

To: Ministry of Transportation (MTO)
Eastern Region
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From: Nathan Yokich
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Project/File: 165001328

Date: January 6, 2026

Reference: Preliminary Design and Class Environmental Assessment – Highway 401 East of Brockville (4111-22-00) – Erosion and Sediment Control Risk Assessment

1 Introduction

Stantec Consulting Ltd. (Stantec) has been retained by the Ministry of Transportation Ontario (MTO) to provide preliminary Design and Environmental Assessment Study for the rehabilitation and/or replacement of Sharpe's Lane Bridge and Butlers Creek Culvert and identifying the future Highway 401 footprint for an interim six lanes and ultimately eight lanes east of the City of Brockville in the township of Elizabethtown-Kitley.

This project is a Group 'B' undertaking following the MTO Class Environmental Assessment (EA) for Provincial Transportation Facilities and Municipal Expressways (2024) and includes undertaking environmental and engineering field investigations and sought input from stakeholders, external agencies, Indigenous communities, and the public.

This memo presents the Erosion and Sediment Overview Risk Assessment (ESORA) for the proposed works within the project limits. The objective of this assessment is to evaluate the potential of erosion and sediment migration off-site during construction and identify the associated risks. The approach to completing the ESORA for this assignment is summarized in the following tasks:

- Review of the project study area and environmentally sensitive areas.
- Review of the expected construction activities.
- An assessment of erosion and sediment risk.
- Detail design considerations and recommendations.

1.1 Background

Previous studies and technical guidance documents related to this project have been reviewed and referenced during the preparation of this report, including:

- Environmental Guide for Erosion and Sediment Control During Construction of Highway Projects, Ministry of Transportation, 2015.

Reference: Preliminary Design and Class Environmental Assessment – Highway 401 East of Brockville (4111-22-00) – Erosion and Sediment Control Risk Assessment

- Fish and Fish Habitat Existing Conditions and Preliminary Impact Assessment Report – Highway 401 East of Brockville, Preliminary Design and Class Environmental Assessment Study (GWP 4111-22-00) Stantec Consulting Ltd., August 2025.
- Groundwater Assessment Report – Highway 401 East of Brockville, (GWP 4111-22-00) Stantec Consulting Ltd. August 15, 2024.
- MTO Environmental Reference for Highway Design. Ministry of Transportation, 2013.
- Preliminary Drainage and Hydrology Report – Highway 401 Planning Study, Brockville East, (GWP 4111-22-00 Stantec Consulting Ltd. March 2025.
- Terrestrial Ecosystems Existing Conditions Report – Highway 401 Planning Study East of Brockville – Preliminary Design and Class Environmental Assessment, Stantec Consulting Ltd. January 6, 2025.

Other data sources and mapping used for the preparation of this memo include:

- AgMaps; Ministry of Agriculture, Food and Rural Affairs (OMAFRA), 2025.
- Aquatic Species at Risk Maps, Fisheries and Oceans Canada (DFO), 2025.
- Natural Heritage Information Centre (NHIC) Species Occurrence – Provincially Tracked, Database, Ontario Ministry of Natural Resources and Forestry (MNRF), 2025.
- Ontario GeoHub, Land Information Ontario (LIO); Aquatic Resource Area Line Segment; Aquatic Resource Area Polygon Segment, 2025.
- Ontario Watershed Information Tool; Natural Heritage Areas, Ministry of Natural Resources and Forestry (MNRF), 2025.

1.2 Site Description

The study area for the Highway 401 rehabilitation and/or replacement of two structures and identifying the future Highway 401 footprint for an interim six lanes and ultimate eight lanes (GWP 4111-22-00) includes Highway 401 from 0.75 km east of North Augusta Road interchange to 3.3 km west of Maitland Road Interchange (approximately 2.6 km). A key plan of the study area is shown on Figure 1.

Reference: Preliminary Design and Class Environmental Assessment – Highway 401 East of Brockville (4111-22-00) – Erosion and Sediment Control Risk Assessment

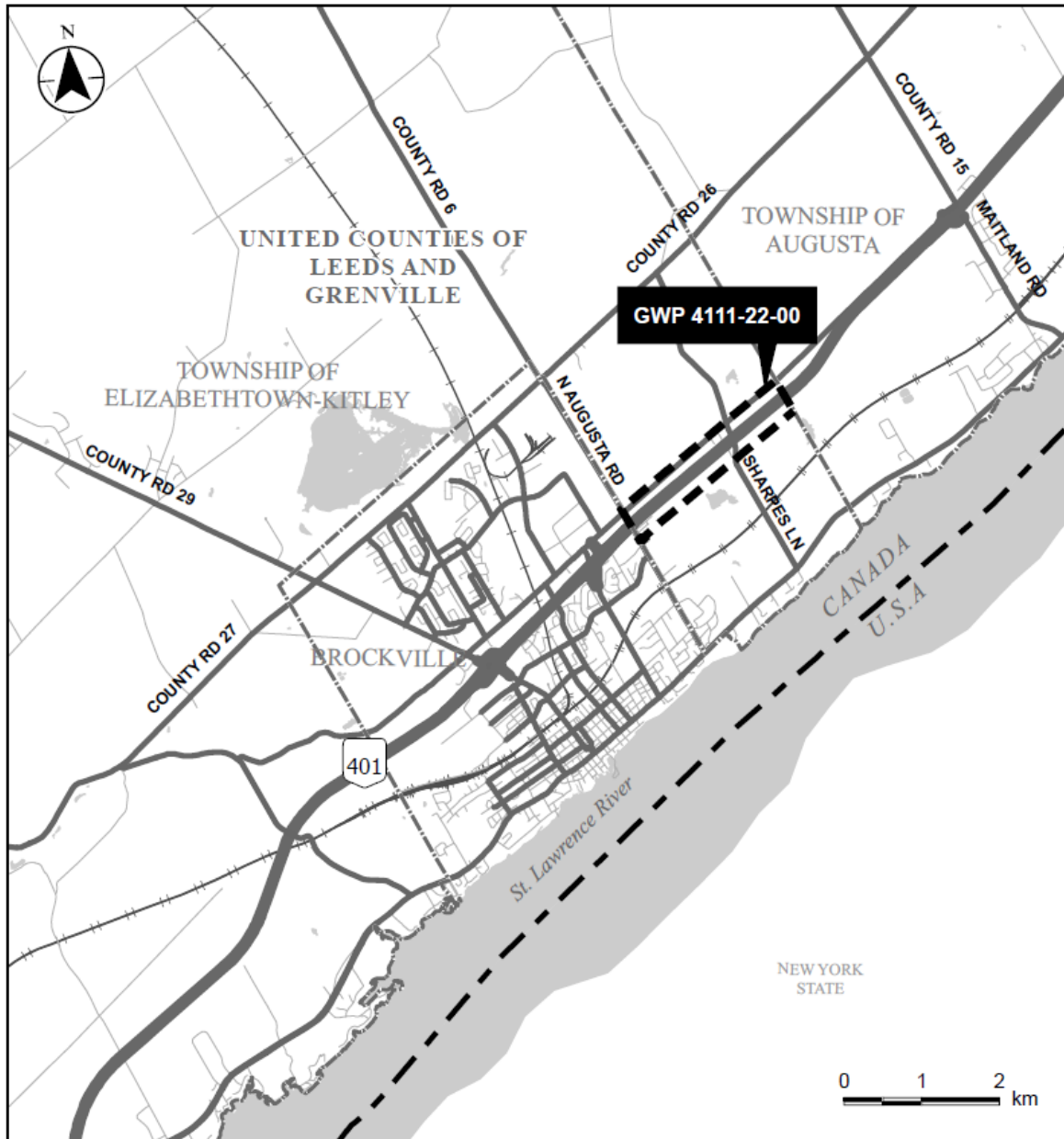


Figure 1: Key Plan of Study Limits

Under existing conditions, Highway 401 (east-west) is classified as a rural divided freeway. In the study area, Highway 401 has a divided two-lane cross section, with a bridge that allows traffic to flow north and south on Sharpe's Lane. The study area is mainly surrounded by unevaluated wetlands, forested and agricultural lands. Two main watercourses cross Highway 401 through the study area, Butlers Creek and an Unnamed Tributary to St. Lawrence River.

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1.3 Project Overview

Significant Erosion and sediment accumulation may occur due to short-term construction activities or catastrophic events that occur during construction of highway projects. The proposed highway modifications include the rehabilitation and/or replacement of two structures and an expanded future footprint of Highway 401. The future footprint of the 401 Highway will include an interim of six lanes and ultimate eight lanes. For the proposed works, potential erosion risks include:

Soil Handling: Dust and stormwater runoff from excavation, exposed soils, transport, stockpiling, and filling.

Water Transfers: When water is pumped from a depressed area or channel, an erosion risk is presented at the outfall area.

Slope Failures: Slope failures due to high pore pressures, often combined with freeze-thaw cycles, can mobilize soil and water. Newly excavated slopes are particularly vulnerable.

In-stream Work: Excavation and material placement in flowing water can introduce large quantities of soil into a watercourse.

Temporary Access Roads: The dust and stormwater runoff from temporary access roads can be a significant source of sediment.

2 Existing Conditions

2.1 Topography and Surface Water Drainage

The drainage areas surrounding the study area are rural. The surrounding drainage area is comprised of forested and agricultural lands to the north and south of Highway 401 and rural residential properties to the north of the Highway along Concession Rd. 2. Located approximately 2.2 km south of Highway 401 is the St. Lawrence River. The general topography of the site area is rolling or gently sloping and ranges from approximately 120 m above mean sea level (AMSL) to 100 m AMSL.

The study area extends across the Upper St. Lawrence River Subwatershed within the geographic boundary of the Cataraqui Region Conservation Authority. The study area has two watercourses that both convey flow to the St. Lawrence River. Most of the study area runoff drains to Butlers Creek, which has been identified as a warmwater creek and ultimately flows through Brockville and subsequently to the St. Lawrence River. Storm sewers on Highway 401 provide drainage for the median, generally out-letting to the north and south (downstream) ditch. In addition to the Butlers Creek structure and the Unnamed Tributary Culvert, there are three additional centreline culverts that assist drainage crossing of Highway 401. Drainage east of Sharpe's Lane is directed to an Unnamed Tributary located on the east end of the study area. The Unnamed Tributary flows south towards a pond located outside of the study area and ultimately conveys flow to the St. Lawrence River.

2.2 Soils and Hydrogeology

Per the Groundwater Assessment Report (Stantec, August 2024), the study area is located within the physiographic region defined as the Smith Falls Limestone Plain. It is characterized by shallow soil that

Reference: Preliminary Design and Class Environmental Assessment – Highway 401 East of Brockville (4111-22-00) – Erosion and Sediment Control Risk Assessment

overlays limestone or dolostone bedrock. But deeper soil is present in some areas as a result of old beach deposits, isolated drumlins, and clay deposits that have infilled depressions in the bedrock surface. Available regional mapping indicates overburden thickness in the Study Area generally ranges from less than 1 m to 4 m in thickness, with an area of thicker overburden ranging between 10 m and 19 m in thickness present near the central Study Area. Overburden primarily consists of topsoil, clay, till and/or sand.

Surficial geological mapping data from the Ontario Geological Survey (2010) indicated fine textured glaciolacustrine massive to well laminated deposits of silt and clay with minor sand and gravel where the Butlers Creek Culvert is located. The Sharpe's Lane Underpass is mapped within stone-poor, carbonate-derived silty to sandy till. The site is located within the Catarauqui Source Protection Area (SPA) and extends across the Butlers Creek watershed. Further review of Water Well records and MTO foundation investigations reports provided the following information at the two sites:

Butlers Creek Culvert (16X-0238/C0) – No MTO foundation reports related to this structure were identified. WWR data in the surrounding area reported thin overburden (topsoil) up the 1.2 m thick underlain by sandstone bedrock. WWR data in the surrounding area indicated static water levels at about 7 m BGS in nearby bedrock wells. Groundwater conditions adjacent to the creek are not known but are likely shallow given the vegetation in the area.

Sharpe's Lane Underpass (16X-0125/B0) - A 1962 foundation investigation report for the Sharpe's Lane Underpass, indicated overburden consisted of 1.0 m to 2.3 m thick black loam (silt and sand) underlain by silty sand till with gravel and boulders to at least 9.8 m Below Ground Surface (BGS). The 1962 foundation investigation report for the Sharpe's Lane Underpass identified groundwater levels near ground surface in boreholes completed within overburden.

Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) mapping indicates the overburden soils primarily consist of Farmington Loam and Grenville Loam from the west end of the study area to east of Sharpe's Lane. Achigan Sand encompasses the east end of the study area.

2.3 Environmentally Sensitive Areas

The screening of Natural Heritage Constraints was reviewed to identify the natural heritage features and confirm the presence of significant wildlife habitat and species at risk / species of conservation within the study area. Review of the background documentation confirmed the following:

- The following is summarized from the Terrestrial Ecosystem Existing Conditions Report (Stantec, January 2025):
 - There were four records of Species at Risk (SAR) and Species of Conservation Concern (SOCC) in the NHIC database that may occur within the Study Area. An additional 19 species were identified as potentially occurring.
 - There were no Vascular Plant Species SAR observed (e.g., butternut or black ash).
 - No Bird species listed as SAR or SOCC were observed within the Study Area.
 - Habitat assessments completed for the Study Area determined that 11 SAR have the potential to occur in the Study Area.

Reference: Preliminary Design and Class Environmental Assessment – Highway 401 East of Brockville (4111-22-00) – Erosion and Sediment Control Risk Assessment

- Meadow habitat was present as linear, narrow features adjacent to and/or within the ROW. Such communities provide limited habitat for SAR and SOCC and therefore, sensitive wildlife are unlikely to occur within the work zone.
- Designated Significant natural heritage features, such as wetlands, ANSIs, or significant valley lands present within or in proximity to the study area and are as follows:
 - South Augusta Wetland Complex PSW.
 - Frontenac Arch World Biosphere Reserve (Significant Ecological Area).
 - SWH – Wildlife Concentration Area – Mixed Wader Nesting Colony.
 - Watercourses (Butlers Creek and unnamed tributary).
 - Unevaluated wetlands.
 - Wildlife corridors and linkages.
- There are 2 mapped watercourse features present in the study area and are identified as follows:
 - Butlers Creek.
 - Unnamed Tributary to St. Lawrence River.
- The following is summarized from the Fish and Fish Habitat Existing Conditions and Preliminary Impact Assessment Report (Stantec, August 2025):
 - There are no records of aquatic SAR within the study area.
 - Stantec determined that the watercourses in the study area do not provide Significant Habitat for Fish.
 - Within the Study Area, two mapped watercourses directly support fish habitat for warm/cool water fish communities. The two highway stations include the watercourses Butlers Creek and an Unnamed Tributary to St. Lawrence River.
 - Additional culvert locations under the Highway 401 were reviewed and determined to only convey roadside drainage and not provide fish habitat at or within 30 m of the locations.
 - Within the study area, a ditch southwest of Unnamed Tributary to St. Lawrence River on Highway 401 Eastbound side for approximately 50 m was identified to also support fish habitat seasonally.
 - The determination of the potential for the death of fish or harmful alteration, disruption or destruction (HADD) of fish habitat will be confirmed during future design stages.

Additional mapping from OMAFRA was reviewed to identify other environmentally sensitive features such as source water protection zones and significant Ecological areas. Review of available information confirmed the following:

- There are no Well-head Protection Areas within the study area.

Reference: Preliminary Design and Class Environmental Assessment – Highway 401 East of Brockville (4111-22-00) – Erosion and Sediment Control Risk Assessment

- Parts of the study area have been identified as Significant Groundwater Recharge locations. These areas have been evaluated and given values that range from either 4 or 6. The values result in medium to high risk to drinking water sources.
- There are no Intake Protection Zones classified within the study area.
- Highly Vulnerable Aquifers have been identified within the study area. Highly Vulnerable Aquifer areas are identified in the western half of the study area. While the eastern side of the study area does not intersect with any Highly Vulnerable Aquifers.

There is no intersection of Provincially Significant Wetlands (PSW), Areas of Natural and Scientific Interests (ANSIs), or significant valley lands within the study area. The nearest PSW is the South Augusta Wetland Complex PSW located approximately 1.5 km northeast of the Sharpe's Lane Underpass. Based on the background review there are multiple environmentally sensitive areas identified within the project limit. The environmentally sensitive areas within or in close proximity to the project limits are as follows:

- Butlers Creek.
- Unnamed Tributary to St. Lawrence River.
- Frontenac Arch World Biosphere Reserve (Significant Ecological Area) (in close proximity to the project limits).
- Unevaluated wetlands.

3 Erosion and Sediment Overview Risk Assessment

An ESORA was completed for the study area to determine the erosion risk potential for the anticipated construction works. To complete the assessment, the study area was divided into polygons based on the underlying soil type per Ontario Soil Survey Complex mapping (AgMaps, 2025). The polygons were each assigned a Soil Erodibility Rating based on soil type, and an Erosion Potential Rating which combined soil type as well as the proposed slope gradient and proposed slope length.

As mentioned above, the study area is generally characterized by Farmington loam soil with localized soil groupings of Grenville loam and Achigan sand. Additionally on the east edge of the site boundary there is a small area of Matilda loam. The soil erodibility rating was based on Table 5.1 – Hierarchy of Soil Erodibility in the Environmental Guide for Erosion and Sediment Control During Construction of Highway Projects (MTO, 2015). The Erosion Potential Rating for each polygon was assigned based on Table 5.2 – Erosion Potential Associated with Slope Length, Slope Gradient and Soil Erodibility Rating of the Environmental Guide for Erosion and Sediment Control During Construction of Highway Projects (MTO, 2015). The slope gradient discretization considered was less than 5% and 20%, and greater than 20%. The slope gradient discretization considered was less than or greater than 100m. The slope gradient throughout the study area is consistently less than 5% and the slope length is generally >100m. The slope gradient varies in locations where watercourses transect the polygon.

An environmental Consequence Rating was also assigned to each polygon based on the likelihood of impacting environmental features during the construction. Multiple environmentally sensitive areas were identified in the study area as unevaluated wetlands that intersected with the polygons within Section 2.3.

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Each polygon was assigned an Environmental Consequence Rating based on the following three (3) levels of connectivity.

Direct Connectivity: Any sediment from a construction site within the polygon would be transported directly downstream to locations of moderate or high sensitivity terrestrial/aquatic habitat.

Indirect Connectivity: Sediment-laden water from a construction site within the polygon would empty into a secondary watercourse (i.e. stream, ditch, swale) before connecting with any stream reach or woodlot with sensitive terrestrial aquatic habitat.

No Connectivity: No connectivity was assumed if the polygon has a significant distance (>300m) from a watercourse or the sediment-laden runoff would terminate before connecting with any named stream reach.

The three-ratings (Soil Erodibility, Erosion Potential and Environmental Consequence) were all considered to assign the cumulative Erosion and Sediment Risk rating to each evaluated area. Results of the completed evaluation, including rationale for the assigned Erosion Potential Rating, Environmental Risk Rating and cumulative Erosion and Sediment Risk rating are shown in Table 1 below. The attached Figure 3 illustrates the Erosion Risk rating for each evaluated polygon.

Table 1 Erosion and Sediment Overview Risk Assessment Summary

Polygon No.	Soil Description (Texture)	Soil Erodibility Rating	Proposed Soil Gradient (%)	Proposed Slope Length (m)	Erosion Potential	Rational for Erosion Potential	Enviro Consequence Rating	Rational for Consequence Rating	Erosion and Sediment Risk
1	Sandy Loam	M	<5	<100	M	Medium Soil Erodibility. Relatively flat urban topography. Well drained soils.	L	Indirect Connectivity to Butlers Creek. Butlers Creek has direct fish habitat per Fish and Fish Habitat Existing Conditions and Preliminary Assessment Report (Stantec 2025).	L
2	Loam	H	<5, Locally higher gradient at Butlers Creek	>100	H	High Soil Erodibility. Gently sloping woodlot land. Well drained soils.	H	Direct Connectivity to Butlers Creek and unevaluated wetlands and Significant Ecological Area. Direct fish habitat is identified in Butlers Creek per Fish and Fish Habitat Existing Conditions and Preliminary Assessment Report (Stantec 2025).	H

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3	Loam	H	<5, Locally higher gradient at Butlers Creek	>100	H	High Soil Erodibility. Gently sloping woodlot land. Well drained soils.	H	Direct Connectivity to Butlers Creek and unevaluated wetlands and Significant Ecological Area. Direct fish habitat is identified in Butlers Creek per Fish and Fish Habitat Existing Conditions and Preliminary Assessment Report (Stantec 2025).	H
4	Loam	H	<5	>100	H	High Soil Erodibility. Gently sloping woodlot lands. Well drained soils.	M/H	Indirect Connectivity to Butlers Creek and Direct Connectivity to unevaluated wetlands in the polygon boundaries.	H
5	Loam	H	<5	>100	H	High Soil Erodibility. Gently sloping Topography. Well drained soils.	M	Indirect Connectivity to Butlers Creek and unevaluated wetlands.	M

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6	Loam	H	<5	>100	M	High Soil Erodibility. Gently sloping woodlot lands. Well drained soils.	M	Indirect Connectivity to Butlers Creek and Direct Connectivity to unevaluated wetlands in the polygon boundaries.	M
7	Loam	H	<5, Locally higher slopes for underpass	<100	M	High Soil Erodibility. Gently sloping woodlot land. Well drained soils.	M/H	Indirect Connectivity to Butlers Creek and Direct Connectivity to unevaluated wetlands and Significant Ecological Area in the polygon boundaries.	H
8	Loam	H	<5	>100	M	High Soil Erodibility. Topographic elevation consistently drops away from highway. Well drained soils.	M	Indirect Connectivity to Butlers Creek and Indirect Connectivity to unevaluated wetlands and Direct Connectivity Significant Ecological Area in the polygon boundaries.	M
9	Sand	L	<5, Locally higher slopes along Unnamed Tributary banks	<100	L	Low Soil Erodibility. Gently sloping topography. Imperfectly	H	Direct Connectivity to Unnamed Tributary to St. Lawrence and unevaluated wetlands. Direct fish habitat is identified in the Unnamed Tributary to St.	H

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Table 1 Erosion and Sediment Overview Risk Assessment Summary

Polygon No.	Soil Description (Texture)	Soil Erodibility Rating	Proposed Soil Gradient (%)	Proposed Slope Length (m)	Erosion Potential	Rational for Erosion Potential	Enviro Consequence Rating	Rational for Consequence Rating	Erosion and Sediment Risk
						drained soils.		Lawrence River per Fish and Fish Habitat Existing Conditions and Preliminary Assessment Report (Stantec 2025).	
10	Sand	L	<5	>100	L	Low Soil Erodibility. Gently sloping topography. Imperfectly drained soils.	H	Indirect Connectivity to Unnamed Tributary to St. Lawrence and Indirect connectivity to unevaluated wetlands. Direct fish habitat is identified in the Unnamed Tributary to St. Lawrence River and ditch southwest of Highway 401 Eastbound per Fish and Fish Habitat Existing Conditions and Preliminary Assessment Report (Stantec 2025).	H

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Polygon No.	Soil Description (Texture)	Soil Erodibility Rating	Proposed Soil Gradient (%)	Proposed Slope Length (m)	Erosion Potential	Rational for Erosion Potential	Enviro Consequence Rating	Rational for Consequence Rating	Erosion and Sediment Risk
11	Loam	H	<5, Locally higher slopes along Unnamed Tributary banks	<100	H	High Soil Erodibility. Gently sloping topography. Imperfectly drained soils.	M	Direct Connectivity to Unnamed Tributary to St. Lawrence and unevaluated wetlands. Direct fish habitat is identified in the Unnamed Tributary to St. Lawrence River per Fish and Fish Habitat Existing Conditions and Preliminary Assessment Report (Stantec 2025). End of limits for work and no significant modifications to culvert.	H

¹ L = Low, M = Medium, H = High

It is expected that erosion potential exists as part of the project due to the anticipated culvert rehabilitation and/or replacement of two structures in watercourses, pavement expansion for the interim and ultimate added lanes, and overall construction activities. As a conservative best management practice, it is recommended that the erosion and sediment control measures consider the study area to have erosion and sediment risks range from Low to high.

3.1 Anticipated Project Activities

As part of the Highway 401 Planning Study, Brockville East, the following project activities, including new structures, are proposed:

- Rehabilitation or replacement and extension of the two structures - Butlers Creek Culvert, and Sharpe's Lane Underpass.
- The construction for the expansion and pavement reconstruction to accommodate interim widening of the existing four-lane, divided highway to six-lanes and ultimately future highway widening to eight-lanes.

Reference: Preliminary Design and Class Environmental Assessment – Highway 401 East of Brockville (4111-22-00) – Erosion and Sediment Control Risk Assessment

- Associated drainage improvements including new culverts, the replacement of existing culverts, ditching and stormwater management features associated with the anticipated works.

3.2 Erosion and Sediment Control Plan Considerations

An effective Erosion and Sediment Control Plan (ESCP) will limit the site disturbance and protect sensitive areas during construction. The ESCP should employ a multi-barrier approach to prevent erosion at the source and reduce sediment transport offsite. The purpose of the ESCP in order of priority is the following (MTO, 2015):

1. Mitigate erosion potential by effective planning, procedures and water management.
2. Apply erosion control measures to prevent mobilization of sediment.
3. Apply sediment control measures to prevent off-site sediment release in the event of sediment mobilization.

An ESCP must be integrated with the overall project design to reduce misunderstandings between the ESC designer, project designer and contractors resulting in failures. The plan should identify how to manage water, control erosion and control sedimentation, including where to install appropriate BMPs, how to install the BMPs and when to install, maintain and remove BMPs. The following ESC procedures will be considered for the ESCP:

- Employ a multi-barrier approach.
- Retain existing vegetation and stabilize exposed soils with cover.
- Limit the duration of soil exposure and phase construction when possible.
- Limit the size of disturbed areas by minimizing nonessential clearing and grading.
- Reduce slope length and gradient of disturbed areas.
- Maintain overland sheet flow and avoid concentrated flows.
- Store/stockpile erodible materials away (e.g., greater than 15 m) from watercourses, drainage features and top of steep slopes.
- Provide reasonable professional effort to involve contractors in ESC practices and determine if the contractors are trained in ESC Plan implementation, inspections, maintenance, and repairs.
- Adjust ESC Plan at construction site to adapt to site features.
- Assess all ESC practices before and after significant rainfall (>10mm) and snowmelt events.

Cover is the single most effective erosion control method to protect downstream receivers. Therefore, the priority of ESCP should be to limit the disturbed areas and preserve the existing cover to protect the exposed soil from wind, rain splash and overland flow.

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4 Recommendations for Detail Design

4.1 Grading Recommendation

The standard grading treatment includes 2:1 maximum fore-slopes and back-slopes for cuts and high fills. However, given the anticipated erodibility of the soils in the study area, maximum slopes of 3:1 are recommended for preliminary design purposes. The flatter slopes will better control sheet drainage velocity and quantity when compared to standard 2:1 slopes, which will help mitigate erosion of the cut and fill slopes. Interceptor ditches can also be implemented along or at the base of slopes to discharge sediment laden water to areas where erosion and sediment control measures are present. The grading cross-sections and erosion and sediment control measures will be confirmed during future design phases.

4.2 Erosion and Sediment Control Plan Recommendation

As summarized in Section 3, the topography, surficial soils and environmentally sensitive features within the study area results in low to high erosion and sediment risk. It is recommended that Approach 3: Main and Supplemental Erosion and Sediment Control Plan (ESCP) be implemented for the study area during future design phases, in accordance with the MTO Guidelines, due to potential Fisheries Act Authorizations required for the Butlers Creek Culvert. This approach includes a technical memo, ESC Drawings and contract documents corresponding to MTO non-standard special provisions (NSSPs). The additional component of the Approach 3 method requires the contractor to develop and supplement ESCP.

Selection of Best Management Practices will be completed during detail design. The BMPs are subject to change during construction and should be evaluated and applied through each phase of construction for successful mitigation of on-site erosion potential. The five categories of ESC BMPs are as follows.

1. Project planning and Design BMPs.
2. Procedural BMPs.
3. Water Management BMPs.
4. Erosion Control BMPs.
5. Sediment Control BMPs.

Categories four (4) and five (5) known as erosion control and sediment control BMPs are often called the structural BMPs because they are tangible (e.g., a pond, a fabric, or a root and leaf system) rather than planning, design or procedural practices.

5 Conclusion

The study area had an overall low to high erosion and sediment risk rating based on the erodibility soils and sensitive environmental features. An erosion and sediment control plan will be developed for all construction zones in future design phases to mitigate the erosion and sediment risk and limit impacts

Reference: Preliminary Design and Class Environmental Assessment – Highway 401 East of Brockville (4111-22-00) – Erosion and Sediment Control Risk Assessment

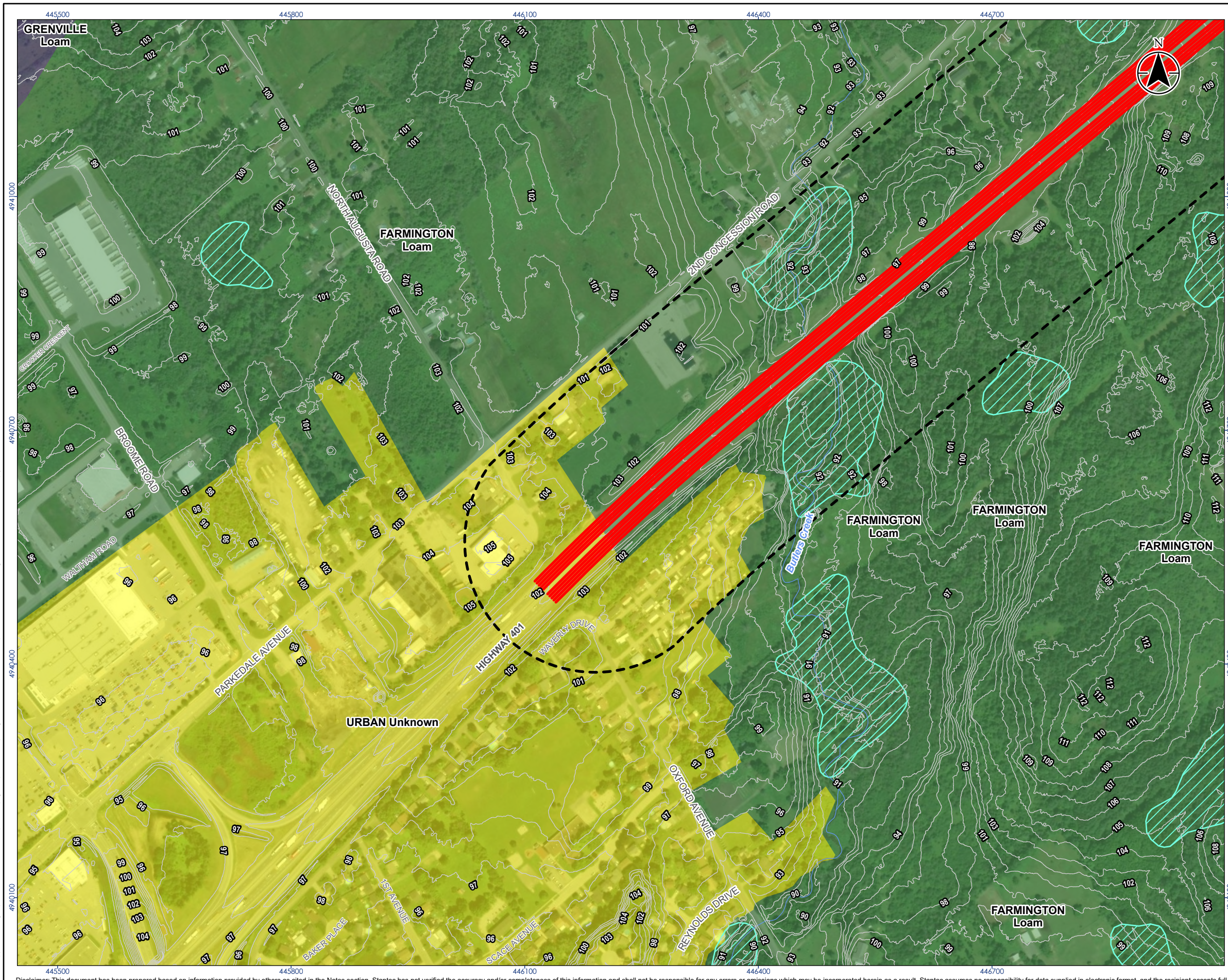
downstream. We trust this memo meets your requirements at this time. Should you have any questions regarding this ESORA please contact the undersigned.

Regards,

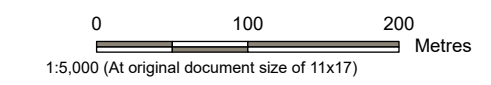
STANTEC CONSULTING LTD.

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Water Resources Engineer
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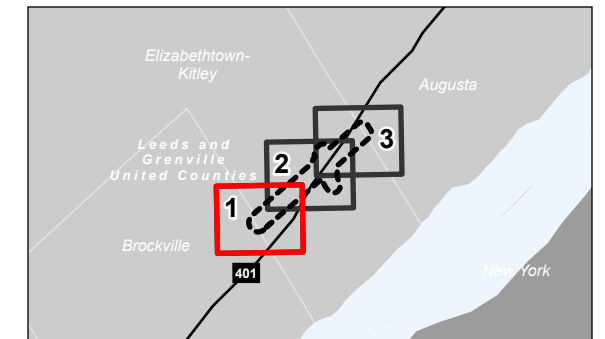
Attachments: Figure 1-1 – Topography and Soils
Figure 2-2 – Erosion Risk
Erosion and Sediment Risk Assessment Table



- Legend**
- Study Area
 - Preliminary Design - Road
 - Contour - 1 m
 - Watercourse (Permanent)
 - Wetland, Unevaluated
- Soil Name**
- FARMINGTON, Loam
 - GRENVILLE, Loam
 - URBAN, Unknown



- Notes**
1. Coordinate System: NAD 1983 UTM Zone 18N
 2. Contains information licensed under the Open Government Licence – Ontario, and the Open Government Licence - Canada, accessed 2025
 3. Topographic Contours derived from the Ontario Digital Elevation Model (LIDAR-Derived). Eastern Ontario 2021-2022 and SNC Lidar 2018-19.



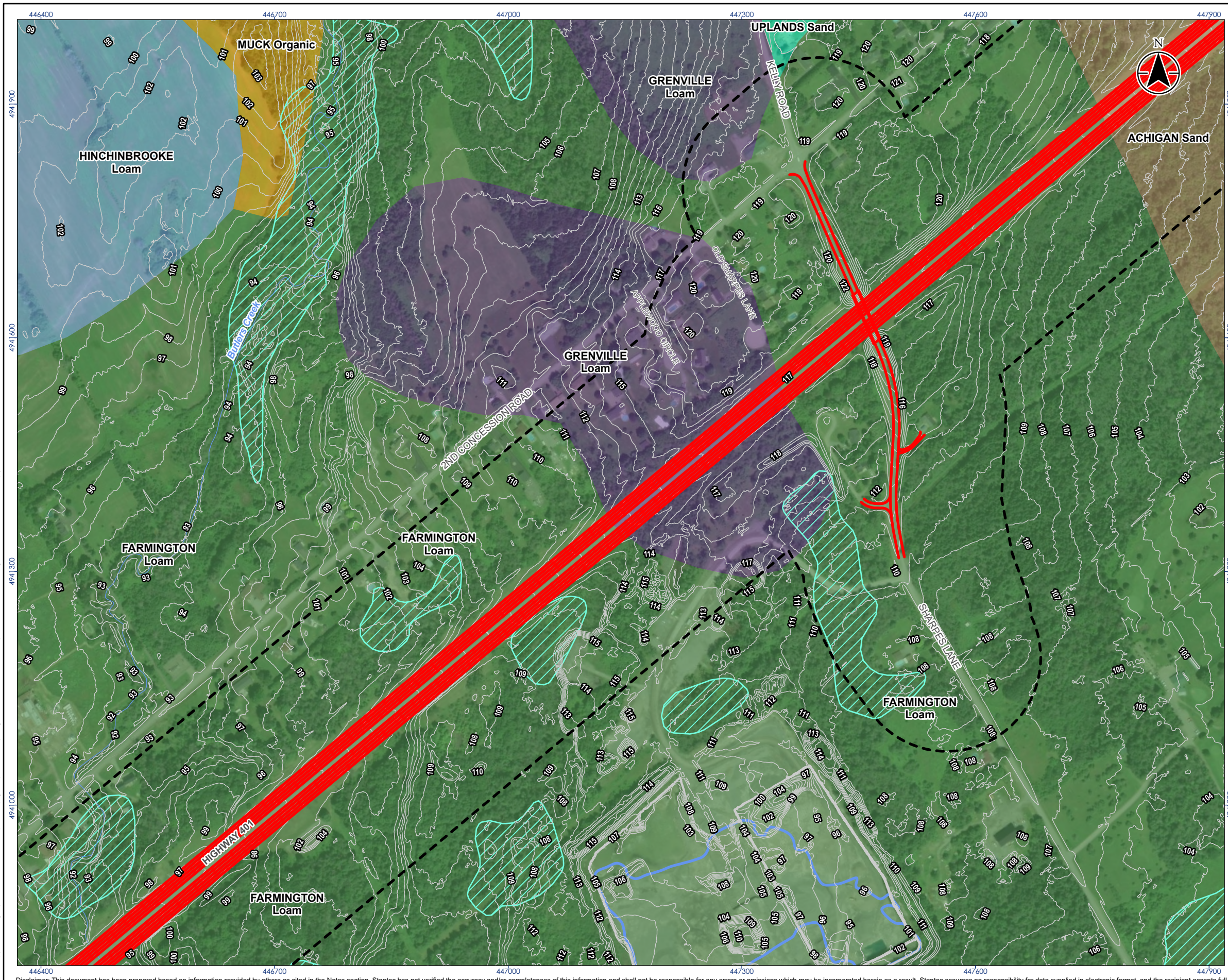
Project Location: United Counties of Leeds and Grenville
 165001328 REV0
 Prepared by jsa on 2025-11-08

Client/Project: MINISTRY OF TRANSPORTATION
 HIGHWAY 401 PLANNING STUDY EAST OF BROCKVILLE (GWP 4111-22-00)

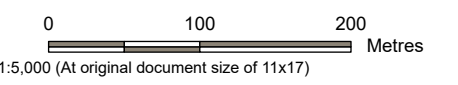
Figure No. 1.1

Title: Topography and Soils

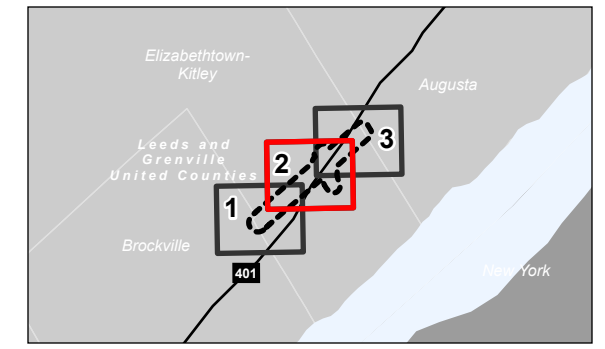
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 Revised: 2025-11-08 By: jsa



- Legend**
- Study Area
 - Preliminary Design - Road
 - Contour - 1 m
 - Watercourse (Permanent)
 - Waterbody
 - Wetland, Unevaluated
- Soil Name**
- ACHIGAN,Sand
 - FARMINGTON,Loam
 - GRENVILLE,Loam
 - HINCHINBROOKE,Loam
 - MUCK,Organic
 - UPLANDS,Sand



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 165001328 REV0
 Prepared by jsa on 2025-11-08

Client/Project:
MINISTRY OF TRANSPORTATION
HIGHWAY 401 PLANNING STUDY EAST OF
BROCKVILLE (GWP 4111-22-00)

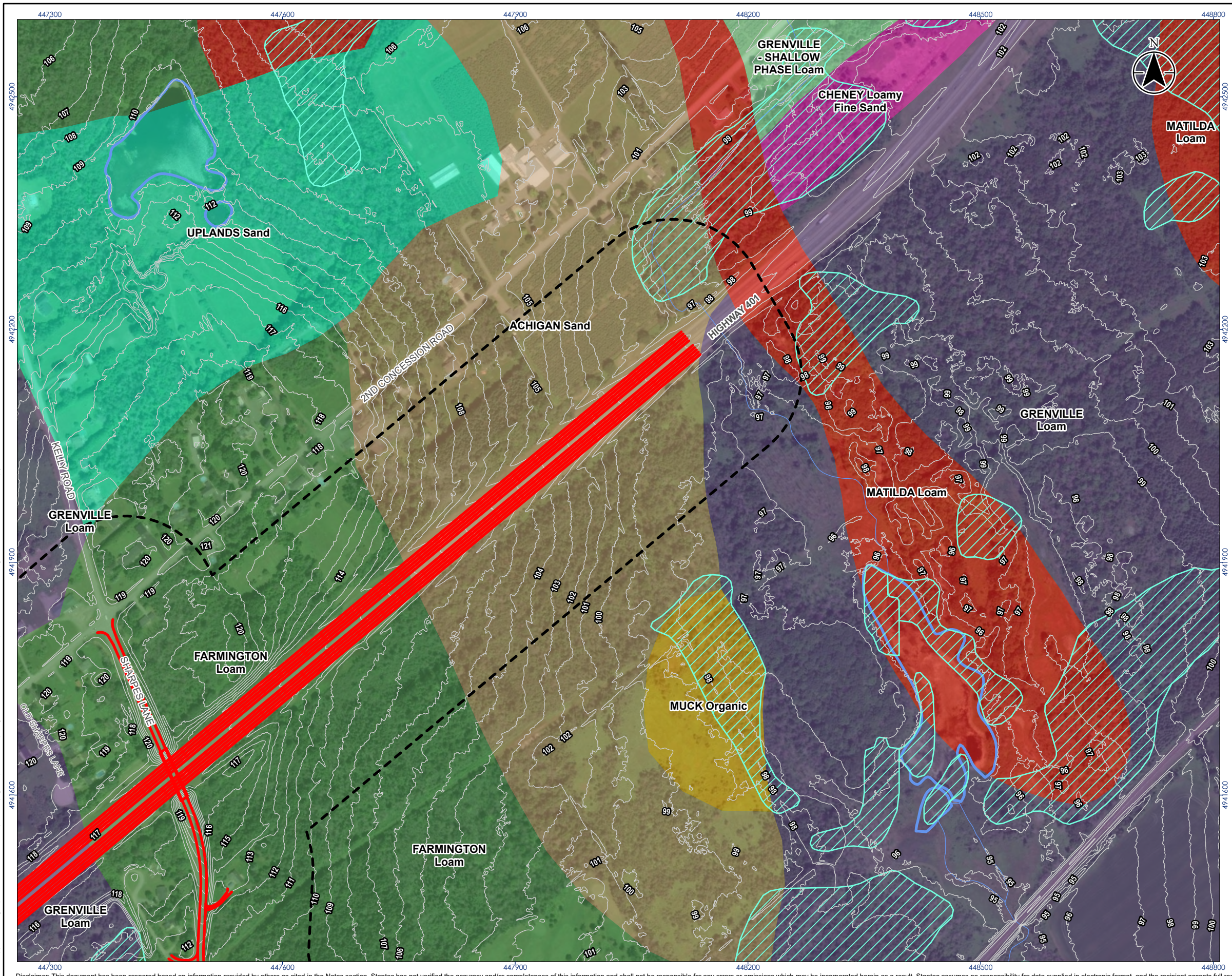
Figure No.

1.2

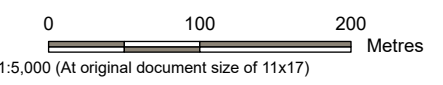
Title

Topography and Soils

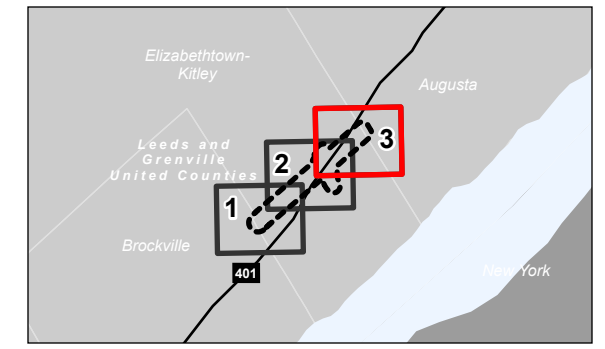
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 Revised: 2025-11-08 By: jsa



- Legend**
- Study Area
 - Preliminary Design - Road
 - Contour - 1 m
 - Watercourse (Permanent)
 - Waterbody
 - Wetland, Unevaluated
- Soil Name**
- ACHIGAN, Sand
 - CHENEY, Loamy Fine Sand
 - FARMINGTON, Loam
 - GRENVILLE, Loam
 - GRENVILLE - SHALLOW PHASE, Loam
 - MATILDA, Loam
 - MUCK, Organic
 - UPLANDS, Sand



- Notes**
1. Coordinate System: NAD 1983 UTM Zone 18N
 2. Contains information licensed under the Open Government Licence - Ontario, and the Open Government Licence - Canada, accessed 2025
 3. Topographic Contours derived from the Ontario Digital Elevation Model (LIDAR-Derived). Eastern Ontario 2021-2022 and SNC Lidar 2018-19.



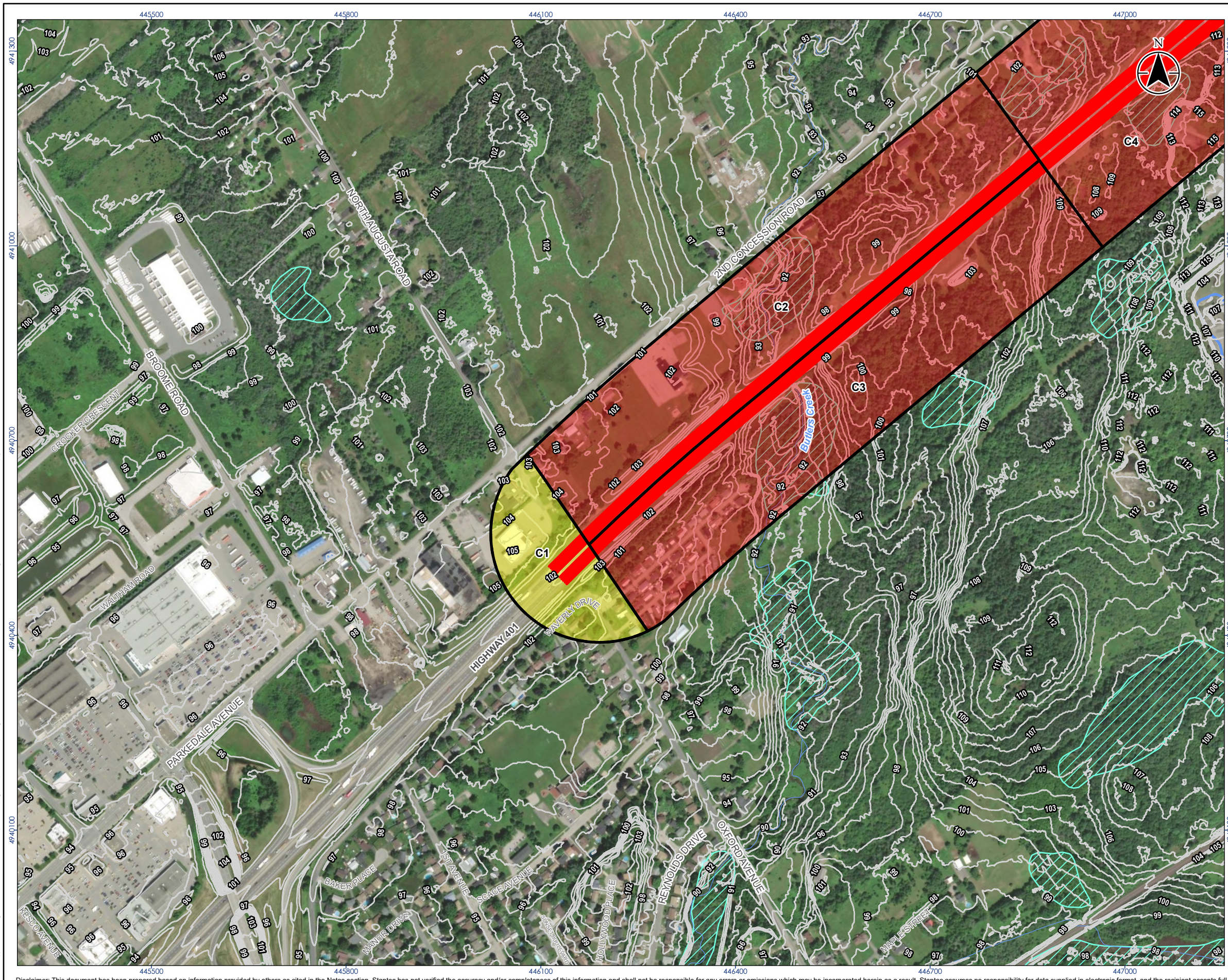
Project Location: United Counties of Leeds and Grenville
 165001328 REV0
 Prepared by jsa on 2025-11-08

Client/Project: MINISTRY OF TRANSPORTATION
 HIGHWAY 401 PLANNING STUDY EAST OF BROCKVILLE (GWP 4111-22-00)

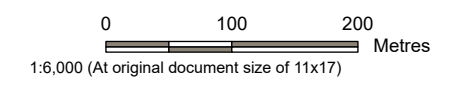
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Title: Topography and Soils

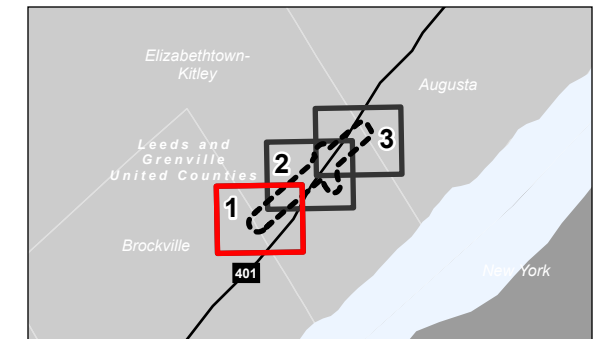
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- Legend**
- Study Area
 - Preliminary Design - Road
 - Contour - 1 m
 - Watercourse (Permanent)
 - Waterbody
 - Wetland, Unevaluated
- Erosion and Sediment Risk**
- High
 - Low



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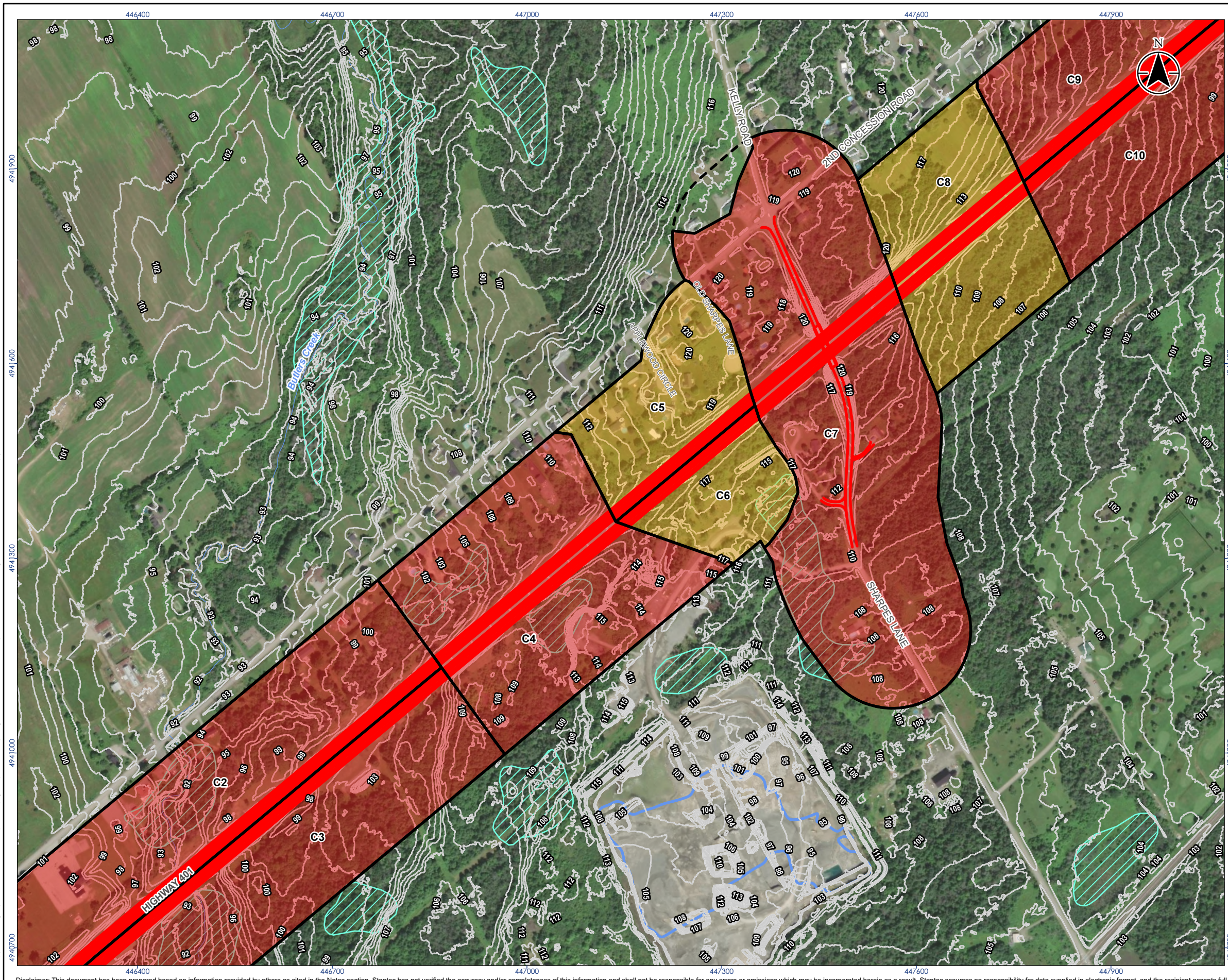
Project Location: United Counties of Leeds and Grenville
 165001328 REV0
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 HIGHWAY 401 PLANNING STUDY EAST OF BROCKVILLE (GWP 4111-22-00)

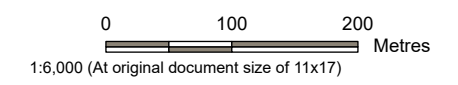
Figure No. 2.1

Title: Erosion Risk

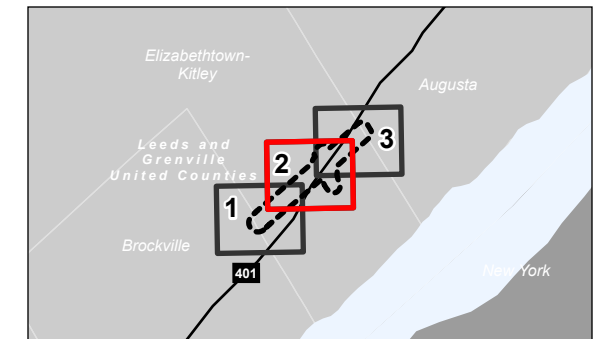
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- Legend**
- Study Area
 - Preliminary Design - Road
 - Contour - 1 m
 - Watercourse (Permanent)
 - Waterbody
 - Wetland, Unevaluated
- Erosion and Sediment Risk**
- High
 - Medium



- Notes**
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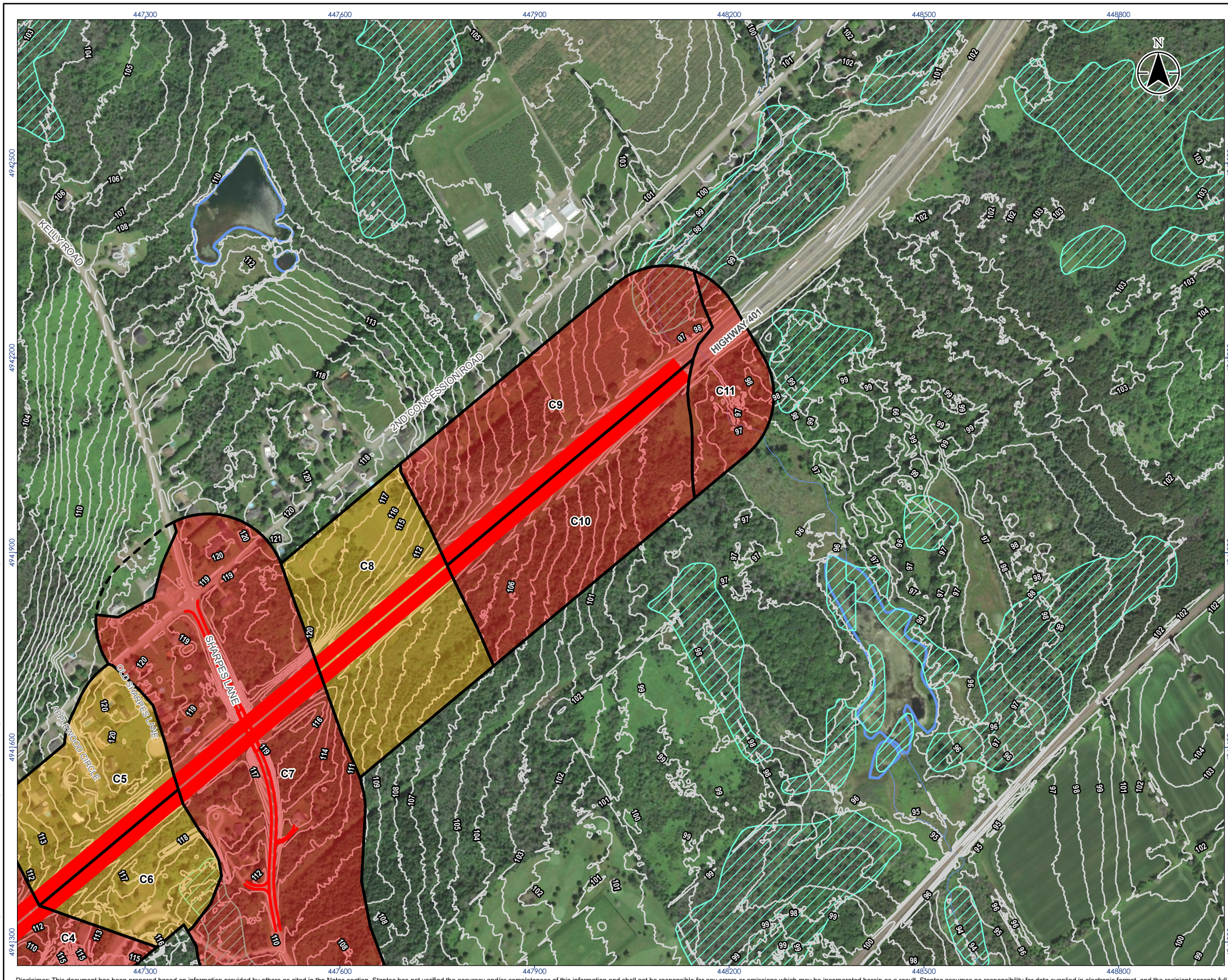
Project Location: United Counties of Leeds and Grenville
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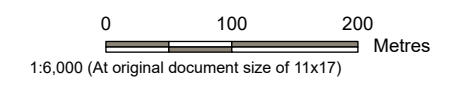
Figure No. **2.2**

Title: **Erosion Risk**

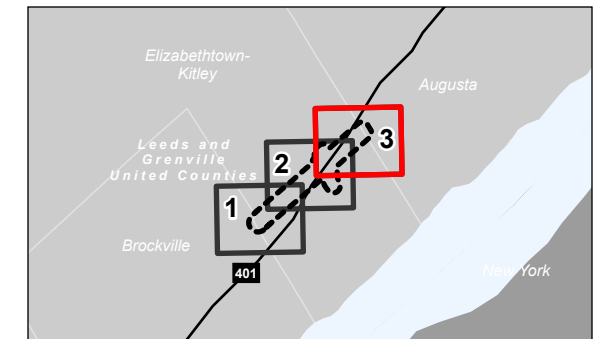
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 Revised: 2025-11-08 by: jsa



- Legend**
- Study Area
 - Preliminary Design - Road
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 - Waterbody
 - Wetland, Unevaluated
- Erosion and Sediment Risk**
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 HIGHWAY 401 PLANNING STUDY EAST OF BROCKVILLE (GWP 4111-22-00)

Figure No.

2.3

Title

Erosion Risk

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Polygon No. 1	Soil Type	Soil Description (Texture)	Soil Description Source	Soil Erodibility Rating	Proposed Soil Gradient (%)	Proposed Slope Length (m)	Erosion Potential	Rational for Erosion Potential	Enviro Consequence Rating	Rational for Consequence Rating	ES Risk
1	Urban based	Sandy loam	OMAFRA	Medium	<5	<100	Moderate	Medium Soil Erodibility. Relatively flat urban topography. Well drained soils.	Low	Indirect Connectivity to Butlers Creek. Butlers Creek has direct fish habitat per Fish and Fish Habitat Existing Conditions and Preliminary Assessment Report (Stantec 2025).	Low
2	Farmington Loam	Loam	OMAFRA	High	<5, Locally higher gradient at Butlers Creek	>100	High	High Soil Erodibility. Relatively flat woodlot land. Well drained soils.	High	Direct Connectivity to Butlers Creek and unevaluated wetlands and Significant Ecological Area. Direct fish habitat is identified in Butlers Creek per Fish and Fish Habitat Existing Conditions and Preliminary Assessment Report (Stantec 2025).	High
3	Farmington Loam	Loam	OMAFRA	High	<5, Locally higher gradient at Butlers Creek	>100	High	High Soil Erodibility. Relatively flat woodlot land. Well drained soils.	High	Direct Connectivity to Butlers Creek and unevaluated wetlands and Significant Ecological Area. Direct fish habitat is identified in Butlers Creek per Fish and Fish Habitat Existing Conditions and Preliminary Assessment Report (Stantec 2025).	High
4	Farmington Loam	Loam	OMAFRA	High	<5	>100	High	High Soil Erodibility. Relatively flat woodlot lands. Well drained soils.	Medium / High	Indirect Connectivity to Butlers Creek and Direct Connectivity to unevaluated wetlands in the polygon boundaries.	High
5	Grenville Loam	Loam	OMAFRA	High	<5	>100	High	High Soil Erodibility. Relatively flat Topography. Well drained soils.	Medium	Indirect Connectivity to Butlers Creek and unevaluated wetlands.	Medium
6	Grenville Loam	Loam	OMAFRA	High	<5	>100	Moderate	High Soil Erodibility. Relatively flat woodlot lands. Well drained soils.	Medium	Indirect Connectivity to Butlers Creek and Direct Connectivity to unevaluated wetlands in the polygon boundaries.	Medium
7	Farmington Loam	Loam	OMAFRA	High	<5 (Locally higher slopes for underpass)	<100	Moderate	High Soil Erodibility. Relatively flat woodlot land. Well drained soils.	Medium / High	Indirect Connectivity to Butlers Creek and Direct Connectivity to unevaluated wetlands and Significant Ecological Area in the polygon boundaries.	High
8	Farmington Loam	Loam	OMAFRA	High	<5	>100	Moderate	High Soil Erodibility. Topographic elevation consistently drops away from highway. Well drained soils.	Medium	Indirect Connectivity to Butlers Creek and Indirect Connectivity to unevaluated wetlands and Direct Connectivity Significant Ecological Area in the polygon boundaries.	Medium
9	Achigan Sand	Sand	OMAFRA	Low	<5, Locally higher slopes along Unnamed Tributary banks	<100	Low	Low Soil Erodibility. Relatively flat topography. Imperfectly drained soils.	High	Direct Connectivity to Unnamed Tributary to St. Lawrence and unevaluated wetlands. Direct fish habitat is identified in the Unnamed Tributary to St. Lawrence River per Fish and Fish Habitat Existing Conditions and Preliminary Assessment Report (Stantec 2025).	High
10	Achigan Sand	Sand	OMAFRA	Low	<5	>100	Low	Low Soil Erodibility. Relatively flat topography. Imperfectly drained soils.	High	Indirect Connectivity to Unnamed Tributary to St. Lawrence and Indirect connectivity to unevaluated wetlands. Direct fish habitat is identified in the Unnamed Tributary to St. Lawrence River and ditch southwest of Highway 401 Eastbound per Fish and Fish Habitat Existing Conditions and Preliminary Assessment Report (Stantec 2025).	High
11	Grenville and Matilda Loam	Loam	OMAFRA	High	<5, Locally higher slopes along Unnamed Tributary banks	<100	High	High Soil Erodibility. Relatively flat topography. Imperfectly drained soils.	Medium	Direct Connectivity to Unnamed Tributary to St. Lawrence and unevaluated wetlands. Direct fish habitat is identified in the Unnamed Tributary to St. Lawrence River per Fish and Fish Habitat Existing Conditions and Preliminary Assessment Report (Stantec 2025). End of limits for work and no significant modifications to culvert.	High