road and Rebecca Road, in the Municipality of Thames Centre, within Middlesex County. The bridge is situated west of the small rural community of Thorndale and is set within a rural and natural area of the municipality.

Thorndale Bridge is a four-span, cast-in-place concrete, two-cell box girder bridge that was constructed in 1953. The bridge, situated west of the small rural community of Thorndale, extends Thorndale Road over the North Thames River within a rural and natural landscape of the Municipality of Thames Centre, within Middlesex County.

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The bridge was designed by M.M. Dillon & Co. and constructed under the County of Middlesex and Upper Thames River Conservation Authority as part of mid-20th century flood control measures on the Thames River system. The box girder structure, once common in the 1950s and 1960s, has become an increasingly rare structure type in the province and few remain, especially over watercourses. Thus, the Thorndale Bridge is a representative example of a mid-20th century box girder bridge over a water crossing that is becoming increasingly rare in the province.

The heritage attributes of the Thorndale Bridge include:

- Four-span cast-in-place concrete two-cell box girder bridge
- Concrete abutments
- Piers with concrete shafts and triangular ice breaker heads on the sides

7.0 Impact Assessment and Mitigation

7.1 Description of Proposed Undertaking

The purpose of the Class EA project is to identify improvements to the Thorndale Bridge on County Road 28/Thorndale Road. The existing bridge is approximately 67 years old and has been identified for replacement within the next 10 years. The Class EA considered alternatives for replacement of the existing structure. Following consideration, the preferred solution is to construct a new bridge on the existing alignment using a temporary detour during construction. The preferred solution includes the following improvements:

- Replace the existing structure with a three-span (34.5 m – 46 m – 34.5 m) integral abutment bridge with a slab-on-steel I girder superstructure. 1700 millimetre (mm) deep steel I-girders, spaced at about 3.6 m, will be used to support the concrete deck. The bridge is designed for a 75-year lifespan.
- Each of the integral abutments consist of a concrete stem supported by a single row of steel H-piles. The new bridge abutments will be situated about 2.0 m beyond the existing abutments to avoid conflict with the existing abutment footing and piles.
- Three in-water piers (8 m length) will be removed to 300 mm below grade (stream bed) and replaced with two in-water piers (5.5 m length) on different footprints. The width of the new piers is approximately equal the width of the existing piers.
- Below the bridge deck, the slope on the west bank will be cut to a 2:1 slope whereas the slope on the east bank will be filled to achieve a 2:1 slope. No grading will take place within 5 m of the river's edge (estimate using a water level of 265 m above sea level (MASL) recorded April 2019).
- The two-lane cross section will be maintained, with the ability to accommodate active transportation. The recommended bridge widening along Thorndale Road accommodates two 3.75 m lanes with 1.6 m paved shoulders at each side, and a 2.5 m raised multi-use trail on the south side.

As noted in Section 2.2, a draft version of the CHER was provided to the client in 2019 to inform the determination of the EA schedule for the Thorndale Bridge EA. The EA study was determined to be a Schedule 'C' project. The draft version of the CHER was amended in May 2020 to include the following impact assessment and mitigation measures.

7.2 Impact Assessment and Mitigation Methodology

The assessment of impacts on heritage resources is based on the impacts defined in *Info Sheet #5* (Government of Ontario 2006b). Impacts to heritage resources may be direct or indirect. Direct impacts include:

- **Destruction** of any, or part of any, significant heritage attributes or features
- **Alteration** that is not sympathetic, or is incompatible, with the historic fabric and appearance

Indirect impacts to cultural heritage resources do not result in the direct destruction or alteration of the feature or its heritage attributes, but may indirectly affect the cultural heritage value of a property by causing:

- **Shadows** created that alter the appearance of a heritage attribute or change the viability of a natural feature or plantings, such as a garden
- **Isolation** of a heritage attribute from its surrounding environment, context or a significant relationship
- **Direct or indirect obstruction** of significant views or vistas within, from, or of built and natural features
- **A change in land** use such as rezoning a battlefield from open space to residential use, allowing new development or site alteration to fill in the formerly open spaces
- **Land disturbances** such as a change in grade that alters soil, and drainage patterns that adversely affect an archaeological resource

(Government of Ontario 2006b)

As Middlesex County does not have specific heritage bridge guidelines, the OHBG were used to provide guidance on the alternatives that may be considered when impacts are anticipated to a bridge with cultural heritage value. The OHBG have eight conservation options for bridges that are subject to repair, rehabilitation, or proposed replacement (MTO 2008). In addition to its role as a provincial guidance document, it should be noted that the OHBG are intended for use in bridges that meet the 60 point threshold for consideration as a heritage bridge. While the Thorndale Bridge does not meet this threshold, the conservation options presented by the OHBG have been considered when refining an appropriate mitigation strategy for impacts identified. The eight conservation options are:

1) Retention of existing bridge with no major modifications undertaken

2) Restoration of missing or deteriorated elements where physical or documentary evidence (e.g. photographs or drawings) existing for their design

3) Retention of the existing bridge with sympathetic modification

4) Retention of the existing bridge with sympathetically designed new structure in proximity

5) Retention of existing bridge no longer for vehicular purposes but adapted for a new use

6) Retention of bridge as heritage monument for viewing purposes on Thorndale Road

7) Relocation of smaller, lighter single span bridges to an appropriate new site for continued use or adaptive re-use

8) Bridge removal and replacement with a sympathetically designed structure
   a) Where possible, salvage elements/members of bridge for incorporation into new structure or for future conservation work or displays; and,
   b) Undertake full recording and documentation of existing structure

(MTO 2008)

7.3 Impact Assessment

The Thorndale Bridge has CHVI since it meets one of the criteria for cultural heritage value included in O. Reg. 9/06. Accordingly, an assessment of impacts must be carried out to determine potential direct and indirect impacts. Table 3 provides an outline the potential direct and indirect impacts on the Thorndale Bridge as defined by Info Sheet #5, which is listed in Section 7.2. The following acronyms are used in the tables to denote the assessment of impacts: NA = Not Anticipated, A = Anticipated Impact, P = Potential Impact.

Table 3: Potential Impacts to Thorndale Bridge

Direct Impact	Assessment	Discussion
Destruction of any, or part of any, *significant heritage attributes* or features.	A	The Class EA determined that the preferred solution is to construct a new bridge on the existing alignment. This will result in the destruction of the existing Thorndale Bridge. The heritage attributes identified are limited entirely to the structure and will be directly impacted by the destruction of the structure itself. The Class EA preferred solution does not propose the alteration of the Thorndale Bridge. Rather, the proposed solution is to remove the existing bridge and construct a new bridge on the existing alignment. **Therefore, mitigation measures are required to mitigate direct impacts.**
Alteration that is not sympathetic, or is incompatible, with the historic fabric and appearance.	N/A	
Shadows created that alter the appearance of a *heritage attribute* or change the viability of a natural feature or plantings, such as a garden	N/A	The Class EA determined that the preferred solution is to remove the existing bridge and construct a new bridge on the existing alignment. Therefore, indirect impacts are not anticipated to the Thorndale Bridge. As the heritage attributes of the bridge are limited to the structure itself, the demolition will remove all heritage attributes. Therefore, the Thorndale Bridge will not be indirectly impacted by shadows, isolation, or obstruction. **Therefore, mitigation measures are not required to mitigate indirect impacts.**
Isolation of a *heritage attribute* from its surrounding environment, context or a *significant* relationship	N/A	
Direct or indirect obstruction of *significant* views or vistas within, from, or of built and natural features	N/A	
A change in land use such as rezoning a battlefield from open space to residential use, allowing new	N/A	

Direct Impact	Assessment	Discussion
development or *site alteration* to fill in the formerly open spaces		

7.4 Summary of Impacts

Following the assessment of impacts presented in Table 3, direct impacts are anticipated to the heritage attributes of the Thorndale Bridge. The direct impact identified is destruction, as all the identified heritage attributes of the Thorndale Bridge will be removed. Therefore, mitigation measures are required. No indirect impacts were identified as the heritage attributes of the Thorndale Bridge are limited to the bridge itself.

7.5 Mitigation Options

As discussed in Section 7.2, as Middlesex County does not have specific heritage bridge guidelines, the OHBG were used to provide guidance on mitigation options that should be considered when impacts are anticipated to a bridge with cultural heritage value. Table 4 presents the eight OHGB conservation options for bridges that are subject to repair, rehabilitation, or proposed replacement (Ontario Ministry of Transportation 2008).

Table 4: Conservation Options from the Ontario Heritage Bridge Guidelines

Conservation Option	Discussion
1. Retention of the existing bridge with no major modifications undertaken	The retention of the current bridge with no major modifications is not feasible since the County of Middlesex has identified that the Thorndale Bridge will reach the end of its lifespan in the next 10 years and has capacity concerns related to pedestrian and cyclist traffic. **Accordingly, this mitigation option is not suitable for the Thorndale Bridge.**

Conservation Option	Discussion
2. Restoration of missing or deteriorated elements where physical or documentary evidence (e.g. photographs or drawings) existing for their design	The current bridge is reaching the end of its lifespan and has capacity concerns related to pedestrian and cyclist traffic. Restoring the bridge increases the chance of structure failure and emergency closure for repairs. Additionally, restoring the bridge does not accommodate active transportation facilities with standard shoulders or sidewalks **Accordingly, this mitigation option is not suitable for the Thorndale Bridge.**
3. Retention of the existing bridge with sympathetic modification	The current bridge is reaching the end of its lifespan and has capacity concerns related to pedestrian and cyclist traffic. Retaining the bridge increases the chance of structure failure and emergency closure for repairs. Additionally, retaining the bridge does not accommodate active transportation facilities with standard shoulders or sidewalks **Accordingly, this mitigation option is not suitable for the Thorndale Bridge.**
4. Retention of the existing bridge with sympathetically designed new structure in proximity	The retention of the current bridge with a sympathetically designed new structure in proximity is not suitable since the current bridge is reaching the end of its lifespan. A new bridge on a different alignment was determined to have a high impact on wildlife, wildlife habitat, and overall cost. **Accordingly, this mitigation option is not suitable for the Thorndale Bridge.**

Conservation Option	Discussion
5. Retention of existing bridge no longer for vehicular purposes but adapted for a new use.	The Thorndale Bridge is reaching the end of its lifespan and serves a utilitarian purpose. A new bridge on a different alignment was determined to have a high impact on wildlife, wildlife habitat, and overall cost. As such, replacement at the current location was determined to be the most appropriate during the Class EA. Given the location of the bridge on a county road, the new design will speak to additional pedestrian and cyclist needs, making retention of the existing bridge redundant. **Accordingly, this mitigation option is not suitable for the Thorndale Bridge.**
6. Retention of bridge as heritage monument for viewing purposes only	The retention of the current bridge as a heritage monument for viewing purposes only is not appropriate since this bridge is part of Thorndale Road and serves a utilitarian purpose. The Thorndale Bridge is a representative beam/girder bridge. Although becoming increasingly rare, the MTO bridge list indicates that there 148 beam/girder bridges with concrete box beams in the province, and 15 of this type specifically within the West Region. **Accordingly, this mitigation option is not suitable for the Thorndale Bridge.**
7. Relocation of smaller, lighter single span bridges to an appropriate new site for continued use or adaptive re-use	The Thorndale Bridge is a four-span bridge over the Thames River. It is not a single span bridge. **Accordingly, this mitigation option is not suitable for the Thorndale Bridge.**
8. Bridge removal and replacement with a sympathetically designed structure a) Where possible, salvage elements/members of bridge for incorporation into new structure or for future	As identified in Table 3, the removal of the bridge would result in the destruction of the heritage attributes. Prior to the removal of the bridge, a full recording and documentation of the existing structure and its landscape setting should be

Conservation Option	Discussion
conservation work or displays; and, b) Undertake full recording and documentation of existing structure	completed to create a public record of the structure. In the case of the Thorndale Bridge, salvage is not a recommended mitigation measure as the CHVI of the bridge is limited to its increasing rarity. The bridge was not identified to contain decorative features or other elements that could be incorporated into a new bridge design or commemoration piece. Given the CHVI identified for the Thorndale Bridge, documentation is an appropriate mitigation strategy finds an appropriate balance with the need to update infrastructure while also retaining a sense of the history of the site. **This mitigation option is suitable for the Thorndale Bridge**

7.6 Mitigation Discussion

The Thorndale Bridge was determined to have CHVI as it meets one criterion set out in O. Reg. 9/06 of the OHA. Specifically, the CHVI of the property related to its design value as a representative example of a mid-20th century box girder structure, that is becoming increasingly rare in the province. Thorndale Bridge scored 40 points according to the OHBG and therefore does not meet the threshold of 60 points to be considered provincially important.

As identified in Table 3, the proposed replacement of the Thorndale Bridge will have an adverse impact on the CHVI of the structure as it will remove all heritage attributes which define its significance. Accordingly, the eight conservation options from the OHBG were presented as potential mitigation options.

Based on the results of the Class EA, the preferred solution is to construct a new bridge on the existing alignment using a temporary detour during construction. Retention or modification of the Thorndale Bridge is not considered a viable option as the current bridge is reaching the end of its lifespan and has capacity concerns related to pedestrian and cyclist traffic. Retaining the bridge increases the chance of structure failure and emergency closure for repairs. Additionally, retaining or modifying the bridge does not accommodate active transportation facilities with standard shoulders or

sidewalks (Middlesex County 2019). The salvaging of materials from the bridge would not convey its identified CHVI, which is limited to its increasing rarity.

The removal of the bridge would result in the destruction of the heritage attributes. Therefore, in order to mitigate the effects of the project on these heritage attributes prior to the removal of the bridge, a full recording and documentation of the existing structure and its landscape setting should be completed to create a public record of the structure.

8.0 Recommendations

An evaluation of cultural heritage value and assessment of impacts resulting from the (Class EA) Study for improvements to the Thorndale Bridge on County Road 28 (Thorndale Road) has determined that the proposed removal of the existing bridge and construct a new bridge on the existing alignment would result in direct impacts to the Thorndale Bridge through demolition. Based on the presence of cultural heritage resources which have the potential to be affected by the proposed undertaking, mitigation measures in the form of documentation is recommended.

Documentation should be undertaken during the detailed design work program prior to any change in site conditions and include:

- Documentation in the form of detailed photography should be completed under the direction of a heritage professional in good standing with the Canadian Association of Heritage Professionals
- The results of the documentation should be made available at local libraries for public use

8.1 Deposit Copies

In order to further the retention of historic information, copies of this report should be deposited with the Middlesex County and a local repository of historic material. Therefore, it is recommended that this report be deposited at the following location:

Middlesex County Library – Thorndale Branch
21790 Fairview Road, PO BOX 88
Thorndale, ON N0M 2P0

Municipality of Thames Centre Municipal Heritage Committee
4305 Hamilton Road
Dorchester, ON N0L 1G3

9.0 Closure

This report has been prepared for the sole benefit of Middlesex County and may not be used by any third party without the express written consent of Stantec Consulting Ltd. Any use which a third party makes of this report is the responsibility of such third party.

We trust this report meets your current requirements. Please do not hesitate to contact us should you require further information or have additional questions about any facet of this report.

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Appendix A
Ontario Heritage Bridge Guidelines

Appendix A: Evaluation Criteria

The following scoring system was developed to provide a clear and easily understood system for evaluating bridges for potential inclusion on the Heritage Bridge List. The scoring, derived from Ontario Regulation 9/06, is divided into three main areas: Design / Physical Value, Contextual Value and Historic / Associative Value. Within these three divisions are further criteria that are individually scored. For the purposes of these Guidelines, a bridge with a score of 60 or greater is considered provincially important.

Criteria	Details	Score	Comments
Design / Physical Value (Total marks 50)			The Score for Design/Physical Value is comprised of three elements: Functional Design, Visual Appeal and Materials.
Functional Design (Maximum score 20)	Excellent	20	Displays a high degree of technical merit or scientific achievement and; • Is one of a kind or prototype (first or earliest example of its kind), or • Is exemplary for its kind (i.e. the longest, highest, etc. of its kind). Examples: Rainy Lake Causeway, reinforced concrete bridge at Massey
	Very Good	16	Displays a high degree of technical merit or scientific achievement and; • Includes types in which fewer than five survive within a Region.
	Fair	12	This category includes types of which fewer than five survive within a Region, regardless of degree of technical merit or scientific achievement, even if many were originally constructed.

Criteria	Details	Score	Comments
	Common	0	Of little value from a technical or scientific perspective. Many were built, many remain.
Visual Appeal (Maximum score 20)	Excellent	20	High degree of craftsmanship or stylistic merit for most of the elements of the bridge; the design elements are well balanced and overall the structure is well proportioned; modifications are sympathetic.
	Good	12	Well-proportioned bridge that has a general massing that is appropriate to the landscape in which it is situated.
	Fair	4	Structure has only one or two noteworthy elements or is severely altered from its original form.
	None	0	No noteworthy features
Materials (Maximum score 10)	Excellent	10	Provincially rare or unusual materials. Stone, wrought iron are examples of provincially rare materials.
	Very Good	8	Regionally rare or unusual materials. Wood and riveted steel are examples of regionally rare materials.
	Good	5	Unusual Combinations: this is reserved for materials that are used in combination(s) that are considered unusual or remarkable.
	Common	0	Common materials or combinations

Criteria	Details	Score	Comments
Contextual Value (Total marks 25)			
Landmark (Maximum score 15)	Excellent	15	Physically prominent: The bridge is highly significant physically and a primary symbol in the area. This includes 'gateway' structures. o It is a critical element in understanding a family of bridges within a corridor
	Good	9	Locally significant: The bridge is perceived in the community as having symbolic value rather than purely visual or aesthetic value. o It is an important element in understanding a family of bridges within a corridor.
	Fair	3	A familiar structure in the context of the area. o It is a contributory element in understanding a family of bridges within a corridor.
	Common	0	No prominence in area
Character Contribution (Maximum score 10)	Excellent	10	The bridge is the critical element in defining the character of the area and is of great importance in establishing or protecting this character.
	Good	6	Maintains or contributes to the overall character of the area and is of municipal importance in establishing or protecting this character.

Criteria	Details	Score	Comments
	Common	0	Character contribution is minimal.
Historic / Associative Value (Maximum score 25)			
Designer/Construction Firm (Maximum 15 points)	Excellent	15	Known influential designer-builder: structure demonstrates or reflects the innovative work or ideas of companies, engineers and/or builders having major impacts on the development of a community. For this item, community is broadly defined to include professional groups who have been demonstrably affected by the work in question.
	Good	9	Known prolific builder-designer: companies, engineers, and/or builders directly responsible for a large number of structures whose activities led to design or construction refinements and the establishment of standard forms.
	Fair	3	Known undetermined contribution: companies, engineers, and/or builders about who have made a limited/minor contribution to a community.
	Unknown	0	Those responsible for the design/construction are not known
Association with a Historical theme, person or event (Maximum score 10 points)	Excellent	10	Direct Association with a theme or event that is highly significant in understanding the cultural history of the nation, province or municipality.
	Good	6	Close association with a theme or event within an area
	Common	0	Limited or no association with historic themes or events.

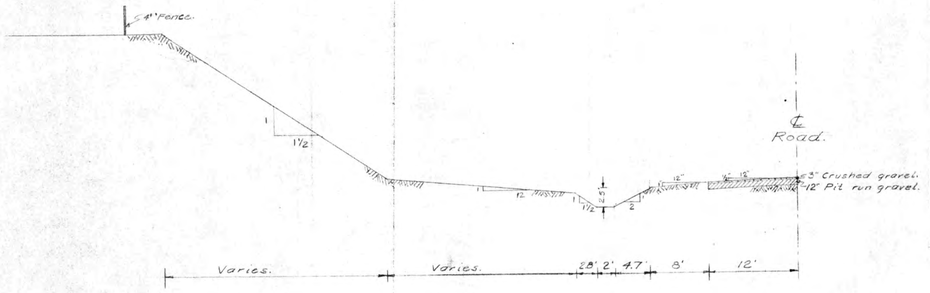
Appendix B1 – Blank Bridge Form

Criteria	Details	Maximum Score	Assigned Score	Comments – Provide justification for the assigned score
Design/Physical Value (Total marks 50)				
Functional Design (Maximum score 20)	Excellent	20		
	Very Good	16		
	Fair	12		
	Common	0		
Visual Appeal (Maximum score 20)	Excellent	20		
	Good	12		
	Fair	4		
	None	0		
Materials (Maximum score 10)	Excellent	10		
	Very Good	8		
	Good	5		
	Common	0		

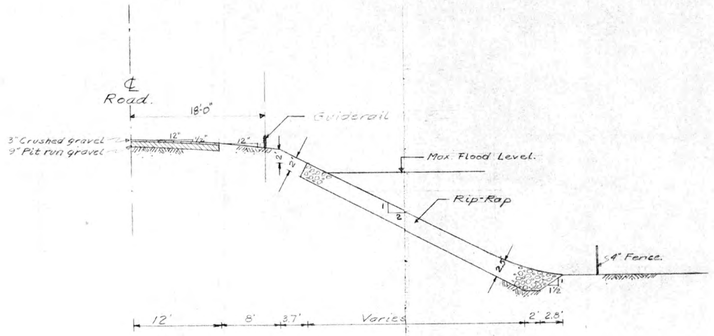
Criteria	Details	Maximum Score	Assigned Score	Comments – Provide justification for the assigned score
Contextual Value (Total marks 25)				
Landmark (Maximum score 15)	Excellent	15		
	Good	9		
	Fair	3		
	Common	0		
Character Contribution (Maximum score 10)	Excellent	10		
	Good	6		
	Common	0		
Historical Association (Maximum score 25)				
Designer/Construction Firm (Maximum 15 points	Excellent	15		
	Good	9		
	Fair	3		
	Unknown	0		

Criteria	Details	Maximum Score	Assigned Score	Comments – Provide justification for the assigned score
Association with a Historical theme, person or event (Maximum score 10 points)	Excellent	10		
	Good	6		
	Common	0		
		Total		

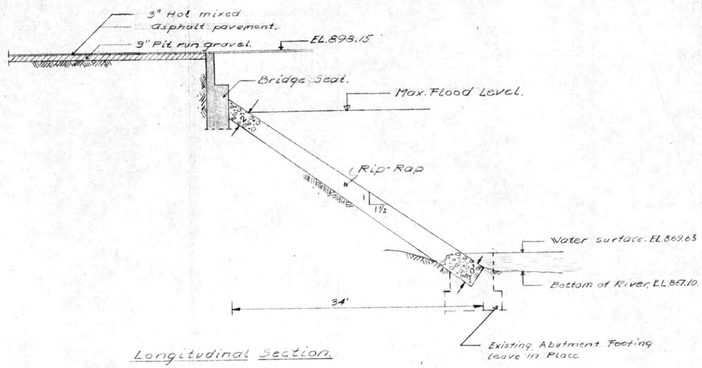
Appendix B
Original Drawings



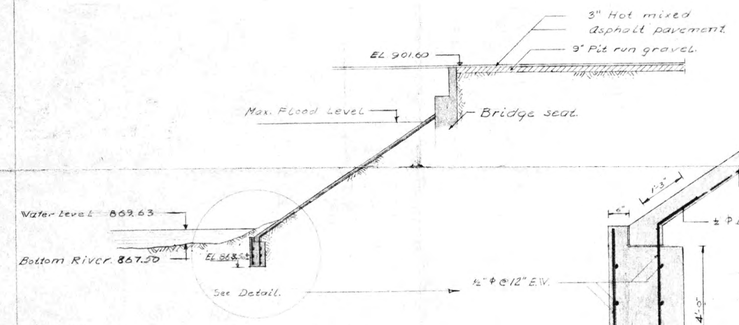
Typical Section.
west cut.

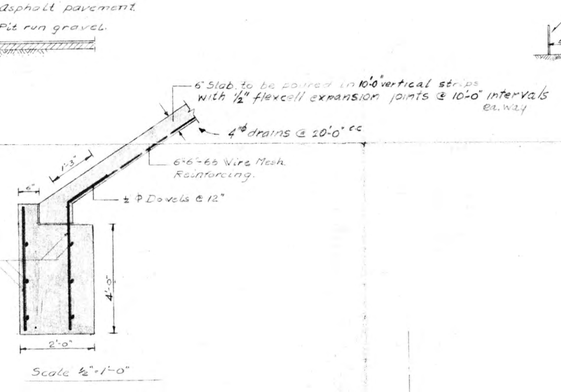


Typical Section.
west fill



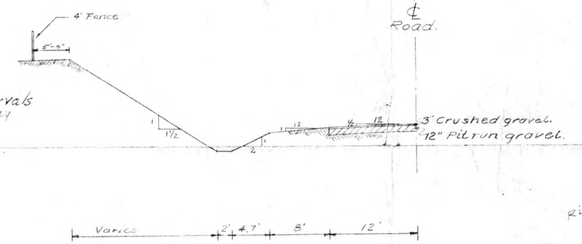
Longitudinal Section.
℄ West Abutment.



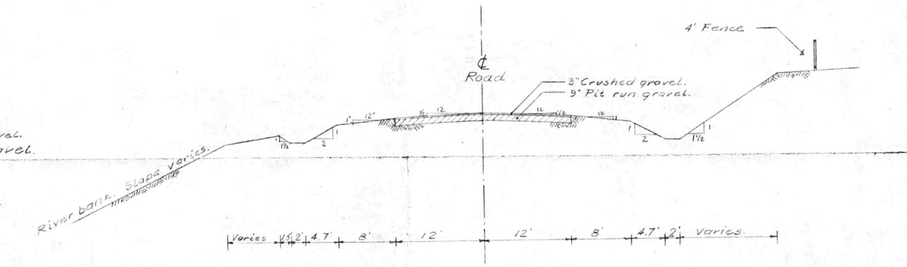


Scale ½"=1'-0"

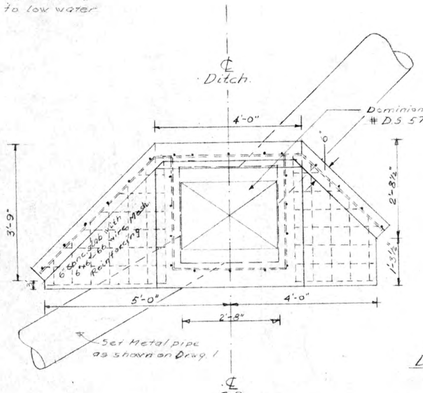
Longitudinal Section.
℄ East Abutment
Old Abutment to be
cut down to low water

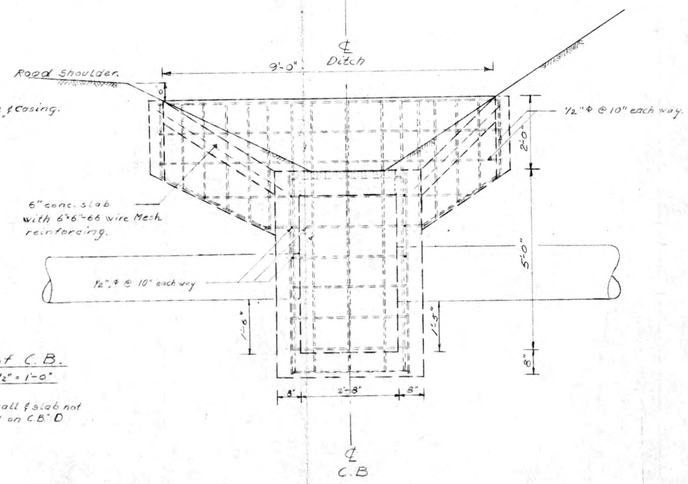


Typical Section.
East cut.



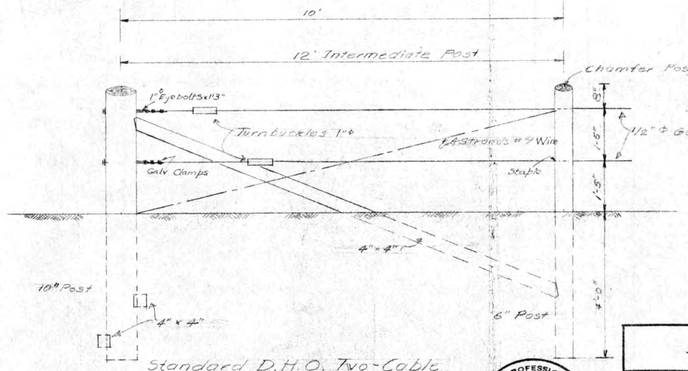
Typical Section.
Township Road
east approach.





Detail of C.B.
Scale: ½"=1'-0"

Note: Headwall & slab not
required on C.B. D



Standard D.H.O. Two-Cable
Guide Rail.
Scale: ½"=1'-0"

REGISTERED PROFESSIONAL ENGINEERS
CIVIL
W. K. CLAWSON
PROVINCE OF ONTARIO

DESIGN BASED ON } f'c = 3,000 LBS./SQ. IN.
f s = REIN. STEEL 20,000 LBS/SQ. IN.

APPROACHES, THORNDALE BRIDGE.		
SECTIONS AND DETAILS.		
SCALE 1"=10'-0"	M. M. DILLON & CO. CONSULTING ENGINEERS	FILE NO. 817-B.
DATE APR-23-52	LONDON ONTARIO	DRWG. NO. 2.
DRAWN BY E.L.	COUNTY OF MIDDLESEX.	

No.	DATE	REVISION	Init.
1	12/6/52	WEST END OF BRIDGE RAISED 2'-0"	

R. M. DILLON — CIVIL — REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

W. K. CLAWSON — CIVIL — REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

THORNDALE BRIDGE

GENERAL LAYOUT

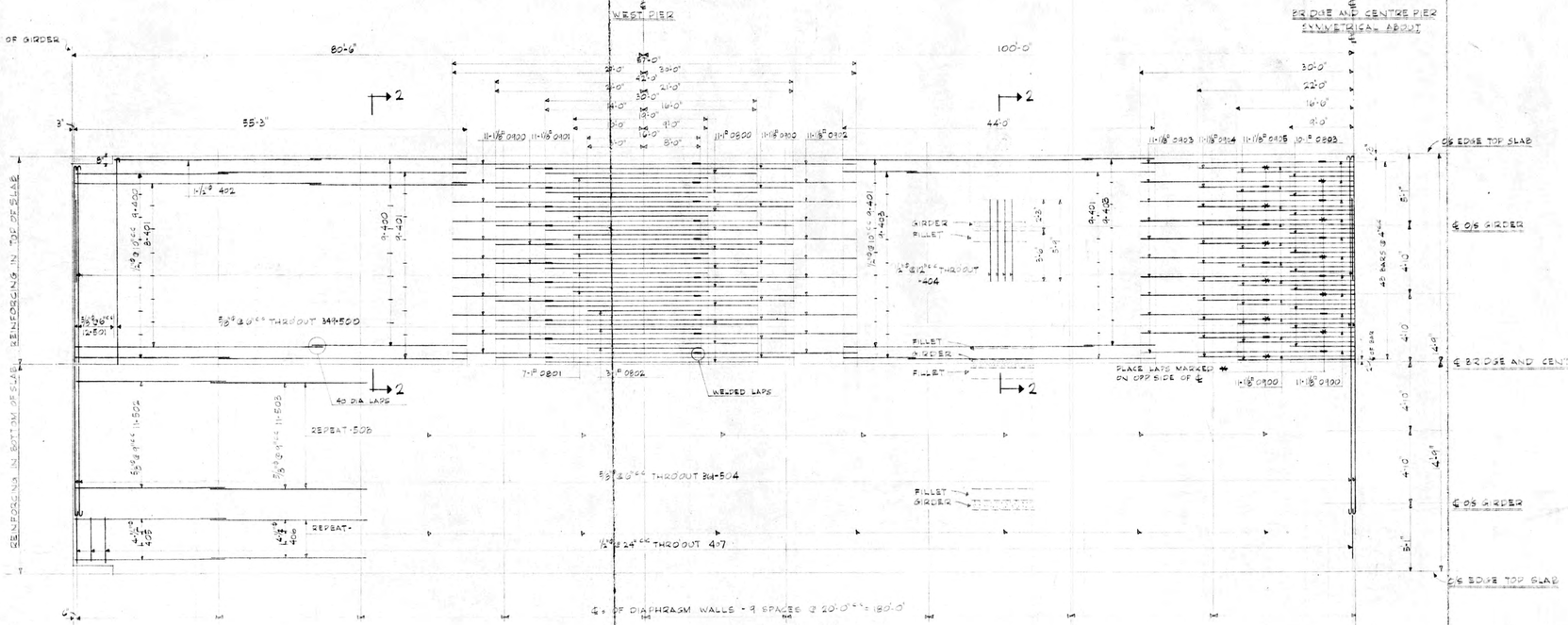
SCALE: AS NOTED
DATE: APR. 28. 1952
DRAWN BY: W.C.O.

M. M. DILLON & CO.
CONSULTING ENGINEERS
LONDON ONTARIO

COUNTY OF MIDDLESEX

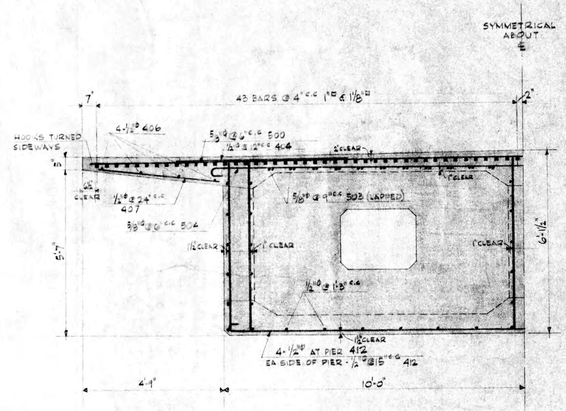
FILE NO. 817A
DRWG. NO. 1

12/28/III/8



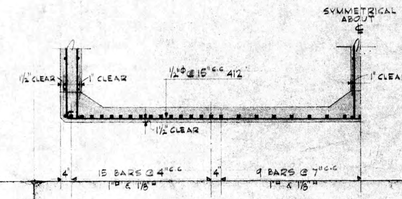
HALF PLAN OF UPPER SLAB

SCALES - LONGITUDINAL - 1/8" = 1'-0"
TRANSVERSE - 1/4" = 1'-0"



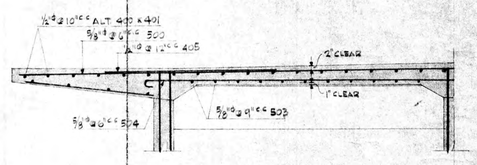
SECTION ON ℄ OF WEST PIER

(EAST PIER SIMILAR)
SCALE - ½" = 1'-0"
CENTRE PIER SIMILAR AS TO ARRG'T OF REINFORCING



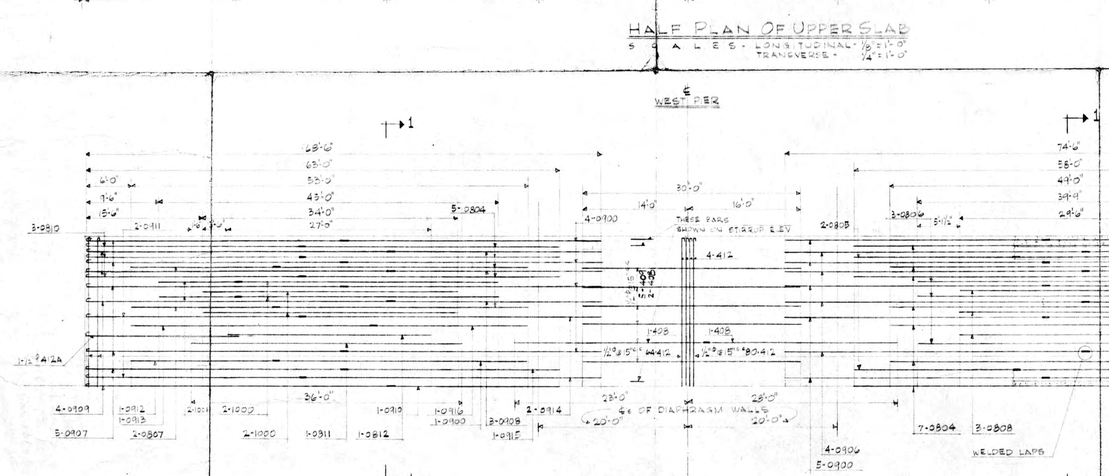
SECTION 1-1

SCALE - ½" = 1'-0"



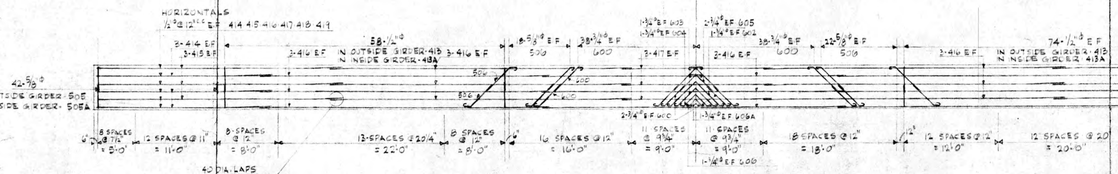
SECTION 2-2

SCALE - ½" = 1'-0"



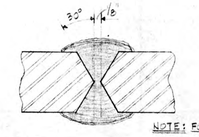
QUARTER PLAN OF LOWER SLAB

SCALES - LONGITUDINAL - 1/8" = 1'-0"
TRANSVERSE - 1/4" = 1'-0"



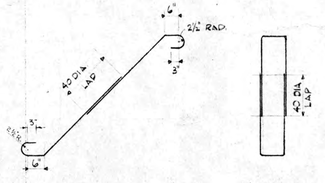
HALF ELEVATION OF GIRDER SHOWING STIRRUPS

SCALE - ⅛" = 1'-0"



NOTE: FOR EVERY 20 WELDS PROVIDE ONE WELD FOR PULL TEST.

DETAIL OF WELDED LAP - MAIN STEEL



STIRRUPS

NOTE: DESIGN BASED ON
f'_c CONCRETE - 3,000 P.S.I. AT 28 DAYS
f_s REINF. STEEL (WELDED - 18,000 P.S.I)
(OTHER - 20,000 P.S.I)

No.	DATE	REVISION	Init.
1	12/6/52	WEST END OF BRIDGE RAISED 2'0"	

THORNDALE BRIDGE

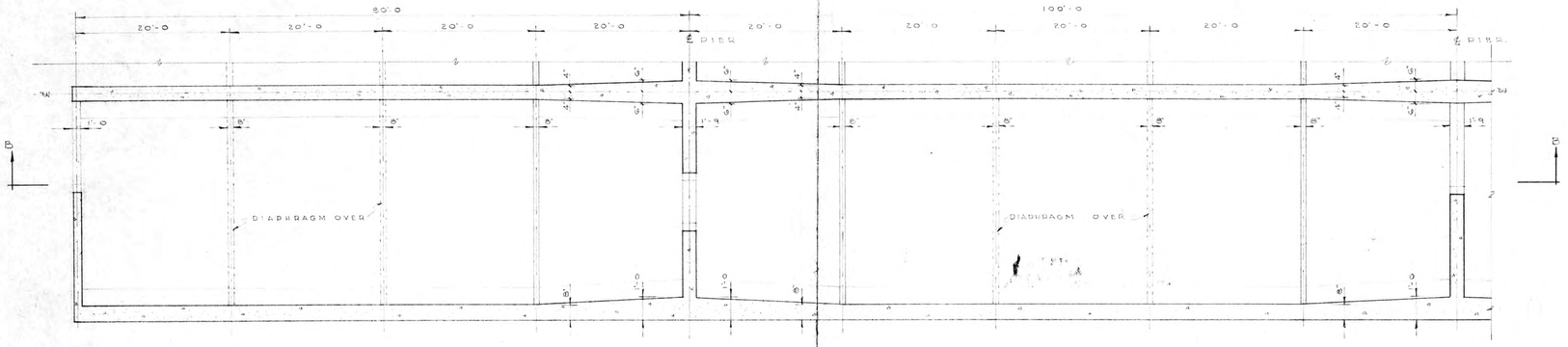
BRIDGE DECK AND GIRDER REINFORCING

SCALE AS NOTED	M. M. DILLON & CO. CONSULTING ENGINEERS	FILE NO. 817A
DATE APR 28-1952	LONDON ONTARIO	DRWG. NO. 2
DRAWN BY W.C.O	COUNTY OF MIDDLESEX	

REGISTERED PROFESSIONAL ENGINEER CIVIL R. M. DILLON PROVINCE OF ONTARIO

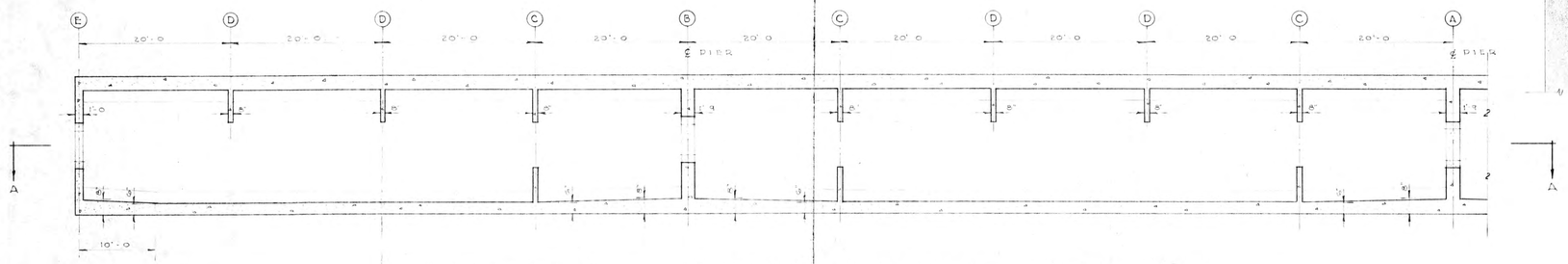
REGISTERED PROFESSIONAL ENGINEER CIVIL W. K. CLAWSON PROVINCE OF ONTARIO

174 12/28/11/6



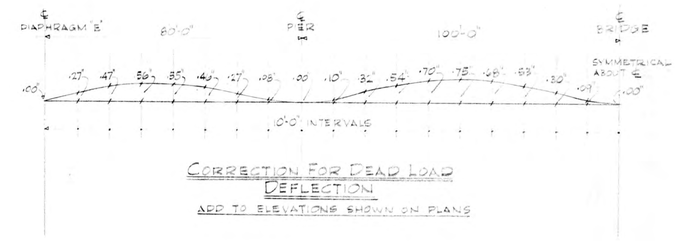
QUARTER PLAN BRIDGE -- SECTION "A-A"

SCALES 1/8" = 1'-0 LONG & 3/8" = 1'-0 TRAN



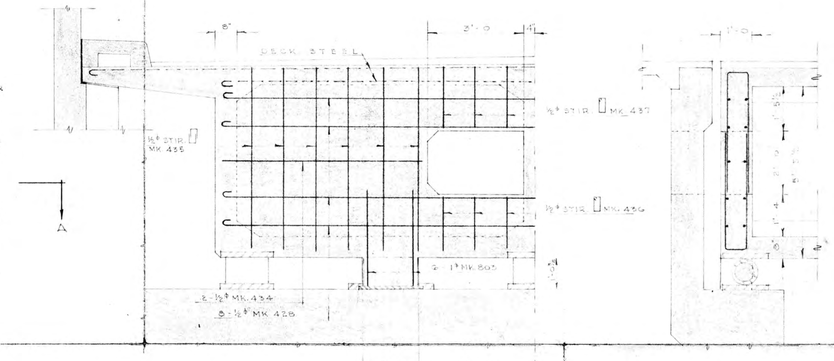
SECTION "B-B" SHOWING DIAPHRAGM LOCATIONS

SCALES 1/8" = 1'-0 HORIZ. & 3/8" = 1'-0 VERT.



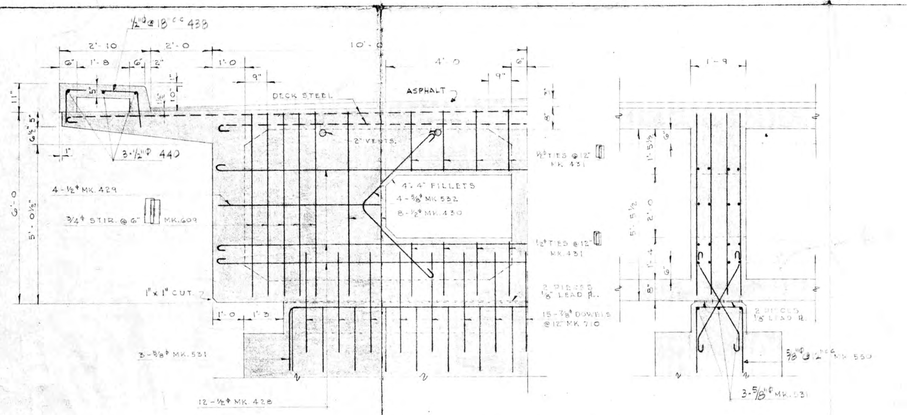
CORRECTION FOR DEAD LOAD DEFLECTION

ADD TO ELEVATIONS SHOWN ON PLANS



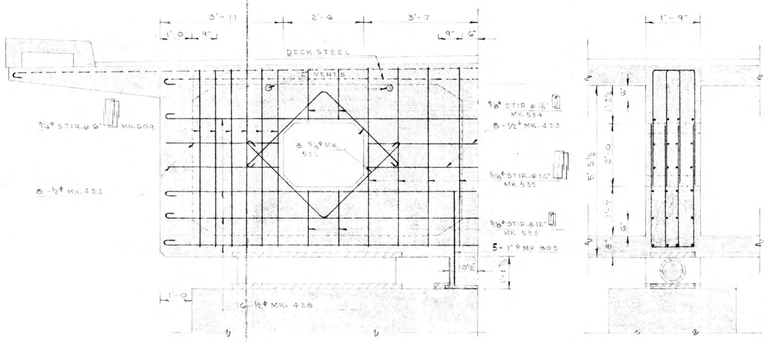
DIAPHRAGM "E"

SCALE ½" = 1'-0



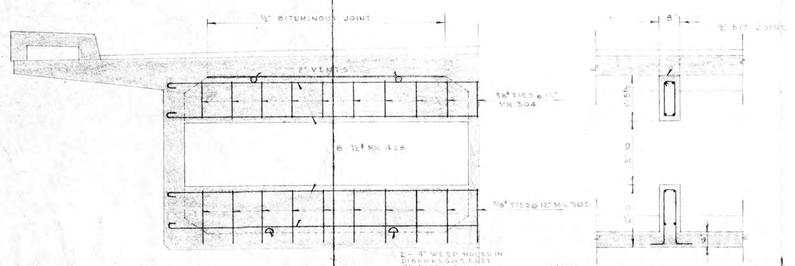
DIAPHRAGM "A"

SCALE ½" = 1'-0



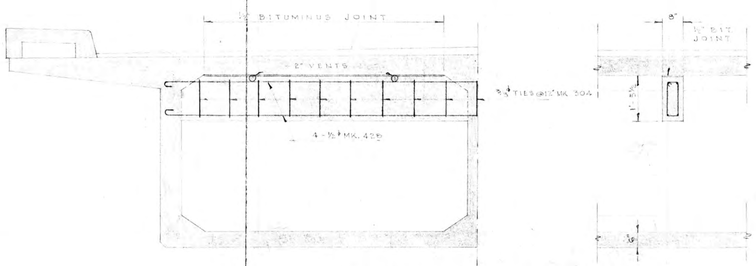
DIAPHRAGM "B"

SCALE ½" = 1'-0



DIAPHRAGM "C"

SCALE ½" = 1'-0



DIAPHRAGM "D"

SCALE ½" = 1'-0

DESIGN BASED ON { f'c = 3,000 LBS. PER SQ. IN. fs = REINF. STEEL 20,000 LBS. PER SQ. IN.

No.	DATE	REVISION	Init.
1	1-16-52	WEST END OF BRIDGE RAISED 2'0"	

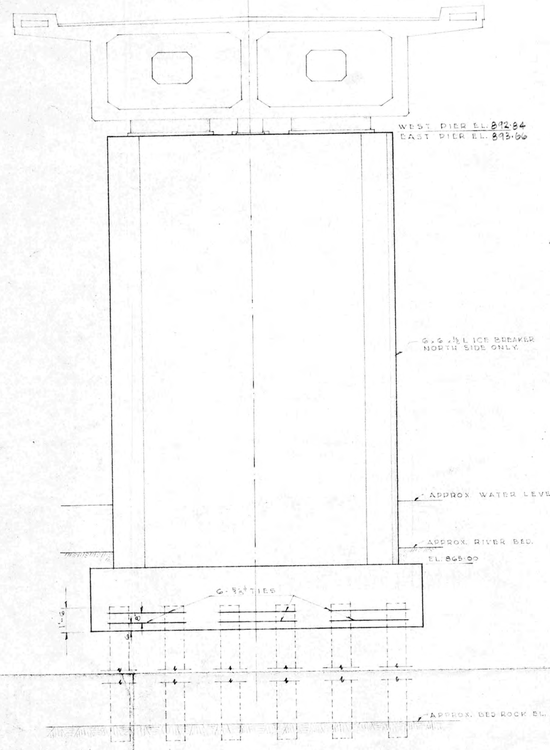
THORNDALE BRIDGE

DIAPHRAGM DETAILS

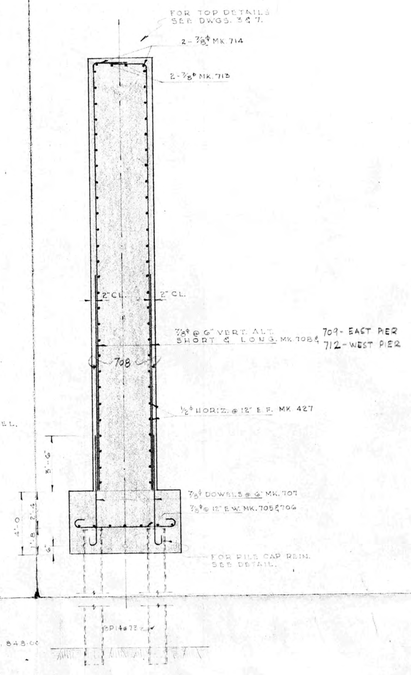
SCALE AS NOTED	M. M. DILLON & CO. CONSULTING ENGINEERS	FILE NO. 817A
DATE APR. 28, 51	LONDON ONTARIO	DRWG. NO. 3
DRAWN BY TD	COUNTY OF MIDDLESEX	

REGISTERED PROFESSIONAL ENGINEER CIVIL R. M. DILLON PROVINCE OF ONTARIO

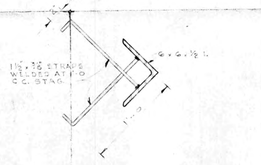
REGISTERED PROFESSIONAL ENGINEER CIVIL W. K. CLAWSON PROVINCE OF ONTARIO



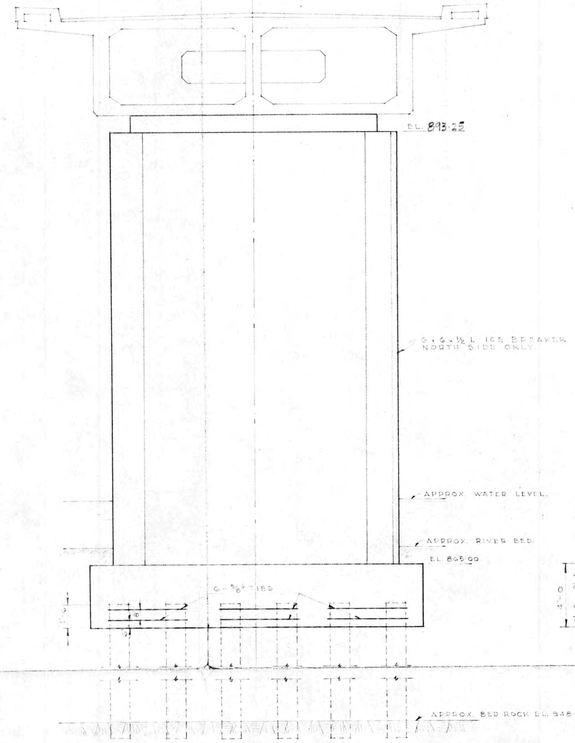
ELEVATION



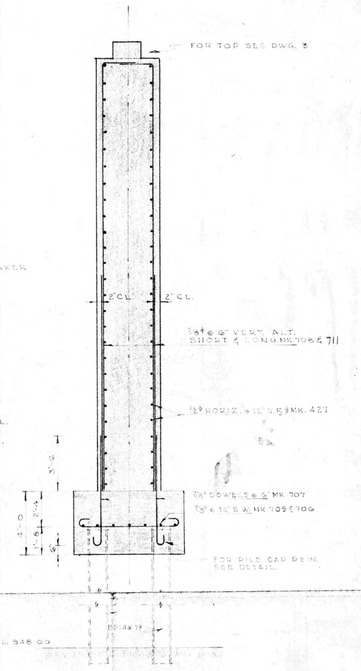
SECTION



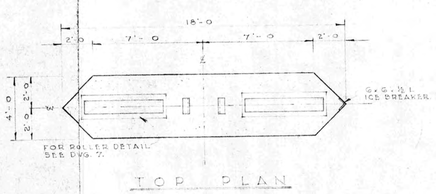
ICE BREAKER ANGLE DETAIL
SCALE 1½" = 1'-0



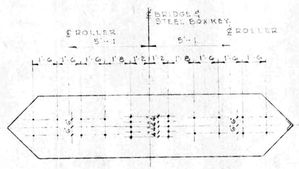
ELEVATION



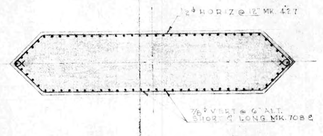
SECTION



TOP PLAN

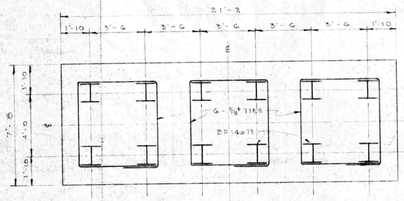


ANCHOR BOLT PLAN
(USE 1" BOLTS 2'-0" LONG)

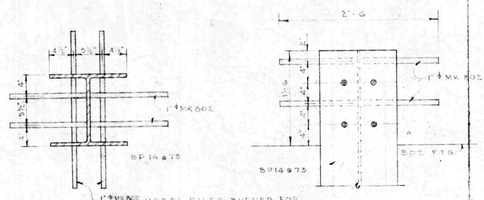


TYPICAL PIER SECTION
SCALE ½" = 1'-0

EAST & WEST PIER DETAIL
SCALE ¼" = 1'-0

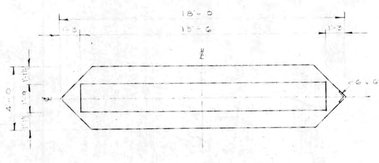


TYPICAL FTG. & PILE DETAIL
SCALE ¼" = 1'-0



PLAN ELEVATION

PILE CAP DETAIL
SCALE 1" = 1'-0



TOP PLAN

CENTRE PIER DETAIL
SCALE ¼" = 1'-0

No.	DATE	REVISION	Init.
4	2/62	WEST END OF PIERS RAISED 2'0"	

THORNDALE BRIDGE

PIER DETAILS

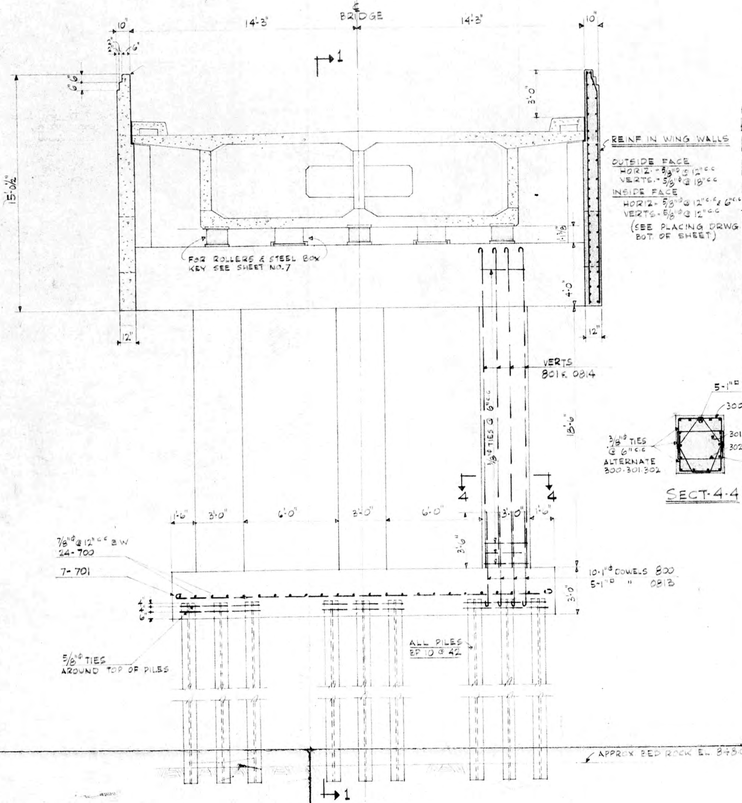
SCALE AS NOTED	M. M. DILLON & CO. CONSULTING ENGINEERS	FILE NO. 817A
DATE APR 16 62	LONDON ONTARIO	DRWG. NO. 4
DRAWN BY P.	COUNTY OF MIDDLESEX	

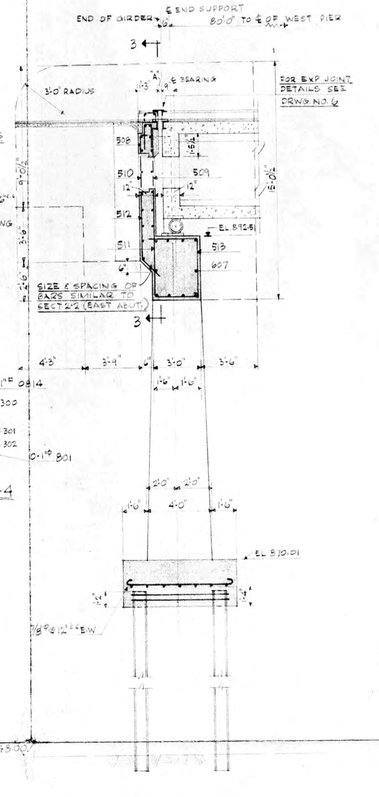
REGISTERED PROFESSIONAL ENGINEER CIVIL R. M. DILLON PROVINCE OF ONTARIO

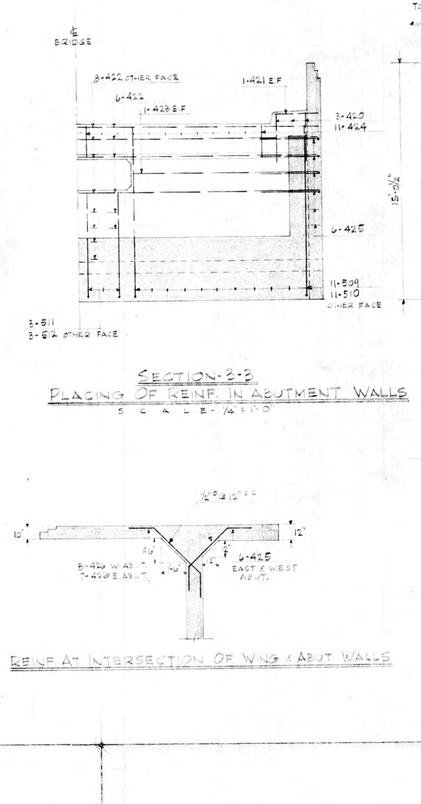
REGISTERED PROFESSIONAL ENGINEER CIVIL W. K. CLAWSON PROVINCE OF ONTARIO

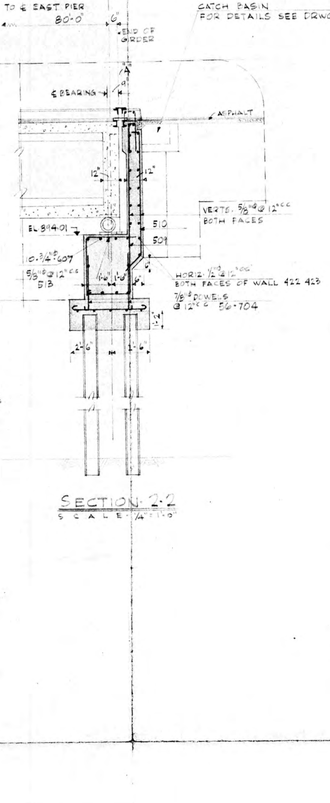
DESIGN f'c = 3,000 LBS/SQ IN. f's = 20,000 LBS/SQ IN.
DETAILS n = 15 REIN. STEEL 20,000 LBS/SQ IN.

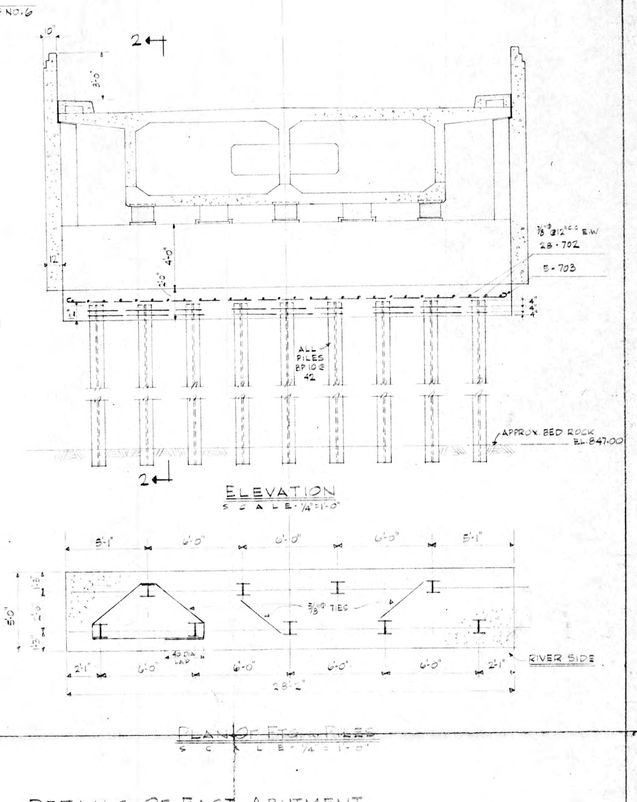
12/28/TYE

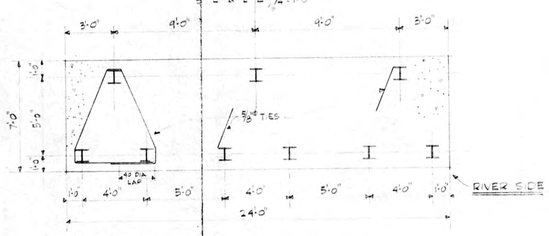


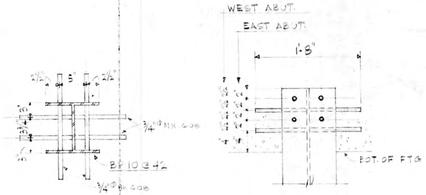




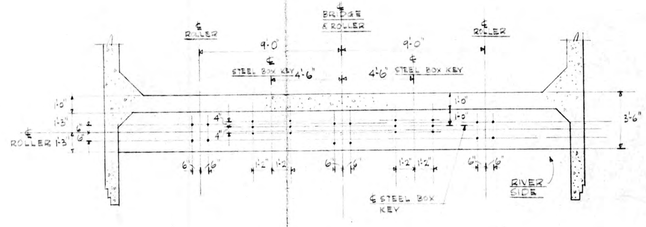




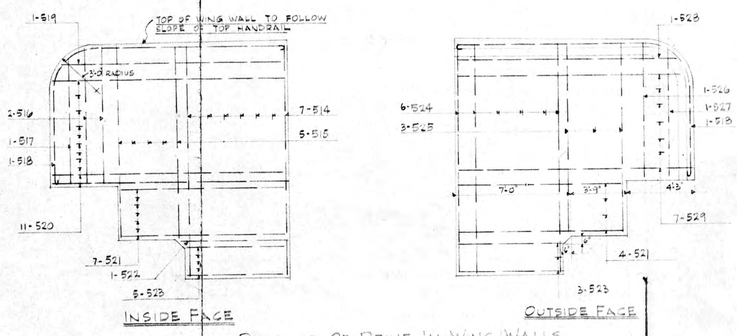


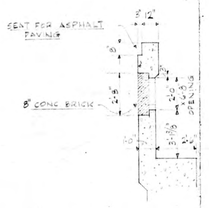


DETAILS OF EAST ABUTMENT



DETAILS OF WEST ABUTMENT





NOTE DESIGN BASED ON
f'_c CONCRETE - 3000# P.S.I.
f_s REINF. STEEL - 20,000 P.S.I.

REGISTERED PROFESSIONAL ENGINEER — CIVIL — R. M. DILLON — PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER — CIVIL — W. K. CLAWSON — PROVINCE OF ONTARIO

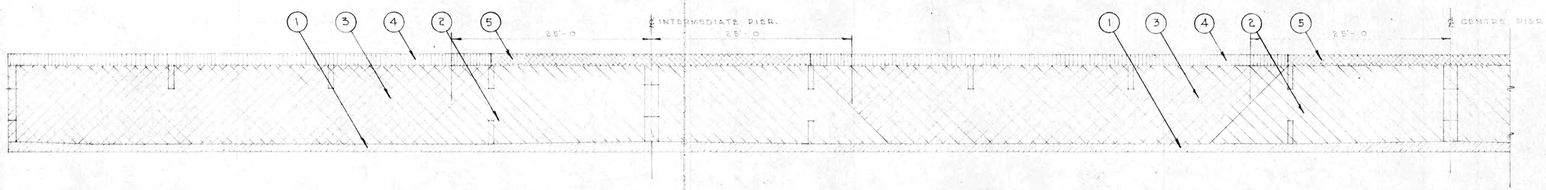
No.	DATE	REVISION	Init.
1	12/6/52	WEST END OF BRIDGE RAISED 2'0	

THORNDALE BRIDGE

EAST & WEST ABUTMENTS

SCALE AS NOTED	M. M. DILLON & CO. CONSULTING ENGINEERS	FILE NO. 817A
DATE APR. 28, 1952	LONDON ONTARIO	DRWG. NO. 5
DRAWN BY W.C.D.	COUNTY OF MIDDLESEX	

174 12/28/II/B



LONGITUDINAL SECTION

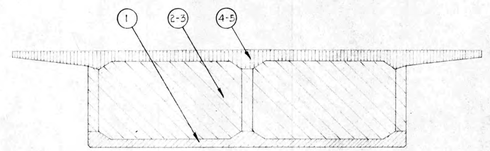
SCALES: HORIZ. 1/8" = 1'-0 VERT. 1/4" = 1'-0

CODE:

- 1ST OPERATION
- 2ND OPERATION
- 3RD OPERATION
- 4TH OPERATION
- 5TH OPERATION

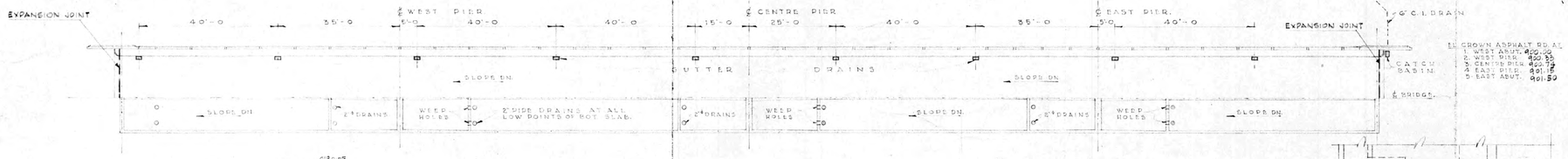
JACK OR SHIM FORMS TO ORIGINAL ELEVATION AFTER EACH OPERATION

CONCRETE PLACEMENT SCHEDULE



CROSS SECTION

SCALE 1/4" = 1'-0

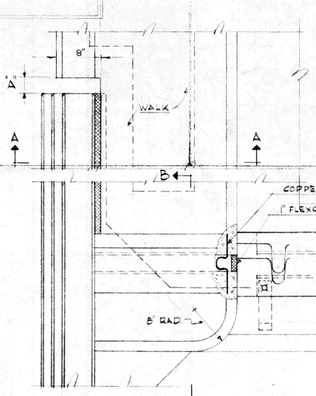


EL. CROWN ASPHALT RD. AT
1. WEST ABUT. 902.02
2. WEST PIER 902.33
3. CENTRE PIER 902.79
4. EAST PIER 901.15
5. EAST ABUT. 901.50

PLAN SHOWING DRAIN LOCATIONS

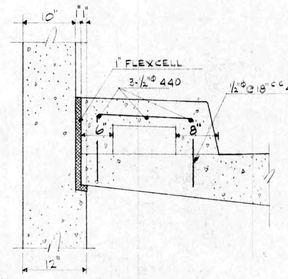
SCALE 1/16" = 1'-0

PIPE DRAIN

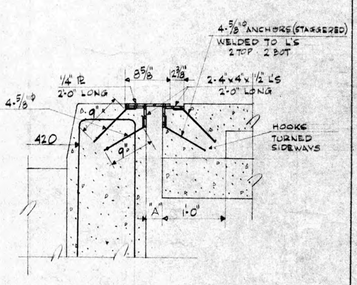


TYPICAL D.H.O. EXPANSION JOINT AS MANUFACTURED BY THE CANADA BRIDGE CO.

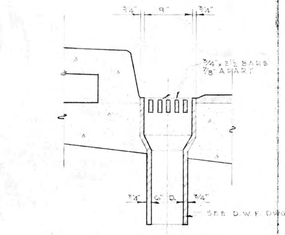
PLAN

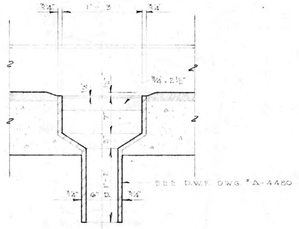


SECTION-A-A



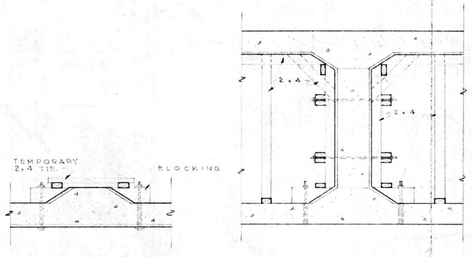
SECTION-B-B





GUTTER DRAIN DETAIL

SCALE 1" = 1'-0

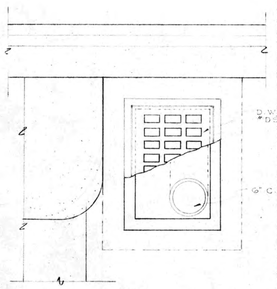


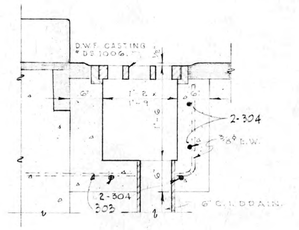
STEP 1

STEP 2

SUGGESTED INSIDE FORM DETAIL

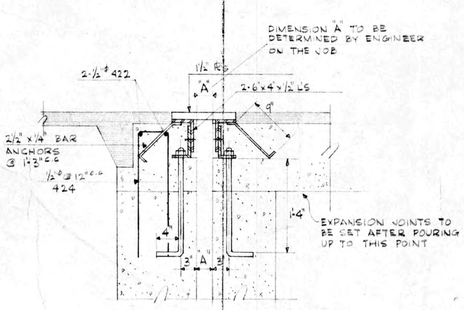
SCALE 1/2" = 1'-0



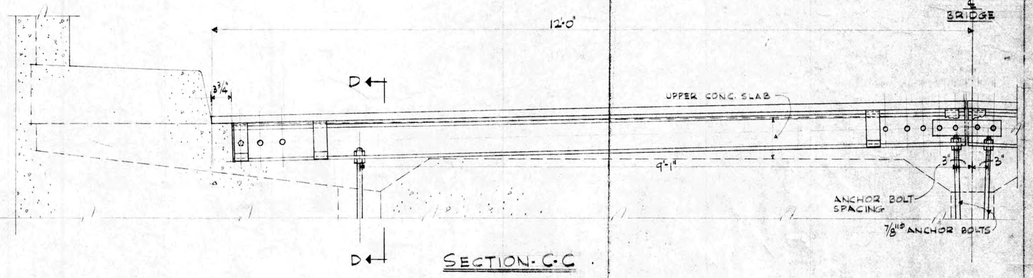


CATCH BASIN DETAIL

SCALE 1" = 1'-0



SECTION-D-D



SECTION-C-C

DETAILS OF EXPANSION JOINTS

SCALE - 1" = 1'-0"

No.	DATE	REVISION	Init.
1	12/6/52	WEST END OF BRIDGE RAISED 20"	

DESIGN BASED ON: f'c - 3,000 LBS./SQ.IN. fs - REIN. STEEL 20,000 LBS./SQ.IN.

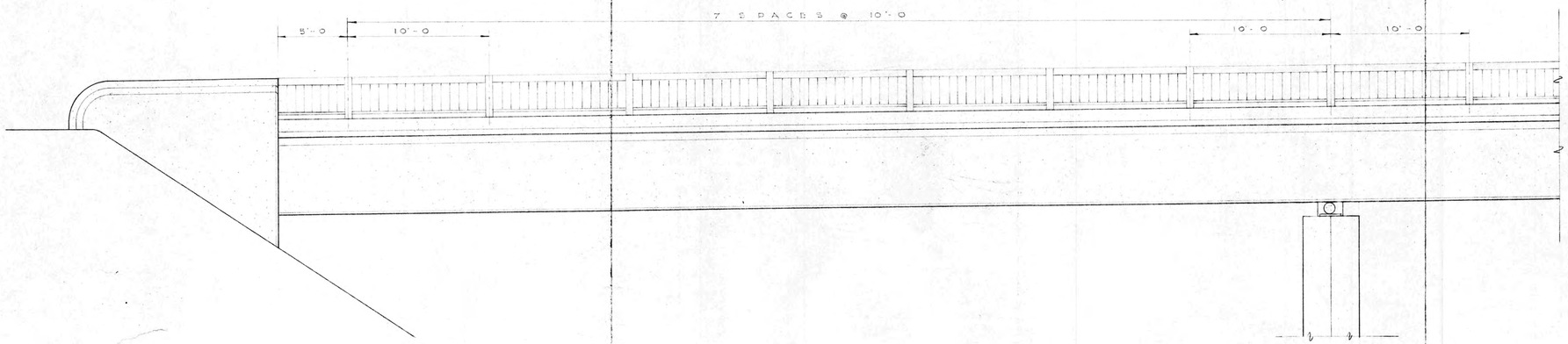
REGISTERED PROFESSIONAL ENGINEER — CIVIL — R. M. DILLON — PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER — CIVIL — W. K. CLAWSON — PROVINCE OF ONTARIO

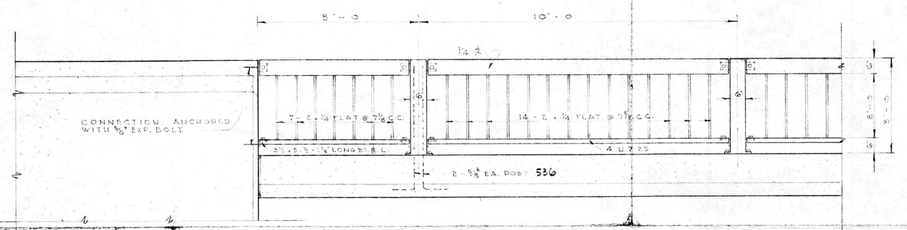
THORNDALE BRIDGE

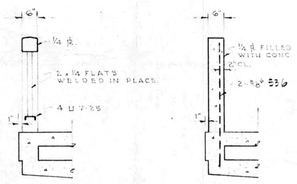
CONC. PLACING - DRAINAGE & EXPANSION JOINT DETAILS

SCALE: AS NOTED	M. M. DILLON & CO. CONSULTING ENGINEERS	FILE NO. 817A
DATE: MAY 5/52.	LONDON ONTARIO	DWG. NO. 6
DRAWN BY: NO	COUNTY OF MIDDLESEX	



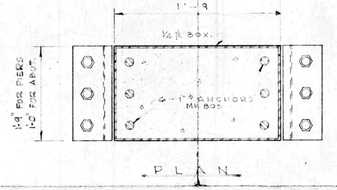
QUARTER SPAN ELEVATION
SCALE ¼" = 1'-0



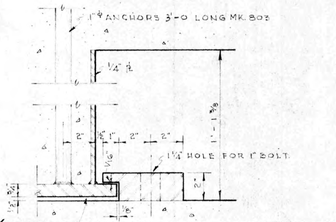


RAIL SECT.

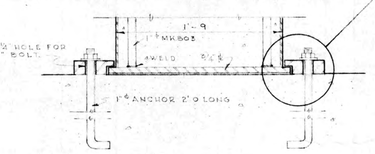
POST SECT.



PLAN



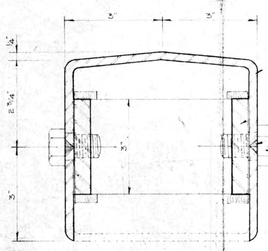
SCALE 3" = 1'-0

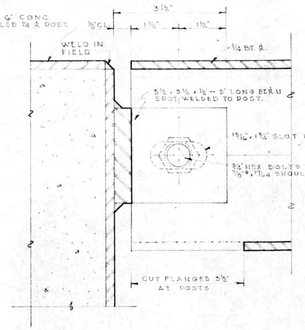


SECTION

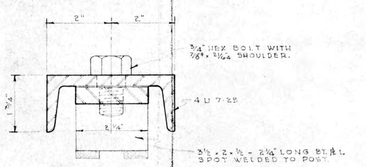
STEEL BOX KEY DETAIL
SCALE 1½" = 1'-0

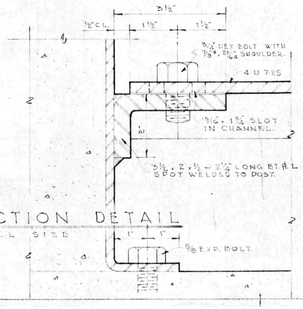
TYPICAL HAND RAIL ELEVATION & SECTIONS
SCALE ½" = 1'-0



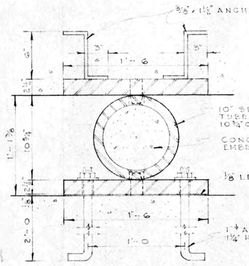


TOP RAIL CONNECTION DETAIL
SCALE ½ FULL SIZE.

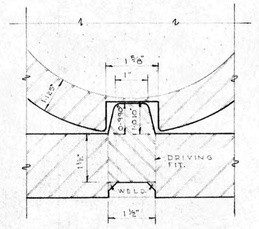




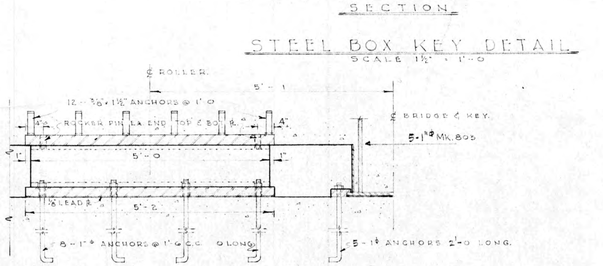
BOTTOM RAIL CONNECTION DETAIL
SCALE ½ FULL SIZE



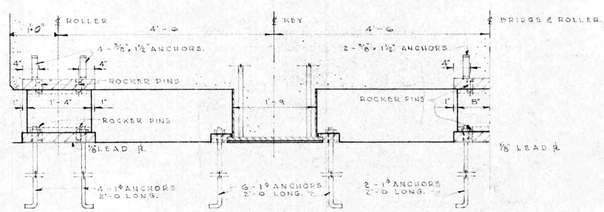
TYPICAL ROLLER SECTION
SCALE 1½" = 1'-0



ROCKER PIN DETAIL
SCALE ½ FULL SIZE



ROLLER & KEY DETAIL AT EAST & WEST PIERS
SCALE ¾" = 1'-0



ROLLER & KEY DETAIL AT ABUTMENTS
SCALE ¾" = 1'-0

DESIGN f'c: 3,000 LBS./SQ. IN.
BASED ON fs: REIN. STEEL 20,000 LBS./SQ. IN.

REGISTERED PROFESSIONAL ENGINEER CIVIL R. M. DILLON PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER CIVIL W. K. CLAWSON PROVINCE OF ONTARIO

No.	DATE	REVISION
1	12/6/52	WEST END OF BRIDGE RAISED 2'0"

THORNDALE BRIDGE

HAND RAIL & ROLLER DETAILS

SCALE	M. M. DILLON & CO. CONSULTING ENGINEERS	FILE NO.
AS NOTED		817A
DATE	LONDON ONTARIO	DWG. NO.
APR. 28, 52		7
DRAWN BY	COUNTY OF MIDDLESEX	
GD		

12/28/1952