City of Brantford

Colborne Street East - Slope Stabilization Municipal Class Environmental Assessment September 2020

In Association with:

Pinchin Environmental Ltd.

Archaeological Research Associates Ltd.

Project Number: 1824

Ecosystem Recovery Inc.
80-2 Courtland Avenue East
Kitchener, Ontario, N2G 2T8
Phone: 519.621.1500
www.ecosystemrecovery.ca

September 8, 2020

Matt Welsh, C.Tech., PMP
Project Coordinator
Design and Construction
Public Works Commission
City of Brantford
100 Wellington Square

Dear Mr. Welsh:

Project No: **1824**

Regarding: **Colborne Street East - Slope Stabilization Municipal Class Environmental Assessment September 2020**

We are pleased to provide you with the Final Environmental Assessment Report for the Colborne Street East Slope Municipal Class Environmental Assessment Study between Linden Avenue and Johnson Road.

Sincerely,
Ecosystem Recovery Inc.

Jeff Prince, P. Eng.
Senior Project Manager

Revision Log

Revision #	Revised By	Date	Issue / Revision Description
1	RC/AV/JP	Dec 2019	Draft Report
2	RC/AV/JP	March 2020	Draft Report
3	RC/JP	Sept 2020	Final Report

Ecosystem Recovery Signatures

Contributing Authors:

Robert Chlumsky, MASc., P.Eng.
Water Resources Engineer

Jeff Prince, P. Eng.
Project Lead,
Senior Consulting Engineer

Reviewed by:

Wolfgang Wolter
Project Manager
Senior Technical Advisor

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Executive Summary

Overview

The City of Brantford has undertaken a Municipal Class Environmental Assessment (EA) for the purpose of addressing slope stability issues along Colborne Street (East), in the area known as 'the Oxbow'. The site has a history of slope stability concerns and experienced a major slope failure in May 1986, which led to the destruction of the CN Railway and forced the evacuation of a number of residents along Colborne Street (East), within the study area.

Problem Statement (Phase 1 of the Municipal Class EA Process)

In May 1986, a major landslide occurred between Colborne Street East and the north bank of the Grand River, between Calvin Street to the west and Johnson Road to the east. The City of Brantford has performed slope monitoring of the area ever since, typically on an annual basis. Several studies have been completed to determine the cause and effects of the landslide. Monitoring shows that slope movement continues to occur. Slope stability concerns revolve around soil type, moisture issues, and toe erosion. This Class EA has been initiated to develop feasible alternatives to address stability concerns and to create a management strategy for the area. It is being completed under Schedule "C" of the Municipal Class EA process.

Background Studies

The slope has been the subject of several studies since 1986, including several slope monitoring programs, geotechnical studies leading to the removal of the CN Railway in 1998, and a previous EA completed in 1995. The 1995 EA initiated by the Grand River Conservation Authority (GRCA) identified the preferred alternative as "Toe Protection with Minor Filling and Trimming Design", which aimed to protect the toe of the slope along the Grand River in combination with minor grading of the slope to improve stability. However, the preferred alternative was not implemented at that time.

Existing Conditions Characterization

Existing conditions along the slope within the study area were characterized in detail to provide an effective basis of evaluation of potential slope stabilization alternatives within the context of the Municipal Class EA. Field and desktop reconnaissance included site walks, LiDAR topographic survey, geotechnical review and field investigation, analysis of the ongoing slope monitoring results, geomorphic characterization, natural environment investigations, a Stage 1 Archaeological Assessment, an assessment of the social and cultural environment, and an economic cost and life cycle analysis. This chapter describes the technical, ecological, and social environments in the study area.

The Study Problem Statement, Environmental Assessment Process and Existing Conditions Characterization was presented in a Public Information Centre (PIC) on September 13, 2018.

Alternative Solutions (Phase 2 of the Municipal Class EA Process)

An initial list of alternative solutions was developed with consideration given to the alternatives evaluated in the previous 1995 Environmental Study Report (ESR) which was updated in 2012. The geotechnical assessment of the study area determined that the stable slope ratio is 5.4:1 (horizontal to vertical) and the alternative solutions were developed to provide that stable slope condition (which is not present under the existing conditions). To achieve a stable slope, either the top of slope or bottom of slope would have to be moved from their current alignments – this approach lead to the development of the following alternative solutions:

Alt. Solution 1.	Do nothing; continue with the current monitoring program and re-evaluate in the future (a baseline comparison case for the evaluation);
Alt. Solution 2.	Monitoring; Assessment and Phased Stabilization;
Alt. Solution 3.	Altering the level of service along Colborne Street East by setting the slope line north, in order to achieve a stable slope line;
Alt. Solution 4.	Providing some form of mechanical stabilization to the slope to allow the slope to remain stable with a steeper slope than 5.4:1 (horizontal to vertical), while maintaining the constraints at the toe and top of slope; or
Alt. Solution 5.	Relocating the Grand River banks further south in order to achieve a stable slope line.

The Study Team assessed the Alternative Solutions against the evaluation criteria which included Public Health and Safety, Technical, Environmental, Archaeological and Heritage Resources, Socio-economic, Construction Cost, and Constructability. Following the initial evaluation, Alternative Solution 2 (Monitoring, Assessment, and Phased Stabilization) was presented as the preferred solution at the second PIC on March 12, 2019.

The comments and feedback received at the second PIC indicated that there was significant public interest to avoid alternative solutions that solely focused on further monitoring without implementing some form of physical slope stabilization. As a result, the preferred alternative carried forward was a hybrid of Alternative Solutions 2 and 4.

Alternative Designs (Phase 3 of the Municipal Class EA Process)

Based on the feedback from the second Public Information Centre (PIC) in March 2019 and the selection of the Alternative Solution (2 and 4), four (4) elements/components were identified and considered through the development of the Alternative Design Concepts. These elements included drainage of the slope, slope toe protection along the Grand River, mechanical stabilization of the slope and ongoing monitoring/assessment. Design Alternatives were developed and included concepts for each of the four elements.

Preferred Alternative Design

The Study Team assessed the Alternative Designs against the evaluation criteria which included Public Health and Safety, Technical, Environmental, Archaeological and Heritage Resources, Socio-economic, Construction Cost, and Constructability. The preferred Alternative Design was presented at the third Public Information Centre (PIC), held in November 2019. The preferred Alternative Design, as presented at the third PIC includes the following elements to be implemented with a phased approach:

Phase 1:

- Installation of a rock toe protection along the Grand River
- Installation of rock fingers (tied into and extending up from the toe of the slope) to facilitate draining of the lower slope and lower of the groundwater to the extent possible
- Installation of an overland flow/drainage strategy including collection trenches, slope drainage pipes and culverts under the existing Rail Trail
- Continued monitoring, including building upon the baseline LiDAR topography

Phase 2:

- Installation of a lower slope rock ballast as a form of mechanical stabilization

This preferred Alternative Design is being recommended for Implementation (Phase 5 of the Municipal EA process). The project is anticipated to have some environmental impacts as a result of the phased construction approach, which are intended to be mitigated to the extent possible in the Implementation Phase (through detailed design), and are considered acceptable to mitigate the potential risk of further slope failure that could have significant impacts to municipally owned infrastructure, transportation along Colborne Street (East), and local residents.

Public and Agency Consultation

In addition to a Notice of Commencement and a Notice of Completion of the Study being distributed to agencies, authorities and utilities, and published for the public, the study also included three (3) Public Information Centres, corresponding to Phases 1, 2, and 3 of the Municipal Class Environmental Process. The Study Team also developed and delivered a First Nations Consultation Plan for the Six Nations of the Grand River and the Mississaugas of the New Credit and presented the materials from the second Public Information Centre to the Six Nations representatives in March 2019.

This Environmental Study Report (ESR) will be placed on Public Record (Phase 4 of the Municipal EA process) following the Notice of Study Completion. The public will have the opportunity to review the ESR in full and make comments/express concerns to the Study Team.

Project Implementation

Detailed design is required to ensure that recommended works will be sustainable considering the flow characteristics of the Grand River and slope processes, to confirm the location of the overland drainage network and sizes, to confirm the limits and scope of the rock fingers and the mechanical stabilization, and to develop engineering drawings for tender and construction.

Following the completion of design and acquisition of the required permits and approvals (anticipated approvals required from Grand River Conservation Authority (GRCA), Ministry of Natural Resources and Forestry (MNRF) and Department of Fisheries and Oceans (DFO)), eligible contractors are recommended to be evaluated and pre-qualified to help contribute to the quality and effectiveness of implementation. This should be based on their previous larger scale water course rehabilitation and erosion control experience, with particular emphasis on in-water work experience.

Preliminary Cost Estimate

A preliminary cost estimate has been developed for capital planning and budget purposes. This cost estimate has been broken down based on the key elements of the preferred Alternative Design.

Preferred Design Element	Estimate Cost
Interceptor trenches and drainage pipes	$1.0 million
Rock fingers	$1.2 million
Rock toe protection (Grand River)	$0.7 million
Additional monitoring	$20,000 per annum
Rock ballast	$3.4 million

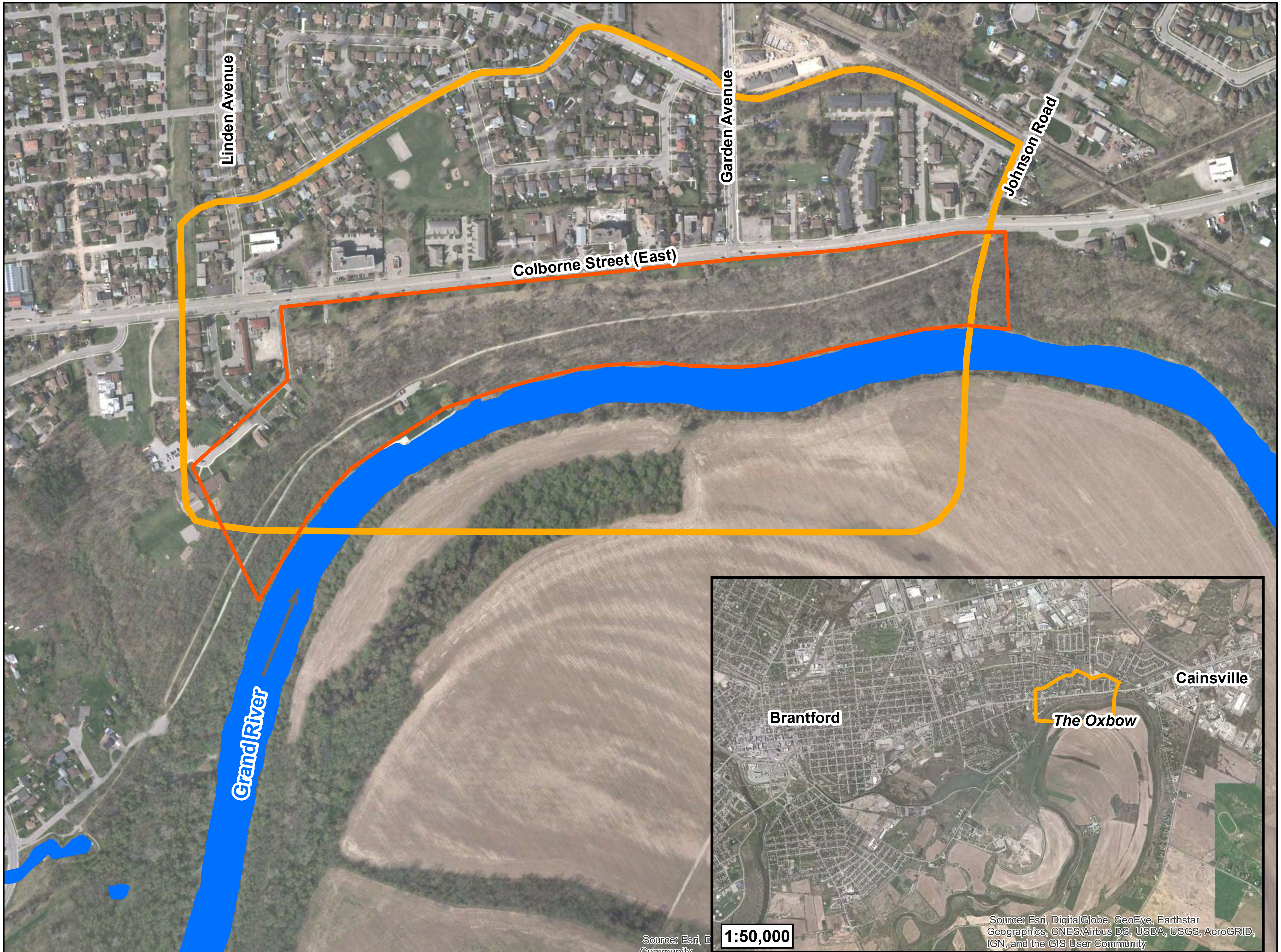
1. Introduction

1.1 Problem Statement

In May 1986, a major landslide occurred between Colborne Street East and the north bank of the Grand River, between Calvin Street to the west and Johnson Road to the east. The City of Brantford has performed slope monitoring of the area ever since, typically on an annual basis. Several studies have been completed to determine cause and effects of the landslide. Monitoring shows that slope movement continues to occur. Slope stability concerns revolve around soil type, moisture issues, and toe erosion. This Class Environmental Assessment (EA) has been initiated to develop feasible alternatives to address stability concerns and to create a management strategy for the area. It is being completed under Schedule “C” of the Municipal Class EA process.

1.2 Study Area

The Grand River flows through the City of Brantford and has a section known as ‘the Oxbow’ near Colborne Street East. The study area is located north of the Grand River and includes the slope of concern as well as the neighbourhoods north of Colborne Street East between Calvin Street and Johnson Road. The study area is shown in **Figure 1-1.** The slope monitoring area (referred to as the site in this report) is a smaller area within the study area where the major slope failure of 1986 occurred and where the slope has been monitored. The study area covers a larger extent in order to consider socioeconomic factors that may be impacted as required by the EA process. The study area also includes the Hamilton-Brantford Rail Trail, located along the former Canadian Pacific Railway. The total study area is approximately 0.63 km^2; the slope monitoring area is approximately 0.17 km^2.



Colborne Street (East) Slope Stabilization EA

Figure 1-1
Site Location Plan

Legend

- Study Area
- Slope Monitoring Area
- Waterbody (GRCA)

ecosystem recovery inc.
PROFESSIONAL ENGINEERS

0 65 130 260
Meters

NAD 1983 UTM 17N | **1:5,000**

Project: 1824 Colborne Street East - Slope Stabilization EA
Date: 2019/02

N W E S

Data Sources: Ecosystem Recovery Inc., 2019:
Contains Information made available under Grand River Conservation Authority's Open Data Licence v1.0.
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1.3 Background

1.3.1 Site Overview and Timeline

The site experienced a major slope failure on May 20, 1986 on the north slope of the Grand River. An Environmental Study Report (ESR) from 1995 states that the landslide was primarily caused by oversteepening due to erosion at the toe of slope, coupled with high groundwater levels within the slope. The landslide impacted several commercial and residential properties along Colborne Street East as well as the Canadian Pacific Railway (previously known as the Toronto, Hamilton & Buffalo Railway) near the toe of the slope. The landslide area occurred across approximately 280 m of the slope.

Following the major slope failure in May 1986, a number of studies were undertaken to analyze the cause of the failure and install monitoring equipment. Studies were undertaken by both Golder Associates and Trow Geotechnical Limited on behalf of the Grand River Conservation Authority (GRCA) and Canadian Pacific (CP) Railway, respectively. The first comprehensive study completed for GRCA was the Preliminary Engineering Study Report in 1987. Following the initial studies, the CP Railway was removed in 1988 and converted to the existing Hamilton-Brantford Rail Trail in 1996. An ESR was completed in 1995, which provided a characterization of existing conditions and presented alternative designs for structural stabilization solutions. A number of additional studies and updates to the ESR have been completed since its initial release; these are summarized in **Section 1.3.2**.

Slope monitoring equipment was installed in 1986 following the major landslide event. Inclinometer data (a device used to measure the angle of a slope) has been monitored since 1986, typically on an annual basis. Numerous boreholes have also been advanced in the study area between 1986 and 2019.

At the time of the 1986 landslide failure, there was a total of about 39 properties within the study area. Between 1986 and the completion of the 1995 EA, several properties were acquired by the City and demolished; as of May 1995 a total of 14 properties were identified in the study area with a total estimated market value of $1,305,500. By 2012, an additional eight (8) properties had been acquired, with seven (7) private property owners still located within the slope monitoring area. Presently, there are six (6) properties which are privately owned located within the slope monitoring area. These include:

- Three residential properties on Clara Crescent (32, 40, and 46 Clara Crescent);
- The Brantford Christian School on 30 Clara Crescent;
- A residential property on 73 Beach Road; and
- A residential property on 981 Colborne Street East (this structure is no longer present on site).

1.3.2 Summary of Previous Studies

This section provides a summary of previously completed studies related to the study area since the 1986 landslide event.

1.3.2.1 *Preliminary Geotechnical Assessment, Grand River Valley Wall (Golder Associates), 1986*

A Preliminary Geotechnical Assessment was completed by Golder Associates in June 1986, following the May 1986 landslide event. The assessment characterized the geotechnical conditions of the site, including a description of the slope as approximately 30 m high, consisting of an upper and lower zone, and possessing an overall slope angle of 14° to 16.5°. The subsurface is described as an extensive deposit of clayey soils with occasional granular layers overlying bedrock; the groundwater levels are described as high with artesian pressures suspected in the area of the lower slope and floodplain. The failure was attributed to a combination of ongoing erosion at the toe of the slope and high groundwater levels. The slope failure was suspected to be caused by an initial failure in the lower slope which removed the support for the upper slope, followed by the 1986 failure of the upper slope. The slope was considered to be inherently unstable, with an expectation of ongoing movements and failures without remedial measures.

Four (4) remedial measures were considered, including the Do Nothing alternative and three forms of erosion protection paired with cutting, filling, and/or regrading. The cost estimates for the alternatives excluding the Do Nothing alternative ranged from \$6 to \$11 million.

This geotechnical assessment was used to inform the geotechnical evaluation in the 1987 Preliminary Engineering Study report.

1.3.2.2 *Geotechnical Investigation Brantford Landslide (Trow Geotechnical Limited), 1986*

A geotechnical investigation was undertaken by Trow Geotechnical Limited at the request of Canadian Pacific Railway. The purpose of this study was to establish the geotechnical conditions and level of slope stability within the study area, provide preliminary comments on remedial measures, and comment on the impact of reinstating the disturbed railway tracks. The investigation included the advancement of 14 boreholes, as well as piezometers and slope inclinometers to monitor the slope.

The slope was characterized as approximately 30 m high with a slope between 3.5 to 4.4 horizontal to one (1.0) vertical. The soil in the slope was comprised of mostly glaciolacustrine sediments consisting of silt, clay, and sand; the soil stratigraphy was described as ‘very complex’.

The primary causes of the failure were found to be the high groundwater table and undercutting of the toe of the slope by the Grand River. The toe of the slope was estimated to have eroded between 13.0 m and 16.5 m from 1913 to 1986 (pre-slide), with the crest of the slope regressed between 2.8 m and 13.0 m in the same time period.

Secondary factors contributing to slope failure included placement of fill along the slope, railway loading and vibrations, discharge of water onto the slope from lawn watering, and leakage from various sources such as swimming pools and sewers. The traffic on Colborne Street East was not considered to have had an impact on the stability of the slope.

The reinstatement of the railway track was considered feasible if remedial measures and continued monitoring were implemented. The recommended remedial measures would include toe protection to prevent erosion and flattening of the slope to a stable angle.

1.3.2.3 *Preliminary Engineering Study, Grand River Valley Slope Failure (Golder Associates), 1987*

The Preliminary Engineering Study was prepared for GRCA in May 1987 by Golder Associates. The study was initiated following the landslide in 1986 and was completed to evaluate alternative remedial measures to stabilize the valley slope within the study area. The study considered the existing conditions including geotechnical conditions, river hydraulics, transportation and municipal services, environmental impacts, existing properties, economics and cost-benefit, and land use planning. The study stated that the 1986 landslide was largely caused by a combination of oversteepening of the clay slope due to river erosion at the toe of the slope and high groundwater levels within the clay soils.

Six (6) alternatives for slope remediation were considered, including their relative economic, social, and environmental costs and benefits. The alternatives included:

1. Do Nothing
2. Relocate Colborne Street
3. Fill Only

4. Cut and Fill
5. Cut Only
6. Oxbow Cut Off

The recommended alternative was to implement the cut and fill scheme, including:

- Protection of the valley slope by fill placement at the toe and excavation trimming at the upper portion, with provision of adequate river erosion protection at the toe of the stabilized slope;
- Acquisition of all properties south of Colborne Street (east of Clara Crescent and south of Calvin Street) within the study area to reduce the risk to life; and
- Implementation of several planning controls, including freezing the current land use and prohibiting building in the study area until stabilization works are carried out, designating the study area as a special hazard category in the Official Plan, and registration of fill lines pursuant to O. Reg. 154/86 under the Conservation Authorities Act to prevent dumping or placing of fill within the study area.

Preliminary design drawings of the recommended plan were also produced. The estimated cost of the project in 1987 was $12.4 million for an immediate construction, or $14.9 million for a phased construction.

1.3.2.4 *Update of Preliminary Engineering Study, Grand River Valley Slope Failure (Golder Associates), 1992*

The Preliminary Engineering Study released in May 1987 was updated in 1992 by Golder Associates. The study was done to re-evaluate the alternatives and their economic costs in consideration of the GRCA's purchase of properties on Colborne Street East, the formal abandonment of the railway line and the storm sewer down the slope, and the reconstruction of Colborne Street on the east end of the site.

The update considered the six (6) alternatives from the original study, as well as an additional alternative consisting of erosion protection at the toe of the slope and riverbank. The recommended alternative was the erosion protection scheme, which included:

- Placement of suitable riprap to protect the riverbank toe of slope zone;
- Minor cutting and regrading of the banks, as well as minor regrading of steep portions of the upper slope to provide a suitable slope for table lands; and
- The same property acquisition and planning controls recommended in the original 1987 study.

The estimated cost of the construction of the recommended scheme in 1992 was approximately $6.0 million. Annual maintenance and monitoring was estimated to cost $20,000.

1.3.2.5 *Environmental Study Report, Grand River Slope Stabilization Class Environmental Assessment (Golder Associates), 1995*

The GRCA initiated the undertaking of a Class Environmental Assessment in 1993 in order to protect life and property from another major slope failure. It was determined that an Environmental Study Report (ESR) was required based on the potential for the project to produce negative impacts, and trade-offs must be made in choosing among alternative methods of remedial work. The study characterized the existing conditions in terms of the physical environment, biological environment, socio-economic environment, cultural environment and the engineering or technical environment.

The three (3) options presented for the Class EA planning process were do nothing, land acquisition or floodproofing, and structural works. It was determined that implementing structural works was the only option that would reduce the potential for another major slope failure and met the requirements for remedial flood and erosion control projects. Eight (8) alternative methods for structural works were examined, including:

1. Do nothing;

2. Relocate Colborne Street;
3. Fill only;
4. Cut and fill;
5. Cut only;
6. Oxbow cut off;
7. Toe erosion protection; and

7A. Toe erosion protection with minor filling and trimming.

The alternative methods were evaluated based on a number of criteria, including public health and safety, physical, biological and environmental, heritage and archaeological resource, social, economic, and engineering criteria. The preferred alternative was Alternative 7A, which included:

- Erosion protection in the form of riprap along the toe of the slope, with minor localized regrading of the lower portion of the slope to accommodate the erosion protection works;
- Minor cut and fill works on the upper portion of the slope; and
- Property acquisitions, including six (6) or seven (7) of the 14 properties present at the time of the study

The preliminary design drawings for the preferred alternative were provided in the study. The estimated cost of the preferred alternative, including construction and property acquisition costs, was estimated in 1995 to be approximately $4.6 million, with an additional annual average maintenance cost of $20,000 for 20 years.

1.3.2.6 *Update of Engineering Component 1995 Environmental Study Report (Golder Associates), 2012*

An update to the engineering component and costs identified in the 1995 ESR was prepared by Golder Associates in 2012, which included a re-evaluation of the slope stability and preferred alternative using the available data.

At the time of the 2012 update, seven (7) properties were occupied within the study area, in comparison to the 14 noted in the 1995 ESR. The additional stability analysis conducted in this study examined factors of safety for failures impacting Colborne Street East and buried utilities within the right of way. The estimated the factors of safety were between 1.2 and 1.5, indicating low probability of failure. The study also noted that the debris deposited into the Grand River as a result of the 1986 landslide event had mostly eroded away, and the Grand River had mostly returned to its pre-failure average width of 50 m. The four characteristic zones identified in the 1987 Preliminary Engineering Study on the basis of slope geometry were labelled Zones A to D, with Zones B and C being subdivided further into Zones B1, B2, B3, C1, and C2. The characteristic slope zones are shown in **Figure 1-2** (ERI, 2015). The apparent rate of toe erosion within Zone A appeared to have increased to 0.5 m per year, with an apparent erosion rate of 0.4 m per year in Zones B, C, and D.

Figure 1-2. Characteristic Slope Zones

The review of the remedial options indicated that Alternative 7A from the 1995 ESR remained the preferred alternative. The updated cost estimate of the alternative was approximately $5.7 million. It was also recommended that the design of the alternative should include improvements to surface drainage across the site. It was noted that a detailed EA would be required if the preferred alternative was adopted by the City of Brantford.

1.3.2.7 *Grand River Valley Slope Monitoring, Colborne Street East Landslide Area (Golder Associates), 2014, Updated 2015*

Grand River Valley Slope Monitoring Reports have been released periodically by Golder Associates since 1992; for brevity, the discussion from the most recent 2014/2015 report is summarized here.

The borehole inclinometers indicated larger deformations (20 mm – 40 mm) in boreholes 104B and 105B east of the former landslide area in slope Zones B2 and C1. Breaks and kinks in inclinometers were noted in boreholes between 103 (located within the former landslide area) and 107 (east of the landslide area). Deformations between 20 mm and 200 mm were previously noted in 2011 and 2012 at boreholes between 103 and 105B located in slope zones A, B2, and C1. Borehole locations are shown on the Golder Figure 1 in **Appendix A**.

The borehole inclinometer monitoring is noted to be consistent with ground surface displacement measurements, with larger deformations in the order of 30 mm to 140 mm between 2011 and 2012 noted in Zones B2 and C1 in the central portion of the slope where tension cracks were previously observed. Ground surface deformations in the order of 65 mm to 300 mm were measured in the lower portion of the slope near the river's edge in slope zones B1, B2 and C1.

The piezometer monitoring indicated that groundwater surface elevations were within typical ranges between 2011 and 2012, with some slightly lower than normal groundwater surface elevations noted in some piezometers.

The report states that increased rates of deformation have been in response to elevated groundwater levels after extended periods of rainfall. Field observations indicate that erosion at the river's edge accompanied by small failures and downed trees is ongoing, and toe erosion east and west of the previous landslide area is also ongoing. Smaller scale slumps and failures are also ongoing in areas of previously noted tension cracks.

Based on the slope monitoring and field investigations, it was anticipated that additional deformations, possibly triggering a larger scale movement, may take place east of the former landslide area particularly with severe or persistently increased precipitation. It was also noted that the toe protection works constructed near the 73/77 Beach Road property may increase erosion downstream of the works (i.e., in the area east of the former landslide area).

1.3.2.8 *Colborne Landslide Documentation Review (Ecosystem Recovery Inc.), 2015*

Ecosystem Recovery Inc. (ERI) prepared a review of the slope monitoring report prepared by Golder Associates in 2015 for the City of Brantford. The review was done to provide additional interpretation of the available data to inform future work.

The review noted that Zones A and B are becoming increasingly unstable and remained at high probability for large scale failure. The probability of failure was rated as moderate for Zone C and low for Zone D. From a geomorphic perspective, based on the position of the slope zones within the river meander, Zone A would have the greatest potential for migration and Zone C would have the least.

The toe erosion rate was found to be consistently the highest in Zone A, while the toe erosion rate at Zone B has shown the greatest increase. The rate of overall slope movement between 2012 and 2015 was found to be the greatest in Zone C and the least in Zone A, while slope movement across the zones was considerably greater in the lower slope than in the upper slopes.

Analysis of meteorological and streamflow records was performed in order to correlate trends in data to slope movements. The review found that most recorded field observations occurred within six months of a monthly precipitation amount close to or exceeding 100 mm. Similarly, most recorded field observations occurred within a two month period following a streamflow event of 200 m^3/s or greater. The general examination of total annual precipitation and maximum daily precipitation indicates a trend towards a marginal increase in total annual precipitation, and an increase in the frequency of extreme precipitation events.

The review discussed the feasibility and cost implications of a number of design elements related to slope stabilization, including drainage improvements, toe protection and regeneration, and structural support in the form of rock ballast or retaining walls. The review also states that in the long term, there was no evidence to suggest that toe protection with minor slope adjustments would solve the slope deformation in the upper zones.

1.3.2.9 *Colborne Landslide Spring Survey Analysis and Field Observations (Ecosystem Recovery Inc.), 2016*

Additional review of collected data and field investigations was undertaken by ERI and summarized in a 2016 memorandum to the City of Brantford.

Review of ground surface monitoring data suggested that Zones B2 and C1 were the most active, followed by Zone A, during the 2002-2016 period. Zone B2 experienced the greatest deformation rate towards the Grand River in its lower zone between 2015 and 2016. It was postulated that the increases in deformation rates of the lower slopes in Zones B2 and C1 may be partially due to the armouring constructed at 73/77 Beach Road, which may also be reducing the deformation rate of the lower slope in Zone A.

Field observations of the study area over three visits during the months of April, August, and November included observations of:

- Erosion scarps in the upper slopes of Zones A and B2;
- Tension cracks along the slope faces;

- Seepage areas found in addition to the ones noted by the 2015 Golder Slope Monitoring Report, which coincide with slope movements toward the Grand River. Seepage was not found in locations where slopes deformed away from the Grand River;
- Seepage locations showed some seasonal variation, implying seasonal variation in groundwater and soil moisture conditions; and
- No notable changes in slope configuration or vegetation at the noted monitoring locations.

1.4 Objectives

The City of Brantford has undertaken this Environmental Assessment to develop and evaluate various alternative solutions and designs for the study area affected by the 1986 landslide near Colborne Street East. The alternative designs will address continued movement within the slope monitoring area, including any potential long-term alignments of Colborne Street East. While addressing the identified technical issues, environmental and socioeconomic impacts will also be explored and considered.

The specific objectives of this study are to recommend slope stabilization alternatives that:

1. Address the slope stability concerns;
2. Reduce the vulnerability of utilities and other infrastructure;
3. Provide little or no disruption to economic activities within the City of Brantford;
4. Maintain transportation function within the City of Brantford and surrounding County areas;
5. Minimize disruption and potential hazards to the natural environment;
6. Maintain the recreational and social function of the study area; and
7. Minimize capital and maintenance costs.

1.5 Study Timeline

The project was initiated by ERI in August 2018 following a procurement process by the City of Brantford. The timeline for this study is shown in **Table 1-1**.

Table 1-1. Study Timeline

Event	Date
Project start-up	August 2018
Notice of Commencement issued	August 2018
Public Information Centre (PIC) #1 at Mohawk Pavilion in Brantford	September 13, 2018
PIC #2 at Woodman Park Community Centre in Brantford	March 12, 2019
Selection of preferred alternative	March 2019
PIC #3 at St. Peter’s School in Brantford	November 23, 2019
Selection of alternative design	December 2019
Draft ESR issued to the City of Brantford	December 2019
Completion of ESR and Placement of ESR in Public Record	September 14, 2020
Notice of Completion issued and public review period	September 17, 2020

1.6 Project Members

The consulting team responsible for the Colborne Street East Slope Stabilization EA consists of:

- Ecosystem Recovery Inc. (ERI) – primary consultant responsible for water resources, fluvial geomorphology, and natural environment input;
- Pinchin Environmental Ltd. – responsible for the geotechnical investigation and alternatives input; and
- Archaeological Research Associates – responsible for the Stage 1 Archaeological Assessment, the Built and Cultural Heritage Assessment, and First Nations consultations.

This study was carried out in co-operation with and for the City of Brantford. GRCA staff were also consulted throughout the project and provided input on the characterization of the study area and alternative solutions and designs.

2. Environmental Assessment Process

2.1 Ontario's Environmental Assessment Act

The Colborne Street East Slope Stabilization Class EA project is subject to the provisions of Ontario's *Environmental Assessment Act*. The Act requires that an environmental assessment of any major public sector project that has the potential for significant environmental effects be undertaken prior to implementation to determine the ecological, cultural, economic, and social impact of the project.

The Act exists to "provide for the protection, conservation, and wise management of Ontario's environment". The act mandates clear terms of reference, focused assessment hearings, ongoing consultation with all parties involved — including public consultation — and, if necessary, referral to mediation for decision. An environmental assessment is a key part of the planning process and must be completed before decisions are made to proceed on a project.

To comply with the requirements of the Act, two types of environmental assessment processes can be applied to projects:

1. **Individual Environmental Assessment** (under Part II of the Act): This process includes the development of a project-specific Terms of Reference that is submitted for review and approval to the Minister of the Environment. This process is typically applied to large, unique or complex projects that do not have precedents that demonstrate a predictable and manageable environmental impact.
2. **Class Environmental Assessment**: This process applies to routine projects that have predictable and manageable environmental effects and follow a Terms of Reference that has been previously approved for certain types of projects. Provided that the approved Class EA process is followed, the project will comply with Section 13(3) a, Part II.1 of the *Environmental Assessment Act*.

2.2 Municipal Class Environmental Assessment

The Colborne Street East Slope Stabilization study falls under the Class EA process as a project with predictable and manageable environmental impacts, and will be carried out under the Terms of Reference established in the Municipal Class EA document, prepared by the Ontario Municipal Engineers Association in June 2000 (as amended in 2011).

Figure 2-1 illustrates the Municipal Class EA Process for the planning and design of projects, which is divided into five phases:

Phase 1 Identify the problem (deficiency) or opportunity.

Phase 2 Identify alternative solutions to address the problem or opportunity by taking into consideration the existing environment and establish the preferred solution taking into account public and review agency input.

Phase 3 Examine alternative methods of implementing the preferred solution, based upon the existing environment, public and review agency input, anticipated environmental effects and methods of minimizing negative effects and maximizing positive effects.

Phase 4 Document, in an Environmental Study Report, a summary of the rationale and the planning, design, and consultation process of the project as established through the above Phases and make such documentation available for scrutiny by review agencies and the public.

Phase 5 Implementation. Complete contract drawings and documents and proceed to construction and operation; monitor construction for adherence to environmental provisions and commitments. Where special conditions dictate, also monitor the operation of the completed facilities.

The Municipal Class EA applies to municipal infrastructure projects including roads, water, wastewater, and stormwater projects. There are several classifications of projects under the Class EA process, known as schedules, based on their potential environmental impact:

- **Schedule "A"** projects generally include normal or emergency operational and maintenance activities, where environmental effects are minimal. Only Phase 1 of the Class EA process must be completed prior to these projects being implemented.
- **Schedule "A+"** projects were introduced in 2007 and include an additional consultation component wherein the public is to be advised prior to the implementation of a Schedule "A" project.
- **Schedule "B"** projects generally include improvements and minor expansions to existing facilities, where there is the potential for some adverse environmental impacts. The first two phases of the Class EA process are completed for these projects, including the preparation and submission for public review of a Project File, prior to implementation.
- **Schedule "C"** projects generally include the construction of new facilities and major expansions to existing facilities and have the potential for significant environmental impact. The complete Class EA process is undertaken for these projects prior to implementation, including the production of an Environmental Study Report.

The Colborne Street East Slope Stabilization Class EA is being completed under Schedule "C" of the Municipal Class EA process, as the project may involve significant environmental impacts and significant impacts to infrastructure within the study area. The project involves works undertaken in and adjacent to a watercourse and major traffic corridor for the purposes of slope stabilization and/or erosion control, which may include:

- Slope stabilization techniques, including cutting and filling or geotechnical stabilization;
- In-channel erosion protection works;
- Relocation, realignment, or channelization of watercourse; or
- Relocation or adjustment to a major traffic corridor.

Due to the factors listed above, as well as the current ownership of private properties directly within the slope monitoring area and the potential for significant adverse environmental impacts as a result of either a future slope failure or slope stabilization method, the project is being undertaken as a Schedule "C" Class EA.

2.3 Part II Order

A project that is carried out following an approved Class EA process will comply with Part II of the *Environmental Assessment Act*, and will thus not require an Individual Environmental Assessment and approval from the Minister of the Environment. However, if during the project planning and consultation process there are agency or public concerns that cannot be resolved, the concerned party may request that the project comply with Part II of the Act and undertake a higher level of assessment. Such a request is called a "Part II Order".

The request for a Part II Order should be made only when there are outstanding significant environmental issues that cannot be resolved through the class EA process, through discussions with the proponent or through mediation. The Part II Order must focus on potential environmental effects of the project and must not be made for the sole purpose of delaying or stopping the project or include issues that are not related to the project.

The request must be made in writing to the Minister of the Environment after the proponent has issued a Notice of Completion of the environmental study report. The proponent must also be copied on the request. Ministry staff will review the request, consider evaluation criteria, consult with other technical staff and make a recommendation to the Minister. Depending on the project, the ministry's review typically lasts between 30 and 66 days. The Minister can:

- Deny the Part II Order request, with or without conditions;
- Refer the matter to mediation; or
- Require that an Individual EA be prepared in order to comply with Part II of the Act.

If a Part II Order request is made prior to filing of the Notice of Completion, the requestor will be advised to bring the concerns to the attention of the proponent (i.e., the City of Brantford).

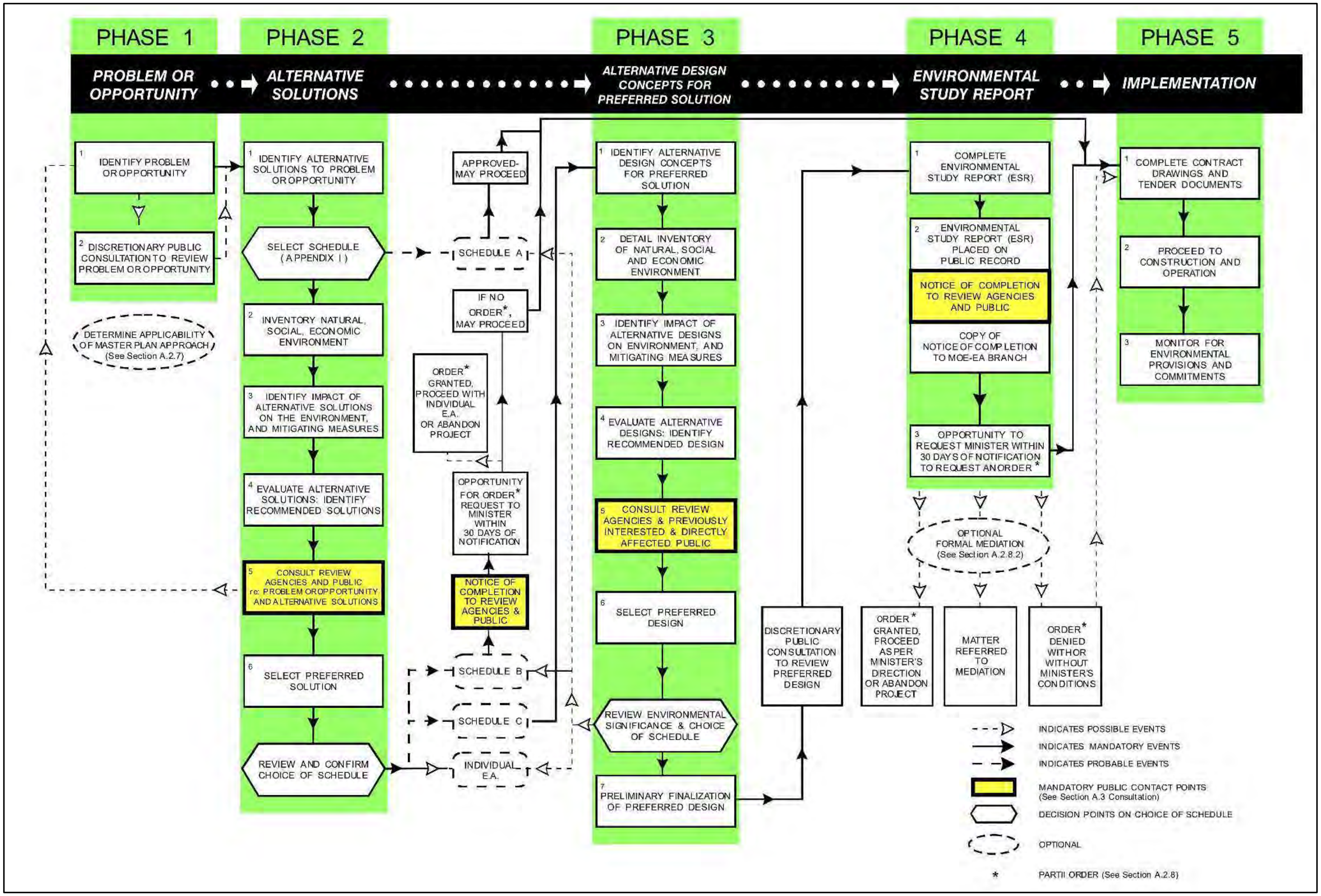


Figure 2-1. Municipal Class EA Process

3. Existing Conditions Characterization

Existing conditions along the slope within the study area were characterized in detail to provide an effective basis of evaluation of potential slope stabilization alternatives within the context of the Municipal Class Schedule 'C' EA. Field and desktop reconnaissance included site walks, a topographic survey, geotechnical investigation, analysis of the ongoing slope monitoring results, geomorphic characterization, natural environment investigations, a Stage 1 Archaeological Assessment, an assessment of the social and cultural environment, and an economic cost and life cycle analysis. This chapter describes the technical, ecological, and social environments in the study area.

3.1 Slope Condition and Monitoring

3.1.1 Slope Conditions

The Site is situated on an outside bend of the Grand River, in an area known as 'The Oxbow'. The slope has an overall height of approximately 28 to 30 m, extending from an elevation of 189 to 190 metres above sea level (masl) at the Grand River to 219 to 220 masl at Colborne Street. The overall total slope is between 3.6:1.0 (horizontal:vertical) and 4.5:1.0; however, the slope can be divided into an upper and a lower slope component separated by the Hamilton-Brantford Rail Trail (the former CP Rail Line).

The upper slope is between 7 m and 18 m high with the shorter slopes located at the east end of the study area. The overall slope is between 2.1:1.0 and 4.4:1.0. It should be noted that in several locations the top 3 to 5 m of the upper slope is over steepened with a slope of more than 2.0:1.0 before it plateaus to the Hamilton-Brantford Rail Trail.

The lower slope, which extends from the Hamilton-Brantford Rail Trail to the Grand River, is between 10 m and 22 m high and is generally sloped at between 3.7:1.0 and 5.8:1.0. There are sections of the slope in the central area and west end of the site where the upper 8 to 10 m of the lower slope is inclined at 2.5:1.0.

The slope is generally covered with mature trees and underbrush; however, several locations where slope failures continue to occur are sparsely vegetated, especially through the center portion of the site.

3.1.2 Slope Monitoring

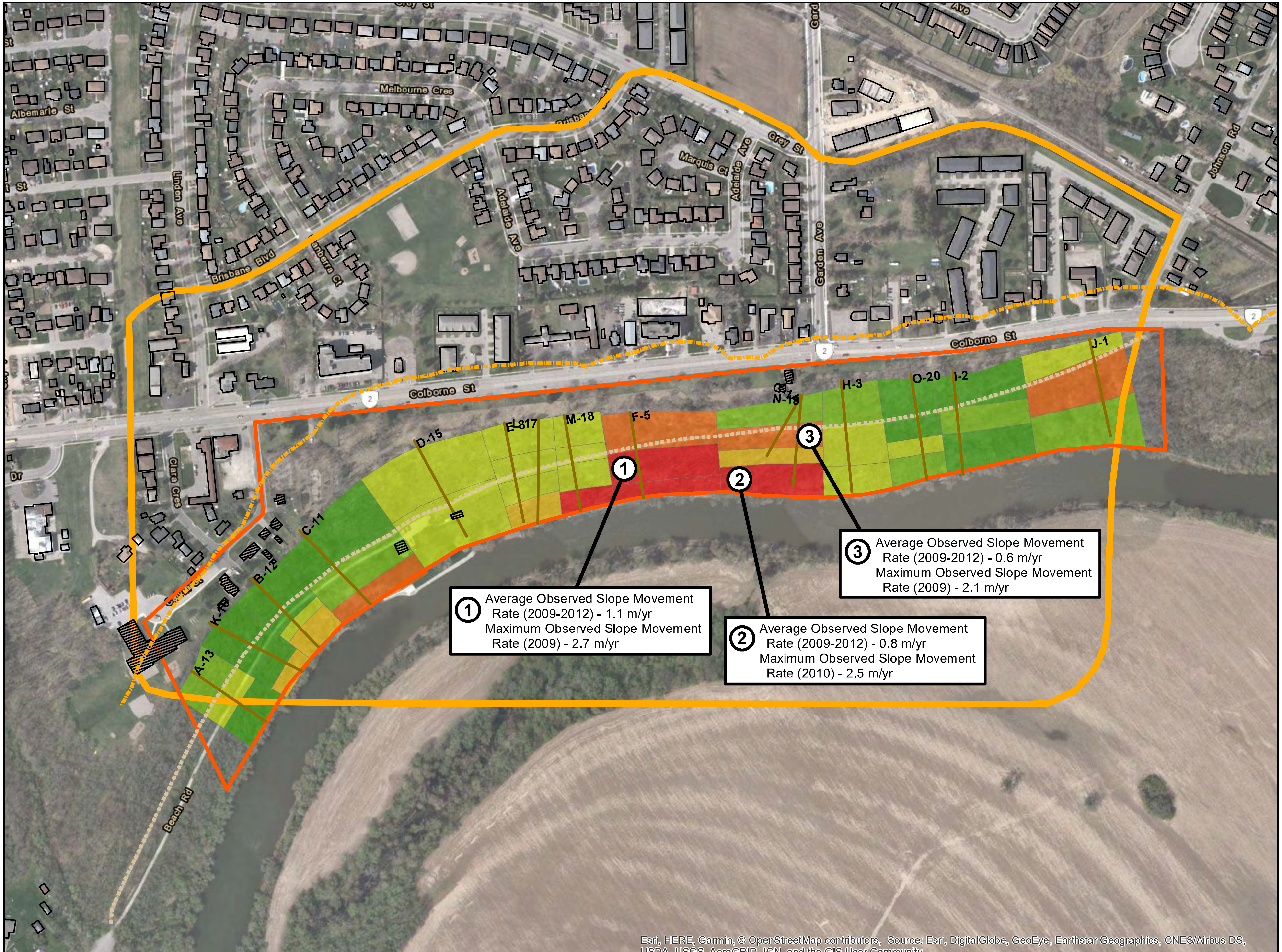
Slope inclinometers were installed at various locations along the slope. Golder Associates Ltd. (Golder) monitored the inclinometers until May 2014. The results of the May 2014 measurements were provided in the following report:

- Golder Associates Ltd. Grand River Slope Monitoring, Colborne Street East Landslide Area, Grand River Valley Wall, Brantford Ontario, June 2014, Report No. 861-3369-25

Golder had been measuring the deformation of eight slope inclinometer borehole wells – boreholes BH1, BH6B, BH101A, BH102, BH103, BH104B, BH105B, and BH107.

Pinchin visited the site in November 2019 to complete borehole inclinometer readings at the above noted slope inclinometers. Their approximate locations are provided on the Golder Figure 1 in **Appendix A**. During the site visit only the monitoring wells at BH6B, BH105B, and BH107 were accessible or able to be found. The measurements were taken with an RST Instruments Inc. MEMS Digital Inclinometer and inputted into the RST Inclinalysis™ software for analysis. The results of the inclinometer readings are provided in **Appendix A**. The plots provided in **Appendix A** indicate that the slope movement is similar at the measured locations, but the magnitude or increase in movement from 2014 until 2019 based on borehole inclinometers is unknown.

In addition to the Golder monitoring, the City of Brantford has continued the slope inclinometer monitoring program to the present date. This inclinometer data measures annual variations in surface movement in the slope area, collected over multiple monitoring lines in the study area. This data was spatially interpolated to generate estimates of slope movement rates from the provided data period of 2002 – 2018. This slope rate interpolation is provided in **Figure 3-1**.



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Colborne Street East Slope Stabilization EA

Figure 3-1
Slope Movement Rates

Legend

- River Slopes Allowance (GRCA)
- Building Footprint - Outside Study Area
- Building Footprint - Within Study Area
- Monitoring Lines
- Hamilton-Brantford Rail Trail
- Slope Monitoring Area
- Study Area

Average Observed Slope Movement Rate (m/yr), 2002-2018

- 0.009 - 0.022
- 0.023 - 0.037
- 0.038 - 0.086
- 0.087 - 0.163
- 0.164 - 0.248
- 0.249 - 0.433

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0 50 100 200
Meters

NAD 1983 UTM 17N | 1:4,000

Project: 1824 Colborne Street East - Slope Stabilization EA
Date: 2018/09

N W E S

Data Sources: Ecosystem Recovery Inc., 2018: City of Brantford

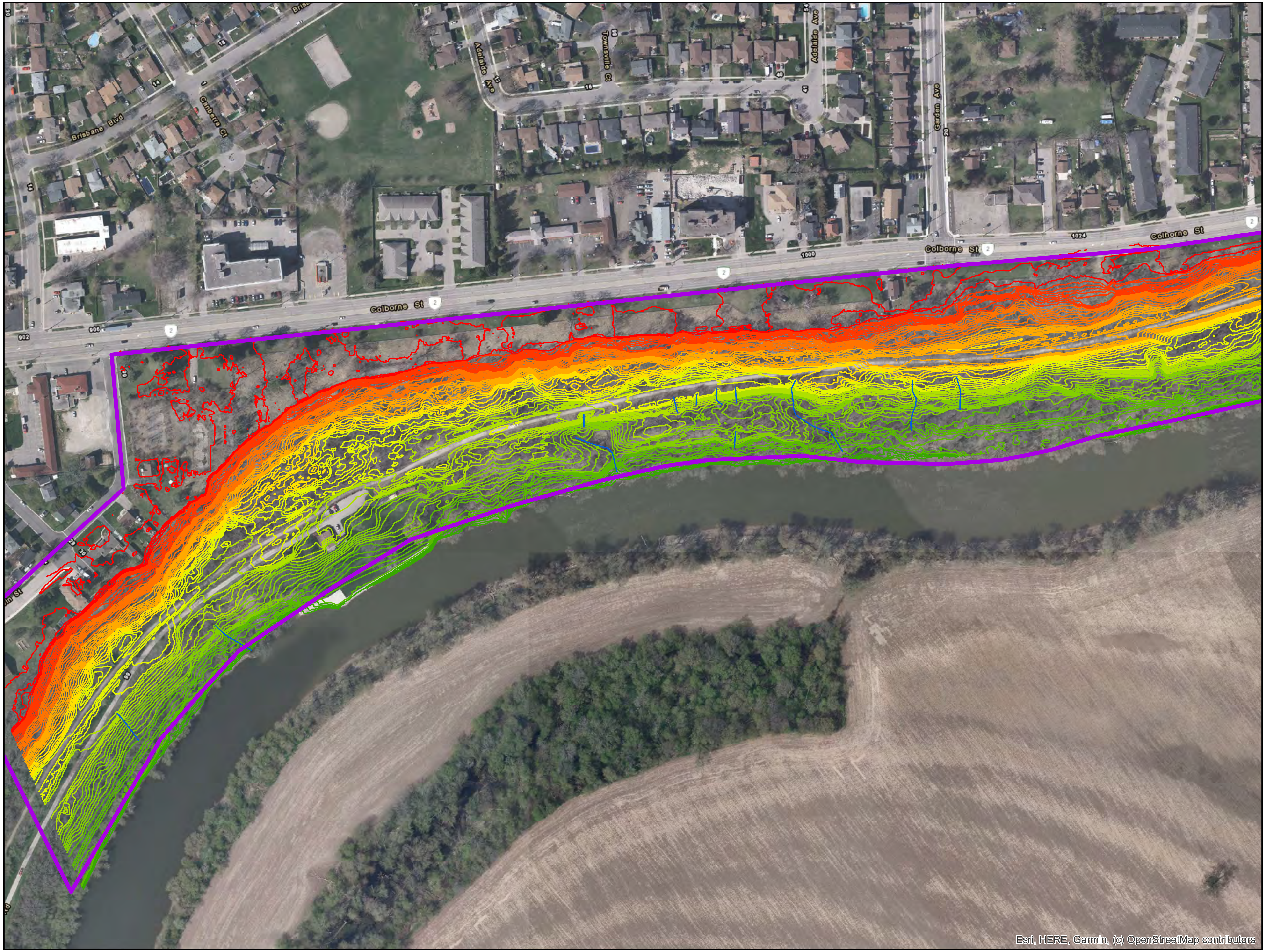
3.1.3 LiDAR Data Collection

A drone LiDAR (Light Detection and Ranging) survey to collect low-level, high-density bare earth topographic data in the slope monitoring area was completed in November 2018 by High Eye Aerial Imaging Inc. The drone collected data with a minimum of 40-80 points per square metre. This data was used to build a bare earth digital terrain model (DTM) of the slope monitoring area. The DTM may be used to locate a number of features on the slope, including low lying wetland features verified in the field, drainage pathways across the Hamilton-Brantford Rail Trail, and potential outfalls with associated erosion in the slope monitoring area.

An additional LiDAR dataset was collected via helicopter on November 28, 2019 by Aethon Aerial Solutions. This dataset was provided with an estimated 31.7 points per square metre and ± 3 cm accuracy. The data is in the CGVD28 vertical datum system.

A Digital Terrain Model (DTM) dataset collected in 2018 was also available from provincial data sources through Land Information Ontario (LIO), which provides coverage for portions of Ontario. These LiDAR sources were used to support other project components where topographic data was required and to obtain a more precise understanding of slope movement within the study area.

The topographic data collected by the 2018 drone survey is shown in **Figure 3-2**. The seepage paths along the slope were manually delineated based on the contour data. An overlay of the LiDAR data over multiple years of data collection may be used in future studies to determine slope failure areas and estimate slope movement rates with a high degree of spatial precision.



Colborne Street East Slope Stabilization EA

Figure 3-2
Drone Survey Data

Legend

- Study Area
- Seepage Paths (LiDAR)

Contour Elevation in metres (50cm resolution) from 2019 LiDAR Survey (CGVD28 Vertical Datum)

- 189.500 - 191.500
- 191.501 - 195.000
- 195.001 - 198.500
- 198.501 - 201.500
- 201.501 - 204.000
- 204.001 - 206.500
- 206.501 - 210.000
- 210.001 - 214.000
- 214.001 - 218.000
- 218.001 - 221.000

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0 30 60 120
Meters

NAD 1983 UTM 17N | 1:2,700

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Date: 2020/04

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Data Sources: Ecosystem Recovery Inc., 2020;
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3.2 Natural Environment

A characterization of the natural environment was completed for the study area and the surrounding lands. A background study was completed based on available information to understand the natural heritage features and species that are known to or have the potential to occur within the study area. This included information from the Ministry of Natural Resources and Forestry (MNRF) Guelph District, Natural Heritage Information Centre (NHIC) data records (MNRF 2017), and GRCA. Background wildlife species records were compiled using Ontario Mammal Atlas (Dobbyn, 1994), Ontario Herpetofauna Atlas (Ontario Nature, 2019), Ontario Breeding Bird Atlas (OBBA) (BSC, 2006), Lands Information Ontario (LIO) records, and the Ontario Butterfly Atlas (Macnaughton et al., 2017). Aerial photography and available mapping were also collected and reviewed.

3.2.1 Background Information

3.2.1.1 *Significant Species Screening*

A screening exercise was completed to identify provincially designated Species at Risk (SAR) and Species of Conservation Concern (SCC) that are known in the vicinity of the study area (i.e., within 10km) and have potential to occur in the study area. The screening was carried out by comparing the preferred habitats of SAR and SCC that are known in the City of Brantford and have records from various wildlife atlases in the vicinity of the study area to the habitats present within the study area.

SAR are those listed on the Species at Risk in Ontario List (SARO, MNRF, 2016). These include species identified by the Committee on the Status of Species at Risk in Ontario (COSSARO) as provincially Endangered, Threatened, or of Special Concern. Species listed by COSSARO as Endangered or Threatened are protected by the Endangered Species Act (ESA) of 2007, which includes protection of their habitat, and are referred to as regulated SAR. Species considered Special Concern are included in the definition of SCC, which includes the following:

- Species designated provincially as Special Concern;
- Species that have been assigned a conservation status (S-Rank) of S1 to S3 or SH by the NHIC; and
- Species that are designated federally as Threatened or Endangered by the Committee for the Status of Endangered Wildlife in Canada (COSEWIC) but not provincially by COSSARO. If these species are listed under the Species at Risk Act (SARA) under Schedule 1 they are protected by the federal Act but not provincially by the ESA.

Full SAR/SCC screening results are provided in **Appendix B (Attachment A).** SCC are discussed further within the context of Significant Wildlife Habitat (SWH) in **Appendix B (Attachment B).**

3.2.1.2 *Significant Wildlife Habitat Screening*

A screening exercise was completed to confirm or identify potential (i.e. “candidate”) SWH that may occur within the study area. SWH is protected under the Ontario Provincial Policy Statement (OMMAH, 2014) and is described in the Ontario Ministry of Natural Resource (OMNR) Significant Wildlife Habitat Technical Guide (SWHTG) (OMNR, 2000) as being comprised of 4 major categories of habitat:

i. Seasonal concentration areas;
ii. Rare vegetation communities and specialized wildlife habitat;
iii. Habitats of species of conservation concern; and
iv. Animal movement corridors.

Specific criteria defining wildlife habitat significance for Ecoregion 7E, in which the study area is located, are described in the SWHTG Addendum (MNRF, 2015). Individual SWH types within these 4 broad categories were assessed as either not present, candidate, or confirmed for the study area based on a comparison of significance criteria against information obtained from relevant background documents and original field surveys. Detailed results of the SWH screening are provided in **Appendix B (Attachment B)**.

3.2.1.3 *Agency Consultation*

The MNRF Guelph District was consulted to request available natural heritage information, SAR records, and relevant wildlife records. The MNRF was contacted by the City of Brantford, and a response was received on September 24th, 2018. The response letters from the MNRF correspondence are provided in **Appendix B (Attachment C)**.

ERI, the City of Brantford, and the Grand River Conservation Authority conducted a site walk on July 30th, 2018 to view the exiting site conditions and discuss the proposed work plan and project undertakings.

3.2.2 Methodology

Information on the existing conditions of the terrestrial and aquatic environment within the study area was gathered from a combination of secondary source research, field investigations, and agency consultation.

3.2.2.1 *Available Secondary Source Information Collection and Review*

Available secondary sources of information were collected and reviewed to determine the existing conditions of the natural environment within the study area. The sources reviewed are outlined in **Table 3-1**.

Table 3-1. Reviewed Sources for Existing Natural Environment Conditions

Source	Information Reviewed
Ministry of Natural Resources and Forestry (MNRF)	• Species at Risk (SAR) • Natural heritage features data layers from Land Information Ontario • Correspondence from Guelph District
Fisheries and Oceans Canada (DFO)	• Species at Risk Fish and Mussel Maps (2018)
Natural Heritage Information Centre	• Data records for study Area
Ontario Breeding Bird Atlas	• Species records for study area
Ontario Mammal Atlas	• Species records for study area
Ontario Reptile and Amphibian Atlas	• Species records for study area
Ontario Butterfly Atlas	• Species records for study area
Atlas of the Mammals of Ontario	• Species records for study area
Ontario Odonate Atlas	• Species records for study area
GRCA Slope Stabilization Class EA	• Environmental Study Report
City of Brantford	• Official Plan Review Natural Heritage Strategy
City of Brantford	• Official Plan

3.2.3 Field Investigation Methodology

ERI staff conducted various site investigations in 2018 and 2019 to identify aquatic and terrestrial habitats and features present within the study area. Incidental wildlife observations were collected during all site visits. Investigations were conducted in the summer of 2018 and the spring of 2019. Dates and locations of specific surveys are presented in **Table 3-2.**

Table 3-2. Field Survey Summary

Field Investigation	Protocol	Date
Aquatic Habitat Assessment	Modified OSAP 2013	August 14, 2018; October 30, 2018
Ecological Land Classification	Lee et. al (2008)	August 23, 2018
Vascular Flora and Fauna Inventory	Systematic search by ELC polygon	August 23, 2018; September 13, 2018
Breeding Bird Survey	OBBA, 2001	June 14, 2019; July 4, 2019
Reptile Basking Survey	MNRF, 2019	June 7, 2019
Species at Risk Survey	MNRF, 2019	June 23, 2019

3.2.3.1 *Aquatic Habitat Assessment*

Detailed aquatic habitat assessments were completed on August 14 and October 30, 2018 to characterize aquatic features in the study area. The assessment was completed using a standardized protocol documented in the Ontario Stream Assessment Protocol 2017. Various characteristics, including stream morphology and riparian features, contribute to the overall condition of the watercourse. The entire 1 km length of the Grand River shoreline within the study area limits was assessed and detailed notes and photos were recorded.

The following information was documented during the aquatic habitat assessment:

- Substrate type and composition (i.e., silt, sand, clay, cobble, gravel, boulder, detritus, etc.);
- Riparian and aquatic vegetation;
- Potential fish habitat or presence of fish;
- Water temperature;
- Flow conditions;
- Adjacent lands (vegetation community type, riparian habitat, canopy cover, land use, etc.);
- Channel morphology;
- Instream habitat and cover;
- Basic field parameters such as pollution sources.

The portion of the Grand River within the study area was not divided into assessment reaches due to similar aquatic habitat and channel morphology along most of its shoreline. Only the north shore was assessed as it relates to the study and the river only to a safe wadable depth. Background aquatic information was made available about this portion of the Grand River, which was used to scope the aquatic assessment. No fish community assessment was required as part of this project after liaison with GRCA, as recent fish records for the area were available.

3.2.3.2 *Water Quality and Flow Monitoring*

Water quality and flow monitoring measurements were performed at defined locations during the aquatic habitat assessment on October 30, 2018. Water quality was monitored using a Horiba U-22 Multiparameter Meter, which measures pH, conductivity, dissolved oxygen (DO), oxidation reduction potential (ORP), turbidity, temperature, salinity, and total dissolved solids (TDS). Results of the water quality monitoring are presented in **Table 3-4**.

Water Temperature

Water temperature is an important indicator of thermal regime within a waterbody and influences the fish species composition, benthic composition, and aquatic vegetation community. In general;

- Warmwater stream (> 25°C);
- Coolwater stream (19°C to 25°C); and
- Coldwater stream (19°C).

pH
The Provincial Water Quality Objectives (PWQO) acceptable range for pH is between 6.5 and 8.5 (MOEE, 1994).

Dissolved Oxygen
DO is directly influenced by temperature and the PWQO acceptable range is variable. A table of acceptable PWQO parameters for dissolved oxygen are shown in **Table 3-3**.

Table 3-3. Acceptable PWQO for Dissolved Oxygen

Temperature (°C)	Cold Water Saturation (% Saturation)	Cold Water Biota (mg/L)	Warm Water Biota (% Saturation)	Warm Water Biota (mg/L)
0	54	8	47	7
5	54	7	47	6
10	54	6	47	5
15	54	6	47	5
20	57	5	47	4
25	63	5	48	4

Conductivity
Conductivity is a measure of Total Dissolved Salts (TDS), where the higher TDS value, the more dissolved salts are present. There is no acceptable range for TDS and measurement is used for baseline investigations to track changes to the TDS value over time.

3.2.3.3 *Fish Community*

A fish community assessment was not required as part of this project as recent fish data for the Grand River was available as a result of GRCA and MNRF electrofishing in close proximity to the study area limits. GRCA provided the data collected from this historical assessment to ERI on August 1, 2018.

3.2.3.4 *Terrestrial Field Assessment*

Ecological Land Classification (ELC)

Vegetation communities were characterized and mapped using the Ecological Land Classification (ELC) system for southern Ontario (Lee et. al., 2008) during two site visits on August 23, 2018 and September 13, 2018. Existing ELC data from the 2005 ESR was confirmed and updated by an ERI biologist. Details of the vegetation communities were recorded including species composition, dominance, and uncommon species or features. The vegetation inventory was compiled and refined by incidental observations recorded throughout all site visits. Specific to wetland communities, boundaries were delineated as per the Ministry of Natural Resources Wetland Evaluation Guidelines for Southern Ontario (MNRF, 2013).

Terminology used to describe each vegetation community is based on ELC sampling protocols that collect information on four vegetation layers in each community. The four layers are:

1) **Canopy** consists of tall vegetation which reaches the light first; typically composed of tall trees (in a forest community);
2) **Sub-canopy** includes vegetation growing just under the canopy; vegetation that receives filtered sunlight through the canopy; typically composed of trees and tall shrubs (in a forest community);
3) **Understory** includes vegetation growing below the sub-canopy; typically composed of both tall and low growing shrubs; and

4) **Ground** consists of vegetation which is closest to and covering the ground; typically composed of herbaceous vegetation.

This protocol classifies vegetation communities through the completion of a multilayer (canopy, sub-canopy, ground cover) vegetation inventory. When wetland communities were observed their boundaries were refined using the 50/50 rule (where plant species cover consists mostly of wetland plants) per the Ministry of Natural Resources Ontario Wetland Evaluation System (MNRF, 2013).

Vascular Flora Inventories

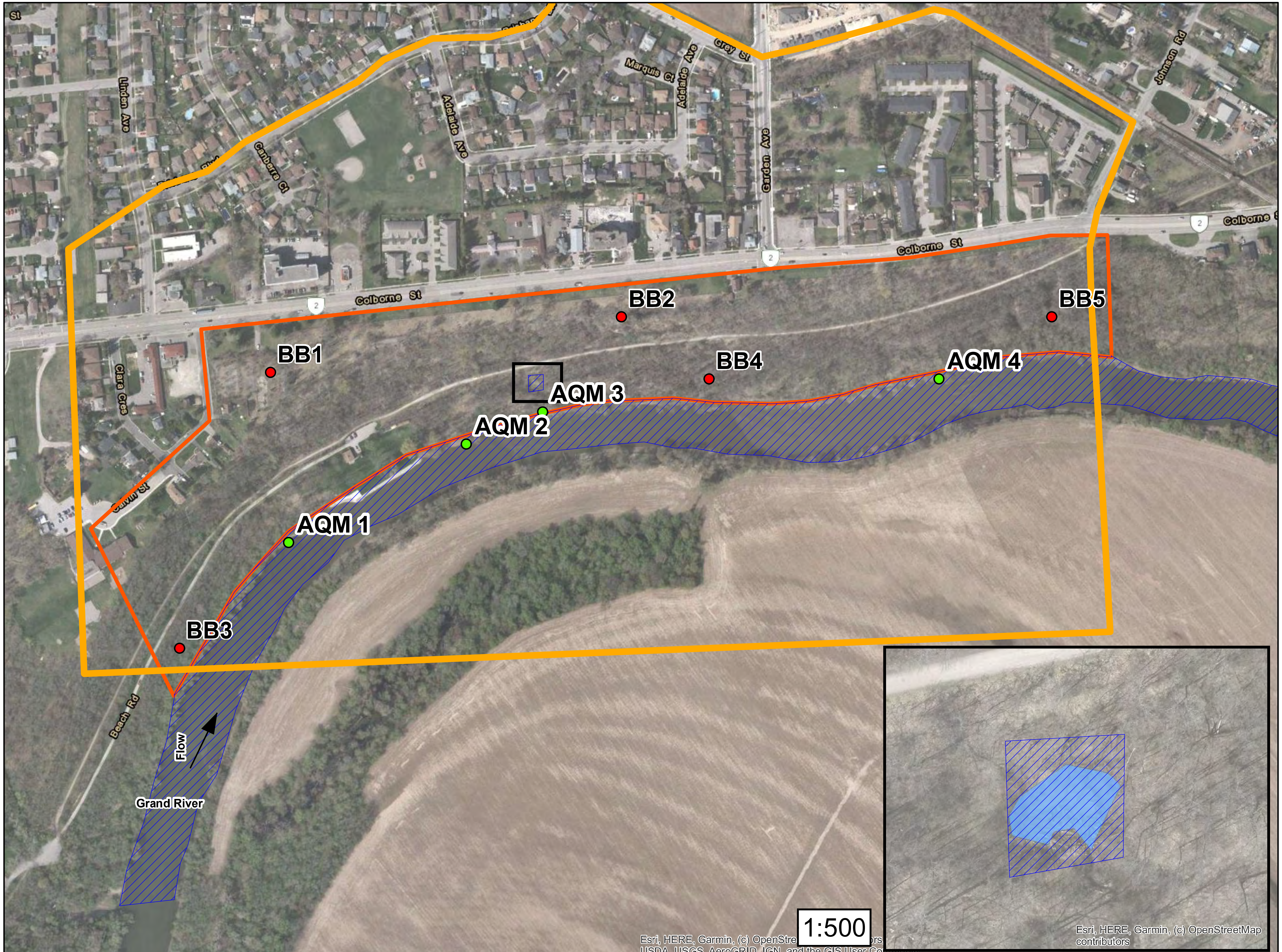
The vascular flora inventories were conducted in conjunction with the ELC on August 23, 2018 and September 13, 2018. An ERI ecologist systematically searched each ELC community and documented all species observed to species level unless a lack of distinguishing features for the flora was present.

Reptile Basking Survey

Reptile basking surveys for basking turtles are required to be completed between the “ice off” in April through mid-June and follow the MNRF survey protocol for Blanding’s turtles. Surveys must be completed on days with sunny conditions, low winds, and air temperatures above 10°C are required. Binoculars are used to scan the aquatic systems to look for basking turtles along the shorelines and on any logs or rocks. A reptile basking survey was conducted on June 7, 2019 along the Grand River and a small wetland within the study area.

Breeding Bird Surveys

Prior to breeding bird surveys, background data from the OBBA, eBird, and previous studies in the local area was collected to identify the species of birds that have been recorded in close proximity to the study area. Two breeding bird surveys were completed based on the OBBA and the Forest Bird Monitoring Protocol (FBMP). These surveys were conducted on June 14, 2019 and July 4, 2019. Five stations were selected in the study area and at each station a 10-minute point count was conducted for both visual and audible documentation of species presence including the highest level of breeding evidence exhibited for each species recorded. Incidental observations were also recorded during travel between stations and during all other field surveys on site for the duration of the project. The point count locations are shown on **Figure 3-3**.



Colborne Street East Slope Stabilization EA

Figure 3-3
Ecological Assessments

Legend

- Breeding Bird Survey Location
- Aquatic Habitat Assessment
- Study Area
- Turtle Basking Survey Location
- Slope Monitoring Area

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0 50 100 200
Meters

NAD 1983 UTM 17N | 1:4,000

Project: 1824 Colborne Street East - Slope Stabilization EA
Date: 2019/12

N W E S

Data Sources: Ecosystem Recovery Inc., 2019:
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When completing the surveys, breeding evidence was noted for each species. Breeding evidence is divided into four categories:

- **Confirmed breeding** (CONF) is identified as observations of any of the following: (1) a distraction display or injury feigning; (2) used nest or egg shell found (occupied or laid within the period of study); (3) recently fledged young or downy young, including young incapable of sustained flight; (4) adults entering or leaving nest site in circumstances indicating occupied nest (e.g., adult carrying fecal sac; adult carrying food for young) or (5) nest containing eggs, or nests with young seen or heard;
- **Possible breeding** (POSS) is indicated by the presence of a singing male (or breeding calls heard) in suitable habitat or the presence of a bird observed in suitable breeding habitat in its breeding season;
- **Probable breeding** (PROB) is defined as an observation of the following: (1) a pair in breeding season in suitable habitat, (2) permanent territory presumed through registration of a territorial song at least two days a week or more apart, at the same location or (3) courtship or display between a male and female or two males, including courtship feeding, copulation; visiting probably nest site; agitated behaviour or anxiety calls of an adult; brood patch on an adult female or cloacal protuberance on an adult male; nest building or excavation of a nest hole; and
- **Observed** (OBS) is defined as a species observed in tis breeding season outside its nesting habitat (no evidence of breeding.

Species at Risk Surveys

Correspondence with MNRF and GRCA identified SAR documentation within the local study area and surrounding Brantford area. A variety of SAR have been observed historically in the study area, identified to have the potential to occur in the vicinity, or identified by DFO mapping within the study area. SAR surveys for identified historical records of SAR within the local area were completed during all field assessments in conjunction with other wildlife and vegetation surveys. These followed MNRF survey guideline protocols.

Incidental Species Observations

Incidental species observations were recorded during all site visits for all wildlife (mammals, birds, butterflies, dragonflies, reptiles, amphibians). This included direct observations of individuals and signs of wildlife presence (i.e. tracks, scat, dens, nests, etc.).

3.2.4 Existing Conditions

3.2.4.1 *Aquatic Habitat Assessment*

The Grand River is a large river in southwestern Ontario, which originates near Wareham and empties into Lake Ontario running through many cities along its path. Within the study area the river is a single channel 45 to 65 m in width. The Grand River is classified as a warm water system, with many different fish species present. A fish community assessment was not performed as part of the current study.

Within the study area, the Grand River is a dominantly naturalized system with only a short length of riprap armouring protecting the shoreline at a private property. Areas of scouring and erosion are found along the shoreline, which is typical of the Grand River as a system. Most of the banks are void of vegetation below the high-water level. The adjacent land use is deciduous forest and agricultural fields and the north bank is deciduous forest on a slope. The water was clear at the time of assessment and the substrate varied, but overall is dominated by rounded coble, sand, and silt. The depth of the channel varied across it's width from 0.2 m to over 2 m.

During the time of survey on October 30, 2019, the water temperature in the river ranged between 6.0°C and 7.1°C. No groundwater inputs or evidence of groundwater inputs were observed.

3.2.4.2 *Water Quality*

Results of the water quality sampling along the Grand River are presented in **Table 3-4**.

Table 3-4. Water Quality Parameters

Parameters	Station 1	Station 2	Station 3	Station 4
pH	8.06	8.43	8.44	8.50
Conductivity (mS/cm)	0.925	0.883	0.882	0.885
Turbidity (NTU)	0	0	0	0
Dissolved Oxygen (mg/L)	8.77	11.9	10.71	10.80
Temperature (C)	6	6.82	7.11	7.10
Total Dissolved Solids (g/L)	0.592	0.566	0.563	0.566
Oxygen-reduction Potential (mV)	217	165	180	-

Flow data was collected in conjunction with the water quality monitoring. Results of the flow monitoring are presented in **Table 3-5**. Flow was collected using a Swoffer 2100 model.

Table 3-5. Flow Monitoring Results

Parameters	Station 1	Station 2	Station 3	Station 4
Flow Velocity (m/Sec)	0.51	0.43	0.73	0.64

3.2.4.3 *Fish Community*

A fish community assessment was not performed during this study because previous records of fish within the Grand River near the study area were provided by GRCA. A total of 18 fish and minnow species have been recorded within the Grand River in proximity to the study area. **Table 3-6** identifies the records of fish found.

Table 3-6. Fish Community Summary

Common Name	Scientific Name	SRANK	MNRF	COSEWIC	SARA	Locally Significant	NHIC	GRCA Records	MNRF Records	ERI Observations
	Cypriniformes									
Common Carp	*Cyprinus carpio*	SNA						x	x	
Mimic Shiner	*Notropis volucellus*	S5						x	x	
Bluntnose Minnow	*Pimephales notatus*	S5						x	x	
Spotfin Shiner	*Cyprinella spiloptera*	S4							x	
White Sucker	*Catostomus commersonii*	S5						x	x	
Northern Hog Sucker	*Hypentelium nigricans*	S4						x	x	
Black Redhorse	*Moxostoma duquesnei*	S2		THR				x	x	
Golden Redhorse	*Moxostoma erythrurum*	S4						x		
Shorthead Redhorse	*Moxostoma macrolepidotum*	S5						x	x	
Greater Redhorse	*Moxostoma valenciennesi*	S3						x		
	Hiodontiformes									
Mooneye	*Hiodon tergisus*	S4						x	x	
	Perciformes									
Rock Bass	*Ambloplites rupestris*	S5						x	x	
Smallmouth Bass	*Micropterus dolomieu*	S5						x	x	
Greenside Darter	*Etheostoma blennioides*	S4						x		
Rainbow Darter	*Etheostoma caeruleum*	S4						x	x	
Johnny Darter	*Etheostoma nigrum*	S5						x	x	
Eastern Sand Darter	*Ammocrypta pellucida*	S2		THR				x		
Logperch	*Percina caprodes*	S5						x	x	
Blackside Darter	*Percina maculata*	S4						x	x	
Round Goby	*Neogobius melanostomus*	SNA							x	
	Siluriformes									
Brindled Madtom	*Noturus miurus*	S2							x	
					Total	**0**	**0**	**18**	**17**	**0**

3.2.4.4 *Terrestrial Ecology Assessment*

Wildlife Communities

Wildlife observations were collected during each site visit in addition to the breeding bird and reptile basking surveys. Incidental faunal species observations are included in the bird and mammal tables found in **Appendix B (Attachments G and I)**.

Amphibians and Reptiles

Reptile basking surveys were conducted on June 7, 2019 along the Grand River and in a small wetland within the study area. The Ontario Reptile and Amphibian Atlas was reviewed and incidental species observations were recorded at each site visit. Based on the background data review, a total of 16 reptile and amphibian species have been recorded in the vicinity (within approximately 10 km) of the study area including 3 Special Concern species. No specific amphibian call surveys were performed during this study.

Reptiles and amphibian species identified in the Ontario Herpetofaunal Atlas as occurring within the study area are:

Reptile:
- Snapping turtle (*Chelydra serpentine*)
- Milk snake (*Lampropeltis triangulum*)
- Eastern gartersnake (*Thamnophis sirtalis sirtalis*)
- Northern map turtle (*Graptemys geographica*)
- Midland painted turtle (*Chrysemys picta marginata*)
- Red-eared slider (*Trachenys scripta elegans*)
- Red-bellied snake (*Storeria occipitomaculata*)

Amphibian:
- Northern leopard frog (*Lithobates pipiens*)
- Gray treefrog (*Hyla versicolor*)
- American toad (*Anaxyrus americanus*)
- Green frog (*Rana clamitans*)
- American bullfrog (*Lithobates catesbeianus*)
- Blue-spotted salamander (*Ambystoma laterale*)
- Red-spotted newt (*Notophthalmus viridescens*)
- Eastern red-backed salamander (*Plethodon cinereus*)
- Spring peeper (*Pseudacris crucifer*)

Species observed during the turtle basking surveys or as incidental wildlife observations by ERI include;
- American toad
- Gray treefrog

Vegetation Communities and Vascular Flora

ERI conducted a vegetation inventory and Ecological Land Classification (ELC) of the study area. The inventory and classification were refined over the course of multiple field visits and build upon the 1995 ESR for the area. ELC mapping of the study area was prepared following Ecological Land Classification for Southern Ontario: A First Approximation (Lee et al., 1998) and is present in **Figure 3-4**. To complete the classification, an ELC certified ecologist conducted two site visits to assess the landform and parent material, soil, and vegetation present on site. Six ELC community classes are represented within the study area, including forest and residential. Characteristics of each of the identified community types are provided below. Detailed vegetation inventories resulted in a total of 210 species of vascular flora being identified on site. Overall, many introduced species are present within this study area. The vegetation inventory is presented in **Appendix B (Attachment D)**.

One SAR tree, red mulberry (*Morus rubra*), was observed during the field surveys or is documented within the 1995 ESR. Non-native and invasive species were documented within the study area, most commonly found along the walking pathway. The invasive species found within the study area include phragmities, invasive honeysuckles, garlic mustard, and European buckthorn. Portions of the study area along Colborne Street consist of former residential properties that have been purchased by the City. As such, the vegetative communities within this area have planted varieties of trees and typical ornamental plants. These sites are also heavily disturbed and portions of the building foundations are still present within the landscape.

Colborne Street East Slope Stabilization EA

Figure 3-4
Ecological Land Classification

Legend

Slope Monitoring Area

ELC Code

- CGL-2: Parkland
- CUM1: Mineral Cultural Meadow
- CUT1: Mineral Cultural Thicket
- CVR-3: Single Family Residential
- FOD7-4: Fresh-Moist Black Walnut Deciduous Forest
- MAS3: Organic Shallow Marsh

0 50 100 200
Meters

NAD 1983 UTM 17N | 1:3,500

Project: 1824 Colborne Street East - Slope Stabilization EA
Date: 2019/12

N W E S

Data Sources: Ecosystem Recovery Inc., 2019:
Contains Information made available under Grand River Conservation Authority's Open Data Licence v1.0.
Contains information licensed under the Open Government Licence – Brantford.

Document Path: E:\1824 - Colborne Street Slope Stabilization EA\GIS\MXD\Ecological\1824_ELC_20191224.mxd

UPLAND

FOD7-4 Fresh-moist Black Walnut Deciduous Forest

This black walnut and Manitoba maple dominated mineral deciduous forest community is located within the riparian zone and slope terrace along the Grand River. This natural community is located between the Grand River and Colborne Street East. The forest is 10-25 m in height, canopy cover is 60-80% and the canopy is composed of black walnut, Manitoba maple, willow, green ash, bitternut hickory, and slippery elm. The sub-canopy is composed of green ash, European buckthorn, black walnut, gray dogwood, multi-flora rose, red osier dogwood, and honeysuckle species and covers 20-30%. The groundcover within this community covers 20-30% and is composed of garlic mustard, white avens, birds-foot trefoil, colts foot, riverbank grape, goldenrod, boneset, and aster species. Invasive species present within the community include phragmities, multiflora rose, and garlic mustard. Red mulberry, an endangered species, was identified within this community. The banks of the Grand River are barren of vegetation in many areas and evidence of erosion is present. Informal walking trails are present within this community, remnant garbage can be found sporadically, and evidence of railroad influences are present. The topography within the unit is varying, with low depressions, but overall is on a slope from Colborne Street down towards the Grand River. Small inclusion wetlands are present sporadically in low lying depressions within this community.

WETLAND

MAS3 Organic Shallow Marsh

This small pocket wetland community is an open water feature present mid slope surrounded by forest. The wetland is fed by drainage paths from upslope culverts, which meander and flow through a small overland flow channel seasonally. The organic substrate is over a metre in depth and narrow-leaved cattail and greater duckweed are present within the wetland. It is surrounded by willow, red osier dogwood, and gray dogwood.

CULTURAL

CGL-2 Parkland

This community is maintained “parkland”, which runs along Colborne Street East. It is not a typical parkland but is maintained as a landscaped community along the roadway. Abandoned residential properties with demolished houses are adjacent to this community and the typical landscaping is influencing the vegetative community. Vegetation includes manicured lawn, street trees, and shrub plantings. Small inclusions of thicket communities are also present within these areas. Tree species present within this community are variable and include northern catalpa and street trees such as gingko, tulip tree, American basswood, little leaf linden, Norway maple, black cherry and London plane tree. Small inclusions of thicket communities are also present within these areas. Other species present include eastern red cedar, Norway spruce, and eastern white cedar.

CVR_3 Single Family Residential

This community includes single family houses and a schoolyard. The residential properties are maintained manicured grass with sporadic landscaped trees, shrubs, and groundcover. This community provides little natural habitat for wildlife species beyond generalist wildlife species that are typically found within urban environments.

CUM1 Mineral Cultural Meadow

Mineral cultural meadow communities are present in multiple areas of the study area. They are present in the former residential property areas, which have had all structures demolished along the top of the slope on Colborne Street and along the public trail approximately halfway down the slope surrounded by fresh-moist black walnut deciduous forest. As these are disturbed communities, many non-native species of vegetation are present within the community including tartian honeysuckle (*Lonicera tartarian*), Phragmities (*Phragmities autralis*), common teasel (*Dipsacus sylvestris*), dame's rocket (*Hesperis matronalis*), common mullein (*Verbascum thapsus*), and European buckthorn (*Rhamnus cathartica*), amongst others. Common vegetation species found within this community include annual fleabane (*Erigeron annuus*), multiple goldenrod species (*Solidago sp*.), Virginia creeper (*Parthenocissus quinquefolia*), wild red raspberry (*Rubus idaeus*), and wild grape (*Vitis riparia*). Canopy cover within this community is 0-25%, with occasional tall trees and shrubs, but is dominated by ground vegetation. Red mulberry, an endangered species was identified within this community along the trail.

CUT1 Mineral Cultural Thicket

This thicket community is located in the western corner of the study area and is a disturbed community. An old building foundation is present within this community and the human influences are evident within the vegetation community. Ornamental tree species, pioneer successional species, and non-native species have established within this community. Vegetation found in this community includes Manitoba maple, black walnut, eastern cottonwood, northern catalpa, staghorn sumac, European buckthorn, honeysuckle species, willow species, eastern red cedar, red raspberry, blackberry, riverbank grape, trumpet creeper, goldenrod species, coltsfoot, poison ivy, common tansy, eastern red cedar, and white sweet clover, amongst others.

Reptile Basking Survey

A reptile basking survey was conducted on June 7th, 2019 along the Grand River and small wetland within the study area. The survey was completed following a modified version of the Survey Protocol for Blanding's Turtle in Ontario. Typically, five basking surveys are required to be conducted during the main basking season, from "ice off" in April through to mid-June. Project timing did not allow for 5 surveys, but a single basking survey was completed. Wetlands and the Grand River were surveyed from the edge with binoculars on a sunny day with low winds and air temperatures >10°C. Additionally, a kayak was used to float down the river from upstream to downstream, using the rivers slow current to drift. This allowed the use of binoculars to scan the shoreline, driftwood, and logs from a great distance away, and not disturb basking turtles prior to identification and a turtle count. The basking survey was carried out by a wildlife biologist trained in turtle identification.

Results of the survey identified many individual turtles basking on logs and the shoreline along the length of the Grand River. Species identified include snapping turtle, midland painted turtle, and red-eared slider. Turtle observed were both mature and juvenile. All turtle observed were within the Grand River and not present in the wetlands. The results of the survey are shown in **Table 3-7**.

Table 3-7. Turtle Basking Survey Results

Common Name	Scientific Name	Age Class	Number of Individuals
Snapping Turtle	*Chelydra serpentina*	Juvenile	0
		Adult	3
Midland Painted Turtle	*Chrysemys picta*	Juvenile	9
		Adult	16
Red-eared Slider	*Trachemys scripta elegans*	Adult	3
		Juvenile	0

Species found during the survey are common to the Brantford area, specifically along the Grand River. Red-eared sliders are considered invasive but are commonly found in habitats in southern Ontario. Snapping turtle is considered Special Concern in Ontario but are commonly observed in most aquatic habitats in southern Ontario.

Bird Species

Breeding bird surveys were conducted on June 14, 2019 and July 4, 2019. A total of 58 species were detected during the surveys and incidental observations. A list of species detected with evidence of breeding is provided in **Appendix B (Attachment F)**. The data obtained from the OBBA (BSC, 2006) includes 87 species that have been observed in proximity to the study area (10 x 10 km square for NHIC) and 92 from eBird. A list of all bird species known from the background data collection is provided in **Appendix B (Attachment G)**.

Based on the SAR and SCC screening (**Appendix B (Attachment A)**), 9 SAR or SCC bird species were identified as having potential to occur within the study area based on existing records in the vicinity and presence of appropriate habitat on-site (BSC, 2006). These species are provided below:

- Barn Swallow (*Hirundo rustica*) THR
- Bald Eagle (*Haliaeetus laeucocephalus*) SC
- Bank Swallow (*Riparia riparia*) THR
- Cerulean Warbler (*Setophaga verulea*) END
- Peregrine Falcon (*Falco peregrinus*) SC
- Wood Thrush (*Hylocichla mustelina*) SC
- Chimney Swift (*Chaetura pelagica*)
- Eastern Wood-Pewee (*Contopus virens*)

Two regulated SAR bird species were observed in the study area during the breeding bird surveys including the barn swallow and eastern wood-pewee. Six species were observed in recent eBird records including the chimney swift, peregrine falcon, barn swallow, bank swallow, rusty blackbird, and eastern wood-pewee. Historical records from the 1995 ESR identified common nighthawk within the study area. No nightjar surveys were performed as part of this study.

Mammal

Mammal-specific field surveys were not conducted as part of the project, but incidental observations were recorded. During field investigations eastern gray squirrel (*Sciurus carolinensis*) and muskrat (*Ondrata zibethicus*) were observed and signs of white-tailed deer (*Odocoileus virginianus*), northern raccoon (*Procyon lotor*), coyote (*Canis latrans*) and eastern cottontail (*Sylvilagus floridanus*) were noted.

According to the Atlas of the Mammals of Ontario (Dobbyn, 1994), 27 mammal species were reported from within 10 km of the study area. Background information and SAR/SCC screening identified potential habitat for little brown myotis (*Myotis lucifungus*), eastern small-footed myotis (*Myotis leibii*), northern myotis (*Myotis septentrionalis*), and tri-colored myotis (*Perimyotis subflavus*). No federally or provincially significant mammal species were observed by ERI during the field surveys of the study area. Refer to **Appendix B (Attachment I)** for a full list of mammals known or observed within the study area.

Butterfly Species

The Ontario Butterfly Atlas includes 38 butterfly species that are known to occur in a 10 x 10 km atlas square that overlaps the study area. This includes one (1) SCC, monarch (*Danaus plexippus*). This species was not observed by ERI during the field studies, but monarch habitat is present due to the presence of common milkweed. Refer to **Appendix B (Attachment H)** for a full list of butterfly species reported in the study area.

Species at Risk

Correspondence with MNRF and GRCA provided SAR documentation for the Brantford Colborne Street East area. A variety of SAR have been observed in the study area, identified by MNRF to have the potential to occur in the area, or have been identified on DFO mapping within the study area. Incidental observations, including SAR encountered, were collected during field investigations and are detailed in **Appendix B (Attachment A)**.

Background GRCA and MNRF records of SAR within the study area and surrounding lands include:

- Black redhorse;
- Silver shiner;
- Eastern sand darter;
- Round pigtoe;
- Wood thrush; and
- Wavy-rayed lampmussel.

NHIC records identify:

- Snapping turtle;
- Northern map turtle;
- Pignut hickory;
- Broad beech fern; and
- Bristly buttercup.

The forested communities within the study area may provide suitable habitat for provincially endangered northern myotis, eastern small-footed myotis, little brown bat, and tri-colored myotis.

Provincially tracked species include:

- Mucket;
- Elktoe;
- Black sandshell;
- Brindled madtom; and
- Greater redhorse.

SAR identified during the field surveys and recent public observations include:

- **Red mulberry (END)** is considered endangered provincially and federally and is a regionally significant plant species. These are smaller trees that grow 6-18 m tall, with fleshy fruit that is deep red in mid-July. They are found in moist, forested habitats on both sandy and limestone-based loamy soils. This species was found in in the FOD7-4, CUM1, and CUT1 ELC communities.
- **Eastern wood-pewee (SC)** is considered a SCC in Ontario. It is listed as Special Concern both provincially and federally. The eastern wood-pewee occurs throughout southern Ontario, breeding most often in

deciduous woods and sometimes in more open habitats, with a preference for open habitats (such as open water, roadways, and clearings) adjacent to nesting sites. The MNRF (OMNR, 2000) further describes the habitat of eastern wood-pewee as open, deciduous, mixed, or coniferous forest, typically in the mid canopy layer of forest clearings and edges of deciduous and mixed forests. It is most abundant in intermediate age mature forest stands with little understory vegetation (MNRF, 2018). This species was found calling and foraging within the FOD7-4 ELC community.

- **Chimney swift (THR)** is considered Threatened provincially and federally. One quarter of its breeding range is in Canada. As an aerial forager that concentrates near water, chimney swift are now associated with urban and rural settings and typically use chimneys as roosting and nesting habitat (COSEWIC, 2007). This species had an eBird observation within the study area on May 18, 2019.
- **Barn swallow (THR)** is considered Threatened provincially and federally. Barn swallows occur throughout Canada, with distribution in close association with human rural settlements. They prefer various open habitats for foraging including grassy fields, pastures, agricultural rows, lake and river shorelines, cleared rights-of-way, islands, farmland, and wetlands (COSEWIC, 2011). This species was found flying over the Grand River during the breeding bird survey.
- **Snapping turtle (SC)** is considered Special Concern federally and provincially and is listed under Schedule 1 of SARA. Snapping turtles use multiple types of habitat including any freshwater habitat, typically slow-moving water with soft mud or sand bottom with abundant vegetation. Snapping turtles were observed during the reptile basking survey.
- **Common nighthawk** is considered Special Concern in Ontario. Habitat of nighthawk is open areas with little to no ground vegetation, such as burned over areas, forest clearings, peat bogs, and lakeshores, but can nest in cultivated fields, orchards, urban parks, and along roads and railways. This species was found during the 1995 ESR surveys.
- **Peregrine falcon (SC)** is considered Special Concern in Ontario. These birds typically nest on tall, steep cliffs close to large bodies of water, but can adapt to city-like settings as they can use ledges of tall buildings for nesting. eBird records from December 24, 2017 identify an observation of peregrine falcon within the study area.
- **Bank swallow** is considered Threatened in Ontario. This species nests in burrows in natural and human-made settings where there are vertical silt and sand deposits. They are typically found on banks of rivers and lakes and in active sand and gravel pits. eBird records identify this species within the study area limits on April 30, 2019.
- **Rusty blackbird** is considered Special Concern in Ontario. They typically inhabit coniferous forest with wetlands nearby and use swamps, ponds edges, and agricultural fields in the winter. eBird contains records of the species from May 3, 2018.

Significant Wildlife Habitat

Background

Significant Wildlife Habitat is identified under Section 2.3 of the Provincial Policy Statement (OMMAH, 2014) as areas where plants, animals, and other organisms live and find adequate amounts of food, water, shelter, and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a vulnerable point in their annual or life cycle and areas which are important to migratory or non-migratory species. Wildlife habitat is considered significant where it is ecologically important in terms of features, functions, representation, or amount, and contributing to the quality and diversity of an identifiable geographic area or natural heritage system.

Defining wildlife habitat significance for Ecoregion 7E, in which the study area is located, is described in the SWHTG Addendum (MNRF, 2015b). SWH is protected under the Ontario Provincial Policy Statement (OMMAH 2014).

Wildlife habitat is divided into four broad categories as described in the OMNR's Significant Wildlife Habitat Technical Guide (SWHTG, OMNR 2000), as follows:

- Seasonal concentration areas;
- Rare vegetation communities or specialized habitats for wildlife;
- Habitats of species of conservation concern, excluding the habitats of endangered and threatened species; and
- Animal movement corridors.

Significant Wildlife Habitat Screening

Based on further analysis following field investigations for ELC, flora, breeding birds, anuran, reptile, and bat habitat surveys, a screening exercise for SWH Ecoregion 7E was completed to confirm or identify potential (i.e. "candidate") SWH that may occur within the study area. Individual SWH types within the four broad categories were assessed as either not present, candidate, or confirmed for the study area based on comparison of significance criteria against information obtained from relevant background documents and field surveys.

A summary of the SWH screening results are provided in the following sections and the detailed analysis is provided in **Appendix B (Attachment B).**

Significant Wildlife Habitat Not Present

Observations during field investigations did not meet the criteria for significance for the following habitats:

- Waterfowl stopover and staging areas (terrestrial);
- Waterfowl stopover and staging areas (aquatic);
- Shorebird migratory stopover area;
- Bat hibernacula;
- Bat migratory stopover area;
- Colonially-nesting bird breeding habitat (bank and cliff);
- Colonially-nesting bird breeding habitat (trees/shrubs);
- Colonially-nesting breeding habitat (ground);
- Migratory butterfly stopover areas;
- Landbird migratory stopover;
- Deer winter congregation areas;
- Cliffs and talus slopes;
- Sand barren;
- Alvar;
- Old growth forest;
- Savannah;
- Tallgrass prairie;
- Other rare vegetation communities;
- Seeps and springs;
- Amphibian breeding habitat (woodland);
- Marsh breeding bird habitat;
- Open country bird breeding habitat;
- Waterfowl nesting area;
- Bald eagle and osprey nesting, foraging and perching habitat;
- Shrub/early successional breeding habitat;
- Terrestrial crayfish;
- Special concern and rare wildlife species: vascular flora; and

- Amphibian movement corridors.

Candidate Significant Wildlife Habitat

The SWH screening found that the criteria for candidate SWH were met for the following eight categories:
- **Raptor Wintering Area** – The habitat for raptor wintering areas is present within the study area as fields, woodlands, and roosting habitat is present. It is recommended that specific surveys be completed during the winter season.
- **Bat Maternity Colonies** - Woodland and forest communities are present within the study area, some with old, damaged, and decaying trees with the potential for cavities. A tree cavity assessment for potential bat maternity is recommended to be completed during the leaf off season.
- **Turtle Wintering Area**- Habitat is present within the Grand River for turtle overwintering. Searches for congregations of basking turtles during spring and fall seasons on sunny days should be conducted.
- **Reptile Hibernaculum**- Habitat for hibernacula exists within the study area in the old rail bed, old building foundations and on the slope. Snake cover board searches should be undertaken in the appropriate seasons.
- **Turtle Nesting Area**- The habitat for turtle nesting is present along the banks of the Grand River. Snapping turtle, midland painted turtle, and red-eared slider were observed during the reptile basking survey. Additional reptile basking surveys are recommended.
- **Woodland Area-Sensitive Bird Breeding Habitat**- Woodland habitat exists within the study area and multiple bird species from the area-sensitive bird list were observed during breeding bird surveys and as eBird records.
- **Special Concern and Rare Wildlife Species: Birds** – Common nighthawk, bald eagle, and peregrine falcon were observed or have historical records within the study area. These species are likely foraging within the habitat and are not likely using the habitat for nesting and breeding.
- **Special Concern and Rare Wildlife Species: Reptiles-** Habitat for northern map turtle and ribbon snake exists within the study area but were not found within the field surveys.

Candidate SWH requires field survey assessments to verify the presence or absence of the species and habitat. This is to be conducted in accordance with accepted protocols within the appropriate season and conditions.

Confirmed Significant Wildlife Habitat

The SWH screening found that the criteria for confirmed SWH were met for the following categories:
- **Special Concern and Rare Wildlife Species: Birds** – Eastern wood pewee was observed during the breeding bird surveys in the FOD7-4 community.
- **Special Concern and Rare Wildlife Species: Reptiles-** Snapping turtle was confirmed within the study area during the reptile basking survey.
- **Special Concern and Rare Wildlife Species: Insects-** Monarch were observed flying on site. Common milkweed, a plant species required by monarchs for their juvenile life stage, was found within the study area.

The confirmed SWH requires protection and no development can occur within these habitats, unless it can be demonstrated that the development has no negative impacts on the natural heritage functions and features of the SWH.

3.3 Stage 1 Archaeological Assessment

3.3.1 Previous Archaeological Assessments

A Stage 1 and 2 Archaeological Assessment was undertaken in May and June of 1994 and completed by Golder Associates in 1995 as part of the 1995 ESR. The investigation failed to recover artifacts or structures. All three zones of the slope, including the lower slope, bench, and top of slope were noted to have archaeological potential, particularly the bench along the rail trail. The 1995 ESR noted that no known archaeological sites were discovered within the study area and thus, the remedial work would not impact the heritage of the area with the exception of the demolition of properties at 1019 Colborne Street East and 957 Colborne Street East, which would require monitoring of the site by a licensed archaeologist. These properties have since been demolished and were not present at the time of this study.

3.3.2 Current Archaeological Assessment

A Stage 1 Archaeological Assessment was undertaken by Archaeological Research Associates (ARA) in November 2018 under Project Information Form #P089-0115-2018. The Stage 1 Assessment determined that the study area is compromised of a mixture of areas with and without archaeological potential, and that there is potential for areas to have been impacted by past construction activities.

A recommendation for Stage 2 property assessment in accordance with Section 2.1 of the Standards and Guidelines for Consultant Archaeologists (MTC 2011:28–39) was made for all sections of archaeological potential that could be impacted by the project, which comprises the majority of the slope monitoring area. The recommended approach for the top of slope, table lands, and Beach Road property is a test pit survey at an interval of five metres; the recommended approach for the remainder of the slope monitoring area is construction monitoring for the duration of construction. The summary map of recommended survey methods for the slope monitoring area is available in **Figure 3-5** and in Map 12 of the Stage 1 Archaeological Assessment Report (**Appendix D**).

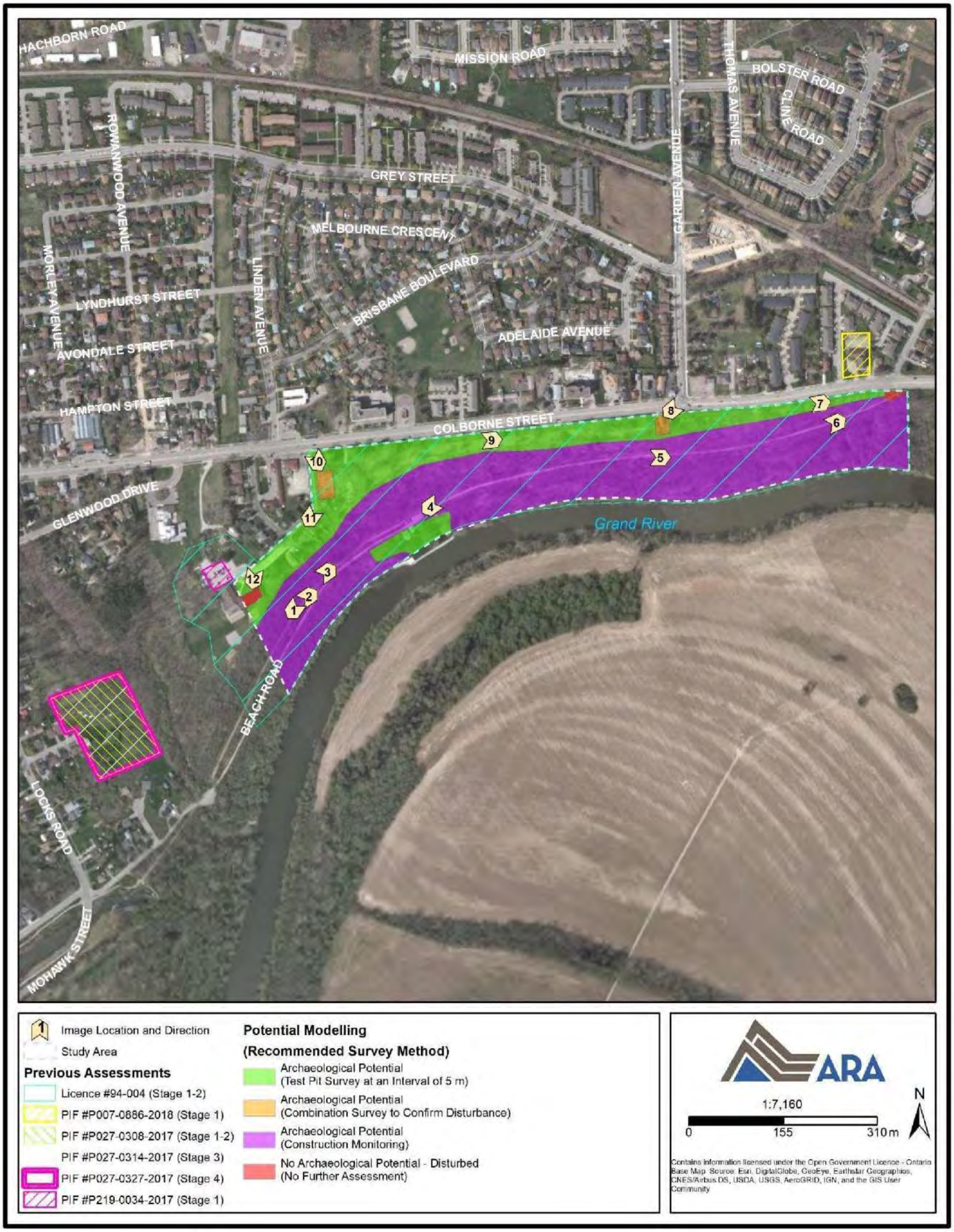


Figure 3-5. Potential Modelling and Recommendations

3.4 Built Heritage and Cultural Heritage Landscape Assessment

A Built and Cultural Heritage Landscape Assessment of landscapes and structures along Colborne Street East was completed by ARA in 2018. The heritage assessment area consisted of approximately 1 km along Colborne Street East; a total area of approximately 17.5 ha. A windshield survey of the broader study area was conducted and all potential heritage resources were evaluated using the criteria of Ontario Regulation 9/06 and Ontario Regulation 10/06. The heritage resources that were identified as a Built Heritage Resources (BHR), a Cultural Heritage Landscape (CHL), or being of Cultural Heritage Value or Interest (CHVI) were:

- BHR 1 — 1059 Colborne Street
- BHR 2 — 1057 Colborne Street
- BHR 3 — 1053 Colborne Street
- BHR 4 — 1047 Colborne Street
- BHR 5 — Beach Road House and Mill (just east of 11 Beach Road)
- BHR 6 — Colborne Street pedestrian underpass
- BHR 7 — Colborne Street rail bridge
- BHR 8 — 1042 Colborne Street (Cainsville United Church)
- BHR 9 — 1036 Colborne Street
- BHR 10 — 1024 Colborne Street
- BHR 11 — 1020 Colborne Street
- BHR 12 — 1022 Colborne Street
- BHR 13 — 29 Clara Crescent
- BHR 14 — 968 Colborne Street
- BHR 15 — 21 Johnson Road
- BHR 16 — 13 Johnson Road
- CHL 1 — View to Bow Park Farm
- CHL 2 — Grand River
- CHL 3 — Buffalo & Lake Huron Railway (B&LHR)
- CHL 4 — Part of the Trans Canada Trail
- CHL 5 — Mohawk Canal Locks

The Built and Cultural Heritage Landscape Assessment report recommends protecting heritage assets in proximity to potential project works as part of the design work. This includes locating project staging and construction areas away from BHRs and CHLs, minimizing the removal of mature trees, and minimizing vibration impacts to sensitive BHRs during construction. In addition, it was recommended that a Heritage Impact Assessment (HIA) report should be undertaken during the detailed design phase of the project to confirm the anticipated impacts of the works and outline mitigation measures as part of the design.

The Built and Cultural Heritage Landscape Assessment completed by ARA is included in **Appendix D**, and includes details of the background research, consultation with the City of Brantford and Brant County, a description of the evaluated heritage assets, and the full list of recommendations. The report may include useful information for the City of Brantford's Heritage Inventory and the identification of heritage assets worthy of inclusion in a Municipal Heritage Register.

The BHR, CHL, and CHVI heritage resources are shown in the context of the study area (slope monitoring area) in **Figure 3-6**.

Figure 3-6. Heritage Assets (Built and Cultural)

3.5 Geotechnical Conditions

The City of Brantford is located within the Haldimand Clay Plain, which is generally composed of deep water glaciolacustrine sediments, including clay, silt, and minor sand. The soils of the study area are generally comprised of fill overlying native clayey silt and silty sand. Bedrock is found at the site between elevations of 178.4 masl and 180.5 masl and appears to be dolomite.

The groundwater level was measured in monitoring wells and is typically within 3 m of the ground surface in the upper slope and tableland and within 1 m in the lower slope section. The piezometer (groundwater pressure) monitor installed at bedrock indicates that groundwater head is at a level of 202 masl in the upper slope and 195 masl in the lower slope; the lower slope groundwater is under artesian pressure.

The main slope failure mechanisms that continue to affect the stability of the existing slope are the high groundwater levels and continued undercutting of the toe of the slope by the Grand River; this in combination with the weakness of the native soils results in the instability of the slopes at their current inclinations.

Additional details of the geotechnical condition of the slope is provided in **Appendix A**.

3.5.1 Site Specific Soil and Groundwater Conditions

Based on a review of the previously completed geotechnical investigations and the most recent geotechnical investigation, the soil conditions are generally comprised of fill overlying native clayey silt and silty sand.

Fill material was placed at the crest of the slope by landowners to extend and level out their properties and fill was placed at the mid-height of the slope for construction and maintenance of the former CP rail line. The fill at the crest of the slope varies in composition from clayey silt to sand with some silt and gravel. Debris was noted at various depths at the crest of the slope. The fill material was generally loose to compact.

A deposit of clayey silt was generally encountered on the upper portion of the slope below the upper fill material and extended to between 202 masl and 207 masl in elevation. The upper clayey silt material generally contained silt and sandy silt layers and has a stiff consistency and became normally consolidated with depth.

Sandy silt/silty sand was encountered below the clayey silt material and below the fill at the plateau of the slope and towards the Grand River. The deposit was encountered at an elevation of 202 masl at the plateau and 188 masl to 195 masl at the toe of the slope. The sandy silt/silty sand deposit varies in thickness from 0.6 m to 3.2 m and was generally compact to dense and saturated.

A lower deposit of clayey silt was encountered below the sandy silt/silty sand layer and extends to the bedrock surface. The clayey silt material contains seams of silt, sandy silt, and silty clay material. Undrained shear strengths measured in situ within the Piezocone Penetration Tests (CPTu) holes indicated that the lower silty clay is soft to stiff and normally consolidated.

Bedrock was encountered across the study area between 178.4 masl to 180.5 masl. The bedrock appeared to be dolomite.

Groundwater was measured in the monitoring wells installed during the previous investigations. Groundwater was typically encountered within 3 m of the ground surface in the upper slope and tableland boreholes and within 1 m of the surface in the lower slope. Piezometers installed in the bedrock indicate the piezometric pressure at the rock surface is 195 masl (artesian pressure) in the lower slope and 202 masl in the upper slope.

3.6 Hydrology and Hydraulics

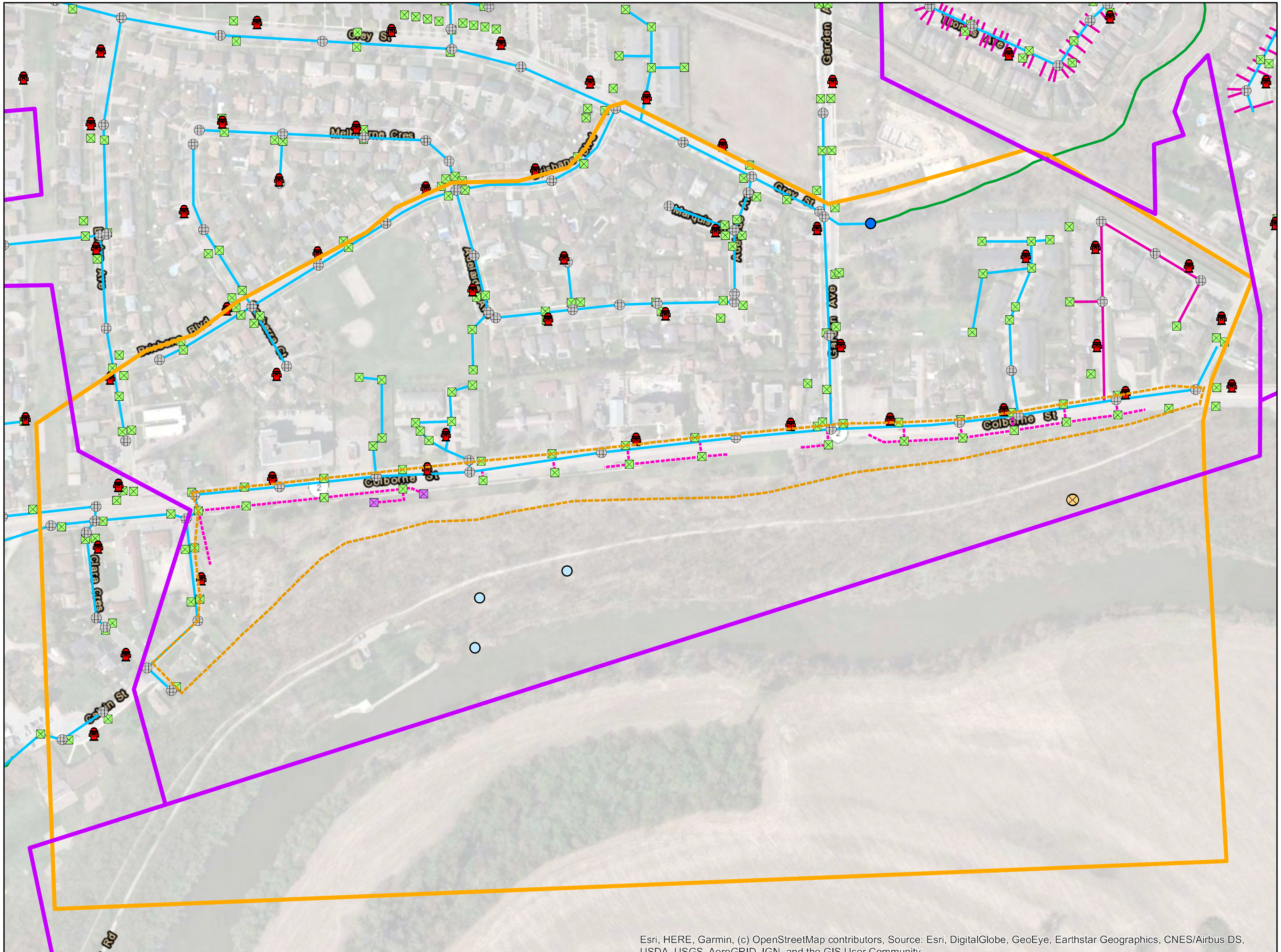
The characterization of the hydrology and hydraulics is discussed in two contexts: (1) the surface water runoff, which considers local catchment areas for major and minor flow events and the relevant stormwater infrastructure within the study area, and (2) the Grand River and its hydraulic characteristics within the study area, particularly in terms of flooding and erosion within the area known as 'the Oxbow' within the slope monitoring area.

3.6.1 Surface Water Runoff

The minor drainage system is defined by the Ministry of Transportation (MTO) as that which captures relatively minor floods (within a 2 to 10-year return period), and consists of the storm sewers, catch basins, and minor channels (MTO, 2013). The stormwater infrastructure within the study area consists of a network of stormwater gravity mains and relevant storm manholes and storm inlets. The stormwater gravity mains collect runoff from Colborne Street East and the Clara Crescent neighbourhood and convey the stormwater to one of four discharge points located outside of the slope monitoring area. The majority of the flows collected along Colborne Street East by storm inlets on the north side of the street are conveyed to the discharge point located north of the slope monitoring area, which becomes a tributary for Fairchild Creek. The other three discharge points are located west of the slope monitoring area and discharge into a short tributary which feeds into the Grand River upstream of the study area.

The area that contributes minor flow to the slope monitoring area consists of the area bounded by the stormwater infrastructure shown in **Figure 3-7**. Field investigations suggested some possible linkages between the storm inlets located on the south side of Colborne Street East and the larger stormwater gravity mains, as well as some storm inlets which may be part of an abandoned system discharging into the Grand River through the slope monitoring area. The stormwater infrastructure located within the slope monitoring area, including culvert outfalls and stormwater laterals, have the potential to be previously damaged as a result of historic slope movements. Further investigation in the field and historic records indicated that all stormwater infrastructure in the slope monitoring area was disconnected at some point following the 1986 event, although some inactive stormwater outfalls still exist in the slope area. These are not considered to be essential to remove as they are no longer active and are not considered to pose additional risk to exacerbating slope movement. The estimated minor drainage area is a maximum of $0.06km^2$.

The major drainage system is defined by the MTO as the path of runoff that is followed when the minor drainage system is exceeded (i.e., for storms greater than the 2 to 10-year design of the minor system). This includes natural topography, roadside ditches, roadways, drainage swales, etc. The major flows catchment area was manually delineated for the study area to estimate the contribution area to the slope monitoring area during a major flow event using the SWOOP2015 contours available from the GRCA. The estimated major flow area is $0.58km^2$. The major flow system is shown in **Figure 3-8**.



Colborne Street East Slope Stabilization EA

Figure 3-7

Minor Drainage and Storm Infrastructure

Legend

- Storm Discharge Points Inferred from Field Investigations
- Manhole Observed in Field (Likely Sanitary)
- Storm Inlets Inferred from Field Investigations
- Laterals Inferred from Field Investigations
- Minor Drainage Area
- City of Brantford Storm Sheds
- Study Area
- Water Hydrants
- Storm Manholes
- Storm Inlets
- Storm Discharge Points
- Storm Gravity Mains
- Storm Lateral Lines
- Storm Inlet Leads
- Stormwater Open Drain

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0 45 90 180

Meters

NAD 1983 UTM 17N	1:3,500

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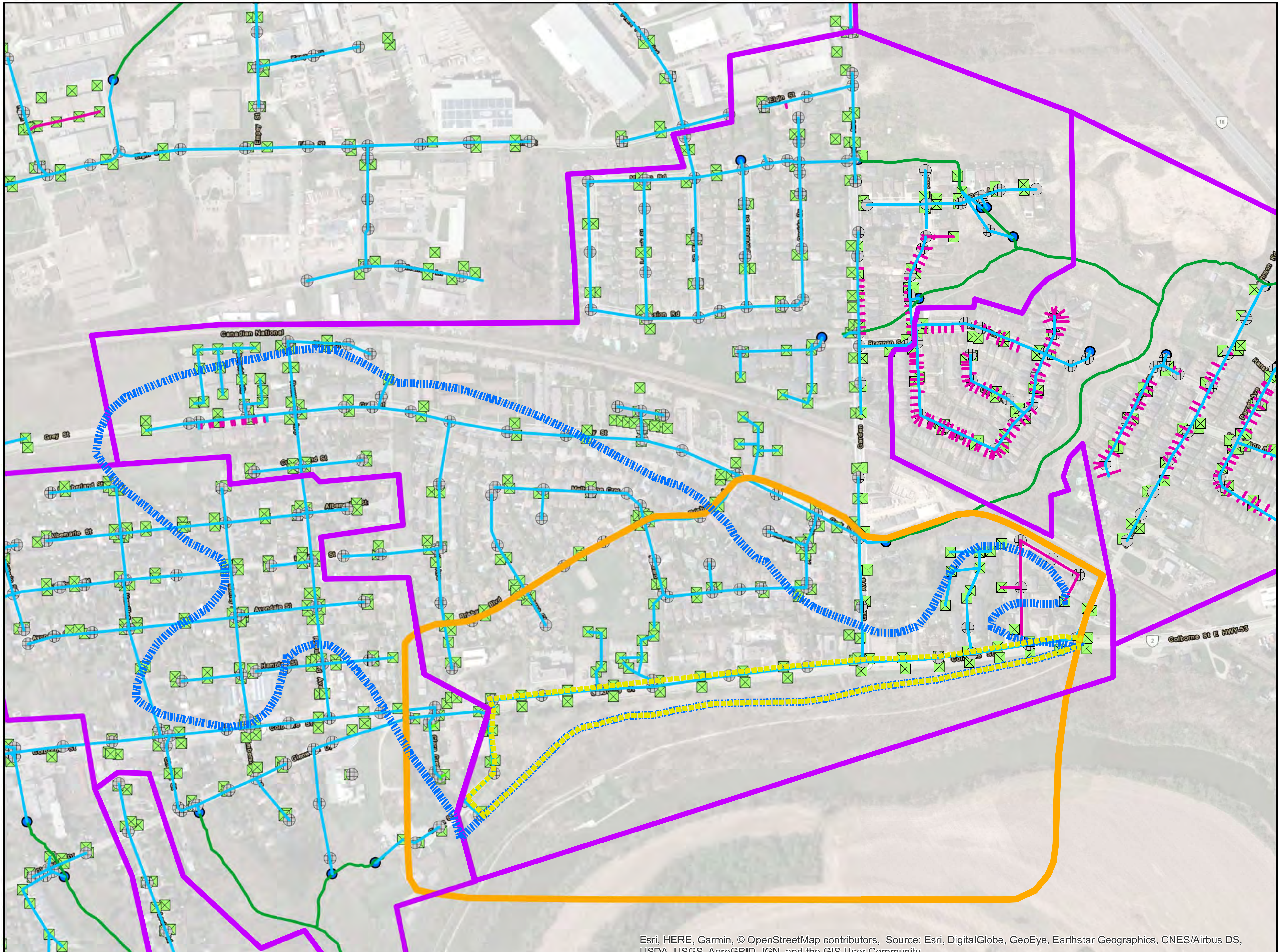

Colborne Street East Slope Stabilization EA

Figure 3-8
Major and Minor Drainage

Legend

- Minor Drainage Area
- Major Drainage Area
- City of Brantford Storm Sheds
- Study Area
- Storm Gravity Mains
- Storm Lateral Lines
- Storm Inlet Leads
- Stormwater Open Drain
- Storm Manholes
- Storm Inlets
- Storm Discharge Points

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0 75 150 300
Meters

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3.6.2 Grand River Hydraulics

An up-to-date HEC-RAS model of the section of the Grand River containing the study area was supplied by GRCA on October 3, 2018. The model was reviewed and updated using elevation data collected by the drone survey in November 2018 at sections 172 and 171 (the existing GRCA HEC-RAS model sections located within the study area). The location of existing HEC-RAS sections relative to the study area are shown in **Figure 3-9**.

The updated hydraulic model was used as an existing conditions model to estimate hydraulic parameters within the study area. The existing conditions results are shown in **Table 3-8**.

Table 3-8. Existing Conditions HEC-RAS Model Results for Slope Monitoring Area

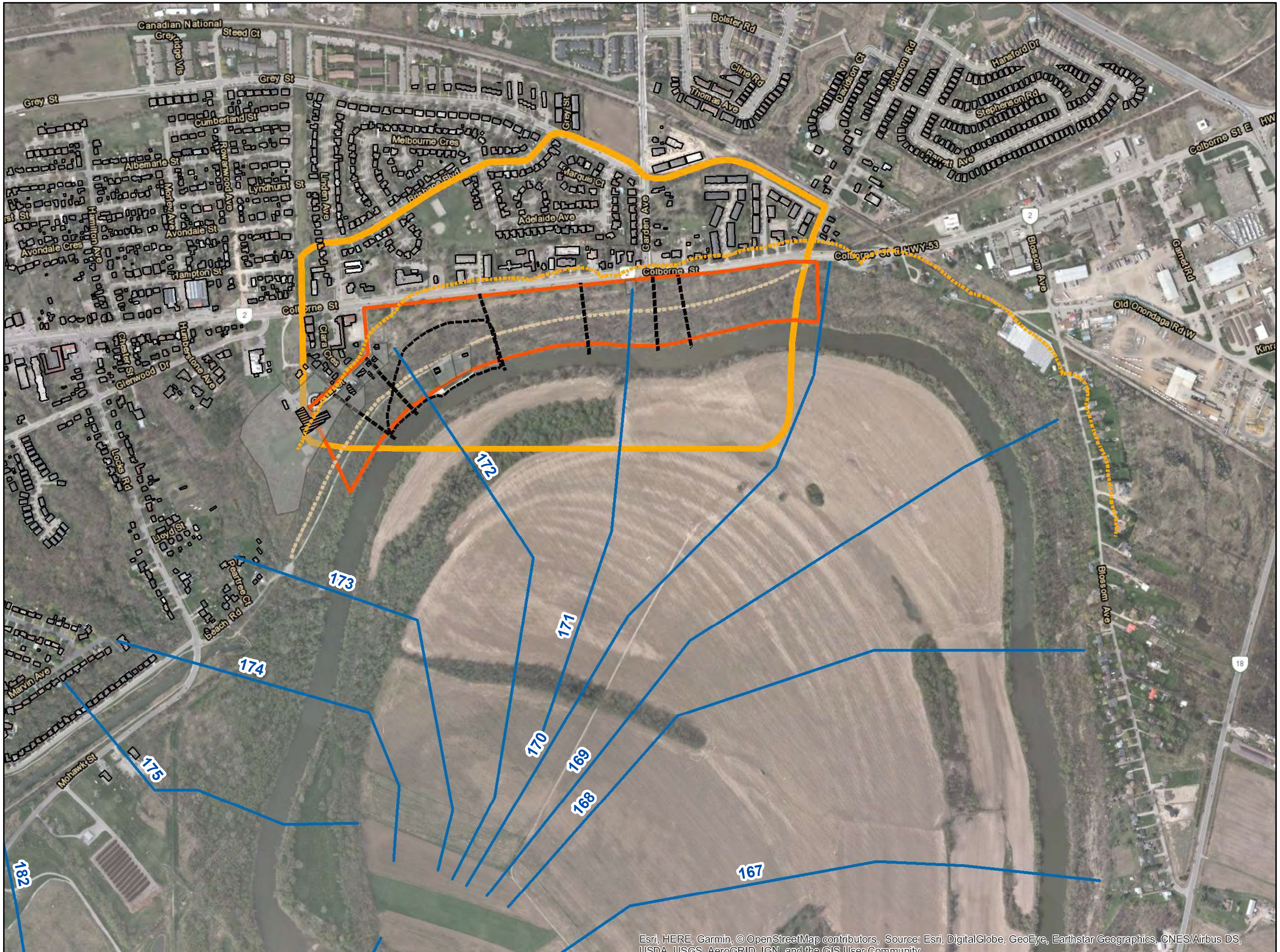
River Station	Flow Profile	Flow (cms)	Water Surface Elevation (m)	Velocity (m/s)	Total Shear (N/m^2)	Channel Shear (N/m^2)
172	Reg	2,510	198.45	3.66	16.4	37.77
	100 Year	1,770	197.09	3.36	13.05	33.32
	50 Year	1,570	196.64	3.27	12.06	32.03
	20 Year	1,310	195.98	3.14	11.98	30.33
	10 Year	1,110	195.39	3.01	10.47	28.77
	5 Year	910	194.67	2.91	8.59	27.69
	2 Year	600	193.33	2.43	15.55	20.85
171	Reg	2,510	198.41	3.08	9.49	25.66
	100 Year	1,770	197.08	2.69	7.91	20.41
	50 Year	1,570	196.64	2.57	7.28	18.88
	20 Year	1,310	196	2.39	6.55	16.74
	10 Year	1,110	195.42	2.23	6.09	14.9
	5 Year	910	194.71	2.05	5.76	12.99
	2 Year	600	193.34	1.72	5.25	9.66

The results in profile indicate that the bank opposite the slope monitoring area overtops at approximately the 2-year event with a flow of approximately 600 m^3/s, which provides a relief on shear stress and erosion on the north slope during larger flood events. The hydraulic model indicates that Colborne Street East would not be impacted up to the Regional event defined in the HEC-RAS model.

A review of the flood frequency estimates from the Grand River at Brantford gauge (02GB001) was performed in conjunction with the GRCA Flood Frequency Analysis (FFA) for managed flows. The flood frequency review used a Gumbel plot and a Generalized Extreme Value (GEV) distribution based on the Water Survey Canada gauge data from 1947 to 2018. The HEC-RAS model flows are consistent with those from the GRCA FFA, and the analysis with other methods is consistently lower than the GRCA estimations. These flows are provided in **Table 3-9**.

Table 3-9. Flood Frequency Analysis Results Summary.

Return Period (years)		2	5	10	20	50	100	200	500
Return Period Flows (cms)	Gumbel Plot	570.3	793.8	941.8	1083.8	1267.5	1405.2	NA	NA
	GEV Estimation	574.9	799.4	941.7	1073.8	1238.4	1357.3	14712.0	1617.9
	GRCA FFA	600.5	908.0	1107.3	1370.7	1569.9	1769.2	1968.4	2231.8



Colborne Street East Slope Stabilization EA

Figure 3-9
Hydraulic Model Sections

Legend

- HEC-RAS River Station
- River Slopes Allowance (GRCA)
- Building Footprint - Outside Study Area
- Building Footprint - Within Study Area
- Property Parcel
- Slope Zones
- 1986 Landslide Area
- Hamilton-Brantford Rail Trail
- Slope Monitoring Area
- Study Area

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0 100 200 400
Meters

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3.7 Fluvial Geomorphology

Observations of channel instability and/or erosion concerns along any watercourse should be placed in the context of its geomorphic system. This includes recognizing that the form and function of watercourses are a result of the interaction between controlling (e.g., geology, flow) and modifying (e.g., vegetation) factors to which the channel has adjusted. When a change in one or more of these factors is greater than what the channel is able to accommodate, a temporary or permanent channel response may occur as the channel seeks to regain a dynamic equilibrium form. Since the response of a watercourse to a disturbance may take years or decades to accomplish, and since a specific site is part of a continuum along a drainage network, analyses of channel morphology should include a broader spatial and temporal perspective.

Characterization of the geomorphological conditions of the Grand River and the unstable slope was undertaken through review of historical data and background materials. The intent of the assessment was to gain insight into channel/slope form and functions to identify areas of concern and to inform the selection and evaluation of alternatives for site remediation.

3.7.1 Historical Conditions

A sequence of historical air photos was obtained from the City of Brantford (1955, 1965, 1971, 1976, 1980, 1981, 1986, 1993, 1995, 2006, 2008, 2009, 2010, 2013, 2015, 2017) and from the National Air Photo Library (NAPL) (1945). Review of aerial photography provides insight into changes that have occurred with the channel, as well as the slope within the area of study. A summary of key observations is provided in **Table 3-10**, and air photos are included within **Appendix C**.

Table 3-10. Historical Observations

Year	Observations
1945	• The CP Railway (Toronto, Hamilton and Buffalo Railway) and Beach Road are present north of the Grand River, with residential developments established in the northeast between the railway and the channel. An area of vegetation clearing is visible at the eastern side of the developments. • Residential developments are present along the south side of Colborne Street East.
1955	• The channel displays a wider active channel flow (flooding), likely indicative of impacts from Hurricane Hazel, occurring in 1954. • Additional residential developments have been established along Colborne Street East.
1986 (April 24)	• The aerial image was taken one month prior to the landslide event, which occurred on May 20, 1986. Bare soils are visible within and adjacent to properties along Colborne Street East (929, 947, 951 Colborne Street East). Such conditions are an indicator of an unstable slope environment prior to the mass movement experienced one month later. • A wetland/pond feature is visible in the 1986 air photo, which remains present today. Additionally, some surface drainage features (i.e., rills) are visible on the slope. The presence of surface drainage may confirm the presence of high groundwater levels within the slope (Golder, 2012). • Based on the historical analyses (i.e., channel overlays), the toe of the slope/channel bank eroded between 1965 and 1986.
1993	• Residential properties along the CP Railway and Beach Road have been removed to that of existing conditions – one residential dwelling at 73/77 Beach Road. • Some residential properties have also been removed along the south side of Colborne Street East. • A scar is visible from the 1986 slope failure, which now lacks mature vegetation. The offset in the previous CP Railway is also visible within the vicinity of 73/77 Beach Road, which removed in 1988.
1995	• Development of the waterfront structure at the residential property remaining along the northern bank of the Grand River have begun. • Local areas of sediment accretion are visible surrounding the banks at 73/77 Beach Road.

Year	Observations
	• Additional developments have been removed along the south side of Colborne Street East.
2006	• Development of the waterfront structure at 73/77 Beach Road has continued, with a greater extent both down the toe of slope/channel bank and into the channel. • Additional developments have been removed along Colborne Street East. • Historical analyses suggest the dominant process occurring between 1993 and 2006 was slumping of the slope into the channel.
2010	• Development of the waterfront structure at 73/77 Beach Road has continued, extending further upstream on the channel bank. • Some scour is visible to the east of the waterfront structure at 73/77 Beach Road.

Rates of change along the Grand River and the slope associated with the 1986 landslide were ascertained through a historic overlay assessment. A series of historical and present air photos were selected for the assessment (1965, 1986, 1993, 2006, 2010, 2019). The edge of water of the Grand River on the northern (right) bank was traced for each of the selected years, and overlaid to measure areas of change, thus resulting in rates of change over time along the system. It is to be noted that the distortion of the air photos, which is an inherent issue associated with air photo overlay assessments, can propagate through the calculation of rates of change over time. In order to minimize such errors, the process of georeferencing or rectifying the images was focussed on the area of the landslide, 73/77 Beach Road, and the Grand River within this area. Rates of change are reported in **Table 3-11**.

Golder (2010) noted that much of the debris from the 1986 landslide was rapidly removed by Grand River flows. This process was confirmed during the current assessment. The erosion caused by the Grand River at the toe of the slope/channel bank appears to be the dominant process occurring within the study area, with a loss of material measured prior to the 1986 landslide, and from 1993 until present. This is not to suggest slope processes (i.e., slumping) is not ongoing; but that the material that may be transported down the slope is being washed away by Grand River flows. Furthermore, the radius of the meander bend over time is generally consistent, which may further indicate that the material being moved down the slope through slope processes and slumping is being carried away by the erosive forces of the channel along the toe of slope / channel bank.

Prior to hardening of the waterfront, the erosion occurring within the area assessed was observed across the 73/77 Beach Road property. Following hardening, bank scour appears to have concentrated in recent years (2010 – 2019) immediately to the east of the waterfront structure. If this process continues, the toe of the slope at the east limit of the waterfront structure may become oversteep and contribute to instability in this location.

Table 3-11. Rates of Channel and Slope Change Over Time

Time Period	Rate (m/year)	Dominant Process	Observations
1965 – 1986	0.14	Toe / bank erosion	Loss of material extends along the area of assessment (**Figure 3-10**).
1986 – 1993	0.66	Toe / bank erosion	Measured to the west of 73/77 Beach Road waterfront works.
1986 – 1993	0.86	Toe / bank erosion	Measured to the east of 73/77 Beach Road waterfront works.
1993 – 2006	0.35	Slope instability (slump)	Measured to the west of 73/77 Beach Road waterfront works.
1993 – 2006	0.25	Slope instability (slump)	Measured to the east of 73/77 Beach Road waterfront works.
2006 – 2010	0.46 (locally)	Toe / bank erosion	Conditions are generally stable along meander bend, with local scour immediately west of the 73/77 Beach Road waterfront works.
2010 – 2019	0.23	Toe / bank erosion	Conditions are generally stable along meander bend, with local scour immediately east of the 73/77 Beach Road waterfront works.

Colborne Street East Slope Stabilization EA

Figure 3-10
Historic Overlay

Legend

- Property Parcel
- Historical Assessment
- 2019 Watercourse
- 2010 Watercourse
- 2006 Watercourse
- 1993 Watercourse
- 1986 Watercourse
- 1965 Watercourse

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0 15 30 60
Meters

NAD 1983 UTM 17N | 1:1,400

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Data Sources: Ecosystem Recovery Inc., 2019:

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3.8 Socio-Economic Environment

3.8.1 The Official Plan and Zoning

The City of Brantford Official Plan was most recently updated in January 2018 and is currently under an Official Plan Review, which includes a master planning process to add the newly acquired Boundary Expansion Lands from Brant County (as of January 1, 2017) into the City of Brantford Official Plan.

The zoning within the slope monitoring area is designated as low density residential and open space; the property parcel for the Brantford Christian School is institutional and is partially within the slope monitoring area. The broader study area contains low, medium, and high density residential lots, as well as open space, commercial lots, and an additional institutional lot at 1042 Colborne Street East (Citygate Church). The Official Plan indicates that the slope monitoring area was amended to a Special Policy Area on April 21, 1992, which permits only existing land uses until such time that the lands above the slope are deemed safe by a competent Professional Engineer and an appropriate amendment has been made to the Official Plan to adjust the designation of the lands. The enforcement of this approval was done through Zoning By-law 160-19, which changed the zoning in the area to a “Development Constraint Zone (DC)”; this zoning district is currently still in effect within the slope monitoring area.

The Official Plan designates a Greenfield Area to the northeast of the study area along the northern section of Johnson Road. The study area is not within or adjacent to any other growth management boundaries, including designated urban growth centres or intensification corridors.

3.8.2 Land Use

The study area includes a mix of residential, commercial, and institutional properties within its limits. The GRCA and the City of Brantford initiated a property acquisition program along the south side of Colborne Street East following the 1986 landslide event in order to reduce the risk to life and property. As of May 1995, there were fifteen (15) structures existing along the top of slope, including thirteen (13) residences, one combined residence/business development, and the institutional Brantford Christian School located at 7 Calvin Street. As of the 2012 update to the 1995 ESR, only seven (7) of the fifteen previously identified properties were occupied. Presently, there are five (5) properties with physical structures currently present in the slope area. These include:

- 73 Beach Road (Residential, zoned DC)
- 46 Clara Crescent (Residential, zoned DC)
- 40 Clara Crescent (Residential, zoned DC)
- 32 Clara Crescent (Residential, zoned DC)
- Brantford Christian School located at 30 Clara Crescent/7 Calvin Street (Institutional, zoned I2-1)

Within the broader study area, there are currently two (2) institutional lots and eight (8) commercial lots. These include:

Institutional Lots:
- 7 Calvin Street (Brantford Christian School)
- 1042 Colborne Street East (Citygate Church)

Commercial Lots:
- 900 Colborne Street East
- 901 Colborne Street East (Bell City Motel)
- 904 Colborne Street East (Scott Veterinary Clinic)
- 930 Colborne Street East (Dairy Queen)

- 950 Colborne Street East (Galaxy Motel)
- 970 Colborne Street East (Colborne Auto Service and Sales)
- 984 Colborne Street East
- 1004 Colborne Street East

The former CP rail bed was converted into the Hamilton-Brantford Rail Trail in 1996, which serves as a recreational use within the slope monitoring area. The Grand River also provides recreational features for activities such as boating and fishing.

The overall land use and DC zoning district within the study area is shown in **Figure 3-11**.

Colborne Street East Slope Stabilization EA

Figure 3-11
Land Use

Legend

- Building Footprint - Outside Study Area
- Building Footprint - Within Study Area
- Development Constraint Zoning District

Land Use Type

- Commercial
- Institutional
- Open Space
- Residential Low
- Residential Medium
- Residential High
- Slope Zones
- 1986 Landslide Area
- Hamilton-Brantford Rail Trail
- Slope Monitoring Area
- Study Area

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0 50 100 200
Meters

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3.8.3 Transportation

The existing transportation infrastructure within the study area and slope monitoring area is characterized in this section. The transportation infrastructure includes traffic corridors, such as major and minor arterial and collector roads, and recreational infrastructure, such as bike trails and recreational pathways.

Due to the consideration of the closure or relocation of Colborne Street East as an alternative in previous studies, alternative traffic routes considering the narrowing or closure of Colborne Street are characterized in this section.

3.8.3.1 *Transportation Plan*

The City of Brantford maintains records of traffic counts at intersections in the City Counts at three intersections within or near the study area along Colborne Street East were conducted between 2010 and 2018. These were conducted at the intersections Glenwood Drive, Garden Avenue, and Johnson Road, from the west to east end of the study area. The traffic flow is primarily in the east-west direction along Colborne Street, with approximately 25% or less of the traffic heading north or south at the intersections monitored. The summary of the Colborne Street East traffic counts is provided in **Table 3-12**; the maximum east-west traffic count is based on maximum traffic count recorded in any direction for a duration of eight (8) hours through the hours of approximately 9am to 5pm.

Table 3-12. Traffic Counts along Colborne Street East

Intersection	Max. East-West Traffic Count	Date
Glenwood Drive	3,826	Thursday June 28, 2012
Garden Avenue	3,377	Thursday August 2, 2018
Johnson Road	3,373	Monday May 10, 2010

The traffic data indicates that Colborne Street East carries approximately 3,800 vehicles daily through the study area, as a conservative estimate.

Due to the consideration of the closure of Colborne Street East in previous studies, the characterization of the transportation network in the vicinity of the study area is also presented. The transportation parameters and estimated capacities based on the transportation design manual are presented in **Table 3-13.** The parameters in the table are summarized for the road sections within the potential alternate routes for Colborne Street (i.e. speed limits and other road parameters may vary outside of the plausible alternate routes).

Table 3-13. Road Parameters along Potentially Alternate Routes

Street	Road Class	Posted Speed Limit (km/h)	No. Lanes
Colborne Street East	Major Arterial	50	5
Garden Avenue	Minor Arterial	50	2
Locks Road	Major Collector	50	2
James Avenue	Minor Collector	50	2
Grey Street	Major Collector	40	2
Elgin Street	Major Collector	50	2
Wayne Gretzy Parkway	Major Arterial	60-70	4
Henry Street	Minor Arterial	60	3-4

Based on the existing traffic counts at locations along Colborne Street East and the estimated capacity of road infrastructure in the vicinity of the study area, several variations of potential alternate routes for traffic redirected due to the closure or reduction of Colborne Street East within the study area. These routes are shown in **Figure 3-12**. The transportation network classifications are consistent with the City of Brantford Official Plan.

3.8.3.2 *Recreational Trails*

The prominent recreational feature within the slope monitoring area is the Hamilton-Brantford Rail Trail, converted from the CP rail bed in 1996. The section of the Rail Trail within the slope monitoring area has been historically subject to narrowing due to slope movements and requires regular maintenance by City of Brantford staff.

The City of Brantford recorded trail usage between March 21, 2018 and October 17, 2018. The average daily trail count during this period was 73.1, with a maximum observed daily trail usage of 368 counts on September 21, 2018. The daily average trail counts by month ranged from 42.1 to 92.7, with a lower daily average trail usage in March and the peak daily average trail usage in September. The daily average trail counts by weekday ranged from 61.1 to 83.9, with less usage on average in the middle of the week and higher usage between Friday and Monday.

Due to the potential for closure of the Rail Trail (depending on the alternative solution selected), a characterization of the existing recreational and bike trail network is presented. Potential alternate routes to connect the east end of Colborne Street East to the opposite end of the existing Rail Trail entrance at Beach Road includes:

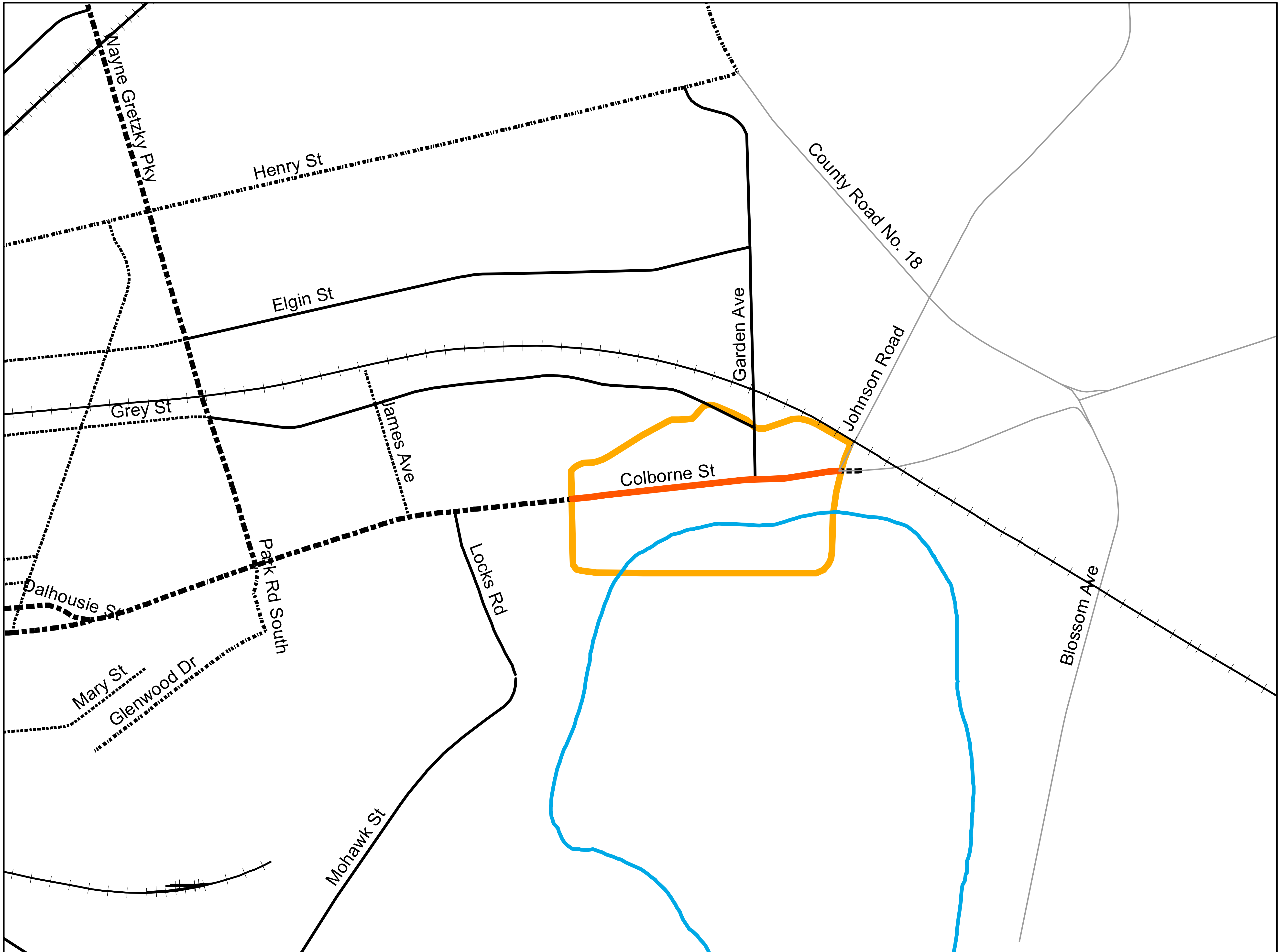
- Creation of a recreational trail along the south side of Colborne Street East, and/or
- Creation/designation of a bikeway along Locks Road.

It is noted that the potential closure of the Rail Trail within the slope monitoring area and the potential closure of Colborne Street East should be considered jointly and independently, as the Rail Trail has the potential for closure without the closure of Colborne Street East. In the event of the closure or reduction of Colborne Street East, a recreational trail may be integrated with the roadway and one or more lanes may be converted into a recreational trail.

The existing bikeway and trail network is presented in **Figure 3-13**; the classification of bikeways and trails is consistent with the City of Brantford Official Plan.

Colborne Street East Slope Stabilization EA

Figure 3-12
Transportation Plan in Study Area



Legend

- Study Area
- Grand River
- Brant County Roads
- Potentially Impacted Section of Colborne Street (East)

City of Brantford Road Network

- Provincial Highway
- Major Arterial
- Minor Arterial
- Major Collector
- Minor Collector
- Active Railway

0 187.5 375 750
Meters

NAD 1983 UTM 17N | 1:15,000

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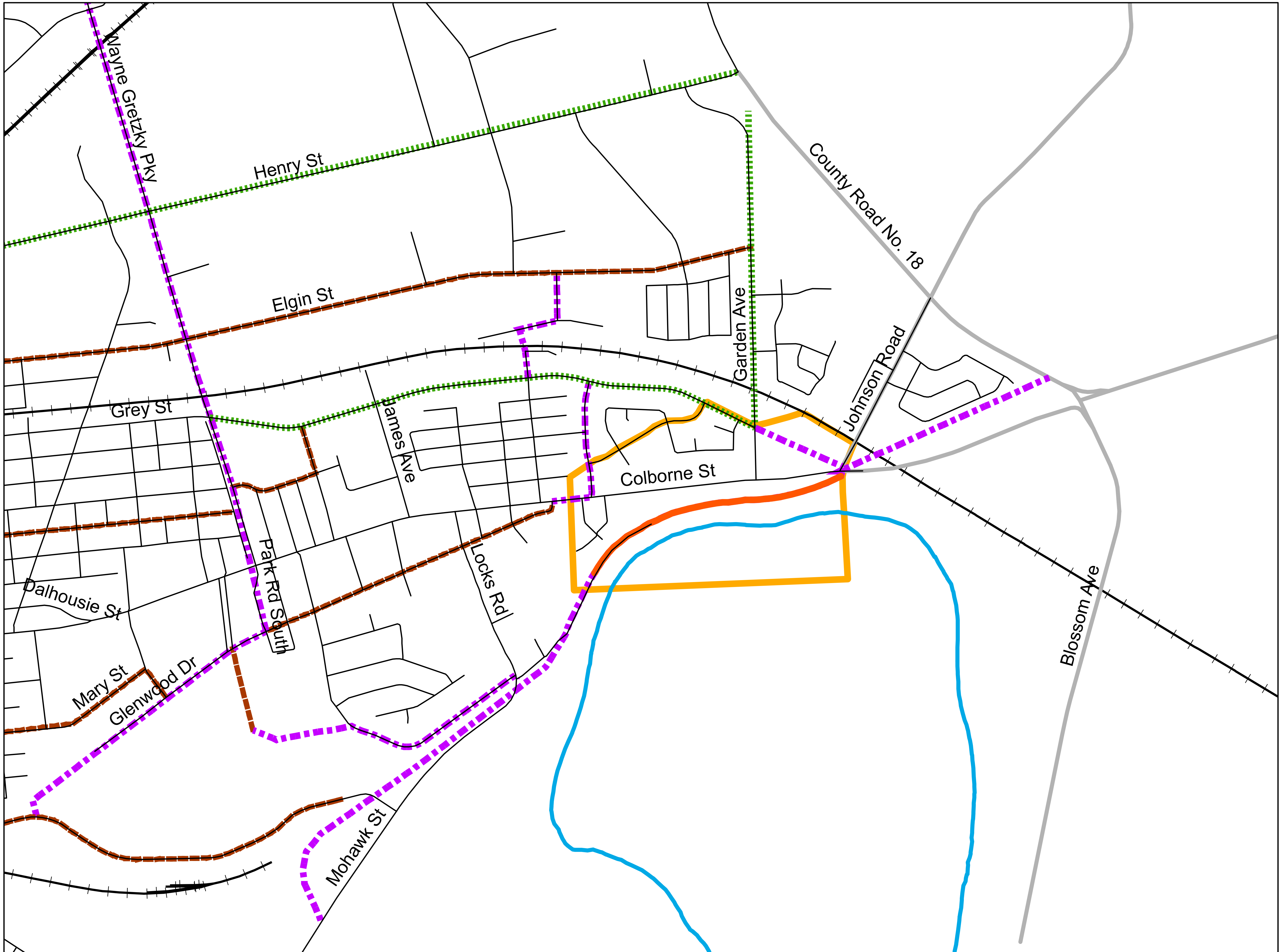

Colborne Street East Slope Stabilization EA

Figure 3-13
Bikeway Network Plan

Legend

- Study Area
- Grand River
- Potentially Impacted Section of Rail Trail
- Brant County Roads
- City of Brantford Road Network
- Active Railway

City of Brantford Bikeway Network (Official Plan)

- Multi-Use Trail
- On Road Bike Lane
- Signed Route

0 175 350 700
Meters

NAD 1983 UTM 17N | 1:15,000

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3.9 Utilities and Infrastructure

Utilities and other municipal infrastructure are often located adjacent to creeks in urban settings due to the availability of space and the natural gradient available to facilitate gravity drainage (i.e., sanitary sewers, water mains, stormwater outlets). The utilities within or near the slope monitoring area that have the potential to be directly impacted by the alternative solutions are identified in this section.

3.9.1 Water Distribution and Sanitary Sewer Municipal Infrastructure

The location of water distribution and sanitary sewer municipal infrastructure was determined based on City of Brantford data records.

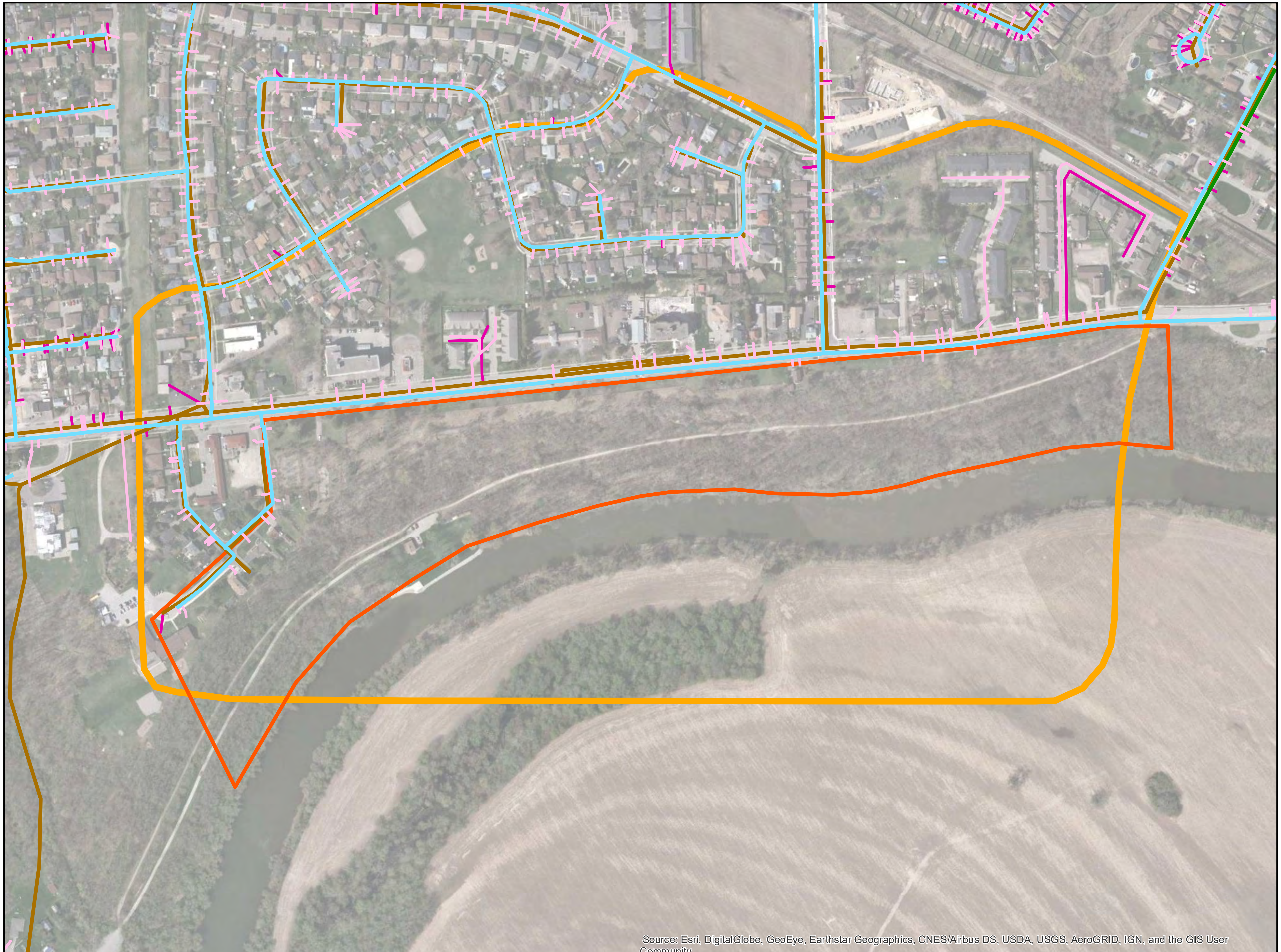
A water main network is located along Colborne Street East, Clara Crescent, and Calvin Street, ranging in size from 200mm to 300mm, with associated services to properties located along the aforementioned streets. No infrastructure was noted within the slope monitoring zone with the exception of a number of presumed abandoned services at the edge of the slope monitoring area, servicing previous properties which have since been acquired by the City. These services were shown at a number of locations, including 48 and 52 Clara Crescent, and numerous locations along Colborne Street East, including 909, 997, 1019, and 1025 Colborne Street East.

A series of gravity sanitary sewer mains and associated servicing connections exist along Colborne Street East and along Clara Crescent and Calvin Street. No sanitary infrastructure was noted within the slope monitoring area based on City records, although it is possible that sanitary sewer services exist in the same locations as abandoned water main services.

The water and sanitary municipal infrastructure data is provided visually in **Figure 3-14**. As noted above, there exist many laterals shown in this figure along Colborne Street (East) and Clara Crescent that are currently disconnected and inactive since the acquisition of private properties at those locations.

Colborne Street East Slope Stabilization EA

Figure 3-14
Water Distribution and Sanitary



Legend

- Water Mains
- Water Lateral Lines
- Sewer Pressurized Mains
- Sewer Gravity Mains
- Sewer Lateral Lines
- Slope Monitoring Area
- Study Area

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0 50 100 200
Meters

NAD 1983 UTM 17N | 1:4,000

Project: 1824 Colborne Street East - Slope Stabilization EA
Date: 2018/11

N E S W

Data Sources: Ecosystem Recovery Inc., 2018: City of Brantford, Bell Communications, Enbridge, Brantford Power

Document Path: E:\1824 - Colborne Street Slope Stabilization EA\GIS\MXD\Utilities\1824_WaterSanitary_20181114.mxd

3.9.2 Stormwater Infrastructure

The location of stormwater infrastructure was determined based on City of Brantford data records. The City data indicated a stormwater gravity sewer located along Colborne Street East, Clara Crescent and Calvin Street varying from 300mm to 750mm in diameter. The stormwater was found to discharge just west of the school located at 7 Calvin Street, as well as at two other locations with outlets from Glenwood Drive to the east of the school, into an open stormwater drain which ultimately outlets into the Grand River upstream of the slope monitoring area. Stormwater inlets (catch basins) were noted at regular intervals along the south side of Colborne Street East; these were investigated as part of the existing conditions characterization.

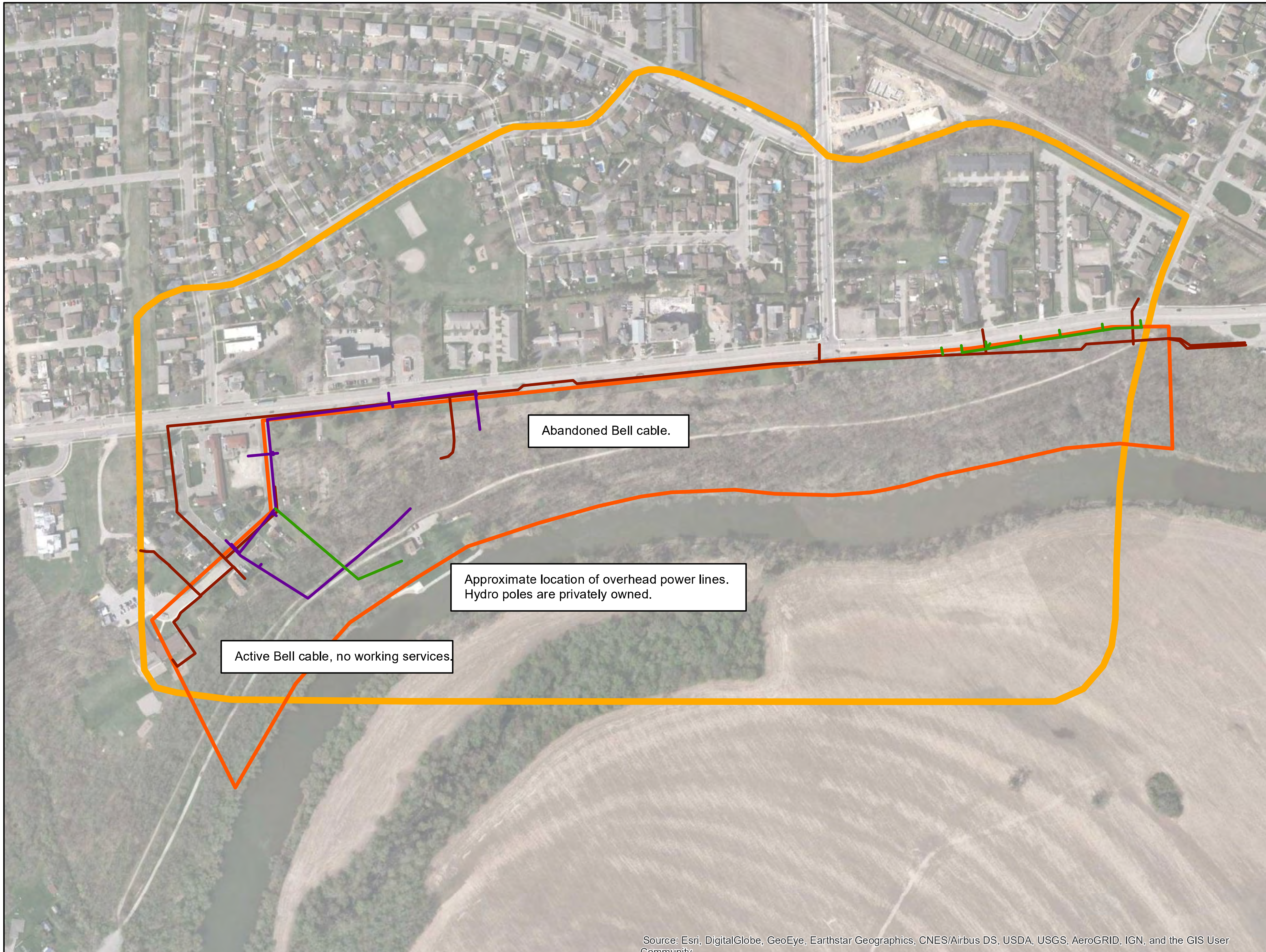
No stormwater infrastructure was noted directly in the slope monitoring area based on City infrastructure data. Additional details on the stormwater infrastructure characterization can be found in **Section 3.6.1**.

3.9.3 Utilities

A number of existing and abandoned utilities exist within and near the slope monitoring area that have the potential to be impacted by the alternatives identified through the EA process. The utilities within and near the slope monitoring area are summarized in the sections below. The utilities located within the slope monitoring area are shown in **Figure 3-15**.

Colborne Street East Slope Stabilization EA

Figure 3-15
Utilities Within Slope Monitoring Area



Legend

- Brantford Power
- Bell Communiations
- Enbridge Utilities
- Slope Monitoring Area
- Study Area

Note: additional utilities exist within Study Area which are not shown.

ecosystem recovery inc. PROFESSIONAL ENGINEERS

0 50 100 200 Meters

NAD 1983 UTM 17N | 1:4,000

Project: 1824 Colborne Street East - Slope Stabilization EA
Date: 2018/11

Data Sources: Ecosystem Recovery Inc., 2018; City of Brantford, Bell Communications, Enbridge, Brantford Power

Document Path: E:\1824 - Colborne Street Slope Stabilization EA\GIS\MXD\Utilities\1824_UtilityMap_20181114.mxd

Enbridge/Union Gas Utilities:

Gas lines are located along the north and south sides of Colborne Street East, as well as in the Clara Crescent neighbourhood to service the residential properties and institutional school property.

At the east side of the slope monitoring area, the gas lines encroach on the slope monitoring area along the south side of Colborne Street East, near the intersection with Johnson Road.

A gas line connection is also shown from the main 420 kPa line from the south side of Colborne Street East to the former property parcel located at 915 Colborne Street East, which is currently part of the City owned amalgamated 929 Colborne Street East property parcel.

Brantford Power:

Brantford Power infrastructure exists along Colborne Street East and within the Clara Crescent neighbourhood to service the existing properties. Encroachment of the infrastructure into the slope monitoring area occurs near the top of slope, east of Garden Avenue to the east limit of the slope monitoring area. It was also noted in communications with Brantford Power that there is an overhead secondary service line extending from near 52 Clara Crescent towards the Grand River to service 73 Beach Road, with privately owned hydro poles. The exact location of this service connection was not available from Brantford Power at the time of request.

Bell Canada:

Bell Canada infrastructure is located along the north and south side of Colborne Street East, as well as the Clara Crescent neighbourhood.

An abandoned cable is located at the 947 Colborne Street East property parcel, which extends approximately 41 m into the slope monitoring area towards the Grand River.

A buried cable is also located from Clara Crescent along Beach Road, which is active but currently does not have any working services.

Rogers Communications:

Rogers Communications infrastructure is located along Colborne Street East and within the Clara Crescent neighbourhood, although no infrastructure exists within the slope monitoring area.

4. Alternative Solutions

4.1 Development of Alternative Solutions

The intent of this study was to address the slope stability concerns along Colborne Street East regarding the risk to public safety, infrastructure, and residents in close proximity to the slope area. The alternative solutions are required to consider the social and economic impacts to the City and its residents, including the cost of construction and maintenance of the work. The background review and the characterization of the study area provided the context for developing and evaluating the broad range of plausible alternative solutions to addressing this challenge.

An initial list of alternative solutions was developed with consideration given to the alternatives evaluated in the previous 1995 ESR and updated in 2012. The alternatives were developed in the context of the stable slope line of 5.4:1 (horizontal:vertical) required to maintain stable conditions, which is not present under the existing conditions. The stable slope line would require the alteration of either the top of slope or bottom of slope constraints, or an alteration to the slope conditions to reduce the required grade. This led to the broad alternative solution categories, including the following:

Alternative 1. Do nothing; continue with the current monitoring program and re-evaluate in the future (a baseline comparison case for the evaluation);

Alternative 2. Monitoring;

Alternative 3. Altering the level of service along Colborne Street East by setting the slope line north, in order to achieve a stable slope line;

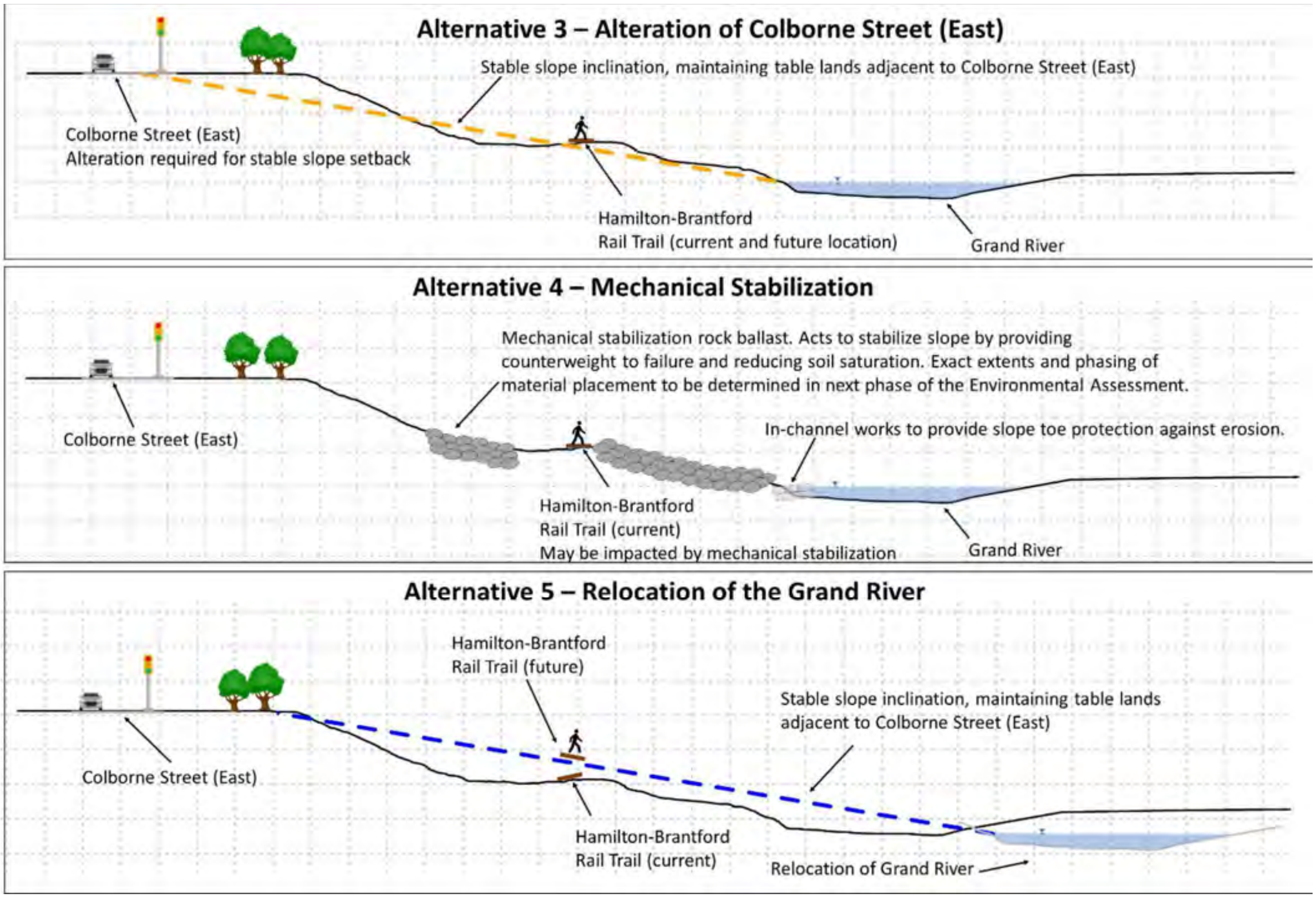
Alternative 4. Providing some form of mechanical stabilization to the slope to allow a slope to remain stable with a steeper slope than 5.4:1 (horizontal to vertical), while maintaining the constraints at the toe and top of slope; or

Alternative 5. Relocating the Grand River banks further south in order to achieve a stable slope line.

Through the course of multiple meetings and communications with the City of Brantford and GRCA staff, alternative two was further developed to include more sophisticated monitoring and phased placement of mechanical stabilization. These five (5) potential alternative solutions are described in more detail in the following sections.

Under all the alternatives, a method of reducing the risk to the public is to continue to acquire private properties within the slope monitoring area that are at risk in the case of a potential slope failure, where opportunities to do so are presented. This would be done in negotiations between the City, GRCA, and private property owners.

The conceptual representations of alternative solutions for Alternatives 3-5 are presented in profile view in **Figure 4-1** and in plan view in **Figure 4-2**.

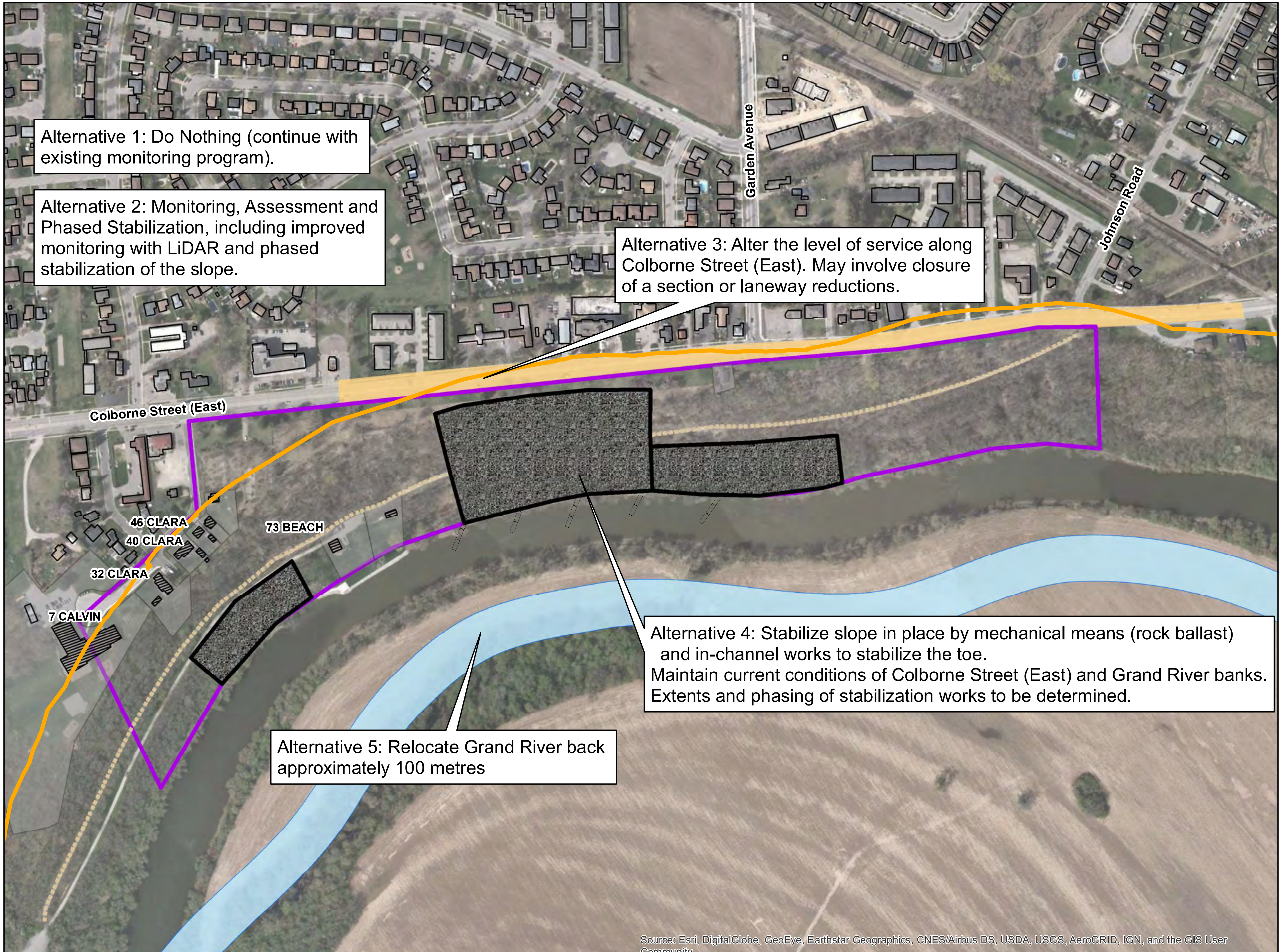


Note: figure provided as displayed at Public Information Centre #2.

Figure 4-1. Alternative Solution Concepts in Profile for Alternative Solutions 3-5

Colborne Street East Slope Stabilization EA

Figure 4-2
Alternative Solutions



Legend

- Hamilton-Brantford Rail Trail
- Building Footprint - Outside Study Area
- Building Footprint - Within Study Area
- Property Parcel
- Slope Monitoring Area
- Alternative 3: Colborne Street Alteration, Impacted Street Section
- Alternative 3: Colborne Street Alteration, Stable Slope Setback
- Alternative 4: Mechanical Stabilization, In-Channel Works
- Alternative 4: Mechanical Stabilization, Rock Ballast
- Alternative 5: Relocate Grand River

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0 50 100 200
Meters

NAD 1983 UTM 17N | 1:4,000

Project: 1824 Colborne Street East - Slope Stabilization EA
Date: 2020/04

N W E S

Data Sources: Ecosystem Recovery Inc., 2020:
Contains Information made available under Grand River Conservation Authority's Open Data Licence v1.0.
Contains information licensed under the Open Government Licence – Brantford.

Document Path: E:\1824 - Colborne Street Slope Stabilization EA\GIS\MXD\Alternative Solutions\1824_AlternativeSolutions_20190417.mxd

4.1.1 Alternative 1 - Do Nothing

The 'Do Nothing' Alternative is always included in EAs and provides a baseline with which to compare the other alternatives. In the case where the risk to public safety was deemed to be within acceptable boundaries and/or construction costs were too prohibitive to justify works, Do Nothing may be a preferred alternative solution.

The Do Nothing alternative would recommend that the City continue to operate with the same approach as prior to the study, which would include the following actions:

- Continue to perform annual monitoring of the slope with inclinometer data and topographic surveys;
- Continue to acquire private properties within the slope area in consultation with GRCA when the opportunity is presented; and
- Consider a re-evaluation of the project risk and timelines at a future date.

Under the Do Nothing alternative, the following outcomes would be anticipated:

- The slope will continue to move at an assumed constant baseline rate and will respond to substantial rainfall events and high ground water levels based on seasonal and annual natural variation; and
- The Grand River will continue to migrate into the slope through erosion at the toe and prevent a regeneration of the banks, contributing to ongoing oversteepening of the slope and slope movements.

4.1.2 Alternative 2 – Monitoring, Assessment, and Phased Stabilization

The 'Monitoring, Assessment, and Phased Stabilization' Alternative was developed in part following recommendations and discussions with City of Brantford staff. This alternative includes continued monitoring using updated technologies and more active approaches, as well as an intent to stabilize the slope in place using a phased approach as more data is collected.

This alternative would include the following actions:

- LiDAR surveys of the slope on an annual or bi-annual basis, using similar methods to those used in this study, either in conjunction with or as an alternative to the inclinometer monitoring being undertaken by the City;
- Continue to acquire private properties within the slope area in consultation with GRCA when the opportunity is presented;
- Consider real-time monitoring of the slope and an associated mitigation plan; and
- Implement phased mechanical stabilization and potentially toe protection on the slope area depending on the results of the LiDAR monitoring efforts (see Alternative 4, Section 4.1.4, for more details on potential methods of mechanical stabilization).

Under this alternative, the following outcomes would be anticipated:

- A more comprehensive understanding of the slope changes would result from the LiDAR surveys, since the entirety of the slope is measured and can be compared, in contrast to the point/line measurements that the current monitoring methods provide;
- The mitigation plan will be connected to real-time monitoring results, where threshold values for further stabilization, property acquisition, or emergency evacuation will be drafted; and
- Mechanical stabilization will begin to be implemented in key areas within 1-2-years, with the need for further stabilization to be implemented as determined from the LiDAR and real-time monitoring data.

4.1.3 Alternative 3 - Alter the Level of Service Along Colborne Street East

The ‘Alter the Level of Service Along Colborne Street East’ Alternative addresses the option to change the constraint at the top of the slope (i.e. Colborne Street East) in order to accommodate a stable slope of 5.4:1.

The implementation of this alternative would include the following actions:

- Continue to perform annual monitoring of the slope with inclinometer data and topographic surveys;
- Continue to acquire private properties within the slope area in consultation with GRCA when the opportunity is presented;
- Reduce the level of service along Colborne Street East, including lane reductions or complete closure of a section, with potential to further adjust the level of service based on monitoring information;
- Provide surface drainage delineation storm system and slope drainage storm system;
- Potential re-routing of traffic with a formal detour through alternate roadways; and
- Potential closure of the Hamilton-Brantford Rail Trail, depending on the implementation of slope grading.

Alteration of the level of service provided by Colborne Street East can be carried out in phases according to monitoring of slope movement. The initial phase could be to re-route traffic and reduce the roadway platform to one lane each way. If the monitoring results suggest further failure will occur, the Colborne Street East right-of-way would be reverted to hazard land and would require the re-routing of buried services such as sanitary, storm, and water as well as utilities.

4.1.4 Alternative 4 - Apply Mechanical Stabilization

The ‘Mechanical Stabilization’ Alternative would maintain the constraints at the top and toe of the slope and provide mechanical stabilization to the slope to reduce the 5.4:1 inclination that would otherwise be required. In this context, mechanical stabilization includes structures founded in stable soil and/or application of rock ballast on the slope surface to provide counter thrust. This alternative would include a surface and, where possible, a sub-surface drainage system to intercept and delineate runoff and seepage. This alternative would also include a stabilization of the Grand River outside meander using erosion protection and local flow training instream structures.

The implementation of this alternative would include the following actions:

- Continue to perform annual monitoring of the slope with inclinometer data and topographic surveys;
- Continue to acquire private properties within the slope area in consultation with GRCA when the opportunity is presented;
- Implement mechanical stabilization in the form of rock ballast (or other means) to provide counter force opposite to the direction of slope movement;
- Provide a surface drainage delineation storm system and slope drainage storm system;
- Provide erosion protection to the toe of the slope, designed to allow natural regeneration of the toe; and
- Potential closure of the Hamilton-Brantford Rail Trail, depending on the implementation of the mechanical stabilization.

The mechanical stabilization would be designed to target both the soil moisture and strength of the native soil, as well as the active toe erosion, improving the resistance of the slope to both deep-seated and less significant failures.

4.1.5 Alternative 5 – Relocate the Grand River

The ‘Relocate the Grand River’ alternative addresses the slope constraint at the bottom of the slope, in which the top of slope and Colborne Street East would be maintained, and the banks of the Grand River would be relocated south in order to accommodate the 5.4:1 safe slope. The Grand River would need to be re-aligned away from the slope a minimum distance of approximately 70 m; the re-alignment would be determined in the following phase of the EA process. This alternative would be carried out in concert with surface drainage improvements.

The implementation of this alternative would include the following actions:

- Continue to perform annual monitoring of the slope with inclinometer data and topographic surveys;
- Continue to acquire private properties within the slope area in consultation with GRCA when the opportunity is presented;
- Relocation of the Grand River to an alignment a minimum of 70 m south of its current position;
- Provide a surface drainage delineation storm system and slope drainage storm system; and
- Potential closure of the Hamilton-Brantford Rail Trail, depending on the implementation of slope grading.

4.2 Evaluation of Alternative Solutions

4.2.1 Evaluation Criteria and Methodology

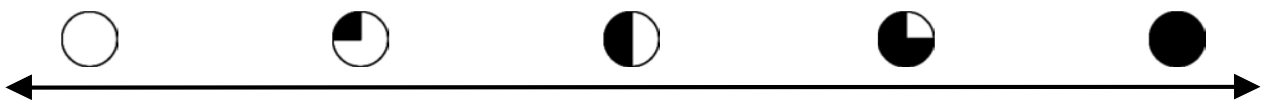
The alternative solutions presented in **Section 4.1** have been evaluated with a consistent methodology, the goal of which was to identify potential challenges and opportunities associated with the options. The evaluation criteria are described in **Table 4-1**. A qualitative rating scale, shown in **Table 4-2,** was used to assess each alternative against the evaluation criteria. An overall rating is then given to each criteria category (i.e., Public Health and Safety, Technical, Environmental, Archaeological and Heritage Resources, Socio-economic, Construction Cost, and Constructability) to allow an alternative-to-alternative comparison of how well the criteria are addressed. The overall weight of each criterion is shown in parentheses following each criterion title, with the largest weight being given to Public Health and Safety.

Table 4-1. Criteria for the Evaluation for the Slope Stability Alternative Solutions

Criteria	Description
Public Health and Safety (25%)	
Protection of residents from eventual slope failure	Protection of residents from risk of eventual slope failure
Protection of property from eventual slope failure	Protection of property and buildings from eventual slope failure
Protection of public from eventual slope failure	Protection of public along Colborne Street East and Hamilton-Brantford Rail Trail from risk of eventual slope failure
Protection of floodplain residents from flood risk	Protection of floodplain residents from flood backwater resulting from river blockage
Reduction of risk impact to major slope failures	Measure of risk reduction for future major slope failures
Technical (10%)	
Protection from erosion	Protection of the riverbanks from continual erosion
River stability	Measure of the impact on stability of the Grand River
Impacts on flooding	Measure of the impact on increased risk of flooding
Protection of traffic use on Colborne Street East	Protection of the existing traffic use on Colborne Street East
Impact on water quality	Measure of the impact on water quality in the Grand River
Environmental (15%)	
Impact on fish habitat	Measure of the impact on fish and other aquatic species and aquatic habitat
Impact on vegetation	Measure of the impact on vegetation on the slope and in surrounding project site
Impact on terrestrial habitat	Measure of the impact on terrestrial habitat and terrestrial species
Heritage and Archaeological Resources (10%)	
Disturbance of heritage resources	Measure of the disturbance of built and cultural heritage landscapes
Disturbance of archaeological resources	Measure of the disturbance of archaeological resources on site
Socio-economic (15%)	
Impact to existing Rail Trail	Measure of the impact on existing usage of the Hamilton-Brantford Rail Trail
Disruption of businesses	Measure of the impact on the disruption of businesses
Impacts to private property	Measure of the impact to adjacent private property and use of the surrounding area
Cost (15%)	
Property acquisition costs	Relative measure of the property acquisition costs
Construction costs	Relative measure of the initial construction costs
Operation and maintenance costs	Relative measure of the ongoing operation and maintenance costs following construction
Constructability (10%)	
Design implementation and access	Feasibility of project implementation, including construction access
Constructability	Overall technical constructability of the alternative
Maintenance requirements	Measure of the ongoing maintenance requirements following construction
Impact to existing utilities	Impact of the construction and maintenance on existing utilities in the study area

Table 4-2. Evaluation Ranking Criteria

Score	Qualitative Rating	Description
1	Least Desirable	Least positive, or negative, impact • Most cost • Environmental degradation • Difficult to implement
2		Minor negative impact
3		Neutral impact
4		Positive impact
5	Most Desirable	Most positive or beneficial impact • Least cost • Environmental improvement/gain



4.2.2 Alternative Solutions Evaluation Matrices

The evaluation of each alternative solution, as presented in the associated Public Information Centre (PIC) (#2, March 12, 2019), is presented in qualitative form in **Table 4-3**.

Table 4-3. Summary of Alternative Solutions Evaluation Results

Criteria	Alternative 1 (Do Nothing)	Alternative 2 (Monitoring, Assessment and Phased Stabilization)	Alternative 3 (Alter Colborne Street)	Alternative 4 (Mechanical Stabilization)	Alternative 5 (Relocate Grand River)
Public Health and Safety (25%)	○	◑	◕	◕	◕
Technical (10%)	◔	◑	◑	◕	◕
Environmental (15%)	●	●	●	◔	◔
Heritage and Archaeological Resources (10%)	●	●	◑	◔	◕
Socio-economic (15%)	◑	●	◔	◑	◑
Construction Cost (15%)	◕	◕	◔	◑	◔
Constructability (10%)	◕	◕	◔	◑	◔
Overall Score	○	●	◑	◕	◔

Table 4-4. Alternative Solutions Detailed Evaluation Matrix

Criteria	Weight (%)	Alternative 1 (Do Nothing)	Alternative 2 (Monitoring, Assessment and Phased Stabilization)	Alternative 3 (Alter Colborne Street)	Alternative 4 (Mechanical Stabilization)	Alternative 5 (Relocate Grand River)	Description
Public Health and Safety (25%)		**0.0**	**2.4**	**3.4**	**3.8**	**3.2**	
Protection of residents from eventual slope failure	5.0	0.0	2.0	4.0	4.0	3.0	Protection of residents from risk of eventual slope failure
Protection of property from eventual slope failure	5.0	0.0	3.0	3.0	4.0	3.0	Protection of property and buildings from eventual slope failure
Protection of public from eventual slope failure	5.0	0.0	3.0	4.0	4.0	3.0	Protection of public along Colborne Street East and Hamilton-Brantford Rail Trail from risk of eventual slope failure
Protection of floodplain residents from flood risk	5.0	0.0	2.0	3.0	3.0	4.0	Protection of floodplain residents from flood backwater resulting from river blockage
Reduction of risk impact to major slope failures	5.0	0.0	2.0	3.0	4.0	3.0	Measure of risk reduction for future major slope failures
Technical (10%)		**1.6**	**2.6**	**2.0**	**3.2**	**3.8**	
Protection from erosion	2.0	0.0	1.0	2.0	4.0	4.0	Protection of the riverbanks from continual erosion
River Stability	2.0	0.0	1.0	1.0	2.0	4.0	Measure of the impact on stability of the Grand River
Impacts on flooding	2.0	2.0	3.0	3.0	3.0	4.0	Measure of the impact on increased risk of flooding
Protection of traffic use on Colborne Street East	2.0	2.0	4.0	0.0	4.0	4.0	Protection of the existing traffic use on Colborne Street East
Impact on water quality	2.0	4.0	4.0	4.0	3.0	3.0	Measure of the impact on water quality in the Grand River
Environmental (15%)		**4.0**	**4.0**	**4.0**	**1.7**	**1.3**	
Impact on fish habitat	5.0	4.0	4.0	4.0	3.0	0.0	Measure of the impact on fish and other aquatic species and aquatic habitat
Impact on vegetation	5.0	4.0	4.0	4.0	1.0	2.0	Measure of the impact on vegetation on the slope and in surrounding project site
Impact on terrestrial habitat	5.0	4.0	4.0	4.0	1.0	2.0	Measure of the impact on terrestrial habitat and terrestrial species
Heritage and Archaeological Resources (10%)		**4.0**	**4.0**	**2.0**	**1.0**	**3.0**	
Disturbance of heritage resources	5.0	4.0	4.0	2.0	1.0	3.0	Measure of the disturbance of built and cultural heritage landscapes
Disturbance of potential archaeological resources	5.0	4.0	4.0	2.0	1.0	3.0	Measure of the disturbance of archaeological resources on site
Socio-economic (15%)		**2.0**	**4.0**	**1.3**	**2.7**	**2.7**	
Impact to existing Rail Trail	5.0	2.0	4.0	2.0	0.0	2.0	Measure of the impact on existing usage of the Hamilton-Brantford rail trail
Disruption of businesses	5.0	2.0	4.0	1.0	4.0	3.0	Measure of the impact on the disruption of businesses
Impacts to private property	5.0	2.0	4.0	1.0	4.0	3.0	Measure of the impact to adjacent private property and use of the surrounding area
Cost (15%)		**3.5**	**3.7**	**1.2**	**2.2**	**0.5**	
Property acquisition costs	2.5	3.0	3.0	2.0	3.0	2.0	Relative measure of the property acquisition costs
Construction costs	10.0	4.0	4.0	1.0	2.0	0.0	Relative measure of the initial construction costs
Operation and maintenance costs	2.5	2.0	3.0	1.0	2.0	1.0	Relative measure of the ongoing operation and maintenance costs following construction
Constructability (10%)		**3.3**	**3.8**	**1.3**	**2.9**	**1.9**	
Design implementation and access	2.0	4.0	4.0	1.0	2.0	1.0	Feasibility of the project implementation, including construction access
Constructability	3.0	4.0	4.0	2.0	3.0	1.0	Overall technical constructability of the alternative
Maintenance requirements	2.0	2.0	3.0	1.0	2.0	1.0	Measure of the ongoing maintenance requirements following construction
Impact to existing utilities	3.0	3.0	4.0	1.0	4.0	4.0	Impact of the construction and maintenance on existing utilities in the study area
Overall Score		**2.32**	**3.39**	**2.36**	**2.64**	**2.35**	

4.3 Preferred Alternative Solution

The purpose of the Municipal Class EA process is to evaluate the existing technical, natural, social, and economic conditions related to the identified problem or opportunity, to develop and evaluate potential alternatives to address the problem, and to select a preferred alternative to proceed to implementation. This section describes the results of the alternative solution evaluation process which included input received from the public and agencies and describes the preferred alternative solution for addressing slope stability concerns.

The preferred alternative solution presented at the second PIC was Alternative 2: Monitoring, Assessment and Phased Stabilization. The comments and feedback received as part of the public consultation process indicated a sense of urgency from the members of the public to stabilize the slope. In discussions with City staff, it was decided that the preferred alternative solution would include an initial stabilization phase that would evaluate the mechanical stabilization of a section of the slope; this selected alternative solution has been described as a hybrid between Alternative Solutions 2 and 4. The additional monitoring proposed with this alternative solution should determine, in part, the success of the slope stabilization and the extent to which the stabilization measure should be applied in the remaining areas of the slope.

The alternative design stage was determined to consider in its scope the precise extent of the initial stabilization effort. In addition, the alternative design would consider different design approaches for:

- The frequency and approach for improved monitoring, including an option for increased LiDAR data collection;
- The configuration of updated drainage works to control surface runoff in the slope area;
- The design of toe protection works along the Grand River; and
- The location, timing, and type of mechanical stabilization to be introduced.

5. Alternative Designs

5.1 Development of Alternative Designs

Based on the feedback from the second Public Information Centre (PIC) in March 2019 and the selection of the alternative solution, several concepts for the components/elements were identified and considered for inclusion in the alternative design. The concepts were considered somewhat independently to address various aspects of the slope stability issue, and were classified into four main categories for evaluation:

- Drainage;
- Slope toe protection;
- Mechanical stabilization; and
- Monitoring.

These concepts are discussed in more detail in the following sections.

5.1.1 Drainage

The presence of high groundwater levels within the valley slope was identified as a key influencing factor on slope instability, as discussed in **Section 3**. Due to the high pore water pressure and groundwater elevations at the site, the installation of drainage measures to lower the groundwater table within the lower, weaker portion of the slope was considered. Further, overland flow on the slope surface has been identified as a destabilizing factor on the valley slope. Therefore, a key component of the alternative designs is the management of drainage along the slope, both via surface and groundwater drainage. Concepts that were identified for potential drainage management of the slope are summarized below:

- **Berm** – manage and redirect overland flows. This drainage measure could be used at the top of the slope to minimize runoff onto the slope surface, preventing further erosion from surface flows.
- **Trail culverts** – culverts to be installed at locations along the existing Hamilton-Brantford Rail Trail to drain pooled overland flow and reduce soil moisture content on the slope.
- **Flexible piping** – high density polyethylene (HDPE) pipe will convey captured near-surface and overland flows down the valley slope towards the Grand River, without breaking during slope shifts and potential failures.
- **Inceptor trenches** – rock trenches for the collection and drainage of near-surface water at the top of the slope and at the trail.
- **Rock fingers** – a series of rock drainage features on the lower valley slope segment to reduce soil moisture. This drainage measure would be required to support mechanical stabilization, as existing soil moisture contents are too high to permit mechanical stabilization measures.

5.1.2 Toe Protection

The processes occurring at the toe of the slope (i.e. erosion, slope failure) due to the interactions between the valley slope and the Grand River has been identified as a major contributing factor of the slope instability within the study area. As such, in order to prevent further slope destabilization, slope toe protection has been recommended as a management measure. The installation of toe erosion protection at the base of the slope will prevent the ongoing removal of soil. Concepts identified for the protection of the valley slope are summarized below:

- **Armourstone spurs** – in-channel armourstone or rock spurs to provide slope toe protection and regenerate lost bank material.

- **Rock protection** – in-channel rock protection works to provide slope toe erosion protection.

The conceptual representations of alternative designs for toe protection are presented in profile view in **Figure 5-1**.

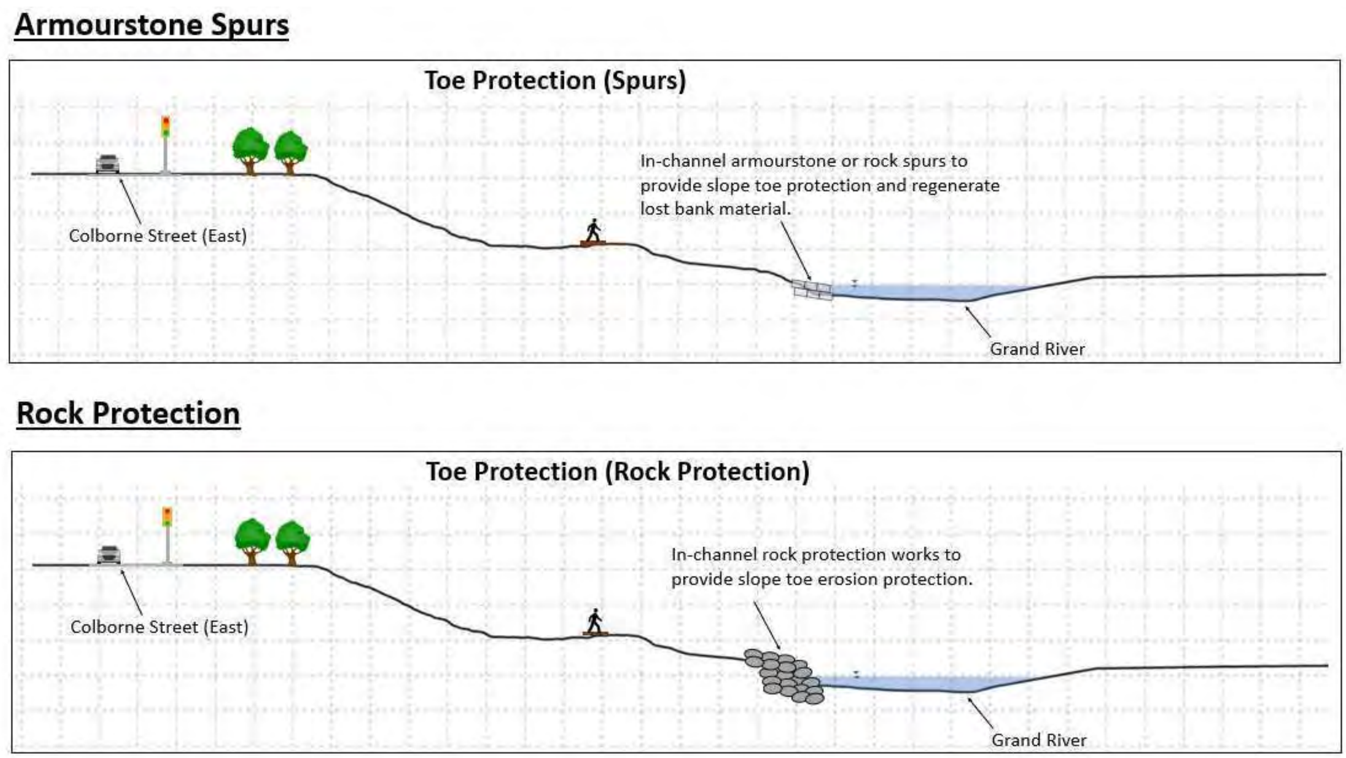


Figure 5-1. Alternative Concepts in Profile for Toe Protection

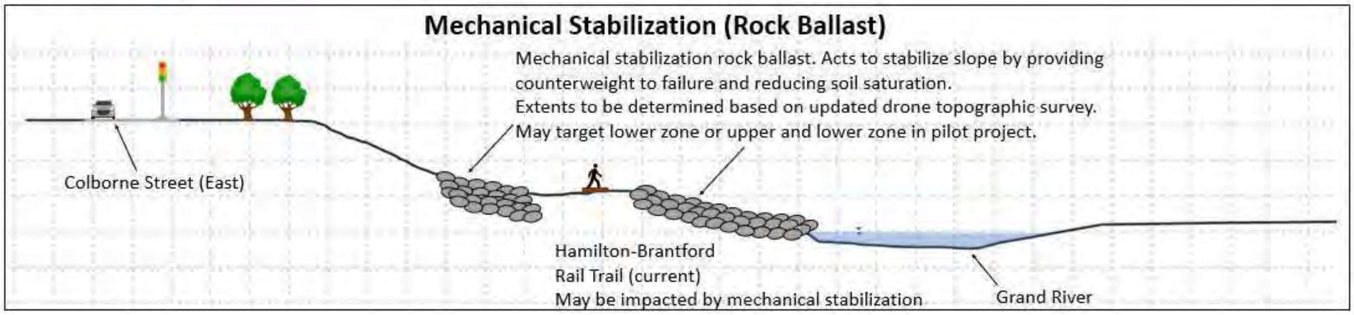
5.1.3 Mechanical Stabilization

Mechanical stabilization of the valley slope has been identified as a method of providing slope stability while maintaining existing constraints at the top and bottom of the slope.

- **Rock ballast** – acts to stabilize the slope by providing counterweight to rotational movement of the slope and reducing soil saturation. The extents of the installation would be determined based on the phased implementation strategy and monitoring results. The ballast would need to be implemented on the lower slope area prior to consideration for use on the upper slope. The Hamilton-Brantford Rail Trail (current) may be impacted by this mechanical stabilization approach.
- **Tiebacks to bedrock** – acts to stabilize the slope by providing a counter force to slope failure through cables anchored into bedrock. The extents of the installation would be determined based on the phased implementation strategy and monitoring results. This approach could be implemented on both the upper and lower slope independently.

The conceptual representations of alternative designs for toe protection are presented in profile view in **Figure 5-2**.

Rock Ballast



Tiebacks to Bedrock

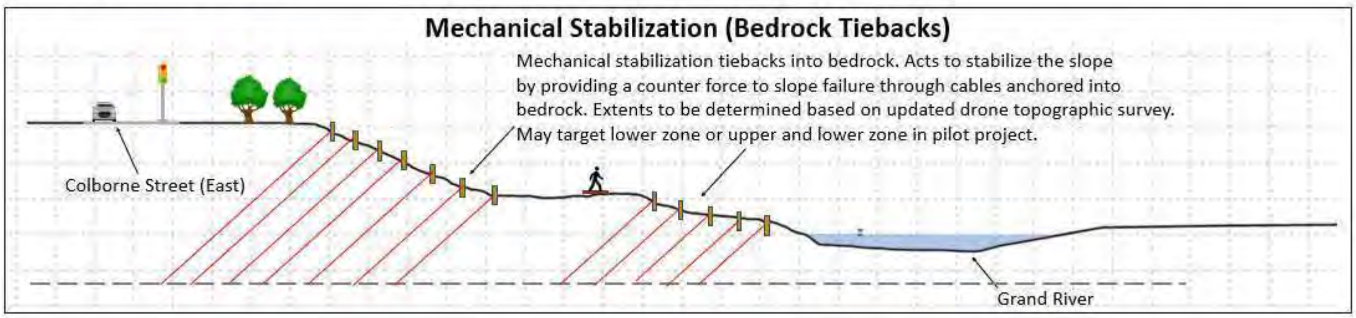


Figure 5-2. Alternative Design Concepts in Profile for Mechanical Stabilization

5.1.4 Slope Monitoring

The continued monitoring of the slope will be an essential component to determine the phasing of the stabilization works, as well as to evaluate the effectiveness of the implementation strategy. Monitoring methods would use updated technologies and more active approaches for annual or bi-annual data collection. The methods of slope monitoring recommended for the site are summarized below:

- **Groundwater monitoring** – monitoring of groundwater conditions will provide insight on the success of the selected drainage measure(s).
- **Annual LiDAR survey** – surveys of the slope on an annual or bi-annual basis using similar methods to those completed in this study, either in conjunction with or as an alternative to the inclinometer monitoring being undertaken by the City.

5.2 Evaluation of Alternative Designs

5.2.1 Evaluation Criteria and Methodology

The alternative designs presented in **Section 5.1** have been evaluated with a consistent methodology, the goal of which is to identify potential challenges and opportunities associated with the design options. The evaluation criteria are described in **Table 5-1**. A qualitative rating scale, shown in **Table 5-2**, was used to assess each alternative against the evaluation criteria. An overall rating is then given to each criteria category (i.e., Public Health and Safety, Technical, Environmental, Archaeological and Heritage Resources, Socio-economic, Construction Cost, and Constructability) to allow an alternative-to-alternative comparison of how well the criteria are addressed. The overall weight of each criterion is shown in parentheses following each criterion title, with the largest weight being given to Public Health and Safety.

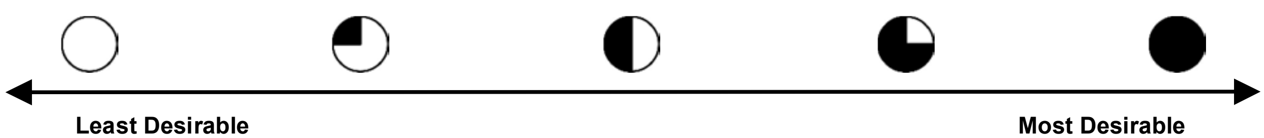
Table 5-1. Criteria for the Evaluation for the Slope Stability Alternative Solutions

Criteria	Description
Public Health and Safety (25%)	
Protection of residents from eventual slope failure	Protection of residents from risk of eventual slope failure
Protection of property from eventual slope failure	Protection of property and buildings from eventual slope failure
Protection of public from eventual slope failure	Protection of public along Colborne Street East and the Hamilton-Brantford Rail Trail from risk of eventual slope failure
Protection of floodplain residents from flood risk	Protection of floodplain residents from flood backwater resulting from river blockage
Reduction of risk impact to major slope failures	Measure of risk reduction for future major slope failures
Technical (10%)	
Protection from erosion	Protection of the riverbanks from continual erosion
River stability	Measure of the impact on stability of the Grand River
Impacts on flooding	Measure of the impact on increased risk of flooding
Protection of traffic use on Colborne Street East	Protection of the existing traffic use on Colborne Street East
Impact on water quality	Measure of the impact on water quality in the Grand River
Environmental (15%)	
Impact on fish habitat	Measure of the impact on fish and other aquatic species and aquatic habitat
Impact on vegetation	Measure of the impact on vegetation on the slope and in surrounding project site
Impact on terrestrial habitat	Measure of the impact on terrestrial habitat and terrestrial species
Heritage and Archaeological Resources (10%)	
Disturbance of heritage resources	Measure of the disturbance of built and cultural heritage landscapes
Disturbance of archaeological resources	Measure of the disturbance of archaeological resources on site
Socio-economic (15%)	
Impact to existing Rail Trail	Measure of the impact on existing usage of the Hamilton-Brantford Rail Trail
Disruption of businesses	Measure of the impact on the disruption of businesses
Impacts to private property	Measure of the impact on adjacent private property and use of the surrounding area
Cost (15%)	
Property acquisition costs	Relative measure of the property acquisition costs
Construction costs	Relative measure of the initial construction costs
Operation and maintenance costs	Relative measure of the ongoing operation and maintenance costs following construction
Constructability (10%)	
Design implementation and access	Feasibility of project implementation, including construction access
Constructability	Overall technical constructability of the alternative

Maintenance requirements	Measure of the ongoing maintenance requirements following construction
Impact to existing utilities	Impact of the construction and maintenance to existing utilities in the study area

Table 5-2. Evaluation Ranking Criteria.

Score	Qualitative Rating	Description
1	Least Desirable	Least positive, or negative, impact • Most cost • Environmental degradation • Difficult to implement
2		Minor negative impact
3		Neutral impact
4		Positive impact
5	Most Desirable	Most positive or beneficial impact • Least cost • Environmental improvement/gain



5.2.2 Alternative Designs Evaluation Matrices

The evaluation of each alternative design element, as presented at the third PIC on November 13, 2019, is presented in qualitative form in **Table 5-3**.

Table 5-3. Summary of Alternative Solutions Evaluation Results

	Drainage					Mechanical Stabilization		Toe Protection		Slope Monitoring		
Criteria	Berms	Trail Culverts	Flexible Piping	Interceptor Trenches	Rock Fingers	Rock Ballast	Bedrock Tiebacks	Rock Protection	Spurs	Groundwater Monitoring	Annual LiDAR Survey	Real-time Slope Monitoring
Public Health and Safety (25%)	◑	◕	◕	◕	●	●	●	◕	◕	◔	◔	◑
Technical (10%)	◔	◑	◑	◑	◑	◕	◑	◕	◕			
Environmental (15%)	◑	◔	◔	◔	◔	◑	◑	◑	◑			
Heritage and Archaeological Resources (10%)	◔	◑	◑	◑	◑	◑	◑	◑	◑			
Socio-economic (15%)	◕	◑	◑	◕	◕	◔	◑	◑	◑			
Cost (15%)	○	◕	◕	◕	◑	◕	○	●	◔	◑	◑	◔
Constructability (10%)	◑	◑	◑	◑	◕	◕	○	●	◔	◑	◕	○
Include in Preferred Alternative Design?	○	●	●	●	●	●	○	●	○	●	●	○

Table 5-4. Alternative Design Detailed Evaluation Matrix

Criteria	Weight (%)	Drainage					Mechanical Stabilization		Toe Protection		Slope Monitoring			Description
		Berms	Trail Culverts	Flexible Piping	Interceptor Trenches	Rock Fingers	Rock Ballast	Bedrock Tiebacks	Rock Protection	Armour -stone Spurs	Inclinometer Surveys	Annual Drone Flight	Real-time Slope Monitoring	
Public Health and Safety (25%)		**2.6**	**3.0**	**3.0**	**3.0**	**4.0**	**4.0**	**4.0**	**3.0**	**3.4**	**1.7**	**1.7**	**2.6**	
Protection of infrastructure from eventual slope failure	7.5	3.0	3.0	3.0	3.0	4.0	4.0	4.0	3.0	3.0	2.0	2.0	2.0	Protection of municipally owned infrastructure from eventual slope failure
Protection of public from eventual slope failure	7.5	3.0	3.0	3.0	3.0	4.0	4.0	4.0	3.0	3.0	1.0	1.0	4.0	Protection of public along Colborne Street East and Hamilton-Brantford Rail Trail from risk of eventual slope failure
Reduction of risk impact to major slope failures	10.0	2.0	3.0	3.0	3.0	4.0	4.0	4.0	3.0	4.0	2.0	2.0	2.0	Measure of risk reduction for future major slope failures
Technical (10%)		**1.2**	**2.2**	**2.2**	**2.8**	**2.8**	**3.0**	**2.4**	**3.2**	**3.2**	**0.0**	**0.0**	**0.0**	
Protection from erosion	2.0	0.0	1.0	1.0	2.0	2.0	4.0	2.0	3.0	4.0	0.0	0.0	0.0	Protection of the riverbanks from continual erosion
River stability	2.0	2.0	0.0	0.0	2.0	3.0	3.0	2.0	3.0	4.0	0.0	0.0	0.0	Measure of the impact on stability of the Grand River
Impacts on flooding	2.0	1.0	4.0	4.0	4.0	3.0	2.0	2.0	3.0	3.0	0.0	0.0	0.0	Measure of the impact on increased risk of flooding
Effectiveness	2.0	1.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	0.0	0.0	0.0	Effectiveness of design at mitigating slope failure and performing intended function
Impact on water quality	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	4.0	1.0	0.0	0.0	0.0	Measure of the impact on water quality in the Grand River
Environmental (15%)		**2.7**	**1.3**	**1.3**	**1.3**	**1.3**	**2.0**	**2.7**	**2.0**	**2.0**	**0.0**	**0.0**	**0.0**	
Impact on fish habitat	5.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	4.0	0.0	0.0	0.0	0.0	Measure of the impact on fish and other aquatic species and aquatic habitat
Impact on vegetation	5.0	3.0	1.0	1.0	1.0	1.0	2.0	3.0	1.0	3.0	0.0	0.0	0.0	Measure of the impact on vegetation on the slope and in surrounding project site
Impact on terrestrial habitat	5.0	3.0	1.0	1.0	1.0	1.0	2.0	3.0	1.0	3.0	0.0	0.0	0.0	Measure of the impact on terrestrial habitat and terrestrial species
Heritage and Archaeological Resources (10%)		**1.0**	**2.5**	**2.5**	**2.5**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**0.0**	**0.0**	**0.0**	
Disturbance of heritage resources	5.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	0.0	0.0	0.0	Measure of the disturbance of built and cultural heritage landscapes
Disturbance of potential archaeological resources	5.0	0.0	3.0	3.0	3.0	2.0	2.0	2.0	2.0	2.0	0.0	0.0	0.0	Measure of the disturbance of archaeological resources on site
Socio-economic (15%)		**3.3**	**2.7**	**2.7**	**3.0**	**3.3**	**1.7**	**2.7**	**2.0**	**2.0**	**0.0**	**0.0**	**0.0**	
Impact to existing Rail Trail	5.0	4.0	3.0	3.0	3.0	4.0	1.0	3.0	2.0	2.0	0.0	0.0	0.0	Measure of the impact on existing usage of the Hamilton-Brantford Rail Trail
Disruption of businesses	5.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	0.0	0.0	0.0	Measure of the impact on the disruption of businesses
Impacts to private property	5.0	4.0	3.0	3.0	4.0	4.0	2.0	3.0	2.0	2.0	0.0	0.0	0.0	Measure of the impact to adjacent private property and use of the surrounding area
Cost (15%)		**0.3**	**3.0**	**3.0**	**3.0**	**2.3**	**3.7**	**0.7**	**4.0**	**1.3**	**2.0**	**2.7**	**1.3**	
Construction costs	10.0	0.0	3.0	3.0	3.0	2.0	4.0	0.0	4.0	1.0	2.0	2.0	2.0	Relative measure of the initial construction costs
Operation and maintenance costs	5.0	1.0	3.0	3.0	3.0	3.0	3.0	2.0	4.0	2.0	2.0	4.0	0.0	Relative measure of the ongoing operation and maintenance costs following construction
Constructability (10%)		**2.3**	**2.5**	**2.5**	**2.5**	**3.0**	**3.4**	**0.8**	**4.0**	**1.9**	**2.6**	**3.4**	**0.6**	
Design implementation and access	2.0	4.0	2.0	2.0	2.0	2.0	2.0	2.0	4.0	0.0	2.0	4.0	0.0	Feasibility of the project implementation, including construction access
Constructability	3.0	3.0	3.0	3.0	3.0	4.0	4.0	0.0	4.0	1.0	4.0	4.0	0.0	Overall technical constructability of the alternative
Maintenance Requirements	2.0	0.0	3.0	3.0	3.0	4.0	3.0	2.0	4.0	2.0	2.0	4.0	0.0	Measure of the ongoing maintenance requirements following construction
Impact to existing utilities	3.0	2.0	2.0	2.0	2.0	2.0	4.0	0.0	4.0	4.0	2.0	2.0	2.0	Impact of the construction and maintenance to existing utilities in the study area
Overall Score		**2.05**	**2.52**	**2.52**	**2.63**	**2.83**	**2.94**	**2.42**	**2.87**	**2.36**	**0.99**	**1.17**	**0.91**	

5.3 Preferred Alternative Design

The purpose of the Municipal Class EA process is to evaluate the existing technical, natural, social, and economic conditions related to the identified problem or opportunity, to develop and evaluate potential alternatives to address the problem, and to select a preferred alternative to proceed to implementation. This section describes the results of the alternative design evaluation process which included input received from the public and agencies and describes the preferred alternative design for addressing slope stability concerns.

The preferred alternative design presented at the third PIC was a hybrid between Alternative Solutions 2 and 4. Based on further evaluation and public and agency consultation, the preferred alternative design includes a potential phased approach. The first phase will include toe protection along the Grand River and the installation of rock fingers to facilitate draining of the lower slope and lowering of the groundwater as much as possible. The first phase will also include an overland flow/drainage strategy, which would include collection trenches and slope drainage pipes including culverts under the existing Rail Trail. Lastly, the first phase would include a monitoring program. The second phase of the alternative design would include the installation of the rock ballast mechanical stabilization.

Elements of the preferred alternative design are further discussed below.

Drainage – Interceptor Trenches with Flexible Drainage Pipes (Phase 1)
The interceptor trenches (subdrains) would be installed from the top of the slope and along the Rail Trail. Flexible HDPE drainage pipes would be installed in the base of the excavation and should follow OPSS 216.021 for either an unwrapped trench or wrapped trench. The HDPE interceptor pipes would be connected to structures that would direct the flow through HDPE pipes down the slope to outlet to the Grand River. The down slope pipes would be on the surface of the slope to facilitate construction and maintenance. The location of the down slope pipes would follow the natural slope topography and the sizing would be based on the contributing drainage area and estimated flows.

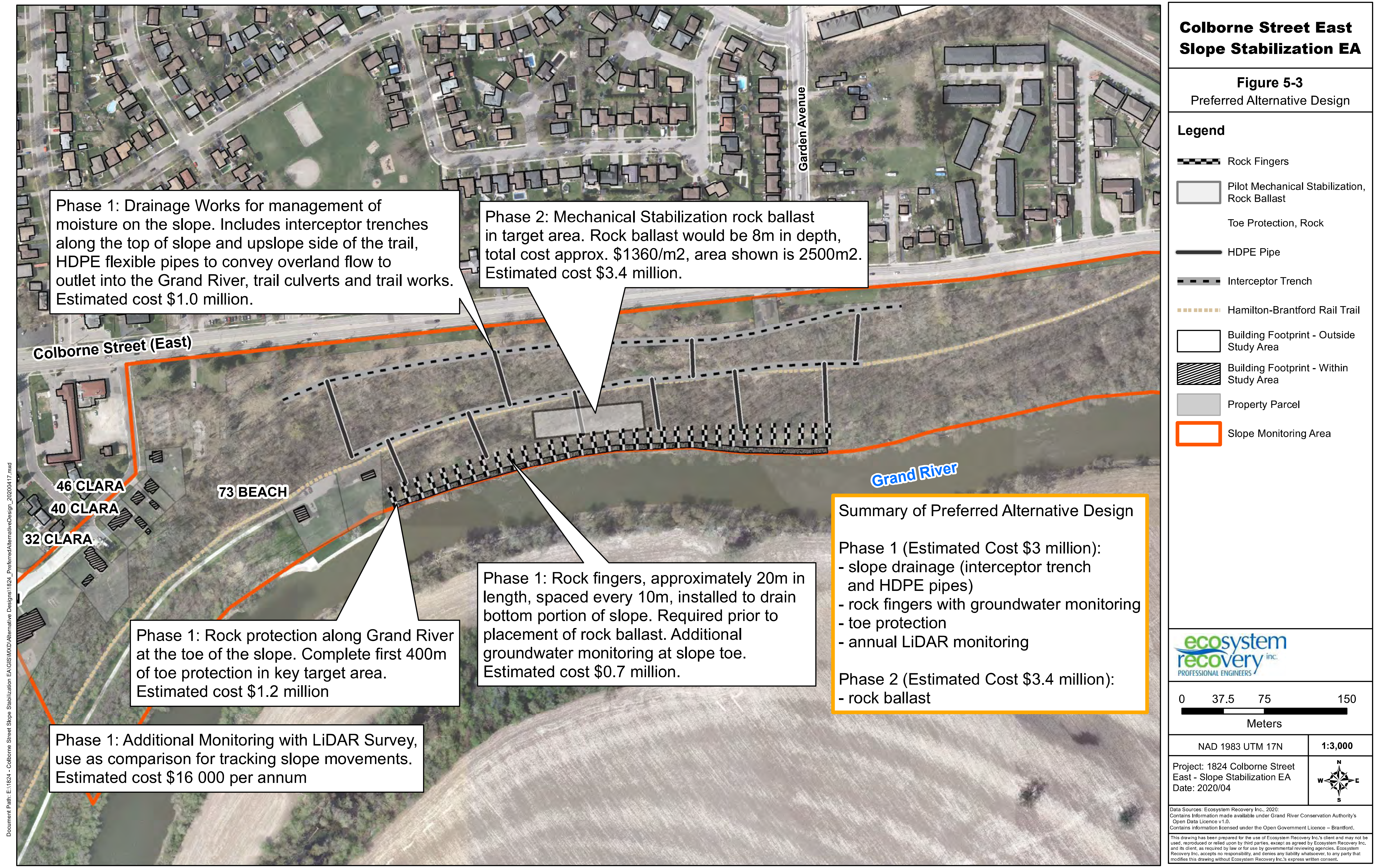
Drainage – Rock Fingers (Phase 1)
Rock fingers would be installed from the toe protection along the Grand River and extended perpendicularly into the lower slope. The rock fingers are intended to be 2 m wide and 3-4 m deep cuts into the existing slope that are filled with angular stone. The fingers should extend approximately 20 m in length (into the slope) and be spaced every 10 m along the extent of the toe protection. These fingers are intended to lower the local groundwater, decrease the pore water pressure in the soils, and increase the structural stability/capacity of the lower slope (along the River). The effectiveness of these fingers will need to be evaluated prior to the implementation of the rock ballast (Phase 2).

Toe Protection – Rock Protection (Phase 1)
Rock toe protection will stabilize the bank along the Grand River and prevent further erosion and loss of stabilizing bank materials. The rock protection will include a mixture of rock sizes to minimize the void ratio and provide a stable mix resistant to the design flows of the Grand River. The toe protection is intended to be placed along the outside of the existing bank and not excavated into the existing toe of the slope. The installation of this rock toe protection will provide a platform for the installation of the rock fingers noted previously.

Slope Monitoring (Phase 1)
Monitoring will be an essential component of alternative design, not only to inform the implementation strategy but to provide feedback on the effectiveness of the approach. Annual LiDAR data will be collected to identify any changes in the surface topography. Data collection will identify areas of concern and inform future analysis and assessment. Real-time groundwater monitoring is also recommended. This data will inform the effectiveness of the drainage strategy in lowering groundwater levels and will provide insight into the response of groundwater levels to rainfall events.

Mechanical Stabilization – Rock Ballast (Phase 2)

The rock ballast is a large mass of rock intended to resist the rotational failure of the slope. The ballast would essentially provide a counterweight to the soils above it and would need to be designed as such. The geotechnical assessment completed as part of this study indicated that the lower slope soils did not have the foundational stability to support the rock required to provide a ballast. As such, the effectiveness of the drainage elements of Phase 1 (interceptor trenches and rock fingers) in lowering the groundwater and improving the soil stability will need to be evaluated prior to the implementation of the rock ballast. The groundwater monitoring recommended as part of Phase 1 will inform the stability analysis necessary to ensure the soils will support the rock required.



Colborne Street East
Slope Stabilization EA
Figure 5-3
Preferred Alternative Design
Legend
Rock Fingers
Pilot Mechanical Stabilization, Rock Ballast
Toe Protection, Rock
HDPE Pipe
Interceptor Trench
Hamilton-Brantford Rail Trail
Building Footprint - Outside Study Area
Building Footprint - Within Study Area
Property Parcel
Slope Monitoring Area
Phase 1: Drainage Works for management of moisture on the slope. Includes interceptor trenches along the top of slope and upslope side of the trail, HDPE flexible pipes to convey overland flow to outlet into the Grand River, trail culverts and trail works. Estimated cost $1.0 million.
Phase 2: Mechanical Stabilization rock ballast in target area. Rock ballast would be 8m in depth, total cost approx. $1360/m2, area shown is 2500m2. Estimated cost $3.4 million.
Garden Avenue
Colborne Street (East)
46 CLARA
40 CLARA
32 CLARA
73 BEACH
Grand River
Phase 1: Rock fingers, approximately 20m in length, spaced every 10m, installed to drain bottom portion of slope. Required prior to placement of rock ballast. Additional groundwater monitoring at slope toe. Estimated cost $0.7 million.
Phase 1: Rock protection along Grand River at the toe of the slope. Complete first 400m of toe protection in key target area. Estimated cost $1.2 million
Phase 1: Additional Monitoring with LiDAR Survey, use as comparison for tracking slope movements. Estimated cost $16 000 per annum
Summary of Preferred Alternative Design
Phase 1 (Estimated Cost $3 million):
- slope drainage (interceptor trench and HDPE pipes)
- rock fingers with groundwater monitoring
- toe protection
- annual LiDAR monitoring
Phase 2 (Estimated Cost $3.4 million):
- rock ballast
ecosystem recovery inc.
PROFESSIONAL ENGINEERS
0
37.5
75
150
Meters
NAD 1983 UTM 17N
1:3,000
Project: 1824 Colborne Street East - Slope Stabilization EA
Date: 2020/04
N
E
S
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Data Sources: Ecosystem Recovery Inc., 2020:
Contains Information made available under Grand River Conservation Authority's Open Data Licence v1.0.
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Document Path: E:\1824 - Colborne Street Slope Stabilization EA\GIS\MXD\Alternative Designs\1824_PreferredAlternativeDesign_20200417.mxd

6. Public Agency Consultation

6.1 Public and Agency Notification

A mailing list of review agencies and other stakeholders was established based on the recommended agency contact list in the Municipal Class EA guidelines. The Notice of Study Commencement was distributed to these contacts to describe the project and to invite feedback.

A Notice of Completion for this Municipal Class Environmental Assessment was sent to relevant agencies, utilities, and the public coincident with the filing of the study report. A list of contacted agencies throughout this process, maintained by the City of Brantford, is provided in **Appendix E**.

6.2 First Nations Consultation

The Notice of Commencement was also delivered to representatives of First Nations groups with potential interest in the project or with potential land claims in the study area. A First Nations Consultation plan was developed in consultation with the City, which described the project background, goals, and timelines, as well as outlined the process for documenting and addressing any concerns raised by First Nations. The consultation plan was distributed to both the Six Nations of the Grand River and the Mississaugas of the New Credit.

The Six Nations of the Grand River responded to the notices and a meeting was held at 1721 Chiefswood Road at the Iroquois Village Plaza in Oshweken, ON, on March 13th, 2019. This was held shortly after the second PIC, where materials from the second PIC were presented with an opportunity to provide input on the currently preferred alternative solution. The Six nations representatives were generally in favour of the characterization and recommended Alternative Solution that had been selected thus far.

A copy of the agency mailing list, sample letter, First Nations Consultation Plan, and First Nations correspondence is included in **Appendix E**.

6.3 Public Information Centre No. 1

A Public Information Center (PIC) was held on September 13, 2018 between 4:00pm and 6:00pm, at the Mohawk Park Pavilion in Brantford, Ontario. The Notice of Commencement and the public announcement of the PIC was posted on the City of Brantford web pages thirty (30) days prior to the scheduled date. City of Brantford staff also placed notices for this first PIC and Notice of Commencement in local newspaper, including the Brantford Expositor on August 30th, September 6th, and September 13th (2018); and in the Two Row Times on September 5th, 2018. The City also hand delivered door knocker ads, and mailed out notices to both residents within the study area and the agency contacts, prior to each PIC.

In total, thirty-four (34) area residents signed the register. The PIC included display boards depicting the study purpose, the EA process, existing conditions including measured slope movement rates, and steps for the second PIC. ERI and City of Brantford staff were present to answer any questions, engage with the public, and assist the public with developing an understanding of the study.

An informal presentation was made to introduce the study area and provide explanation and background for the display boards. This was followed by a question and answer period that was facilitated by City of Brantford and ERI staff. The concerns raised at this PIC were addressed in this period by City of Brantford and ERI staff, and any outstanding concerns were encouraged for submission in hardcopy at the PIC or digitally for a two week period following the PIC.

Six (6) forms with written feedback were received from residents living within the study area, and are included along with the PIC display materials and public comment sheets in **Appendix E**. The comments received are summarized in **Table 6-1**, and are summarized for both residents within the study area and those with properties within the slope monitoring area.

Table 6-1. Summary of Written Comments Received from PIC No. 1

Category	Residents within the Study Area	Residents within the Slope Monitoring Area
Transportation concerns	• Heavy truck traffic on Colborne Street East noted by several residents, including heavy truck and other traffic driving in excess of speed limits and during evenings and overnight periods • Potential link between heavy truck traffic and slope instability in study area noted • Concern over the northeast railway track producing excessive vibration as a contributing factor to slope instability; it was noted that the railway was to be discontinued 5.5 years ago and turned into a rail trail, and is instead being renewed for continued use as a railway	
Planning and urban design concerns	• Recommendation to limit building heights and building density along Colborne Street East within the study area	
Economic impacts	• Concern with the potential impact on residential and business property values (and property taxes) on the north side of Colborne Street East as a result of the changes to the street within the study area	
Slope movement monitoring		• Significant change noted in the top of slope near 46 Clara Crescent within the last two years • Rate of slope change in this area does not seem to be reflected in the slope study area movement rates figure posted at the PIC

Table 6-2. Responses to Comments from PIC No. 1

PIC #1 Received Comment	Response
Heavy truck traffic on Colborne Street East often in excess of speed limit, including during evening and overnight periods.	Truck traffic will be considered in any potential changes made to Colborne Street East as a result of the slope stability

	project. Truck traffic is not thought to have significant impact on slope stability.
Concern over the northeast railway, crossing Colborne Street East and Johnson Road, causing excessive vibration with potential to impact slope stability.	Railway is located sufficiently far from the slope area and is unlikely to have significant impacts on the stability of the slope.
Recommendation made to limit building heights and building density along Colborne Street East within the study area.	Planning staff at the City of Brantford and GRCA have been informed of this slope stability project and will consider potential outcomes in development applications.
Concern on potential impact on property values and businesses on north side of Colborne Street East as a result of changes to the site.	Addressing slope issues to reduce long term risk of movements will act to maintain long term stability of the street and bolster economic viability. Further impacts to property values and businesses will be considered on a specific basis as an alternative solution is selected.
Significant changes noted to the top of slope at Clara Crescent.	Rate of slope movement is not shown in slope monitoring data, however, local large movements are possible. Any slope stability measure will address the slope near specific properties in more detail.
Recommendation to consider geotechnical slope stabilization measures on the slope, such as helical piles and anchors.	Mechanical stabilization is being considered as an alternative, although the depth to bedrock makes the use of helical piles or anchors impractical.
Concern over a large proposed development within the study area along the north side of Colborne Street East.	The recommendations resulting from the selection of an alternative solution following the PIC today will be passed onto the City development staff for use in reviewing any development applications within the study area.
Erosion issues noted along the stormwater drain along Locks Road, upstream of the study area.	The ravine is located outside of the study area, and thus does not impact the slope stability and is not considered as part of this process. The concern regarding the stormwater drain has been recorded by the City for future reference.

6.4 Public Information Centre No. 2

A second PIC was held at the Woodman Park Community Centre in Brantford, ON, on March 12, 2019 between 5:00pm and 7:00pm. The public announcement of the PIC was posted on the City of Brantford web pages thirty (30) days prior to the public meeting. The City also placed advertisements in local newspaper prior to the PIC, including the Brantford Expositor on February 28th and March 7th (2019), and the Two Row Times on February 27th (2019). As for the first PIC, door knocker ads were delivered to residents within the study area and agency contacts prior to the second PIC.

This PIC included a formal presentation and question and answer period, in addition to the display boards set up at the meeting location. The PIC sign-in sheet collected the names of twenty-nine (29) attendees. The information centre included display boards and presentation materials depicting the study purpose and EA process, updates on the existing conditions since the previous PIC, and a presentation of the alternative solutions considered at this phase of the EA process. The alternative solution called “Alternative 2: Monitoring, Assessment and Phased Stabilization” was presented as the preferred alternative solution at this stage, with an opportunity for public input prior to a formal decision on the alternative solution to be pursued.

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ERI, Pinchin Environmental, and City of Brantford staff were present to answer any questions, engage with the public, and assist the public with developing an understanding of the study. An informal presentation was made with the same materials as the PIC boards to provide background on the study and existing conditions, with an emphasis on the alternative solutions considered. This was followed by a question and answer period that was facilitated by the City of Brantford, Pinchin Environmental, and ERI staff. A summary of the comments and concerns raised during the PIC, notes of conversations with members of the public by the project team, and comments received in digital or hardcopy during or following the PIC are summarized in **Table 6-3**. The PIC sign-in form and records of comment forms and meeting minutes are included in **Appendix E**.

Table 6-3. Summary of Comments and Concerns Raised During PIC No. 2

Comments/Concerns During the PIC

Category	Comment/Concern	Response (during PIC Discussion)
Rail vibration	Concern over excessive rail vibration and its impact on both his home and the slope condition was noted by a resident of Clara Crescent.	The main issue with the slope is deep seepage and moisture content of the soil; rail vibration is not the primary cause of the instability. However, there is potential to install vibration monitoring equipment to determine if the vibration exceeds standards.
Grand River toe erosion	Concern over the erosion at the outside bend of the river, and the lack of protection existing on the bend through the years and previous studies.	The erosion of the toe by the Grand River prevents the regeneration of the bend for improved stability; this will be addressed in the alternative solution and design selected.
Slope stability and drainage	Suggestion that the use of tile drains can be used to drain the slope to reduce soil moisture and improve slope stability.	The soil type in the slope makes this approach infeasible, as the clay soil has a very small radius of influence.
Slope protection and timing	General consensus from members of the public is that action to stabilize the slope should be taken as soon as possible, and not prolong action to stabilize the slope with additional analysis and data collection.	The timing of the slope protection can be considered in the evaluation of the alternative solutions and in the evaluation of the alternative designs.
EA process	Question regarding the next steps in the process, and who brings this project to council.	EA process must precede the detailed design and construction tender, which follows from the filing of this report from the EA.
Slope rates	Comment that the red areas on the slope rate figure presented in the PIC should be targeted first.	The selection of an alternative design, following the selection of the preferred alternative solution, will address the details of the stabilization placement.
Content sharing	Request from several attendees to receive the slides from the presentation.	Matt Welsh (City of Brantford Project Manager) noted that slides may be sent out after the PIC and will also be posted on the City website.
PIC 3 timing	Comment that the third PIC should occur in the first week of September 2019 to ensure that members of the public are able to attend.	Date can be set for that timeframe.
Project scope	Blossom Avenue thought to have similar issues, surprised that Blossom Avenue was	Blossom Avenue is a County Road and is thus outside the scope of this City of Brantford project. However, it is expected

	not included in the study scope for this project.	that slope stabilization and particularly surface runoff control and in stream works here may benefit downstream issues.
Comments/ Concerns Received Following the PIC		
Category	**Comment/Concern**	**Response**
Home acquisition	Concern over potential for house to be sold in the future for far less than it is worth (address located on the north side of Colborne Street).	The proposed alternatives are intended to protect the local infrastructure and address the slope stability.
Restoration	Comment that all alternatives should focus on restoration of the vegetation in the area in order to aid the bank stabilization, as well restoration of in-river features. Presumably federal funding would be available as the United Nations (UN) named the next decade the one for Ecological Restoration.	Bank restoration will be included in any construction undertaking to the slope to restore the slope to pre-construction condition. While vegetation may help to stabilize the bank from small movements, the larger concern is the deep-seated failure, which will not be mitigated by vegetation restoration.
Species at Risk	Concern that herptiles are not listed in the existing conditions characterization. Turtles should also be checked for in the NHIC records, as they exist in the area. Adjacent wetlands may also have chorus frogs.	This will be reviewed in the Species at Risk assessment as part of the project, particularly at the alternative design phase, in order to mitigate risk to endangered or at-risk species.
Slope stability and drainage	Suggestion that soil moisture is the key cause of the slope instability, and therefore tile drains should be used to drain the slope (50-80 m horizontally into the slope, positioned every 2-5 m or so).	The soil type in the slope makes this approach infeasible, as the clay soil has a very small radius of influence.
Slope stability for engineering design	Concern that the slope is in fact more stable than presented at the PIC, and that a 5.4:1 slope is overly conservative and is not motivated by sound engineering judgement, and that 2.5:1 would be sufficient. Concern that the road and/or river do not need to be moved, and that the engineering consultants are creating needless work.	With respect to the slope, the 5.4:1 slope was calculated in the Trow report based on the cohesion and internal angle of friction of clay and is recommended again by the geotechnical consultant on this project. Empirically, the current slope is moving and has an inclination of 4:1 or less depending on the examined section, indicating that a steeper inclination would not be stable. The preferred alternative solution is recommended to proceed with more advanced monitoring and stabilize the slope in place with a phased approach, which is a recognition that the relocation of Colborne Street or the Grand River is not a practical solution due to economic and other constraints.

6.5 Public Information Centre No. 3

A third PIC was held at St. Peter's School in Brantford, ON on Wednesday, November 13, 2019 between 7:00pm and 8:30pm. The public announcement of the PIC was posted on the City of Brantford web pages thirty (30) days prior to the public meeting. The City placed ads in local newspapers prior to the PIC, including into the Brantford Expositor on October 31st and November 7th (2019) and into the Two Row times on November 6th and 13th (2019). As for the first and second PICs, door knocker ads were delivered to residents within the study area and agency contacts prior to the third PIC.

The information centre included display boards and presentation materials depicting the study purpose and EA process, updates for information on the existing conditions since the previous PIC, and a presentation of the alternative designs considered at this phase of the EA process. The alternative design is a highbred of Alternative Solutions 2 and 4 and was presented as the preferred alternative design, with an opportunity for public input prior to a formal decision on the alternative solution to be pursued.

ERI, Pinchin Environmental, and City of Brantford staff were present to answer any questions, engage with the public, and assist the public with developing an understanding of the study.

Category	Comment	Response
Project responsibility	Concern that GRCA does not seem to be involved in the project.	Consultation was undertaken with GRCA through the project. GRCA staff were in attendance at the first PIC.
Grand River and slope stability	Comment suggesting the use of piers or concrete to prevent the river from moving towards the outside bend, and a suggestion to move the river a few hundred metres south.	Both these options were considered through the development of the preferred design approach, but these were not evaluated as the preferred.
Slope stability and drainage	Concern that sliding is caused by unstable wet clay, may be impacted by heavy trucks on Colborne Street East. Suggestion to install drains to prevent rainwater from reaching the slope (expensive). A cheaper option would be to stabilize the slope with willow live stakes.	These comments were all considered and included through the evaluation of the preferred alternative.

7. Project Implementation

7.1 Next Steps

It is recommended that the City of Brantford proceed with implementation of the preferred alternative design for the study area as detailed in **Section 5.3**, subject to capital planning and Council approval.

Detailed design is required to ensure that recommended works will be sustainable considering the flow characteristics of the Grand River and slope processes, to confirm the location of the overland drainage network and sizes, to confirm the limits and scope of the implementation, and to develop engineering drawings for tender and construction.

At the outset of the detailed design process, a Phase 2 archaeological assessment should be initiated as recommended in the ASA report to ensure no constraints to project implementation are identified. Similarly, a Phase 2 Bat Assessment should be undertaken when the limits of implementation are determined (through detailed design) to identify potential maternity roosting sites for provincially endangered northern myotis, eastern small-footed myotis, little brown bat, and tri-colored myotis.

Following the completion of design and acquisition of the required permits and approvals, eligible contractors are recommended to be evaluated and pre-qualified to help contribute to the quality and effectiveness of implementation. This should be based on their previous creek rehabilitation and erosion control experience, with particular emphasis on in-water work experience.

7.2 Permits and Approvals

The detailed design of the proposed works, when completed, must be submitted for approval to GRCA along with the completed “Application for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses” form (pursuant to Ontario Regulation 160/06), prior to any construction activities taking place.

The MNRF will need to be consulted once the impacts of the implementation of the detailed design as they relate to SAR are identified. Submission to the DFO will need to be made as it relates to the construction impacts of the detailed design.

7.3 Preliminary Cost Estimate

A preliminary cost estimate for budgeting purposes was developed for the preferred alternative concept. A breakdown of key components is provided in **Table 7-1** below.

Table 7-1. Cost Estimates for Preferred Alternative Design

Preferred Design Element	Estimate Cost
Interceptor trenches and drainage pipes	$1.0 million
Rock fingers	$1.2 million
Rock toe protection (Grand River)	$0.7 million
Additional monitoring	$20,000 per annum
Rock ballast	$3.4 million

7.4 Monitoring Program and Mitigation Measures

To ensure the future protection of ecological features within the preferred site, the following mitigation features should be implemented during construction.

7.4.1 Construction Impacts and Monitoring

The potential negative effects to the natural environment as a result of the proposed remediation can be reduced with the implementation of standard mitigation measures. The following describes general mitigation measures that are recommended while implementing the proposed works.

- **Erosion and sediment control**: Mitigation measures must be used for erosion and sediment control to prohibit sediment from entering the surrounding natural areas. The primary principles associated with sedimentation and erosion protection measures are to: (1) minimize the duration of soil exposure, (2) retain existing vegetation, where feasible, (3) encourage re-vegetation, (4) divert runoff away from exposed soils, (5) keep runoff velocities low, and (6) trap sediment as close to the source as possible. To address these principles, the following mitigation measures are proposed:
  - According to Ontario Provincial Standard Specifications, silt fencing (OPSD 219.110) is required along all construction areas;
  - All surfaces susceptible to erosion should be re-vegetated through the placement of seeding, mulching, or sodding immediately upon completion of construction activities;
  - All exposed areas should always be kept to a minimum to minimize the potential for soil erosion and sedimentation within the creek; and
  - All dewatering required for construction is to be discharged to a sediment trap at least 15 m from the watercourse.

- **Grading techniques**: Site grading and runoff controls should be developed during final design to mitigate potential stormwater runoff impacts to the surrounding natural areas. This plan should provide for post-construction contours that minimize runoff to the natural areas.

- **Tree removals**: Tree removal should be completed by or overseen by a Certified Arborist using proper arboricultural techniques. If a new woodland edge is created during the removal of trees, the new edge should be inspected before and after tree removal in order to analyse the reaction of newly exposed trees. This will reduce structural failure of trees that may be poorly adapted to increased winds and other external forces. Native species should be replaced, if possible, at a 3:1 ratio.

- **Riparian vegetation removals**: Clearing of riparian trees and/or shrubs should be minimized such that the physical and biological functional attributes of the terrestrial vegetation can be maintained as they relate to aquatic ecological function.

- **Construction timing (birds)**: To mitigate impacts to breeding birds, any tree and site clearing should take place between September 1 and March 31; this avoids the months of April through August during which the removal of vegetation can disrupt or harm birds and their nests. The Migratory Birds Convention Act (MBCA, 2013) protects migratory birds, their eggs, and nests from being harmed or destroyed during the breeding bird window. According to the Canadian Wildlife Service (CWS), the core breeding period for migratory birds that nest in forested habitat in southern Ontario is between May 1 and July 31 (CWS, 2012). During this period, the CWS recommends that no clearing of vegetation occurs. The CWS (2012) advises that nest searches, as a measure to mitigate impacts to nesting birds during the core breeding period, not occur within "complex" habitats such as woodlands. In these habitats, the likelihood of observing all nests and eggs is low, while the potential to disturb nesting birds is high. However, nest searches may be undertaken in "simple" habitats, such as hedgerows, isolated trees, or constructed features (e.g. bridges) where the potential to observe all active nests is relatively high. Where feasible, it is recommended that tree and vegetation removal occur outside of the peak breeding period; however, nest searches may be acceptable prior to any works required on the bridge structures or if isolated trees are recommended for removal.

- **Tree cavity search (SAR bat):** Once the details of the creek restoration construction area are known, a detailed cavity tree assessment should be completed to assess the potential for regulated SAR bats within the proposed limits of construction. Any removal of trees with suitable cavities for SAR bats should consider the appropriate mitigation strategies.

- **Breeding bird surveys**: Should tree clearing be scheduled within the months of April through August, comprehensive breeding bird surveys need to be conducted prior to tree clearing to ensure there is no disturbance of nesting/breeding birds. Surveys should document the location of breeding pairs and potential location of nests. Should nests/breeding pairs be discovered within the clearing area, the location should be clearly marked/flagged and a 10 m buffer surrounding the nest be implemented. The space within this buffer should be protected until the young are fully fledged. An ecologist with ornithological experience should conduct the surveys and monitor the nests (should nests be discovered) periodically. Clearing can only be undertaken if the ecologist is satisfied there are no breeding/nesting pairs within the affected area.

- **Construction timing (fish):** Construction should adhere to the MNRF and DFO in-water works timing restrictions for warm water systems (March 15 to July 15) or if specified otherwise by the MNRF, DFO, and GRCA (DFO 2013, OMNR 2013). All in-water works should be completed during the dry, low-flow season and not during or after a significant rainfall event. The duration of in-water works should be kept to a minimum. In-water works should be completed in isolation from the main flow of the river and a fish salvage should be completed during any worksite isolation and dewatering.

- **Contaminant and spill response plan**: A plan should be developed and implemented immediately in the event of a sediment release or spill of a deleterious substance and an emergency spill kit must be kept on site. No storage of construction equipment, materials, chemicals, stockpiled resources of soil, or storage of any other objects associated with site alteration is to occur within the delineated natural area or within 30 m of the Grand River. Maintenance of machinery during construction should also occur a minimum of 30 m away from the watercourse.

Additional measures that will protect and/or minimize impacts to the natural environment include:

- Machinery will arrive on site in a clean and washed condition and is to be maintained free of fluid leaks;
- Wash, refuel, and service machinery and store fuel and other materials for the machinery away from water to prevent any deleterious substance from entering the water;
- Re-vegetation of disturbed areas should be completed promptly;
- All activities, including maintenance procedures, shall be controlled to prevent the entry of petroleum products, debris, rubble, concrete or other deleterious substances into the river;
- Re-fuelling and servicing and inspection of all construction equipment should take place no less than 30 metres away from the river to ensure no leakage of any deleterious substances to the river or the local environment;
- Construction material, excess fill, construction debris, stockpiling and empty containers should be stored no less than 30 metres away from the water to ensure no run-off of any deleterious substances to the river occurs; and
- Any areas of bare soil along the adjacent slopes, or within the construction zone are to be re-vegetated as soon as feasible to prevent erosion of soils into the Grand River.

Construction monitoring is undertaken during the implementation of proposed works to ensure that methods for mitigating concerns and for environmental enhancement are performed as planned and approved, and that any problems that may arise during construction are effectively addressed. Construction activities are to be undertaken in accordance with all applicable guidelines, policies, regulations, and statutes.

Construction monitoring is to be undertaken by the proponents of the project (City of Brantford) or agents thereof. Responsibilities for construction monitoring include:

- **Ensuring adherence** to the approved design and monitoring requirements;
- **Meetings with project construction staff** to ensure the function and correct installation of mitigation measures are understood;
- **Providing direction** in unplanned situations with the potential for environmental impacts; and
- **Addressing noted deficiencies** promptly, as required, with construction staff and proponents.

Detailed monitoring and compliance records are to be developed as construction progresses and submitted to the project proponents for review on request.

7.4.2 Post-Construction Monitoring

Post-construction monitoring of the creek remediation works is to be undertaken to assess the effectiveness and environmental performance of the project.

For the Colborne Street East Slope Stabilization project, the following components and features are to be monitored on site following the completion of construction, as required:

- Stability of overland drainage features;
- Conditions of interceptor trenches and trail culverts;
- Conditions of rock fingers, slumping of materials, and local changes in topography;
- Toe protection appearance, loss of rock material, and change in channel form; and
- Success of site restoration measures and riparian plantings.

These features should be monitored every three months for the first year following construction and once per year thereafter, if required. In addition, the stabilization works should be inspected after any large flow or precipitation events during the first year following construction to assess performance under high-stress conditions.

Post construction monitoring is also to include analysis of the LiDAR data and the geotechnical monitoring data. These results should be compared to baseline conditions to determine the effectiveness of the implemented stability works.

A post construction effectiveness monitoring and evaluation report must be completed within one year of project completion. This should be submitted to the project proponents and agencies or government reviewers that expressed a concern during the planning and design of the project.

The post-construction monitoring report is to include, as required:

- An assessment of the effectiveness of the undertaking in addressing the identified issues of the EA;
- Documentation of follow-up maintenance;
- A summary of the baseline inventory with respect to any potential impacts that were identified;

- Documentation of any changes in the baseline conditions as a result of the remedial works, including a photographic record;
- Identification of measures that will be undertaken to address any identified impacts; and
- A schedule for ongoing maintenance, if relevant.

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Appendix A

Geotechnical Report

FINAL

Slope Stability Review and Stabilization Recommendations

Colborne Street Slope Stabilization, Brantford, Ontario

Prepared for:

Ecosystem Recovery Inc.
80 Courtland Avenue East, Unit 2
Kitchener, Ontario N2G 2T8

Attention: Jeff Prince

May 6, 2020

Pinchin File: 223798

Issued to:	**Ecosystem Recovery Inc.**
Contact:	**Jeff Prince**
	Contact Title
Issued on:	**May 6, 2020**
Pinchin File:	**223798**
Issuing Office:	**Waterloo, ON**
Primary Pinchin Contact:	**Vanessa Marshall**

Author: Vanessa Marshall, M.Eng., P.Eng.
National Practice Leader, Geotechnical Services
519.746.4210 ext. 3756
vmarshall@pinchin.com

Reviewer: Kyle Rundle Drake, P.Eng.
Project Manager
226.898.4682
krundledrake@pinchin.com

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APPENDICES

1.0 INTRODUCTION

Pinchin Ltd. (Pinchin) is pleased to provide this supplemental report to Ecosystem Recovery Inc. (Client) with the results of our supplemental testing and based on those findings a review of the design alternatives for the stabilization of the slope located along Colborne Street in Brantford, Ontario (Site). The Site location is shown on Figure 1, appended.

In 1986, the Colborne Street slope experienced a major slope failure. Since this time several studies and investigations have been completed which provide recommendations and remediation measures for the slope, which continues to experience movement.

The Site is located between the west leg of Clara Crescent to where the Hamilton-Brantford Rail Trail and Colborne Street East intersect, approximately 1 km of slope. The slope extends down from Colborne Street East to the Grand River.

The initial slope failure occurred on May 20, 1986. The slope failure occurred approximately 50 m from the west end of the Site and was 365 m wide. A large portion of material from the slope failure landed in the Grand River and provided temporary toe erosion relief for the slope. This material has since been eroded away and there is concern that a future failure may occur.

The purpose of this letter is to provide an updated summary of the soil and groundwater conditions at the Site and assess the potential design of the slope stabilization measures.

2.0 PREVIOUS INVESTIGATIONS

As part of the current geotechnical study the following reports were reviewed:

- Golder Associates Ltd. Geotechnical Investigation Proposed Grand River Rechannelization, Colborne Street East, Brantford Ontario, March 1987, Report No. 861-3127
- Trow Geotechnical Ltd., Geotechnical Investigation, Brantford Landslide, Colborne Street, Brantford, Ontario, September 1986, Project No. G86-0266-A/G
- Golder Associates Ltd., Preliminary Geotechnical Assessment, Grand River Valley Wall, Colborne Street East, Brantford, Ontario, June 1986, File No. 861-3127
- Golder Associated Ltd., Update of Engineering component 1995 Environmental Study Report, Colborne Street East Landslide Area, Grand River Valley Wall, Brantford, Ontario, May 2012, Report No 861-3368-6000-R01

The relevant information from the above noted reports has been included in this report.

3.0 FIELD INVESTIGATION

Pinchin completed field investigations at the Site on July 30, 2019 to August 6, 2019 by advancing a total of two sampled boreholes and five Cone Penetration Tests (CPTu) at the Site. The boreholes and CPTu tests were advanced to depths of approximately 20.4 to 32.5 metres below existing ground surface (mbgs). The approximate spatial locations of the boreholes advanced at the Site are shown on Figure 2.

The boreholes were advanced with the use of a Geoprobe 7822 DT direct push drill rig which was equipped with standard soil sampling equipment.

The CPTu testing was completed by DownUnder Geotechnical Limited and the results are appended to this report. The CPTu test involves the advancement 35mm diameter instrumented cone and friction sleeve assembly that was hydraulically thrust into the soil at a rate of about 2 cm/s. The soundings were conducted using a 10 tonne capacity audio GEOTECH AB cone with a tip area of 10 cm^2, a friction sleeve area of 150 cm^2 and a u2 filter location. Measurements were taken at about 2 cm depth intervals during penetration and corrected for verticality based on the inclinometer readings in the cone. The sound waves are then decoded by a CPT-interface and sent to a laptop computer on-site.

The results of the CPTu testing can be used for empirical correlations to the soil type, undrained shear strengths, equivalent SPT N values, Overconsolidation Ratio (OCR) and peak friction angle. The results are provided in Appendix II.

Groundwater observations and measurements were obtained from the open boreholes during and upon completion of drilling. The groundwater observations and measurements recorded are included on the appended borehole logs.

The borehole locations and ground surface elevations were surveyed by Pinchin using a Sokkia Model GCX2 Global Navigation Satellite System (GNSS) rover. The ground surface elevations are geodetic, based on GNSS and local base station telemetry with a precision static of less than 20 mm.

The field investigation was monitored by experienced Pinchin personnel. Pinchin logged the drilling operations and identified the soil samples as they were retrieved. The recovered soil samples were sealed into plastic bags and carefully transported to an independent and accredited materials testing laboratory for detailed analysis and testing. All soil samples were classified according to visual and index properties by the project engineer.

The field logging of the soil and groundwater conditions was performed to collect geotechnical engineering design information. The borehole logs include textural descriptions of the subsoil in accordance with a modified Unified Soil Classification System (USCS) and indicate the soil boundaries inferred from non-continuous sampling and observations made during the borehole advancement. These boundaries reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The modified USCS classification is explained in further detail in Appendix I. Details of the soil and groundwater conditions encountered within the boreholes are included on the Borehole Logs within Appendix III.

4.0 SITE DESCRIPTION

The Site is situated on an outside bend of the Grand River, known as the Oxbow. The slope has an overall height of approximately 28 to 30 m, extending from Elevation 219 to 220 metres above sea level (masl) at Colborne Street to Elevation 189 to 190 masl at the Grand River. The overall total slope is generally inclined at 3.6 horizontal (H) to 1.0 vertical (V) to 4.5H to 1.0V; however, the slope can be divided into an upper and a lower slope component separated by the Hamilton-Brantford Rail Trail, the former CP Rail Line.

The upper slope is approximately 7 to 18 m high with the shorter slopes located at the east end of the Site and is overall sloped at 2.1H to 1.0V to 4.4H to 1.0V. It should be noted that in several locations the upper 3 to 5 meters of the upper slope is oversteepened at slopes of steeper than 2.0H to 1.0 vertical and then plateaus to the Hamilton-Brantford Rail Trail.

The lower slope, which extends from the Hamilton-Brantford Rail Trail to the Grand River, is approximately 10 to 22 m high and is generally sloped at 3.7 to 5.8H to 1.0V. There are sections of the slope in the central and west ends of the Site where the upper 8 to 10 m of the lower slope is inclined at 2.5H to 1.0V.

The slope is generally covered with mature trees and underbrush; however, several locations where slope failures continue to occur are denuded of this, especially through the center portion of the Site. It was noted during several Site visits that over the year the east end of the Hamilton-Brantford Rail Trail has shifted upwards from movement at the top end of the slope.

5.0 SOIL CONDITIONS

5.1 Geology of Brantford Area

The Site is located within the physiographic region of Southern Ontario known as the Haldimand Clay Plain (Chapman and Putnam, 1984). The region is generally composed of deep water glaciolacustrine sediments consisting of laminated to varved clay, silt and minor sand. The area was once occupied by Glacial Lakes Whittlesey and Warren, both inland lakes which covered a large portion of Southwestern Ontario during the last stages of the Wisconsinan Ice Age. The silt and clay plains formed by the lakes have been dissected by streams that easily erode these sediments. The stream channels are often filled with organic material comprising thick topsoil.

The region is underlain by Silurian bedrock of the Paleozoic system. The rock type is typically dolomite of the Salina Formation, and the rock surface dips slightly southward under Lake Erie.

5.2 Site Specific Soil and Groundwater Conditions

Based on a review of the previously completed geotechnical investigations and boreholes at the Site and the results of the additional CPTu and borehole testing, the soil conditions generally comprise fill overlying native clayey silt and silty sand.

Fill material was placed at the crest of the slope by landowners to extend and level out their properties and fill was placed at the mid-height of the slope for construction and maintenance of the former CP rail line. The fill at the crest of the slope varies in composition from clayey silt to sand with some silt and gravel. Debris was noted at various depths in the fill at the crest of the slope. The fill material was generally loose to compact based on Standard Penetration Test (SPT) N-Values of 6 to 16 blows per 300 mm penetration of a split spoon sampler.

The fill through the midsection of the slope is generally 1.2 to 5.5 m thick and comprises silty sand and gravel, with noted cinders and slag. This fill generally has a compact to loose relative density with depth, based on SPT N-values of 2 to 20 blows per 300 mm.

A deposit of clayey silt was generally encountered on the upper portion of the slope below the upper fill material and extended to between Elevation 202 and 207 masl. The upper clayey silt material generally contained silt, and sandy silt layers and has a stiff consistency based on undrained shear strengths of 110 to 123 kPa. Undrained shear strengths measured insitu within the CPTu holes ranged between 86 and 187 kPa and the OCR ranged from 6 to 2 indicating that the upper portions are overconsolidated becoming normally consolidated with depth. Particle size distribution analyses performed on samples of the upper clayey silt material indicated that the samples contained 21 to 42% clay, 58 to 77% silt, and 0 to 5% sand. The upper clayey silt material had measured moisture contents of 19 to 30%.

Sandy silt/silty sand was encountered below the clayey silt material and below the fill at the plateau of the slope and dips towards the Grand River. The deposit was encountered at Elevation 202 masl at the plateau to Elevation 188 to 195 masl at the toe of the slope. The silty sand/sandy silt deposit varies in thickness from 0.6 to 3.2 m. The silty sand/sandy silt deposit is generally compact to dense based on corrected SPT N values from the CPTu test of 10 to greater than 50 blows per 300 mm. Particle size distribution analyses performed on samples of the sandy silt/silty sand material indicated that the samples contained 14 to 22% clay, 40 to 58% silt, and 20 to 46% sand. Moisture contents measured in the sandy silt/silty sand ranged from 16 to 23%.

A lower deposit of clayey silt was encountered below the sandy silt/silty sand layer and extends to the bedrock surface. The clayey silt material contains seams of silt, sandy silt and silty clay material. Particle size distribution analyses performed on samples of the clayey silt material indicated that the samples contained 13 to 42% clay, 58 to 86% silt, and 1 to 18% sand. Particle size distribution analyses performed on samples of the silty clay seams indicated that the samples contained 45 to 73% clay, 27 to 55% silt, and 0 to 1% sand. The clayey silt material had moisture contents that ranged between 11 and 40% and undrained shear strengths of 37 to 185 kPa. The silty clay material had moisture contents that ranged from 21 to 47% and undrained shear strengths of 35 to 110 kPa. Undrained shear strengths measured insitu within the CPTu holes ranged between 20 and 109 kPa and the OCR ranged from 1 to 3 indicating that the lower clayey silt/silty clay is normally consolidated.

Bedrock was encountered across the Site between Elevation 178.4 to 180.5 masl. The bedrock appeared to be dolomite.

Groundwater measured in the monitoring wells installed during the previous investigations indicated that groundwater was typically encountered within 3 m below ground surface (mbgs) in the upper slope and tableland boreholes and within 1 mbgs in the lower slope. Piezometers installed in the bedrock indicate a piezometric pressure of the rock surface to Elevation 195 masl (artesian pressure) in the lower slope and to Elevation 202 masl in the upper slope.

6.0 FAILURE MECHANISMS

The slope failure of 1986 was caused by several different slope failure mechanisms that compounded onto each other until the slope failed. The initial component of the failure was the lower slope failing due to toe erosion, high groundwater levels within the lower slope, and weak soil conditions. The toe erosion undermined the soil of the lower slope and due to weak conditions, the slope experienced a deep seated failure into the Grand River. This lower slope failure removed soil from below the toe of the upper slope, and due to weak soil conditions and high groundwater levels in the slope, the upper slope then proceeded to fail. In addition, fill placed at the top of both the lower slope and upper slope resulted in additional loading on the slope increasing the chances for failure.

The two main slope failure mechanisms that continue to affect the stability of the existing slope is the high groundwater levels within the slopes and undercutting of the toe of the slope by the Grand River. The high groundwater levels within the slope combined with the weakness of the native soils results in instability of the slopes at the current inclinations.

7.0 RESULTS OF 2019 SLOPE INCLINOMETER MEASUREMENTS

Slope inclinometers were installed at various locations along the Colborne Street Slope. Golder Associates Ltd. (Golder) had been monitoring the slope inclinometers up until May 2014. The results of the May 2014 measurements were provided in the following letter report:

- Golder Associates Ltd. Grand River Slope Monitoring, Colborne Street East Landslide Area, Grand River Valley Wall, Brantford Ontario, June 2014, Report No. 861-3369-25

Within that report Golder has been measuring the deformation of eight slope inclinometer wells, Boreholes BH1, BH6B, BH101A, BH102, BH103, BH104B, BH105B, and BH107.

Pinchin visited the Site in November 2019 to complete inclinometer readings at the above noted slope inclinometers. Their approximate locations are provided on the Golder Figure 1, in Appendix IV. During the Site visit only the monitoring wells at Boreholes BH6B, BH105B and BH107 were accessible or able to be found. The measurements were taken with an RST Instruments Inc. MEMS Digital Inclinometer and inputted into the RST Inclinalysis™ software for analysis. The results of the inclinometer readings are provided in Appendix V; however, it should be noted that the background data from the Golder readings was not available to be able to compare the current readings to the past readings. The plots do indicate that in general the same shape of movement is occurring at the measured locations however the magnitude or increase in movement from 2014 until 2019 is unknown.

8.0 DESIGN ALTERNATIVES REVIEWED

In order to review the design alternatives, the stability of the existing slope was reviewed to confirm the input parameters for the design of the slope stabilization measures. As part of the EA process the Client completed a LiDAR scan of the slope and Pinchin was provided with slope cross sections for every 50 m of the slope. The information from the previous boreholes, current CPTu test holes and two of the slope profiles (Station 0+400 and Station 0+500) were used for slope stability analyses. The slope analyses were modelled using Slope/W program part of the Geo-Studio 2019 software package. These cross sections locations where chosen based on the results of the slope movement analysis completed by the Client and where the new testing was completed.

The slope stability analyses were carried out for a number of potential failure modes. The various failures analyzed include shallow transitional type failures of the residual soil, medium depth rotational failures at the bottom and top of the slope, and deep rotational failures through the entire height of the slope.

The results of the analyses indicate that the slope currently has factors of safety against slope failure of between 0.8 and greater than 2.0. The factors of safety are closely related to the steepness of the slopes, groundwater level and the soil strength. The lowest factors of safety were obtained in the lower bench of the slope for shallow depth rotational failures and within the over-steepened areas of the upper slope.

As indicated within the Trow Geotechnical report the long-term stable slope of the site would be 5.4 horizontal to 1 vertical. In order to construct the slope at this angle, either the Grand River would need to be moved or Colborne Street would need to be moved.

A major contributor to the 1986 failure was the toe erosion of the base of the slope, which cause the lower portion of the slope to fail into the Grand River, effectively removing the toe of the upper slope causing it to subsequently fail. Regardless of the upper and lower slope remediation measures, toe erosion protection should be completed to protect the bottom of the slope from ongoing erosion that will over-steepen the slope following a failure.

In order to resist the sliding forces of the rotational failures, one concept that was reviewed was to place a large quantity of blast rock to offset the sliding forces of failure in the slope. Following completion of the CPTu testing it was determined that the quantity of rock required to stop the movement of the slope would fail under its own weight due to the lower shear strengths associated with the silty clay soils at the bottom of the slope.

As indicated in the previous studies the depth to groundwater and the effects on the pore pressure of the underlying silty clay materials is a significant contributor to the overall stability of the slope. It is therefore recommended that in addition to the toe protection at the bottom of the slope a drainage system comprising pipes embedding in granular material be constructed into the slope perpendicular to the river and toe protection. The drainage pipes should be wrapped in filter cloth and should be spaced between 10 and 15 m apart. The pipes should extend as far possible into the slope and be between 3 and 5 m below the slope surface. Additionally, to assist with the water which is in the upper portions of the slope it is recommended that drainage pipes be installed in the upstream side of the Hamilton-Brantford Rail Trail. Any storm sewers or overland flow should also be diverted away from the slope and not allowed to run overland down the face of the slope.

The installation of the drainage system and the toe protection will increase the stability of the slope to a moderate level; however, it should be noted that ongoing failures of the oversteepened sections will continue to occur.

In order to monitor the effectiveness of the slope improvements it is recommended that a LiDAR survey be completed annually to review any new slope movements. Due to several of the slope inclinometers being damaged, continuous readings of these inclinometers may not provide the same benefit as the LiDAR survey will. Additionally, it is recommended that water levels be biannually monitored within the existing wells to be able to review the drawdown of the water due to the installed drainage systems.

9.0 TERMS AND LIMITATIONS

This Geotechnical Investigation was performed for the exclusive use of Ecosystem Recovery Inc. (Client) in order to evaluate the subsurface conditions at Colborne Street Slope Stabilization, Brantford, Ontario. Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practises in the field of geotechnical engineering for the Site. Classification and identification of soil, and geologic units have been based upon commonly accepted methods employed in professional geotechnical practice. No warranty or other conditions, expressed or implied, should be understood. Conclusions derived are specific to the immediate area of study and cannot be extrapolated extensively away from sample locations.

Performance of this Geotechnical Investigation to the standards established by Pinchin is intended to reduce, but not eliminate, uncertainty regarding the subgrade soil at the Site, and recognizes reasonable limits on time and cost.

Regardless how exhaustive a Geotechnical Investigation is performed, the investigation cannot identify all the subsurface conditions. Therefore, no warranty is expressed or implied that the entire Site is representative of the subsurface information obtained at the specific locations of our investigation. If during construction, subsurface conditions differ from then what was encountered within our test location and the additional subsurface information provided to us, Pinchin should be contacted to review our recommendations. This report does not alleviate the contractor, owner, or any other parties of their respective responsibilities.

This report has been prepared for the exclusive use of the Client and their authorized agents. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third parties. If additional parties require reliance on this report, written authorization from Pinchin will be required. Pinchin disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs. No other warranties are implied or expressed. Furthermore, this report should not be construed as legal advice.

The liability of Pinchin or our officers, directors, shareholders or staff will be limited to the lesser of the fees paid or actual damages incurred by the Client. Pinchin will not be responsible for any consequential or indirect damages. Pinchin will only be liable for damages resulting from the negligence of Pinchin. Pinchin will not be liable for any losses or damage if the Client has failed, within a period of two years following the date upon which the claim is discovered (Claim Period), to commence legal proceedings against Pinchin to recover such losses or damage unless the laws of the jurisdiction which governs the Claim Period which is applicable to such claim provides that the applicable Claim Period is greater than two years and cannot be abridged by the contract between the Client and Pinchin, in which case the

Claim Period shall be deemed to be extended by the shortest additional period which results in this provision being legally enforceable.

Pinchin makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and these interpretations may change over time. Please refer to Appendix IV, Report Limitations and Guidelines for Use, which pertains to this report.

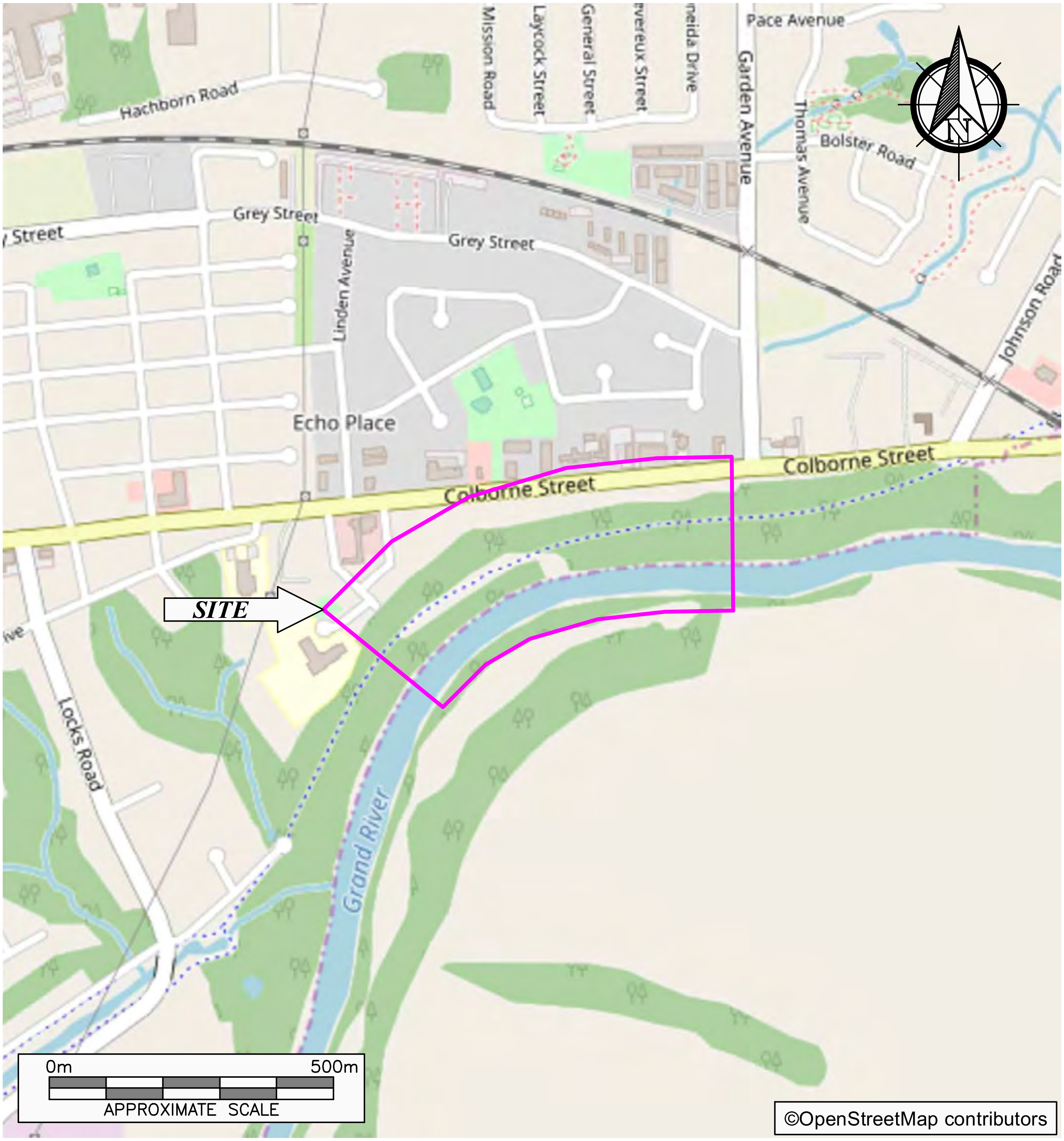
Specific limitations related to the legal and financial and limitations to the scope of the current work are outlined in our proposal, the attached Methodology and the Authorization to Proceed, Limitation of Liability and Terms of Engagement which accompanied the proposal.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

\\pinchin.com\wat\Job\223000s\0223798.000 EcosystemRecColbourneStGEOSlopeStabiliz\Deliverables\223798 FINAL Slope Stability Report, Colborne Street, Brantford, ON Ecosystem May 6, 2020.docx

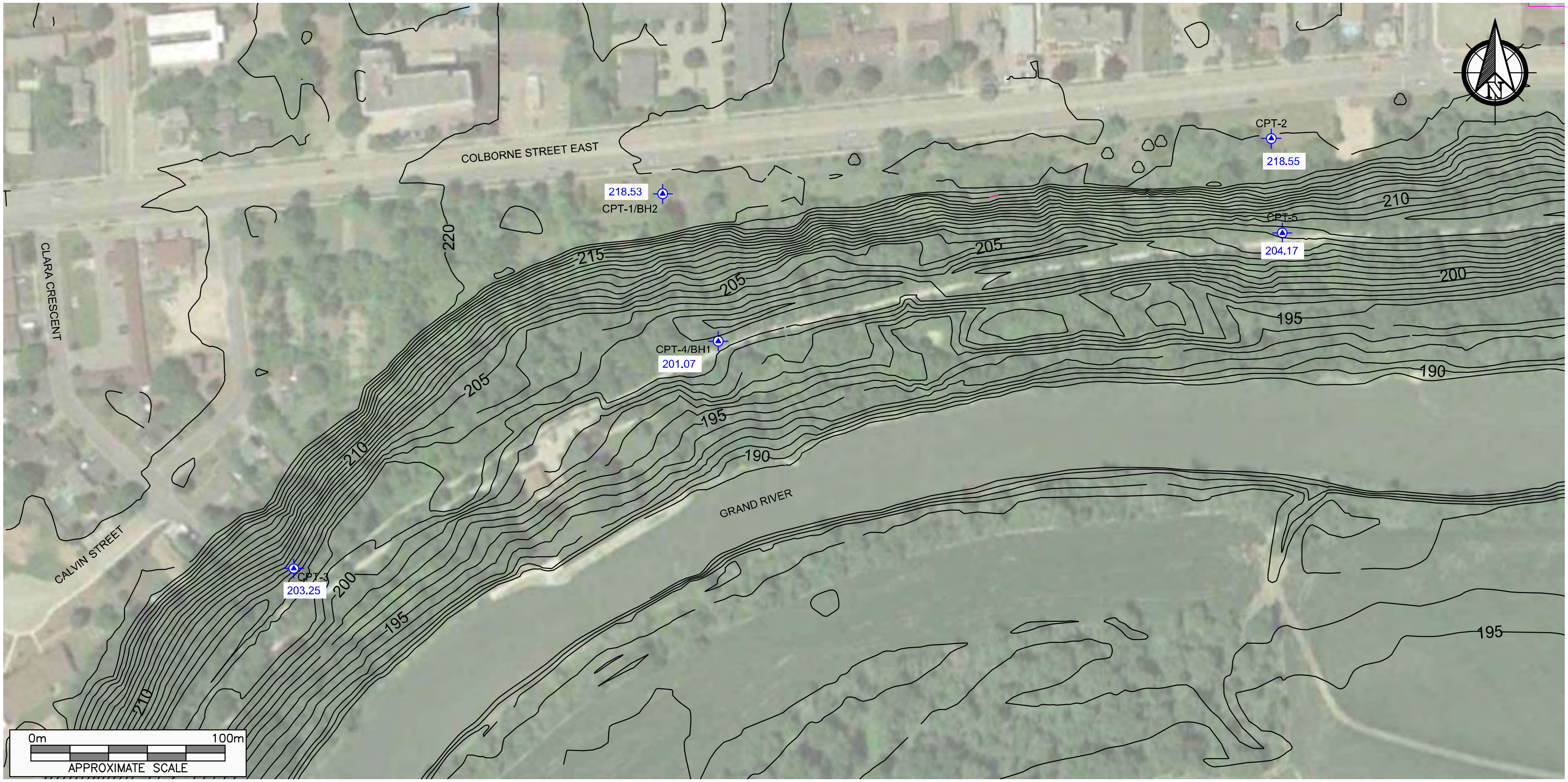
Template: Master Geotechnical Investigation Report – Ontario, GEO, April 18, 2019

FIGURES



PINCHIN

PROJECT NAME: COLBORNE SLOPE STABILIZATION		
CLIENT NAME: ECOSYSTEM RECOVERY INC.		
PROJECT LOCATION: COLBORNE STREET EAST, BRANTFORD, ONTARIO		
FIGURE NAME: KEY MAP		FIGURE NO.: 1
APPROXIMATE SCALE: AS SHOWN	PROJECT NO.: 223798	DATE: DEC. 2019



PINCHIN

LEGEND

- BOREHOLE/CPT LOCATION
- [87.20] GROUND SURFACE ELEVATION (MASL)
- MASL METRES ABOVE SEA LEVEL

PROJECT NAME COLBORNE SLOPE STABILIZATION			
CLIENT NAME ECOSYSTEM RECOVERY INC.			
PROJECT LOCATION COLBORNE STREET EAST, BRANTFORD, ONTARIO			
FIGURE NAME BOREHOLE/CPT LOCATION PLAN			FIGURE NO. 2
APPROXIMATE SCALE AS SHOWN	PROJECT NO. 223798	DATE DEC. 2019	

APPENDIX I

Abbreviations, Terminology and Principle Symbols used in Report and Borehole Logs

ABBREVIATIONS, TERMINOLOGY & PRINCIPAL SYMBOLS USED

Sampling Method

AS	Auger Sample	**w**	Washed Sample
SS	Split Spoon Sample	**HQ**	Rock Core (63.5 mm diam.)
ST	Thin Walled Shelby Tube	**NQ**	Rock Core (47.5 mm diam.)
BS	Block Sample	**BQ**	Rock Core (36.5 mm diam.)

In-Situ Soil Testing

Standard Penetration Test (SPT), "N" value is the number of blows required to drive a 51 mm outside diameter spilt barrel sampler into the soil a distance of 300 mm with a 63.5 kg weight free falling a distance of 760 mm after an initial penetration of 150 mm has been achieved. The SPT, "N" value is a qualitative term used to interpret the compactness condition of cohesionless soils and is used only as a very approximation to estimate the consistency and undrained shear strength of cohesive soils.

Dynamic Cone Penetration Test (DCPT) is the number of blows required to drive a cone with a 60 degree apex attached to "A" size drill rods continuously into the soil for each 300 mm penetration with a 63.5 kg weight free falling a distance of 760 mm.

Cone Penetration Test (CPT) is an electronic cone point with a 10 cm2 base area with a 60 degree apex pushed through the soil at a penetration rate of 2 cm/s.

Field Vane Test (FVT) consists of a vane blade, a set of rods and torque measuring apparatus used to determine the undrained shear strength of cohesive soils.

Soil Descriptions

The soil descriptions and classifications are based on an expanded Unified Soil Classification System (USCS). The USCS classifies soils on the basis of engineering properties. The system divides soils into three major categories; coarse grained, fine grained and highly organic soils. The soil is then subdivided based on either gradation or plasticity characteristics. The classification excludes particles larger than 75 mm. To aid in quantifying material amounts by weight within the respective grain size fractions the following terms have been included to expand the USCS:

Soil Classification		Terminology	Proportion
Clay	< 0.002 mm		
Silt	0.002 to 0.06 mm	“trace”, trace sand, etc.	1 to 10%
Sand	0.075 to 4.75 mm	“some”, some sand, etc.	10 to 20%
Gravel	4.75 to 75 mm	Adjective, sandy, gravelly, etc.	20 to 35%
Cobbles	75 to 200 mm	And, and gravel, and silt, etc.	>35%
Boulders	>200 mm	Noun, Sand, Gravel, Silt, etc.	>35% and main fraction

Notes:

- Soil properties, such as strength, gradation, plasticity, structure, etcetera, dictate the soils engineering behaviour over grain size fractions; and
- With the exception of soil samples tested for grain size distribution or plasticity, all soil samples have been classified based on visual and tactile observations. The accuracy of visual and tactile observation is not sufficient to differentiate between changes in soil classification or precise grain size and is therefore an approximate description.

The following table outlines the qualitative terms used to describe the compactness condition of cohesionless soil:

Cohesionless Soil	
Compactness Condition	**SPT N-Index (blows per 300 mm)**
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

The following table outlines the qualitative terms used to describe the consistency of cohesive soils related to undrained shear strength and SPT, N-Index:

Cohesive Soil		
Consistency	**Undrained Shear Strength (kPa)**	**SPT N-Index (blows per 300 mm)**
Very Soft	<12	<2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

Note: Utilizing the SPT, N-Index value to correlate the consistency and undrained shear strength of cohesive soils is only very approximate and needs to be used with caution.

Soil & Rock Physical Properties

General

W Natural water content or moisture content within soil sample

γ Unit weight

γ' Effective unit weight

γ_d Dry unit weight

γ_{sat} Saturated unit weight

ρ Density

ρ_s Density of solid particles

ρ_w Density of Water

ρ_d Dry density

ρ_{sat} Saturated density e Void ratio

n Porosity

S_r Degree of saturation

E_{50} Strain at 50% maximum stress (cohesive soil)

Consistency

W_L	Liquid limit
W_P	Plastic Limit
I_P	Plasticity Index
W_S	Shrinkage Limit
I_L	Liquidity Index
I_C	Consistency Index
e_{max}	Void ratio in loosest state
e_{min}	Void ratio in densest state
I_D	Density Index (formerly relative density)

Shear Strength

C_u, S_u	Undrained shear strength parameter (total stress)
C'_d	Drained shear strength parameter (effective stress)
r	Remolded shear strength
τ_p	Peak residual shear strength
τ_r	Residual shear strength
ø'	Angle of interface friction, coefficient of friction = tan ø'

Consolidation (One Dimensional)

C_C	Compression index (normally consolidated range)
C_r	Recompression index (over consolidated range)
C_S	Swelling index
m_V	Coefficient of volume change
c_V	Coefficient of consolidation
T_V	Time factor (vertical direction)
U	Degree of consolidation
σ'_O	Overburden pressure
σ'_p	Preconsolidation pressure (most probable)
OCR	Overconsolidation ratio

Permeability

The following table outlines the terms used to describe the degree of permeability of soil and common soil types associated with the permeability rates**:**

Permeability (k cm/s)	Degree of Permeability	Common Associated Soil Type
> 10^{-1}	Very High	Clean gravel
10^{-1} to 10^{-3}	High	Clean sand, Clean sand and gravel
10^{-3} to 10^{-5}	Medium	Fine sand to silty sand
10^{-5} to 10^{-7}	Low	Silt and clayey silt (low plasticity)
>10^{-7}	Practically Impermeable	Silty clay (medium to high plasticity)

Rock Coring

Rock Quality Designation (RQD) is an indirect measure of the number of fractures within a rock mass, Deere et al. (1967). It is the sum of sound pieces of rock core equal to or greater than 100 mm recovered from the core run, divided by the total length of the core run, expressed as a percentage. If the core section is broken due to mechanical or handling, the pieces are fitted together and if 100 mm or greater included in the total sum**.**

RQD is calculated as follows:

$$\text{RQD (\%)} = \frac{\Sigma \text{ Length of core pieces} > 100 \text{ mm} \times 100}{\text{Total length of core run}}$$

The following is the Classification of Rock with Respect to RQD Value:

RQD Classification	RQD Value (%)
Very poor quality	**<25**
Poor quality	25 to 50
Fair quality	50 to 75
Good quality	75 to 90
Excellent quality	90 to 100

APPENDIX II

Results of CPT Testing

DRAFT
PIEZOCONE PENETRATION TESTING
COLBORNE STREET EAST and HAMILTON-BRANTFORD RAIL TRAIL
BRANTFORD, ONTARIO

For:
Pinchin Ltd.
283 Northfield Drive East, Unit #9
Waterloo, Ontario
N2J 4G8

August 2019
Ref. No. D19133

DownUnder Geotechnical Limited

P.O. Box 96737, Jane/Major Mackenzie P.O., 2943 Major Mackenzie Drive, Maple, Ontario L6A 0A2
Tel 905-553-2483 Toll Free Fax 1-866-478-4593 Email office@downundergeotechnical.com

TABLE OF CONTENTS

1.0 INTRODUCTION

Downunder Geotechnical Limited (Downunder Geotechnical) was retained by Strata Drilling Group to carry out Piezocone Penetration Tests (CPTu) along Colborne Street East and the Hamilton-Brantford Rail Trail in Brantford, Ontario, in order to provide data to Pinchin Ltd. in support of slope stability analyses along the grand River valley wall. This report contains the findings of piezocone soundings advanced by Downunder Geotechnical.

2.0 FIELD TESTING PROCEDURES

Five CPTu soundings (CPT-1 to CPT-5) were carried out between July 30 and August 1, 2019. The CPTu soundings were carried out in general accordance with ASTM standards (D 5778). The CPTu soundings were carried out using an anchored Geoprobe 3230DT rig owned and operated by Strata Drilling Group.

At the CPTu locations a 35mm diameter instrumented cone and friction sleeve assembly was hydraulically thrust into the soil at a rate of about 2 cm/s to depths of about 20.7 to 32.5m below grade. The soundings were conducted using a 10 tonne capacity audio GEOTECH AB cone with a tip area of 10 cm^2, a friction sleeve area of 150 cm^2 and a u_2 filter location. The pore pressure brass filters were saturated overnight with glycerine under pressure. The cordless audio-cone uses sound waves to transmit the measured tip resistance, friction and pore pressure results up through the rods to a microphone at the surface. Measurements were taken at about 2 cm depth intervals during penetration and corrected for verticality based on the inclinometer readings in the cone. The sound waves are then decoded by a CPT-interface and sent to a laptop computer on-site. Data loss was experienced at CPT-3 to CPT-5 locations due to a damaged data cable.

Figure No.1 presents the approximate CPTu locations. The CPTu soundings are included graphically in Appendix A.

3.0 CPT RESULTS

The results of the soundings are presented in Appendix A. Each sounding log comprises the measured results and soil behaviour classification. Interpreted geotechnical parameters are discussed in Section 4.0. The following provides a brief discussion on each of the measured results.

Tip Resistance

The CPT provides a continuous measurement of the cone resistance, q_c. The measured cone resistance is corrected to total cone resistance, q_t, using the following equation,

$$q_t = q_c + u_2\,(1-a)$$

where u_2 = pore pressure acting behind the cone
a = cone area ratio = A_n/A_c = 0.57 for GEOTECH AB cone
A_n = cross-sectional area of the load cell or shaft
A_c = projected area of the cone

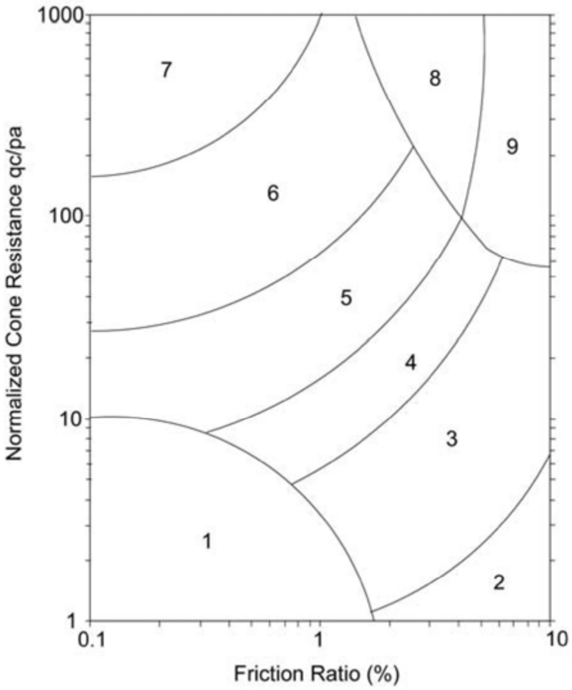
Sleeve Friction and Friction Ratio
The friction along the cone sleeve, f_s, is continuously measured during cone penetration. Friction Ratio is a commonly used parameter for determination of soil profiling and classification. Friction ratio is determined by the following equation.

$$FR\ (\%) = \frac{f_s}{q_t}$$

Pore Pressure
Continuous measurements of porewater pressure are taken during penetration. Due to the dynamic nature of the cone penetration, the porewater pressure measurements within fine grained soils are not representative due to undrained conditions and may even be negative in overconsolidated soils or dilatant silts.

The CPTu was stopped at select locations to measure the hydrostatic groundwater pressures within the silty sand layers. These are noted graphically in Appendix A and in Section 5.0.

Soil Behaviour Type
One of the main applications of CPT soundings is for rapid soil profiling and classification. Normalized soil behaviour type (SBTn) on the sounding logs is based on the classification chart by Roberston (1990). A reproduction of one of the charts and the soil behaviour types are presented in the chart below. The chart is typically a 2-chart system, one assessing normalized cone resistance vs. friction ratio and the second chart assessing normalized cone resistance vs. pore pressure ratio (which is not presented).



NORMALIZED SOIL BEHAVIOUR TYPE (after Robertson 1990)

ZONE		SBT
1		Sensitive, fine grained
2		Organic materials
3		Clay
4		Silty Clay to Clay
5		Silty Sand to Sandy Silt
6		Sand to Silty Sand
7		Sand
8		Very dense/stiff soil*
9		Very dense/stiff soil*

* heavily overconsolidated and/or cemented

To simplify the SBTn charts, Jefferies and Davies (1993) proposed a CPT Soil Index I_C, which is also used as an indicator for soil stratigraphy, and was further normalized by Robertson (2009).

$$I_C = [(3.47-\log (Q_t))^2 + (1.22 + (\log F))^2]^{0.5}$$

where Q_t = normalized tip resistance = $(q_t - \sigma_{V0})/ \sigma_{V0}'$
F = normalized sleeve friction = $f_s / (q_t - \sigma_{V0})$

It should be noted that the above chart is an indication of soil behaviour and not an indication of grain size distribution.

4.0 INTERPRETATION

Undrained Shear Strength

The relationship between cone resistance and undrained shear strength can be empirically represented by the following equation.

$$S_u = \frac{(q_t - \sigma_V)}{N_{kt}}$$

where S_u = undrained shear strength (kPa)
σ_V= vertical stress (kPa)

N_{kt}= dimensionless constant

Typically N_{kt} varies from 10 to 20, with higher results in fissured clay, silts or varved clay deposits. A N_{kt} of 20 was used for the site, which is likely a conservative correlation for the site and underestimating the undrained shear strength. The N_{kt} value can be confirmed by comparison with in situ shear vane test results.

Equivalent N_{60} SPT Value

Based on Jefferies and Davies (1993) the following empirical equation is used to correlate to equivalent Standard Penetration Test results.

$$N_{60} = \frac{q_C}{0.85 \times (1 - I_C/4.75)}$$

where q_C = tip resistance (MPa)
I_C = Soil Classification Index

Overconsolidation Ratio (OCR)

The estimate of the overconsolidation ratio, OCR, in clays is based on the following equation,

$$OCR = k\,(q_t - \sigma_v)/\sigma'_v$$

Where k is constant typically ranging from 0.3 to 0.5 for clays. A 'k' value of 0.3 was used for the soil deposits at the site.

Peak Friction Angle

The effective friction angle (ϕ') of the silty clay/clayey silt soils is typically estimated using the following equation.

$$\phi' = 29.5^0\, B_q^{0.121}\,(0.256 + 0.336\, B_q + \log Q_t)$$

$$\text{Where } B_q = (u_2 - u_0)/(q_t - \sigma_{vo})$$

The above equation is an approximate algorithm for the NTH solution by Mayne (2005), applicable only for $20^0 \leq \phi' \leq 45^0$ and $0.1 \leq B_q \leq 1.0$.

Although the following equation is based on laboratory correlation in sands, the results appear reasonable for effective friction angles for Southern Ontario silty soils.

$$\phi' = 17.6^0 + 11\ \mathrm{LOG}\ Q_{tn}$$

5.0 SUMMARY OF RESULTS

The measured and interpreted results of the 5 CPTu tests carried out at the site are presented in Appendix A. The following stratigraphy and strength parameters are inferred from the data.

CPT No.	Inferred Stratigraphy	Average Drained Parameters		Average Undrained Parameters
		Effective Friction Angle (φ')	Apparent Cohesion (kPa)	Undrained Shear Strength
1	0 to 2.7m compact Silty Sand FILL	45^0	0	-
	2.7 to 4.6m very stiff to hard SILTY CLAY	43^0	0	171 kPa
	4.6 to 5.7m compact SANDY SILT/SILTY SAND	40^0	0	-
	5.7 to 11.1m stiff to very stiff SILTY CLAY	42^0	0	101 kPa
	11.1 to 12.4m compact SANDY SILT/SILTY SAND	34^0	0	-
	12.4 to 17.6m stiff SILTY CLAY	36^0	0	80 kPa
	17.6 to 20.4m compact to dense SILTY SAND	35^0	0	-
	20.4 to 32.5m stiff to very stiff SILTY CLAY	32^0	0	97 kPa
2	0 to 0.8m loose to compact Silty Sand FILL	51^0	0	-
	0.8 to 4.0m very stiff to hard SILTY CLAY	43^0	0	187 kPa
	4.0 to 5.5m compact SANDY SILT/SILTY SAND	38^0	0	-
	5.5 to 12.6m stiff to very stiff SILTY CLAY	39^0	0	86 kPa
	12.6 to 13.8m loose to compact SANDY SILT	33^0	0	-
	13.8 to 19.2m stiff SILTY CLAY	33^0	0	76 kPa
	19.2 to 21.0m compact to dense SILTY SAND	34^0	0	-
	21.0 to 32.4m stiff to very stiff SILTY CLAY	32^0	0	86 kPa
3	0 to 0.6m loose to compact Silty Sand FILL	50^0	0	-
	0.6 to 3.1m stiff to very stiff SILTY CLAY	42^0	0	105 kPa
	3.1 to 5.4m loose to compact SANDY SILT	38^0	0	-
	5.4 to 12.2m firm to stiff SILTY CLAY	34^0	0	64 kPa
	12.2 to 13.3m loose SANDY SILT	32^0	0	-
	13.3 to 16.7m firm to stiff SILTY CLAY	30^0	0	57 kPa
	16.7 to 17.7m compact SILTY SAND	32^0	0	-
	17.7 to 22.4m stiff to very stiff SILTY CLAY	36^0	0	86 kPa
4	0 to 3.1m loose to very dense Silty Sand FILL	47^0	0	-
	3.1 to 6.9m compact to very dense SILTY SAND	41^0	0	-
	6.9 to 13.5m stiff to very stiff SILTY CLAY	37^0	0	109 kPa
	13.5 to 14.6m compact SANDY SILT	33^0	0	-
	14.6 to 16.0m stiff to very stiff SILTY CLAY	33^0	0	104 kPa
	16.0 to 17.9m compact to dense SILTY SAND	35^0	0	-
	17.6 to 20.7m stiff to very stiff SILTY CLAY	38^0	0	106 kPa
	20.7m BEDROCK	-	-	-
5	0 to 3.6m loose to compact SILTY SAND/SANDY SILT	45^0	0	-
	3.6 to 4.0m firm SILTY CLAY	**	**	20 kPa
	4.0 to 4.9m soft SILTY CLAY	**	**	20 kPa
	4.9 to 6.6m compact SILTY SAND	39^0	0	-

	6.6 to 19.4m stiff SILTY CLAY	39^0	0	79 kPa
	19.4 to 20.4m compact to dense SILTY SAND	33^0	0	-
	20.4 to 21.1m stiff to very stiff SILTY CLAY	36^0	0	91 kPa

**=data is outside the bounds of the correlation

A bulk unit weight of 19.8 kN/m^3 was used based on the borehole logs provided. The above average friction angles and average undrained shear strengths must be reviewed by the Geotechnical Engineer to downgrade the values appropriately as required.

The above peak effective friction angles at depth are comparable to consolidated drained triaxial tests carried out on glaciolacustrine hard silty clays in Toronto.

In order to estimate the groundwater pressures within the sands, the following equilibrium pressures were obtained.

CPT No.	Depth	Groundwater Pressure
1	19.0m	90 kPa
2	4.9m	23 kPa
	14.0m	40 kPa
	19.3m	60 kPa
	20.2m	65 kPa
3	4.0m	16 kPa
4	5.8m	8 kPa
	17.9m	133 kPa

The groundwater table(s) can be estimated from the above equilibrium pressures with comparison to the measured u_2 data. Assumptions are made in Appendix A.

6.0 REFERENCES

Houlsby, G.T. and Teh, C.I. 1988. Analysis of the piezocone in clay. Proceedings of the International Symposium on Penetration Testing, ISOPT-1, Orlando, pp 777-83, Balkema Pub., Rotterdam.

Jamiolkowski, M. Ladd, C.C., Germaine, J.T. and Lancelotta, R. 1985. New developments in field and laboratory testing of soils. State-of-the-art report. Proceedings of the 11th International Conference on Soil Mechanics and Foundation Engineering, San Francisco, 1, pp.57-153, Balkema Pub., Rotterdam.

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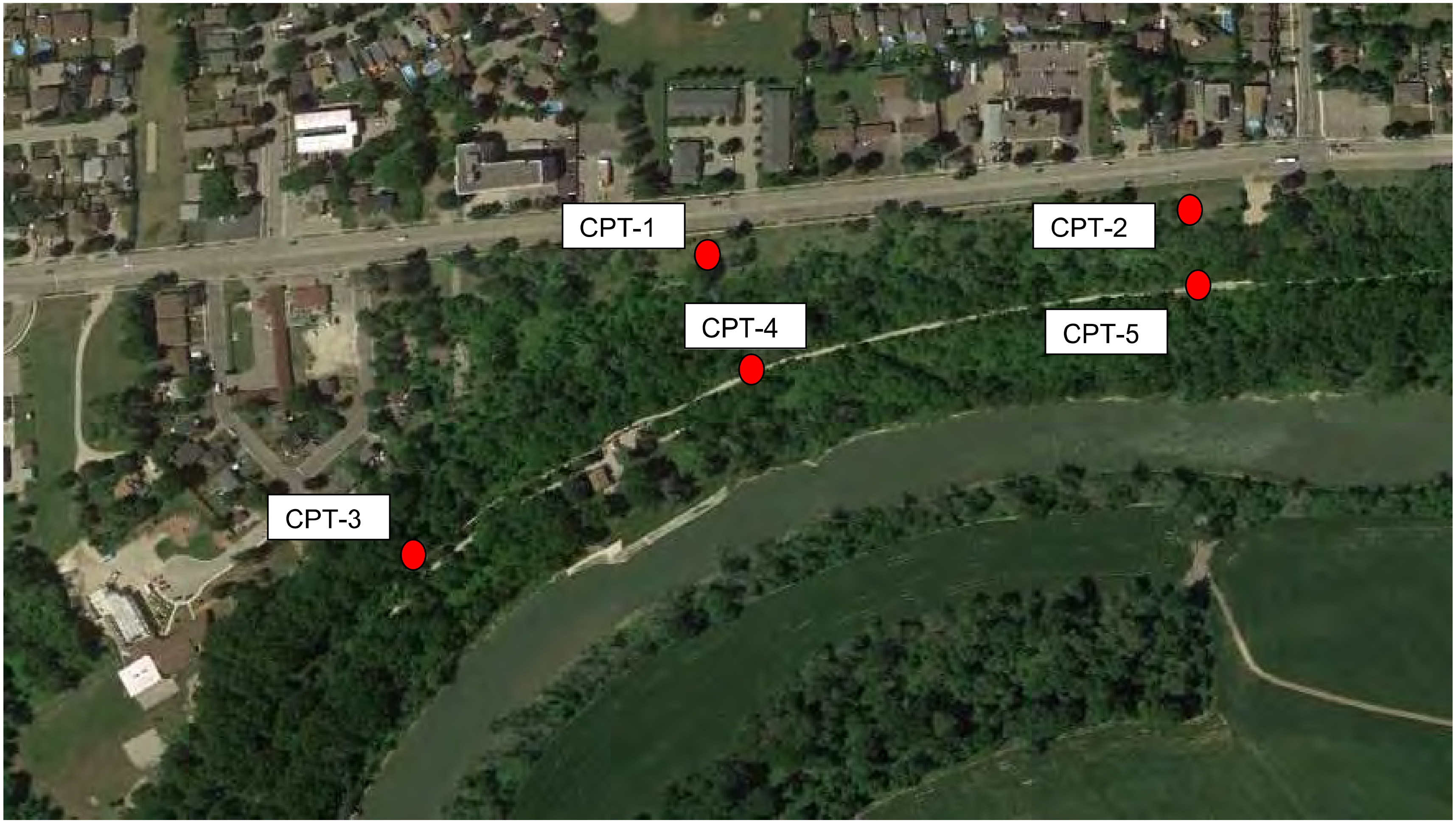
7.0 LIMITATION OF REPORT

Subsurface and groundwater conditions beyond the CPT locations may differ from those encountered at the CPT locations. The information herein in no way reflects on the environmental aspects of the project.

This report has been prepared for this specific project and the information herein is not applicable to any other project or site location. This report is for use by the client. Any use of this report by another third party, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Downunder Geotechnical does not take any responsibility for the use of the soil parameters summarized in this report unless consulted during geotechnical design.

Report prepared by:

Andrew Drevininkas, P. Eng.
President

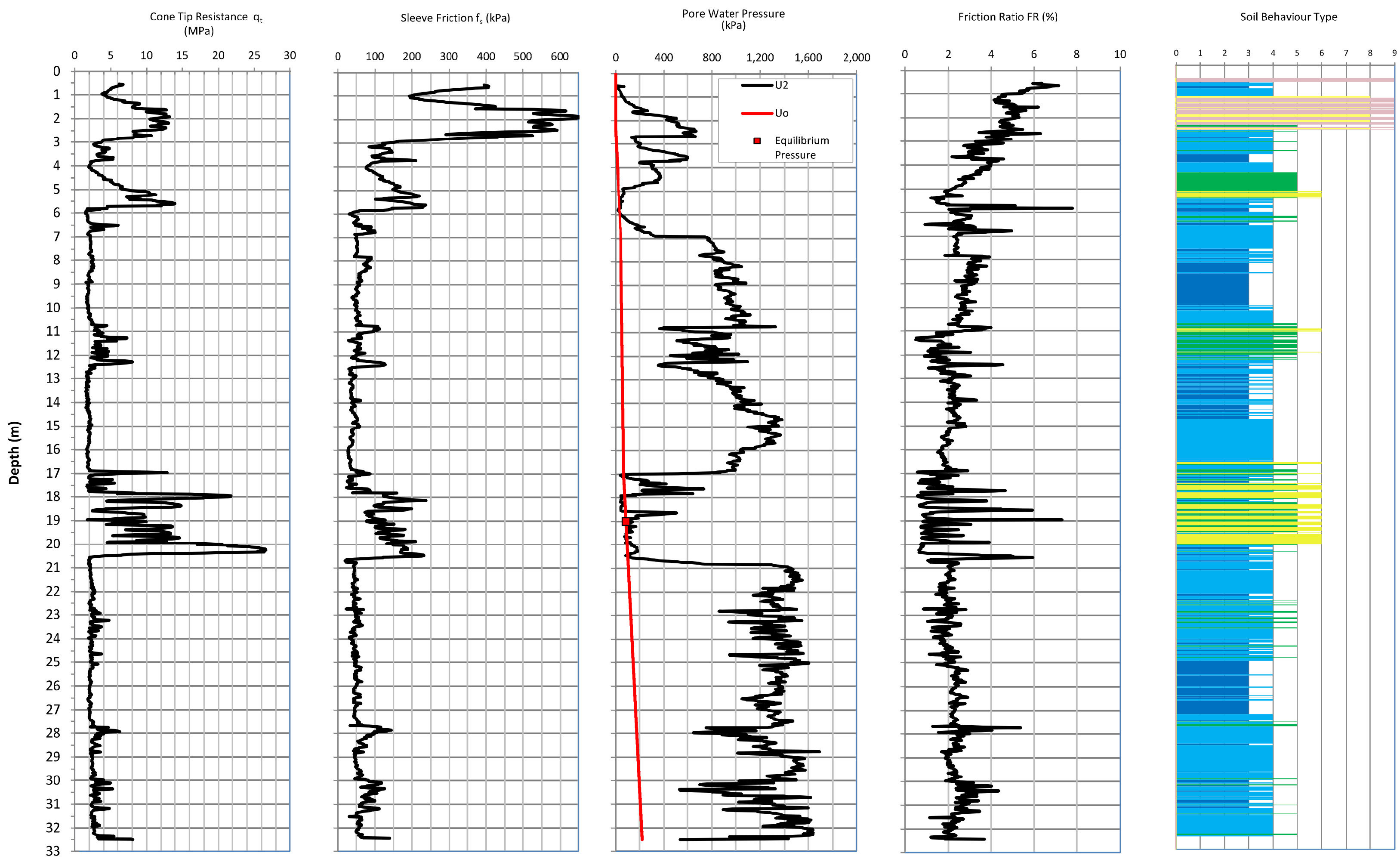


Locations are approximate.

Figure No.1
CPT Location Plan

APPENDIX A

PiezoCone Penetration Test



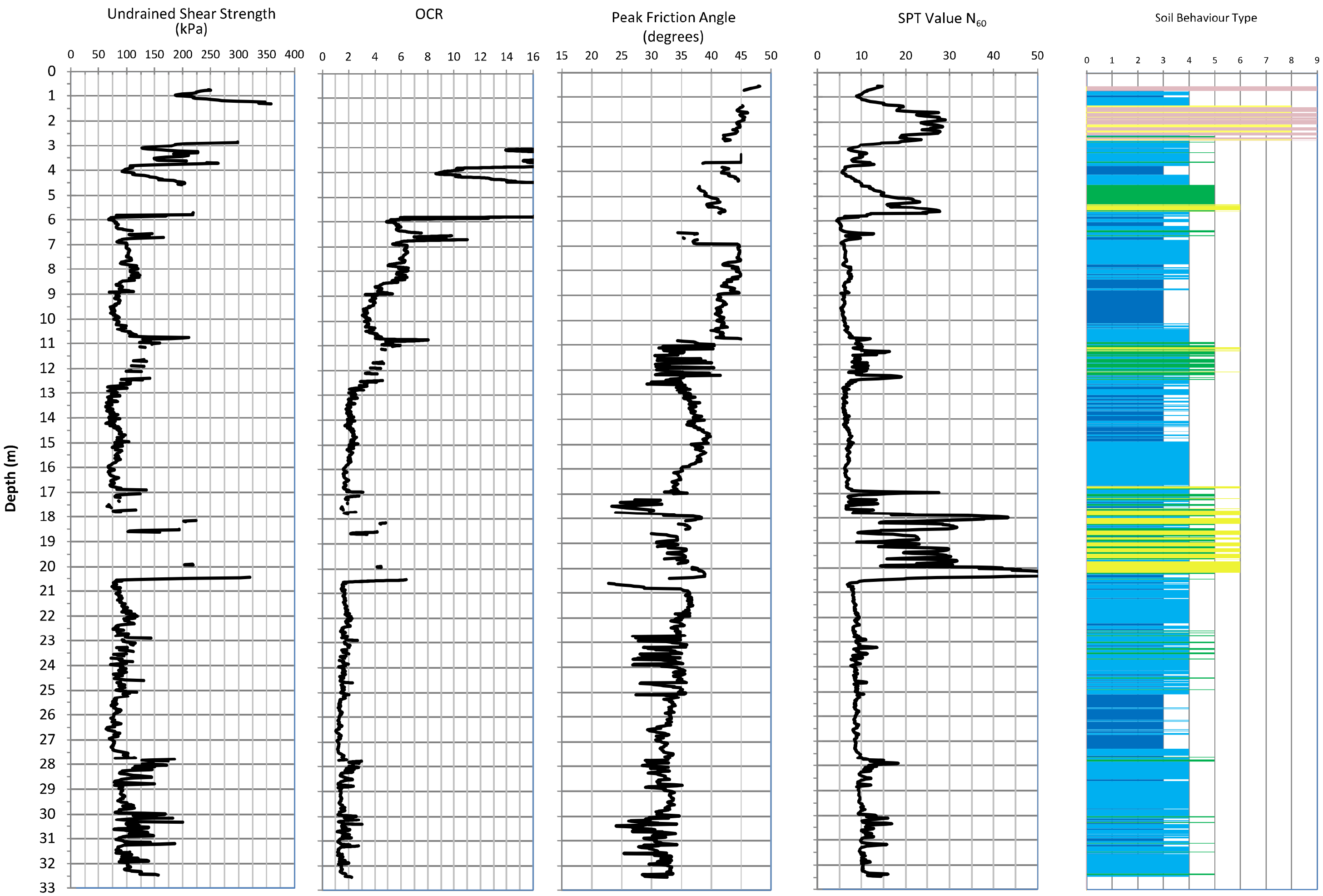
CPT-1

Date: July 30, 2019
Location: Colborne Street East, Brantford, Ontario
Engineer: A.Drevininkas
Cone: GEOTECH AB 10 tonne
Tip Area: 10 cm^2
Friction Sleeve Area: 150 cm^2
Filter Location: U_2

CPT Probe 4143

DownUnder Geotechnical Limited

PiezoCone Penetration Test



Silty Sand FILL compact occasional Silty Clay layers
SILTY CLAY very stiff to hard
compact SANDY SILT to SILTY SAND
SILTY CLAY stiff to very stiff
compact SANDY SILT to SILTY SAND
SILTY CLAY stiff
compact to dense SILTY SAND occasional Silty Clay layers
SILTY CLAY stiff to very stiff

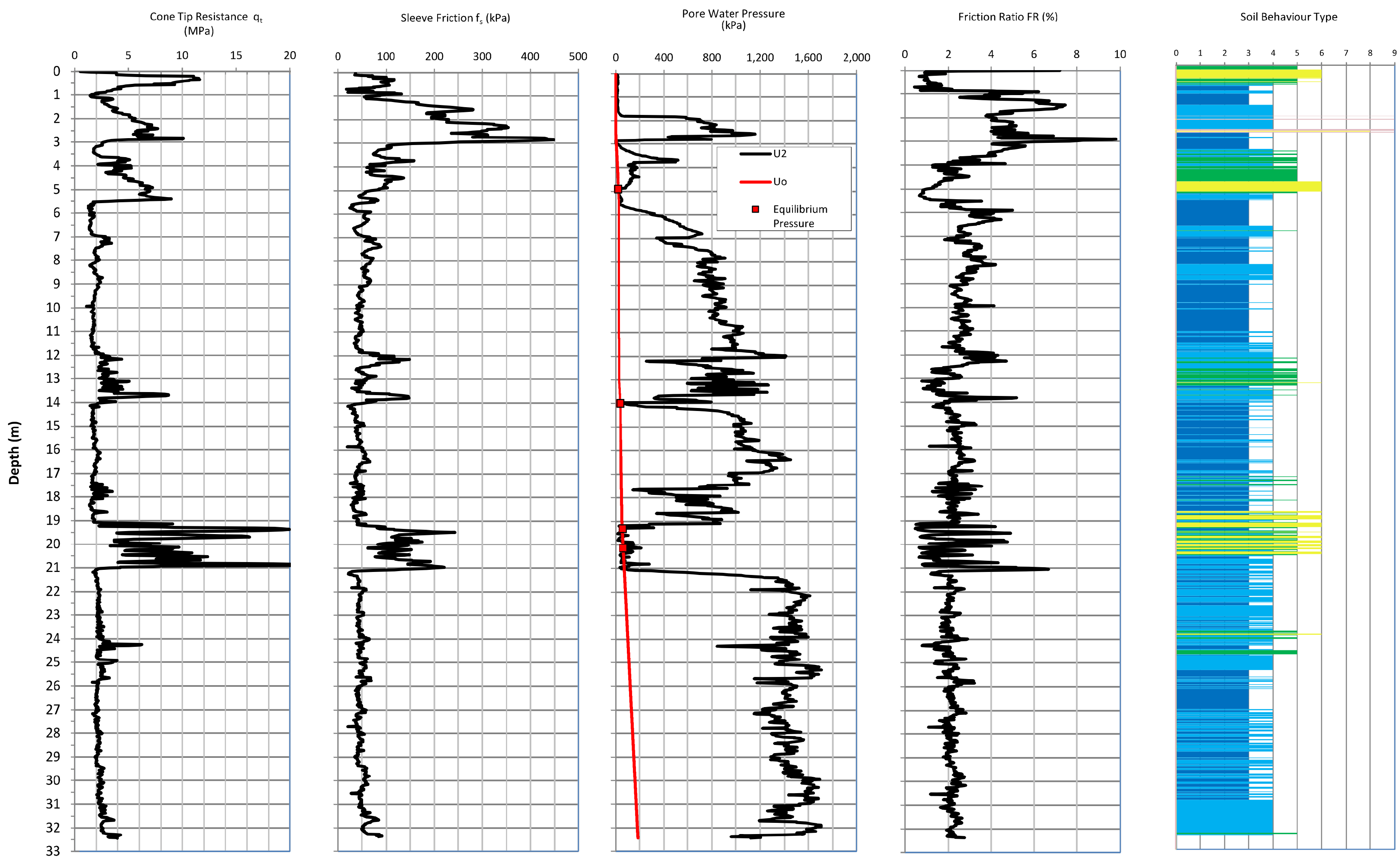
Date: July 30, 2019
Location: Colborne Street East, Brantford, Ontario
Engineer: A.Drevininkas
Cone: GEOTECH AB 10 tonne
Tip Area: 10 cm^2
Friction Sleeve Area: 150 cm^2
Filter Location: U_2

CPT-1

CPT Probe 4143

DownUnder Geotechnical Limited

PiezoCone Penetration Test



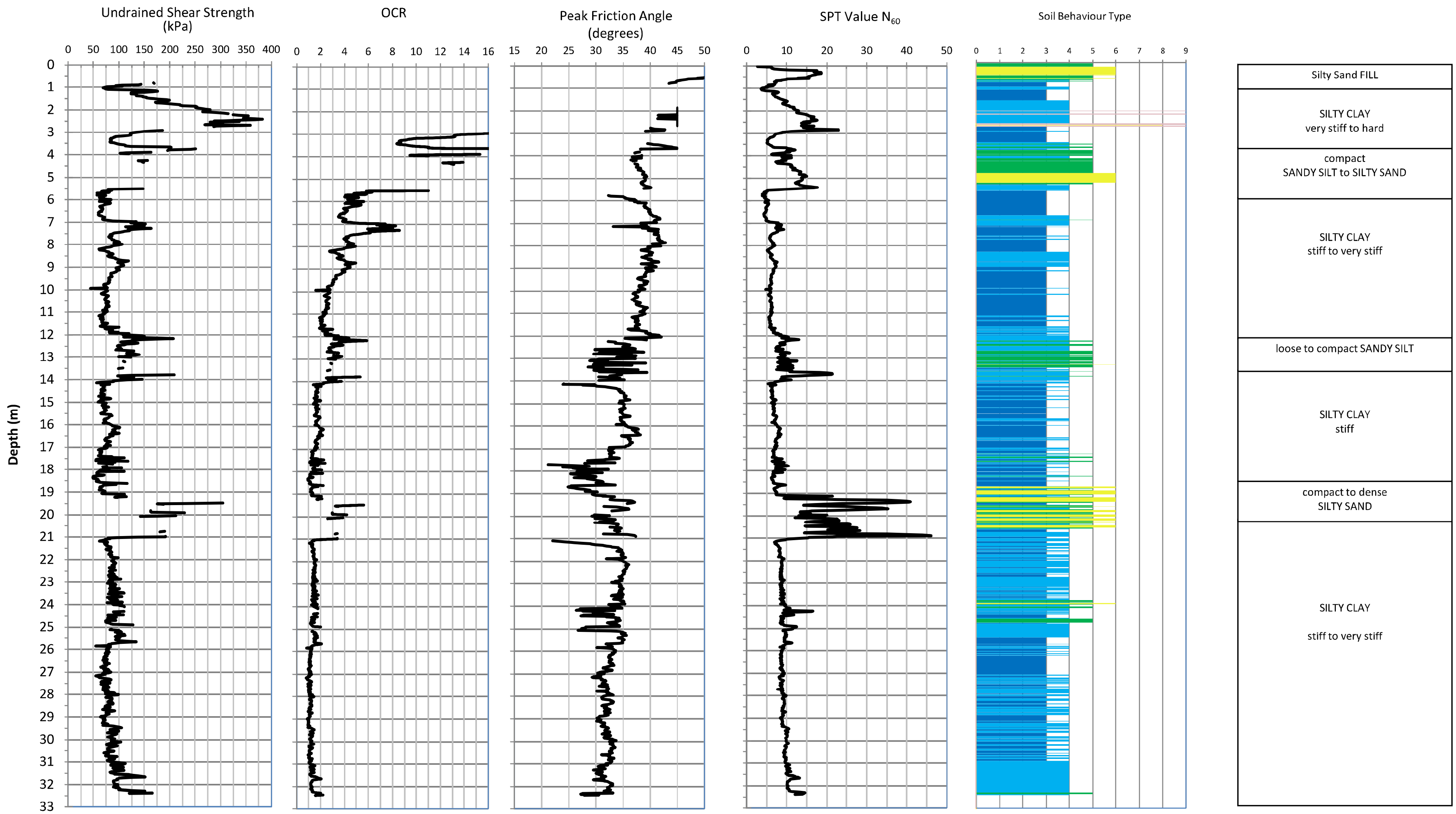
CPT-2

Date: July 31, 2019
Location: Colborne Street East, Brantford, Ontario
Engineer: A.Drevininkas
Cone: GEOTECH AB 10 tonne
Tip Area: 10 cm^2
Friction Sleeve Area: 150 cm^2
Filter Location: U_2

CPT Probe 4143

DownUnder Geotechnical Limited

PiezoCone Penetration Test



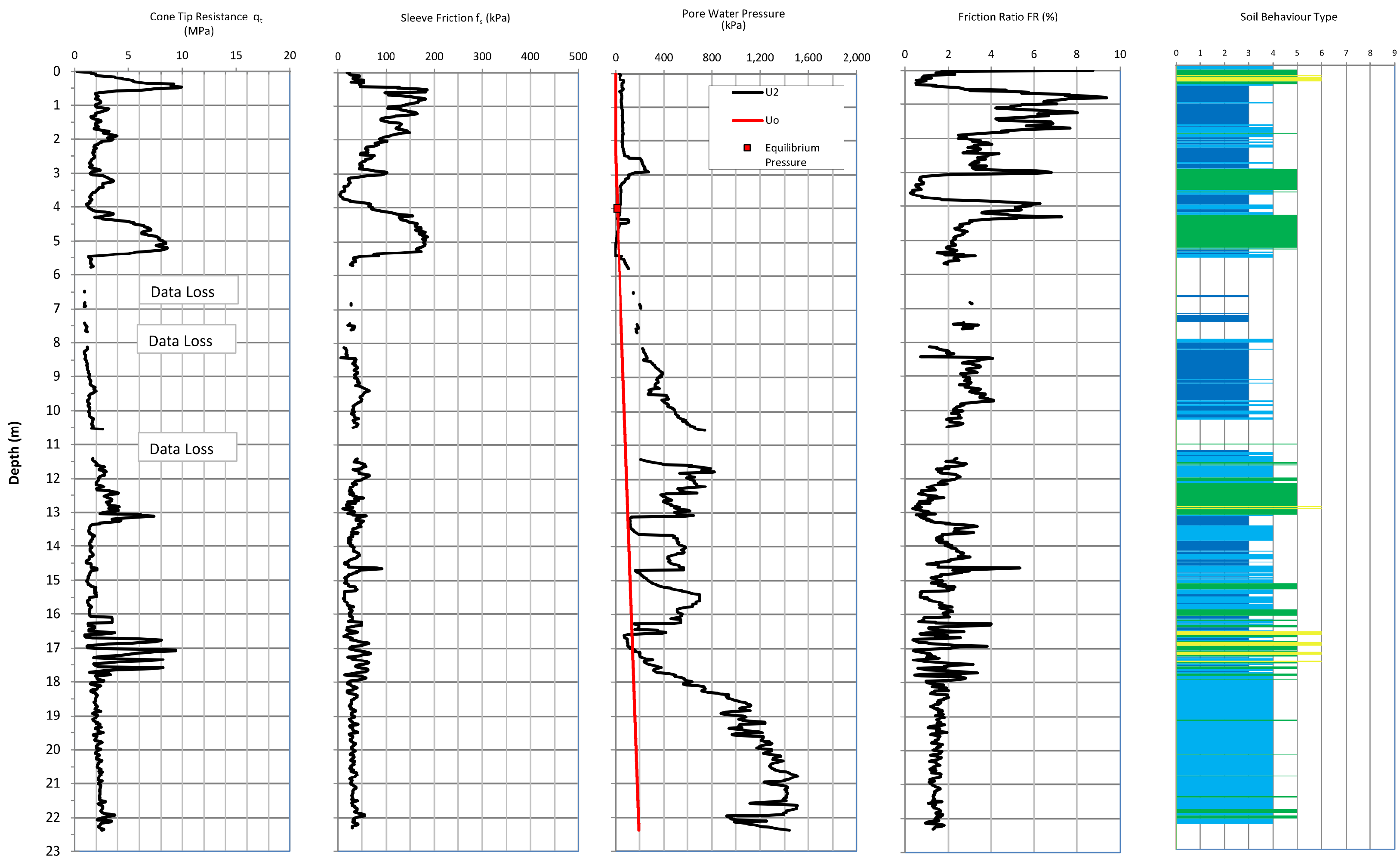
Date: July 31, 2019
Location: Colborne Street East, Brantford, Ontario
Engineer: A.Drevininkas
Cone: GEOTECH AB 10 tonne
Tip Area: 10 cm^2
Friction Sleeve Area: 150 cm^2
Filter Location: U_2

CPT-2

CPT Probe 4143

DownUnder Geotechnical Limited

PiezoCone Penetration Test



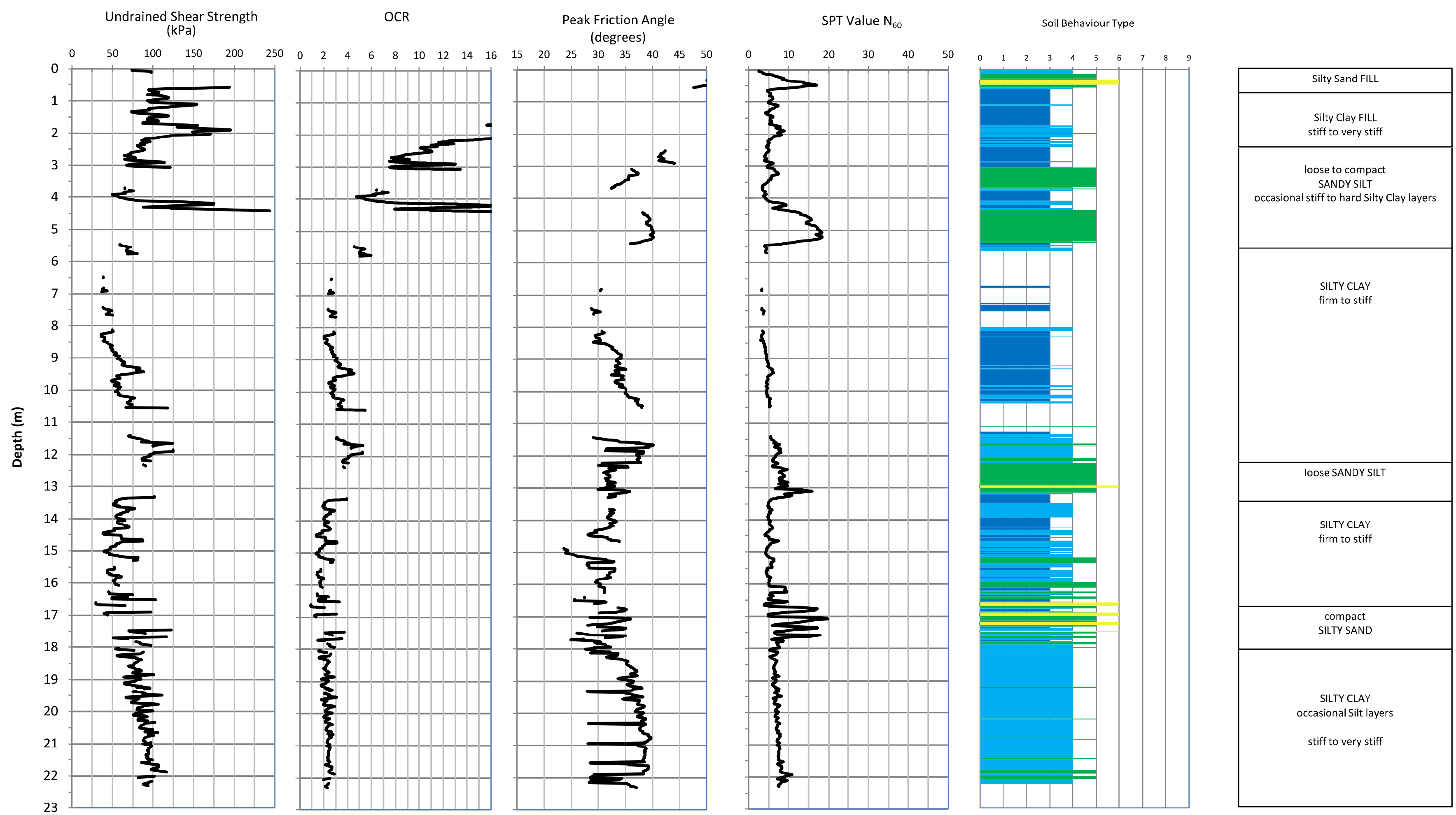
CPT-3

CPT Probe 4143

Date: July 31, 2019
Location: Hamilton-Brantford Rail Trail, Brantford, Ontario
Engineer: A.Drevininkas
Cone: GEOTECH AB 10 tonne
Tip Area: 10 cm^2
Friction Sleeve Area: 150 cm^2
Filter Location: U_2

DownUnder Geotechnical Limited

PiezoCone Penetration Test



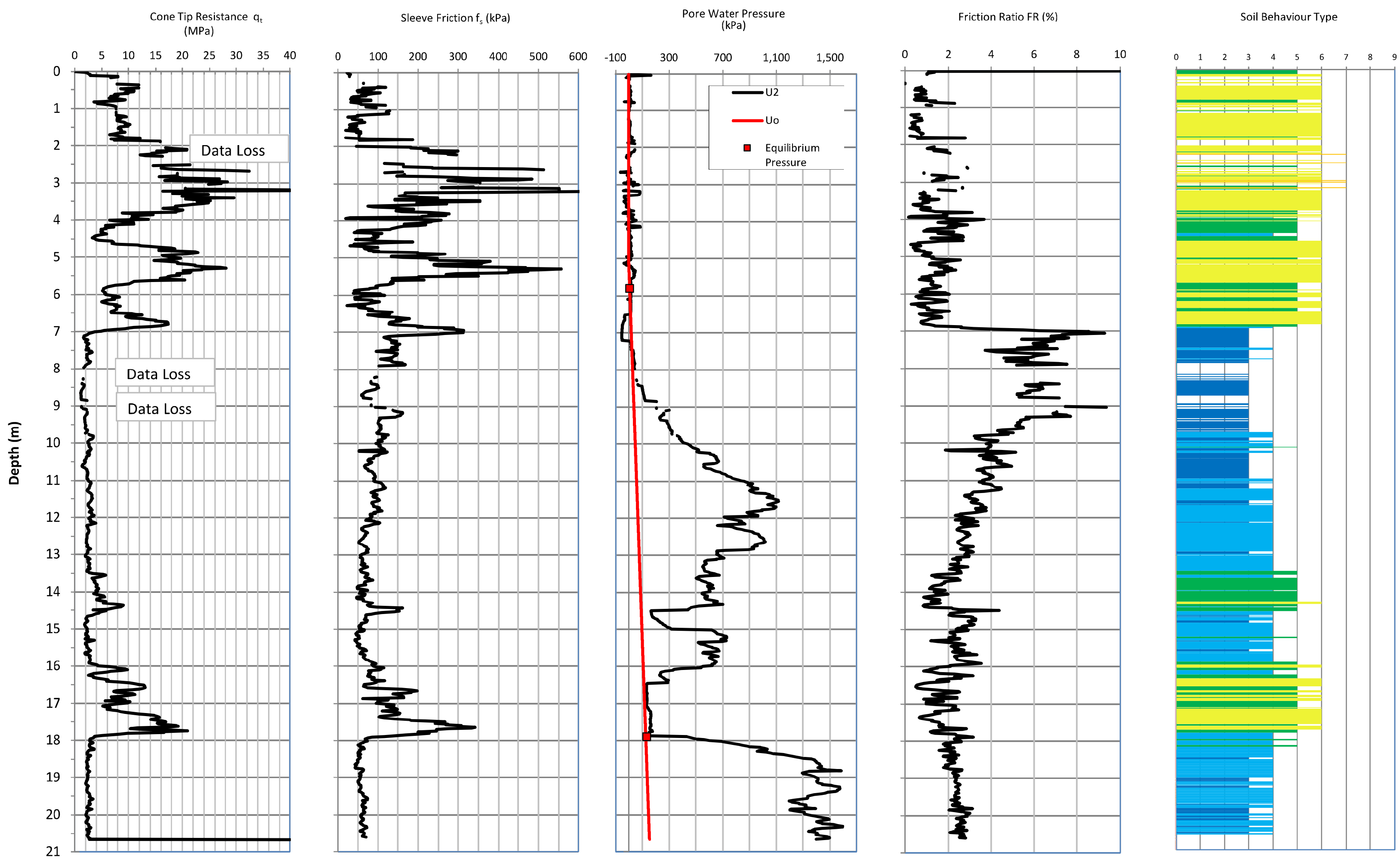
Date: July 31, 2019
Location: Hamilton-Brantford Rail Trail, Brantford, Ontario
Engineer: A.Drevininkas
Cone: GEOTECH AB 10 tonne
Tip Area: 10 cm^2
Friction Sleeve Area: 150 cm^2
Filter Location: U_2

CPT-3

CPT Probe 4143

DownUnder Geotechnical Limited

PiezoCone Penetration Test



CPT-4

Date: August 1, 2019
Location: Hamilton-Brantford Rail Trail, Brantford, Ontario
Engineer: A.Drevininkas
Cone: GEOTECH AB 10 tonne
Tip Area: 10 cm^2
Friction Sleeve Area: 150 cm^2
Filter Location: U_2

CPT Probe 4143

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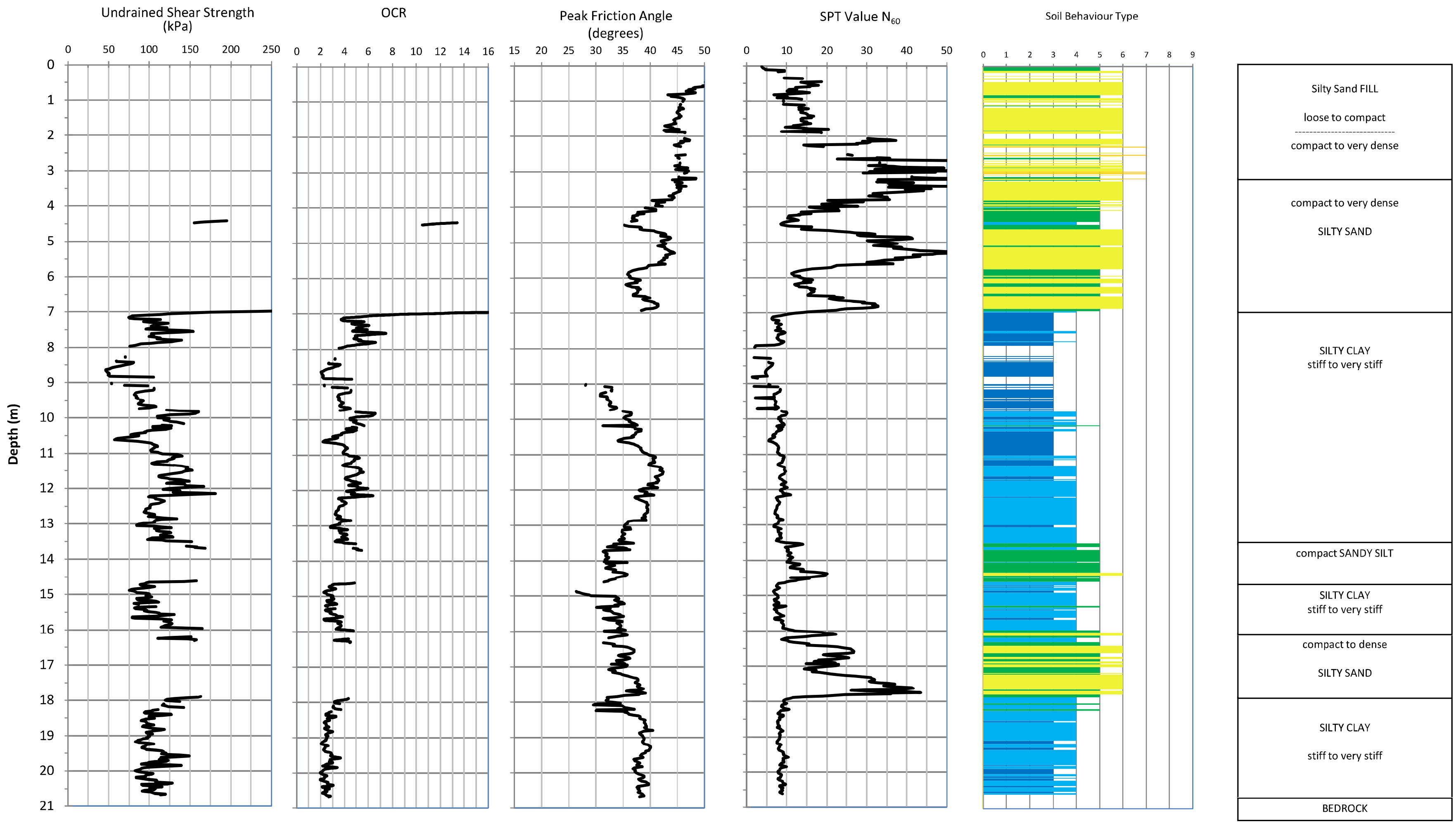
PiezoCone Penetration Test



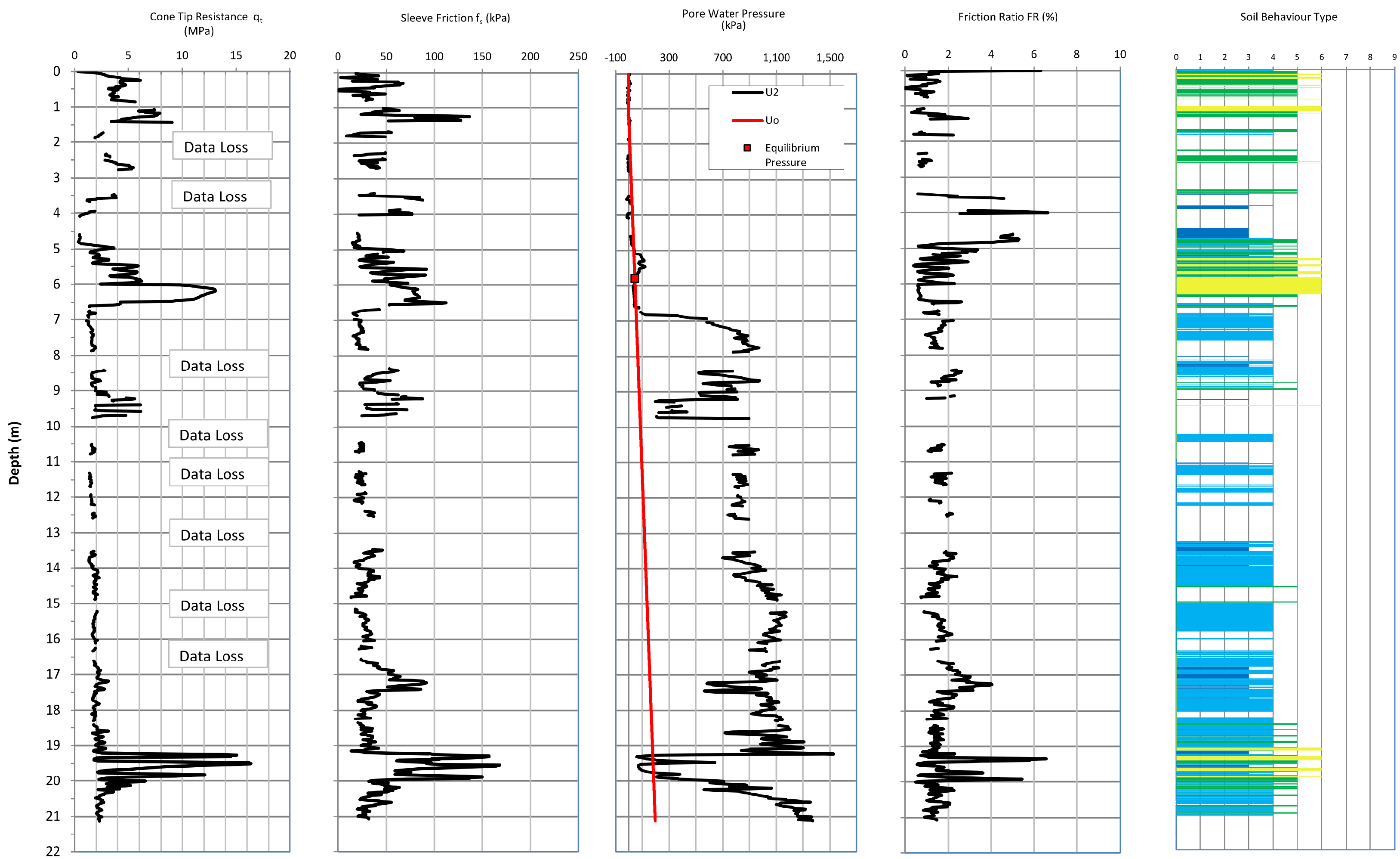
Date: August 1, 2019
Location: Hamilton-Brantford Rail Trail, Brantford, Ontario
Engineer: A.Drevininkas
Cone: GEOTECH AB 10 tonne
Tip Area: 10 cm^2
Friction Sleeve Area: 150 cm^2
Filter Location: U_2

CPT-4

CPT Probe 4143

DownUnder Geotechnical Limited

PiezoCone Penetration Test



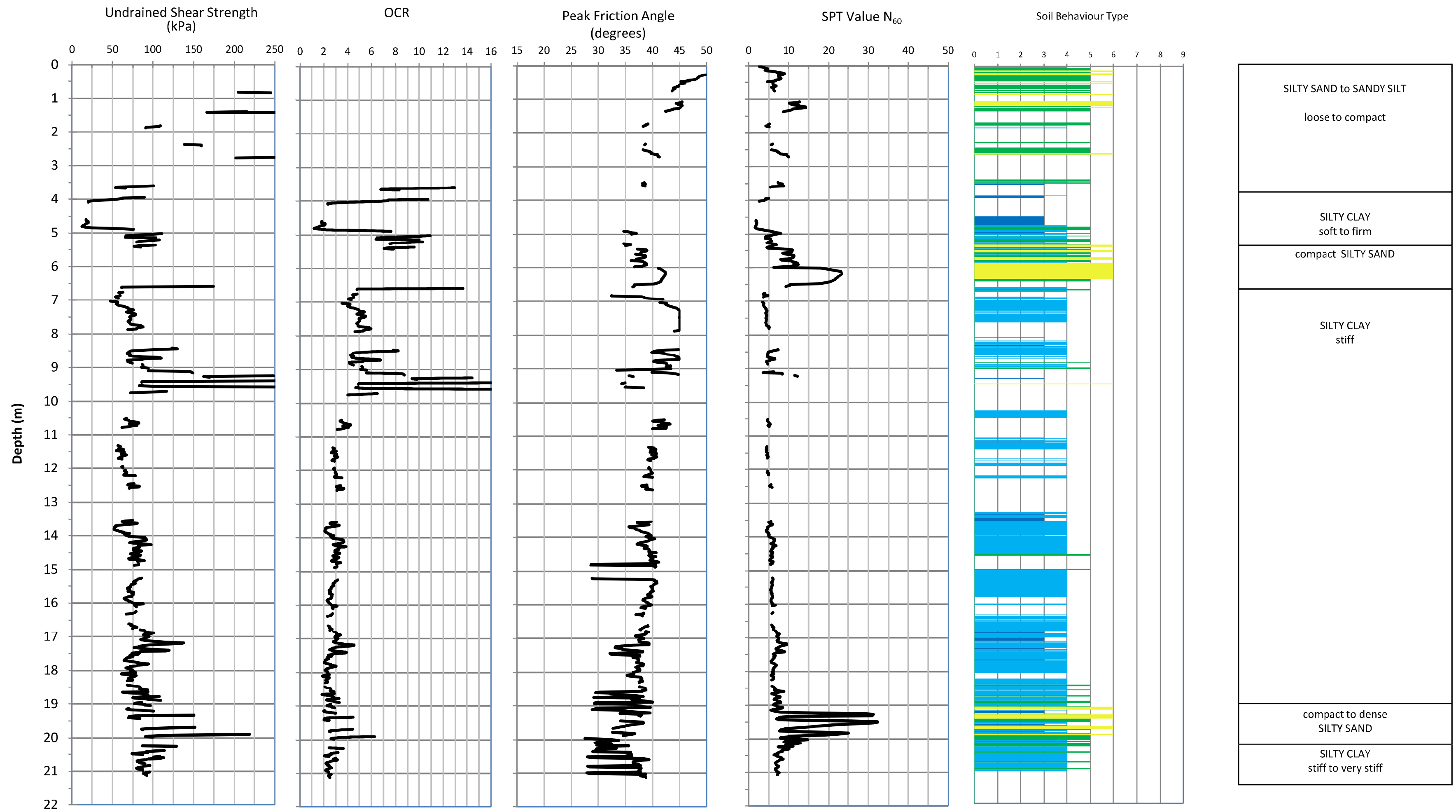
CPT-5

Date: August 1, 2019
Location: Hamilton-Brantford Rail Trail, Brantford, Ontario
Engineer: A.Drevininkas
Cone: GEOTECH AB 10 tonne
Tip Area: 10 cm^2
Friction Sleeve Area: 150 cm^2
Filter Location: U_2

CPT Probe 4143

DownUnder Geotechnical Limited

PiezoCone Penetration Test



Date: August 1, 2019
Location: Hamilton-Brantford Rail Trail, Brantford, Ontario
Engineer: A.Drevininkas
Cone: GEOTECH AB 10 tonne
Tip Area: 10 cm^2
Friction Sleeve Area: 150 cm^2
Filter Location: U_2

CPT-5

CPT Probe 4143

DownUnder Geotechnical Limited

APPENDIX III

Borehole Logs

Log of Borehole: BH1 at CPT4

Project #: 223798.000 **Logged By:** DB

Project: Geotechnical Investigation

Client: Ecosystem Recovery Inc.

Location: Colborne Street, Brantford, ON

Drill Date: August 2, 2019 **Project Manager:** VM

SUBSURFACE PROFILE

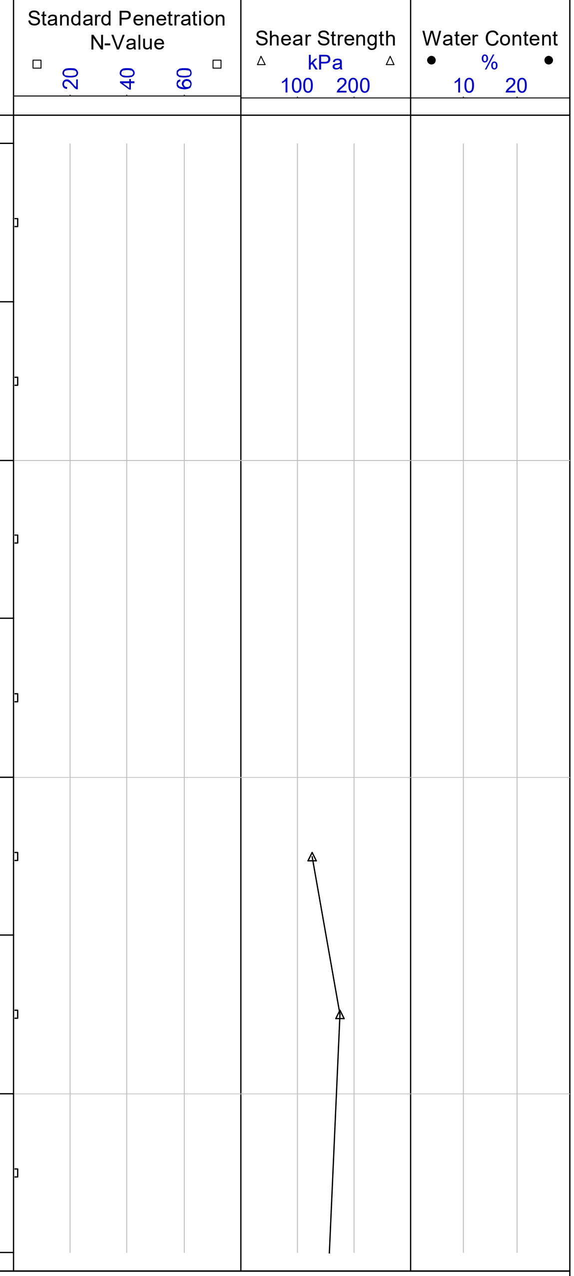
Description	Elevation (m)
Ground Surface	201.07
Fill	200.77
Brown sand and gravel, damp.	200.46
Black asphalt.	
Brown sand and gravel, some cobbles, loose.	199.55
Some silt, dense.	198.02
Moist.	197.41
Black and brown, with shale lock fragments	196.50
Sand	196.19
Brown silty sand with gravel, moist, dense.	195.74
Brown, coarse.	
Some silt, fine.	194.97
Wet.	194.67
Silty Clay	
Brown silty clay, trace to some sand and gravel, APL.	
WTPL.	192.99
Grey and brown, trace sand, black organic staining, DTPL to APL.	191.47
Brown with orange and grey mottling.	190.40

Depth (m): 0–10

Monitoring Well Details: No Monitoring Well Installed

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value
DP	S1	60	NM
DP	S2	52	NM
DP	S3	70	NM
DP	S4	60	NM
DP	S5	58	NM
DP	S6	75	NM
DP	S7	92	NM



Contractor: Strata Drilling Group **Grade Elevation:** 201.07 masl

Drilling Method: Direct Push **Top of Casing Elevation:** NM

Well Casing Size: NA **Sheet:** 1 of 3

Log of Borehole: BH1 at CPT4

Project #: 223798.000 **Logged By:** DB

Project: Geotechnical Investigation

Client: Ecosystem Recovery Inc.

Location: Colborne Street, Brantford, ON

Drill Date: August 2, 2019 **Project Manager:** VM

SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)	Monitoring Well Details
11	WTPL to APL.	189.64	No Monitoring Well Installed
	WTPL.	183.09	
18	**Silty Sand** Grey and brown, dense, fine, saturated.	182.48	
19	**Silty Clay** Grey, soft to stiff, APL to WTPL	179.73	

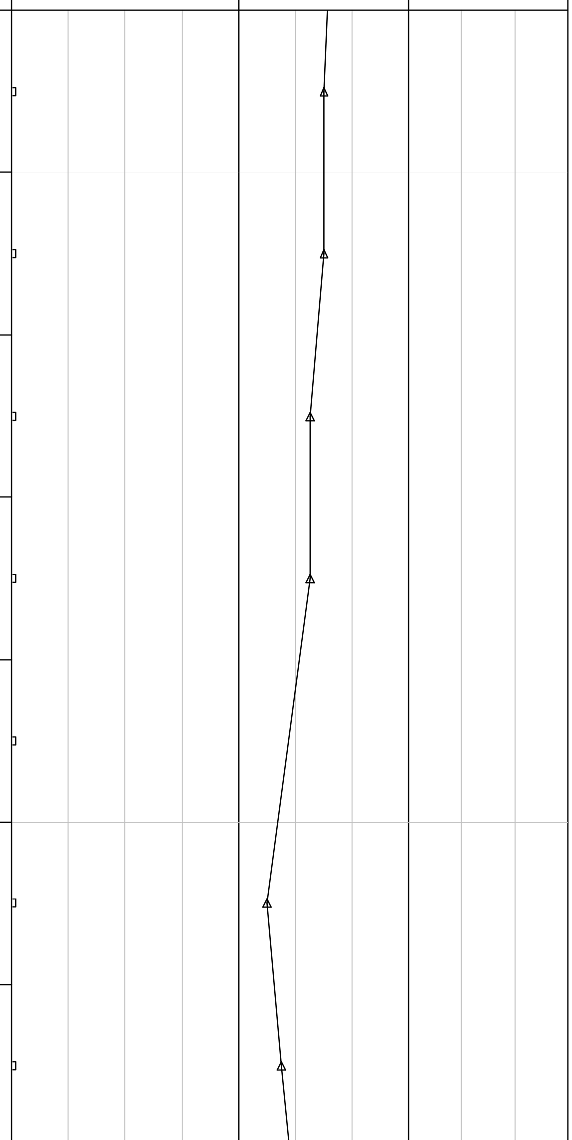
SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value
DP	S8	100	NM
DP	S9	100	NM
DP	S10	100	NM
DP	S11	100	NM
DP	S12	100	NM
DP	S13	100	NM
DP	S14	100	NM

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

Water Content %: 10 20



Contractor: Strata Drilling Group

Drilling Method: Direct Push

Well Casing Size: NA

Grade Elevation: 201.07 masl

Top of Casing Elevation: NM

Log of Borehole: BH1 at CPT4

Project #: 223798.000 **Logged By:** DB

Project: Geotechnical Investigation

Client: Ecosystem Recovery Inc.

Location: Colborne Street, Brantford, ON

Drill Date: August 2, 2019 **Project Manager:** VM

SUBSURFACE PROFILE					SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Standard Penetration N-Value (20, 40, 60)	Shear Strength kPa (100, 200)	Water Content % (10, 20)
		Saturated silty sand seam.									
22		Grey silty clay, soft WTPL.	178.51		DP	S15	80	NM			
		End of Borehole									

Depth scale (m): 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32

Contractor: Strata Drilling Group **Grade Elevation:** 201.07 masl

Drilling Method: Direct Push **Top of Casing Elevation:** NM

Well Casing Size: NA **Sheet:** 3 of 3

Log of Borehole: BH2 at CPT1

PINCHIN

Project #: 223798.000 **Logged By:** DB

Project: Geotechnical Investigation

Client: Ecosystem Recovery Inc.

Location: Colborne Street, Brantford, ON

Drill Date: August 6, 2019 **Project Manager:** VM

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Standard Penetration N-Value (20, 40, 60)	Shear Strength kPa (100, 200)	Water Content % (10, 20)
	Ground Surface	218.53	No Monitoring Well Installed							
0	**Fill** Dark brown silt, some sand, some organic material.			DP	S1	50	NM			
1	Medium to light brown sandy silt, trace clay, moist.	217.01		DP	S2	100	NM			
2	**Silt** Medium brown silt with some grey mottling, trace clay, moist.	216.24		DP	S3	100	NM			
	Moist to very moist.	215.48		DP	S4	100	NM			
3	Grey with some medium brown mottling.	214.57		DP	S5	10	NM			
4	Grey, trace to some clay, wet.			DP	S6	100	NM			
5				DP	S7	100	NM			
		212.74		DP	S8	100	NM			
6	**Silty Clay** Grey, trace to some sand, WTPL.			DP	S9	100	NM			
				DP	S10	100	NM			
7				DP	S11	100	NM			
8				DP	S12	100	NM			
9				DP	S13	100	NM			
				DP	S1	100	NM			

Contractor: Strata Drilling Group **Grade Elevation:** 218.53 masl

Drilling Method: Direct Push **Top of Casing Elevation:** NM

Well Casing Size: NA **Sheet:** 1 of

Log of Borehole: BH2 at CPT1

Project #: 223798.000 **Logged By:** DB

Project: Geotechnical Investigation

Client: Ecosystem Recovery Inc.

Location: Colborne Street, Brantford, ON

Drill Date: August 6, 2019 **Project Manager:** VM

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value
10		207.86	No Monitoring Well Installed	DP	S15	100	NM
11	**Silt** Grey, sandy silt, some clay, wet.	207.10		DP	S1	100	NM
				DP	S1	10	NM
12	**Silty Clay** Grey, trace sand, APL to WTPL			DP	S18	100	NM
13				DP	S19	100	NM
14				DP	S2	100	NM
15				DP	S21	100	NM
				DP	S2	100	NM
16		201.77		DP	S2	10	NM
17	**SIlty Sand** Grey, some clay, wet.			DP	S24	100	NM
				DP	S25	100	NM
18		200.24		DP	S26	10	NM
19	Grey with occassional reddish brown mottling and clayey silt layers.			DP	S2	10	NM
				DP	S2	100	NM

Standard Penetration N-Value: 20 40 60
Shear Strength kPa: 100 200
Water Content %: 10 20

Contractor: Strata Drilling Group **Grade Elevation:** 218.53 masl

Drilling Method: Direct Push **Top of Casing Elevation:** NM

Well Casing Size: NA **Sheet:** 2 of 3

Log of Borehole: BH2 at CPT1

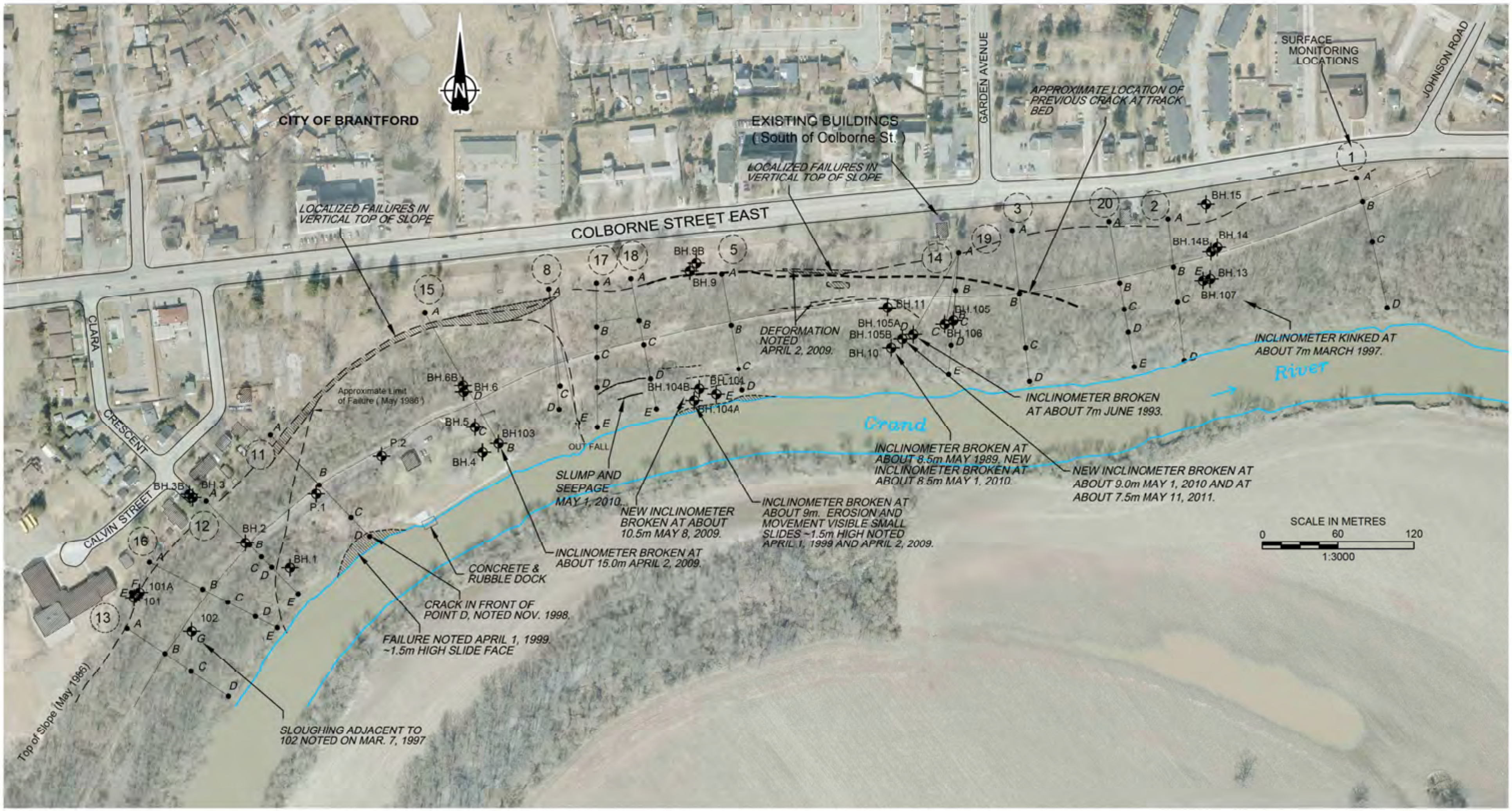
Project #: 223798.000
Logged By: DB
Project: Geotechnical Investigation
Client: Ecosystem Recovery Inc.
Location: Colborne Street, Brantford, ON
Drill Date: August 6, 2019
Project Manager: VM

SUBSURFACE PROFILE					SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Standard Penetration N-Value (20, 40, 60)	Shear Strength kPa (100, 200)	Water Content % (10, 20)
						S28		NM			
20			198.26		DP	S29	100	NM			
21		***Silty Clay*** Grey silty clay, trace sand, wet.			DP	S3	100	NM			
22					DP	S31	100	NM			
			195.82		DP	S32	100	NM			
23		Grey with reddish brown mottling sandy silt seam, wet.				S33		NM			
		Grey silty clay trace sand, WTPL.			DP	S34	10	NM			
24			194.15		DP	S35	100	NM			
		End of Borehole									
25											
26											
27											
28											
29											

Contractor: Strata Drilling Group
Grade Elevation: 218.53 masl
Drilling Method: Direct Push
Top of Casing Elevation: NM
Well Casing Size: NA
Sheet: 3 of

APPENDIX IV

Slope Inclinometer Plan



LEGEND

- BOREHOLE AND MONITORING INSTALLATIONS
- (16) SLOPE MONITORING LOCATIONS
- A● MONITORING POINT
- TENSION CRACKS
- SLUMP / FAILURE ZONE

REFERENCES

DATA SUPPLIED BY THE CITY OF BRANTFORD

ORTHOPHOTO FROM
GRAND RIVER CONSERVATION AUTHORITY
APPROXIMATE IMAGERY DATE 2009.

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.
2. SEE FIGURE 36 FOR PRECIPITATION DATA AND DEFORMATION NOTED IN CHRONOLOGICAL ORDER.

PROJECT
GRAND RIVER VALLEY SLOPE MONITORING
COLBORNE STREET EAST LANDSLIDE AREA
GRAND RIVER VALLEY WALL, BRANTFORD, ONTARIO

TITLE
LOCATION PLAN

Golder Associates
LONDON, ONTARIO

PROJECT No.	861-3369	FILE No.	8613369-R25001	
		SCALE	AS SHOWN	REV. 0
CADD	WDF	May 29/14	FIGURE 1	
CHECK				

Drawing file: 8613369-R25001.DWG May 29, 2014 - 3:45pm

APPENDIX V

Slope Inclinometer Measurements

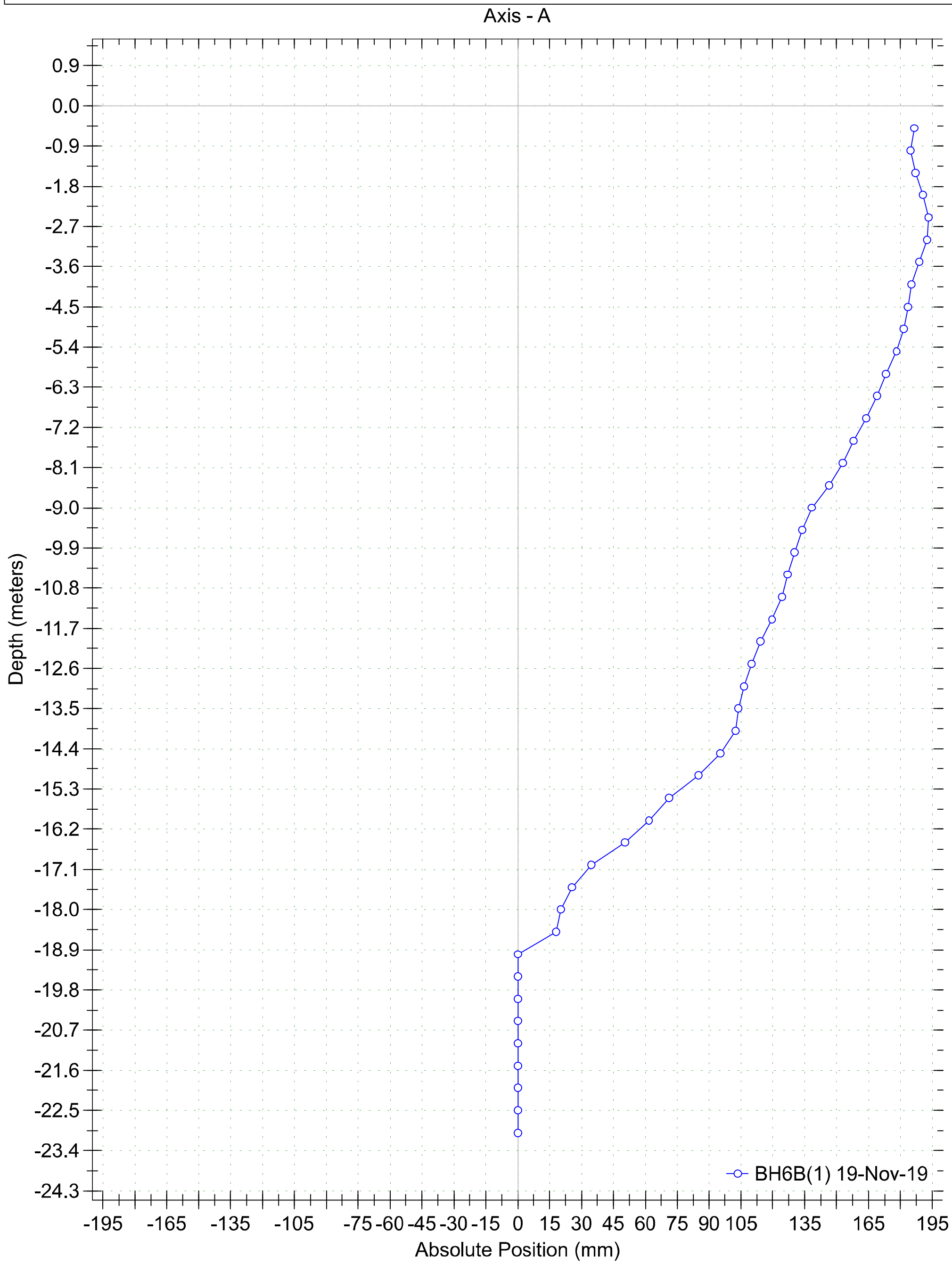
RST Instruments Ltd.

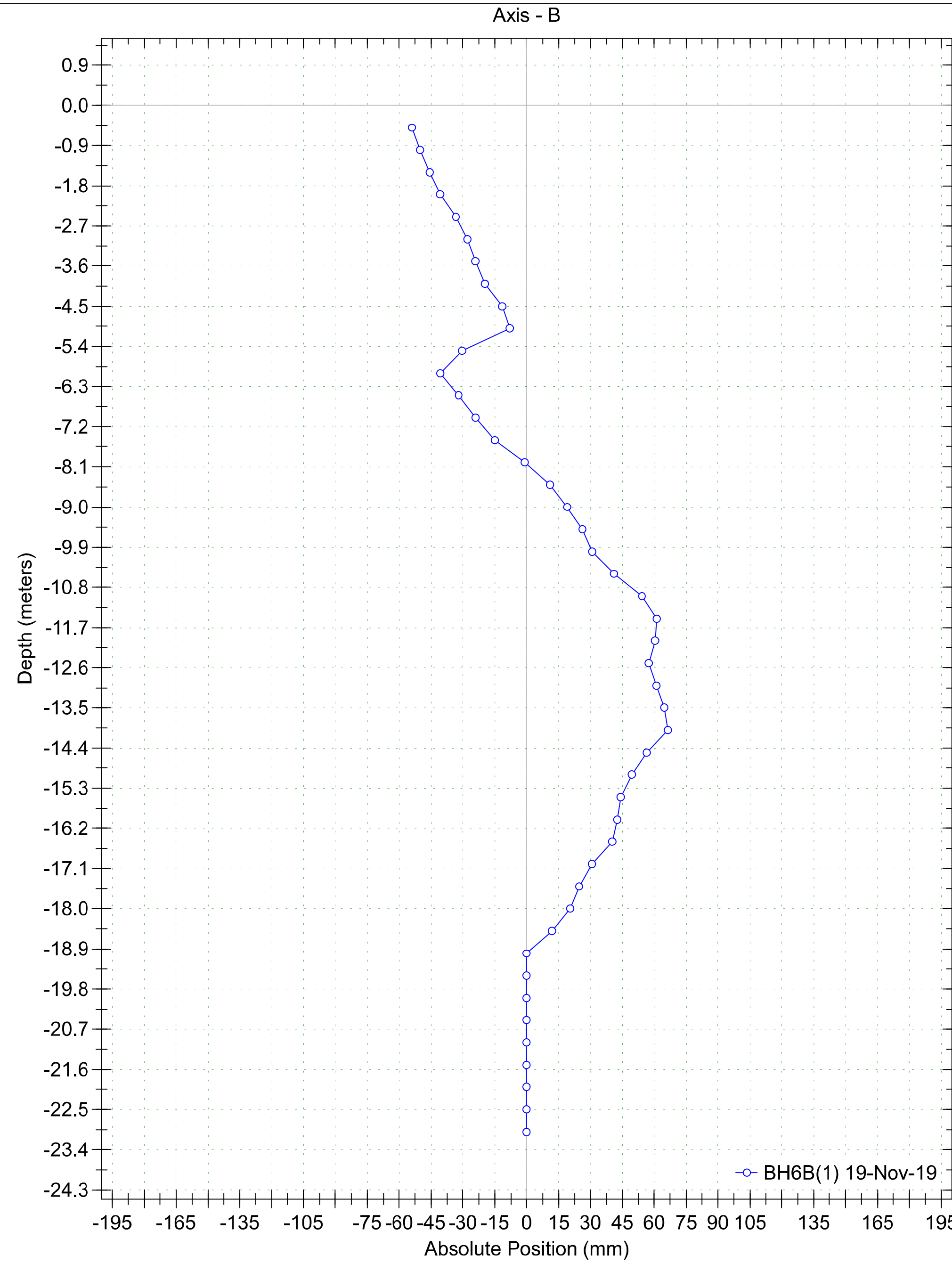
ABSOLUTE POSITION

Inclinalysis v. 2.48.7

Borehole : BH6B
Project : Colborne Slope
Location :
Northing :
Easting :
Collar :

Spiral Correction : N/A
Collar Elevation : 0.00 meters
Reading Depth : 23.0 meters
A+ Groove Azimuth :
Base Reading : 2019 Nov 19 12:59
Applied Azimuth : 0.0 degrees





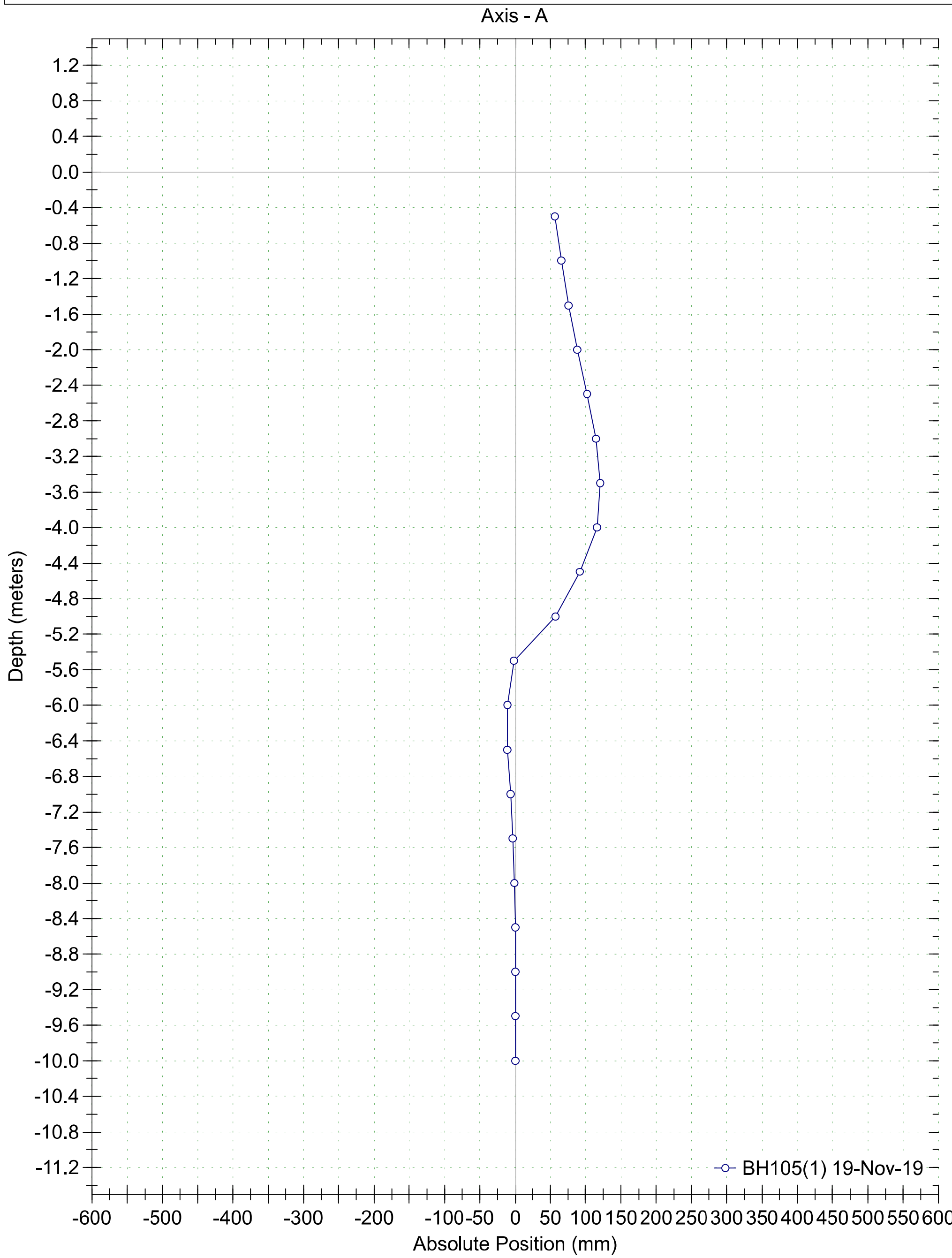
RST Instruments Ltd.

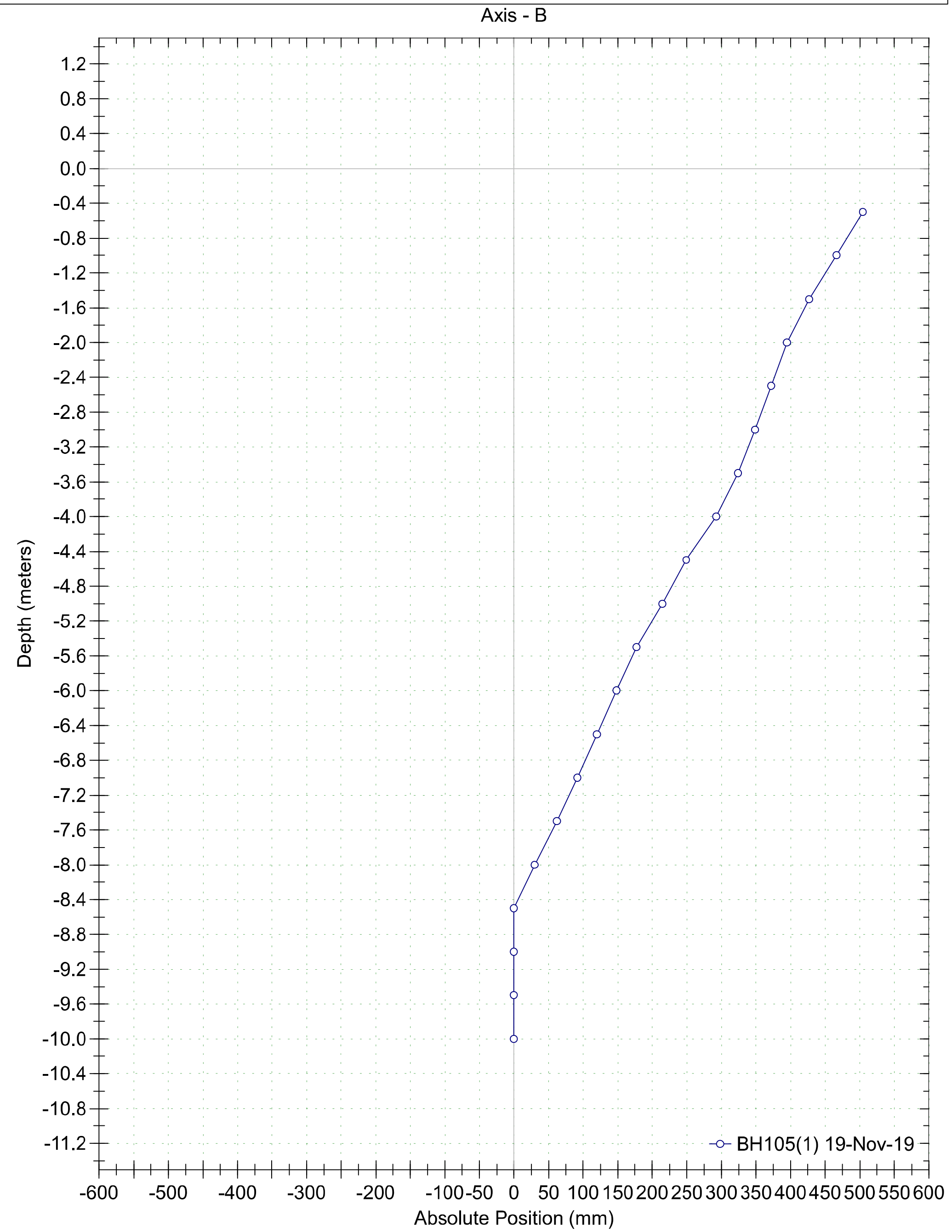
ABSOLUTE POSITION

Inclinalysis v. 2.48.7

Borehole : BH105
Project : Colborne Slope
Location :
Northing :
Easting :
Collar :

Spiral Correction : N/A
Collar Elevation : 0.00 meters
Reading Depth : 10.0 meters
A+ Groove Azimuth :
Base Reading : 2019 Nov 19 12:15
Applied Azimuth : 0.0 degrees

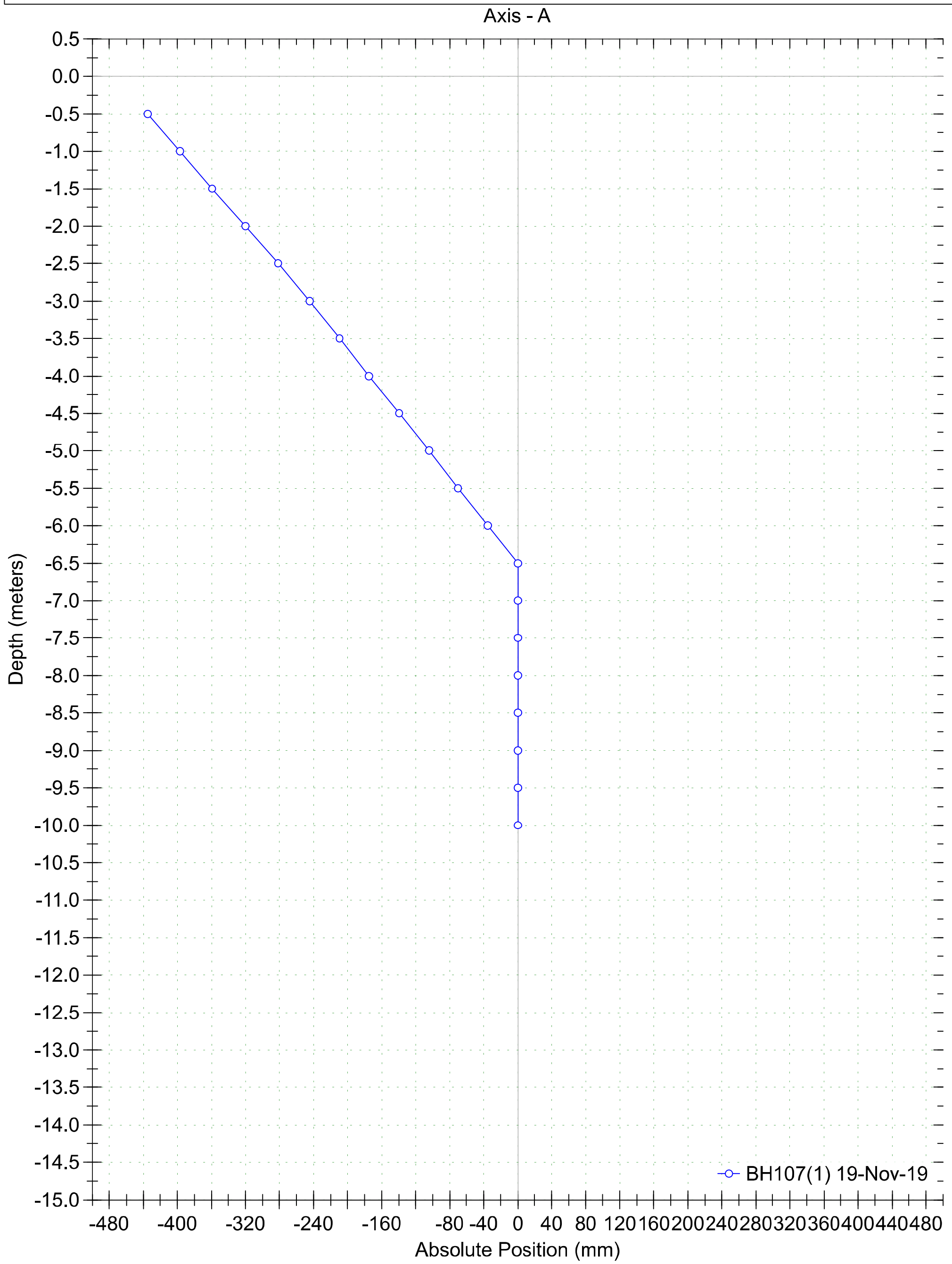


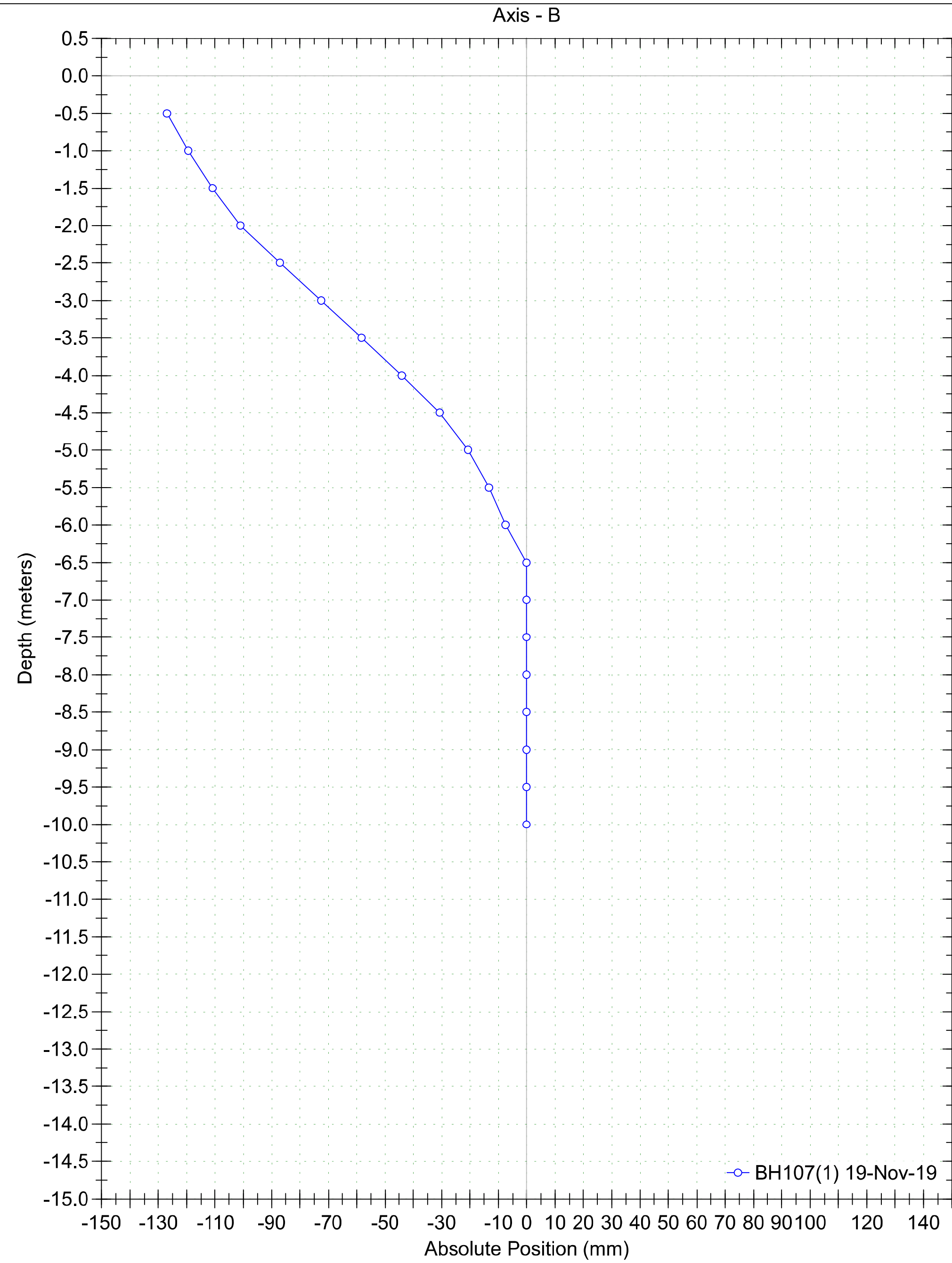


RST Instruments Ltd. | ABSOLUTE POSITION | Inclinalysis v. 2.48.7

Borehole : BH107
Project : Colborne Slope
Location :
Northing :
Easting :
Collar :

Spiral Correction : N/A
Collar Elevation : 0.00 meters
Reading Depth : 10.0 meters
A+ Groove Azimuth :
Base Reading : 2019 Nov 19 11:42
Applied Azimuth : 0.0 degrees





APPENDIX VI

Report Limitations and Guidelines for Use

REPORT LIMITATIONS & GUIDELINES FOR USE

This information has been provided to help manage risks with respect to the use of this report.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS AND PROJECTS

This report was prepared for the exclusive use of the Client and their authorized agents, subject to the conditions and limitations contained within the duly authorized work plan. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third parties. If additional parties require reliance on this report, written authorization from Pinchin will be required. Pinchin disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs. No other warranties are implied or expressed. Furthermore, this report should not be construed as legal advice.

SUBSURFACE CONDITIONS CAN CHANGE

This geotechnical report is based on the existing conditions at the time the study was performed, and Pinchin's opinion of soil conditions are strictly based on soil samples collected at specific test hole locations. The findings and conclusions of Pinchin's reports may be affected by the passage of time, by manmade events such as construction on or adjacent to the Site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations.

LIMITATIONS TO PROFESSIONAL OPINIONS

Interpretations of subsurface conditions are based on field observations from test holes that were spaced to capture a 'representative' snap shot of subsurface conditions. Site exploration identifies subsurface conditions only at points of sampling. Pinchin reviews field and laboratory data and then applies professional judgment to formulate an opinion of subsurface conditions throughout the Site. Actual subsurface conditions may differ, between sampling locations, from those indicated in this report.

LIMITATIONS OF RECOMMENDATIONS

Subsurface soil conditions should be verified by a qualified geotechnical engineer during construction. Pinchin should be notified if any discrepancies to this report or unusual conditions are found during construction.

Sufficient monitoring, testing and consultation should be provided by Pinchin during construction and/or excavation activities, to confirm that the conditions encountered are consistent with those indicated by the test hole investigation, and to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated. In addition, monitoring, testing and consultation by Pinchin should be completed to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining Pinchin for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions. However, please be advised that any construction/excavation observations by Pinchin is over and above the mandate of this geotechnical evaluation and therefore, additional fees would apply.

MISINTERPRETATION OF GEOTECHNICAL ENGINEERING REPORT

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having Pinchin confer with appropriate members of the design team after submitting the report. Also retain Pinchin to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having Pinchin participate in pre-bid and preconstruction conferences, and by providing construction observation. Please be advised that retaining Pinchin to participation in any ‘other’ activities associated with this project is over and above the mandate of this geotechnical investigation and therefore, additional fees would apply.

CONTRACTORS RESPONSIBILITY FOR SITE SAFETY

This geotechnical report is not intended to direct the contractor's procedures, methods, schedule or management of the work Site. The contractor is solely responsible for job Site safety and for managing construction operations to minimize risks to on-Site personnel and to adjacent properties. It is ultimately the contractor’s responsibility that the Ontario Occupational Health and Safety Act is adhered to, and Site conditions satisfy all ‘other’ acts, regulations and/or legislation that may be mandated by federal, provincial and/or municipal authorities.

SUBSURFACE SOIL AND/OR GROUNDWATER CONTAMINATION

This report is geotechnical in nature and was not performed in accordance with any environmental guidelines. As such, any environmental comments are very preliminary in nature and based solely on field observations. Accordingly, the scope of services do not include any interpretations, recommendations, findings, or conclusions regarding the, assessment, prevention or abatement of contaminants, and no conclusions or inferences should be drawn regarding contamination, as they may relate to this project. The term "contamination" includes, but is not limited to, molds, fungi, spores, bacteria, viruses, PCBs, petroleum hydrocarbons, inorganics, pesticides/insecticides, volatile organic compounds, polycyclic aromatic hydrocarbons and/or any of their by-products.

Pinchin will not be responsible for any consequential or indirect damages. Pinchin will only be held liable for damages resulting from the negligence of Pinchin. Pinchin will not be liable for any losses or damage if the Client has failed, within a period of two years following the date upon which the claim is discovered within the meaning of the Limitations Act, 2002 (Ontario), to commence legal proceedings against Pinchin to recover such losses or damage.

Appendix B

Natural Environment Characterization

Attachment A

Species at Risk Screening

SAR Screening

Common Name	Scientific Name	S-Rank	COSEWIC	ESA/COSSARO	SARA	ERI Observation	Habitat Preference	Suitable Habitats within the Subject Property	Rationale	Background Source
Mammals										
Little Brown Myotis	*Myotis lucifungus*	S5	END	END	END	No	Uses caves, quarries, tunnels, hollow trees or buildings for roosting; winters in humid caves; maternity sites in drak warm areas such as attics and barns; feeds primarily in wetlands and forest edges	Yes	Wooded area present within the study area. Likely to required a cavity tree assessment, follow up acoustic survey following MNRF protocol if suitable roosting habitat found.	Dobbyn 1994
American Badger	*Taxidea taxus*	S1	END	END	END	No	Prefers open habitats, whether natural (grasslands) or man-made (agricultural fields, road right of ways, golf courses.	No	No grasslands, or open areas present in Study Area.	MNRF, 2019
Northern Myotis	*Myotis septentrionalis*	S3	END	END	END	No	Hibernates during winter in mines or caves; during summer males roost alone and females form maternity colonies up to 60 adults; roosts in houses, man-made structures but prefers hollow trees or under loose bark; hunts within forest, below canopy	Yes	Wooded area present within the study area. Likely to required a cavity tree assessment, follow up acoustic survey following MNRF protocol if suitable roosting habitat found.	Dobbyn 1994
Tri-coloured Bat	*Perimyotis subflavus*	S3?	END	END	END	No	Open woods near water; roosts in trees, cliff crevices, buildings or caves; hibernates in damp, draft free, warm caves, mines or rock crevices	Yes	Wooded area present within the study area. Likely to required a cavity tree assessment, follow up acoustic survey following MNRF protocol if suitable roosting habitat found.	Dobbyn 1994
Small-footed Myotis	*Myotis leibii*	S2/S3?	END	END		No	Rock outcrops, hollow trees, bridges, buildings, and caves and hibernate in caves and mines. They forage in a broad range of habitats.	Yes	Wooded area present within the study area. Likely to required a cavity tree assessment, follow up acoustic survey following MNRF protocol if suitable roosting habitat found.	MNRF, 2018
Birds										
Acadian Flycatcher	Emphidonax virescens	S2/S3	END	END	END	No	Generally requires large areas of mature, undisturbed forest; avoids the forest edge;often found in wooded swamps and ravines	No	Woodland has vast edge habitat and a walking path running through the woodland. Swamp not present.	MNRF, 2019
Bald Eagle	Haliaeetus laeucocephalus	S2/S4		SC		No	Prefers deciduous and mixed deciduous forest ; and habitat close to water bodies such as lakes and rivers. They roost in super canopy trees such as Pine	Yes	No super canopy trees present within the Study Area. No nests found during site surveys, but Ebird records of species in the local area.	MNRF, 2019
Bank Swallow	Riparia riparia	S4B	THR	THR	THR	No	Nests in a wide variety of naturally and anthropogenically created vertical banks, which often erode and change over time including aggregate pits and shores of large lakes and rivers.	Yes	Eroded banks over 2 m in height present along the Grand River.	MNRF, 2019
Barn Swallow	*Hirundo rustica*	S4B	THR	THR	THR	No	Prefer forgaring in open areas including suburban parks, agricultural fields, beaches and over open water. Breeding habitat includes open area for foraging, in close proximity to a source of mud and structures of cliffs.	Yes	No open foraging habitat present within the Study Area.	BSC 2007, MNRF, 2017
Bobolink	*Dolichonyx oryzivorus*	S4B	THR	THR	THR	No	Generally prefers open grasslands and hay fields. In migration and in winter uses freshwater marshes and grasslands.	No	No open grasslanda present within the Study Area.	MNRF, 2019
Canada Warbler	*Cardellina canadensis*	S4B	THR	SC	THR	No	Generally prefers wet coniferous, deciduous and mixed forest types, with a dense shrub layer. Nests on ground, on logs or hummocks and uses dense shrub layer to conceal a nest.	No	Deciduous forest present, but is lacking a dense shrub layer and wet habitat in general.	MNRF, 2019
Cerulean Warbler	*Setophaga cerulea*	S3B	END	THR	END	No	Generally found in mature deciduous forests with an open understorey; also nests in older, second- growth deciduous forests.	Yes	Mature forest habitat present with relatively open understory.	MNRF, 2019
Eastern Meadowlark	*Sturnella magna*	S4B	THR	THR	THR	No	Generally prefers grassy pastures, meadows and hay fields. Nests are always on thr ground and usually hidden in or under grass clumps.	No	Open areas not present within the Study Area.	MNRF, 2019
Chimney Swift	*Chaetura pelagica*	S4B, S4N	THR	THR	THR	No	Breed in urban and suburban habitats and are most common in areas with large concentrations of chimneys. Nest in hollow trees, tree cavities, caves and chimneys. Feed over urban neighbourhoods, grasslands, forests, fields and marshes.	Yes	While Study Area is mature forest, likely with cavities and located in close proximity to an urban environment, more preferred habitat likley present in local area outside of Study Area.	MNRF, 2017
Golden-winged Warbler	*Vermivora chrysoptera*	S4B	THR	SC	THR	No	Generally prefers areas of early successional vegetation, found primarily on field edges, hydro or utility right-of-ways or recently logged areas.	No	Habitat not present within Study Area.	MNRF, 2019
Louisiana Waterthrush	*Seiurus motacilla*	S3B	THR	THR	SC	No	Generally inhabits mature forests along steeply sloped ravines adjacent to running water. It prefers clear cold streams and densely wooded swamps.	No	Habitat not present within Study Area.	MNRF, 2019
Northern Bobwhite	*Colinus virginianus*	S1	END	END	END	No	Generally inhabits a variety of edge and grassland type-habitats including non-intensively farmed agricultural lands.	No	Habitat not present within Study Area, but present in close proximity to Study Area.	MNRF, 2019
Peregrine Falcon	*Falco peregrinus*	S3B		SC	SC	No	Generally nest on tall,steep cliff ledges adjacent to large waterbodies; some birds adapt to urban environmentals and nest on ledges of tall buildings, even in densely populated towns.	Yes	Breeding habitat not present within Study Area, but Ebird records identify records in the local area	MNRF, 2019
Red-headed Woopecker	*Melanerpes erythroephalus*	S4B	END	SC	THR	No	Generally prefer open oak and beech forests, grasslands, forest edges, orchards, pastures, riparian forests, roadsides, urban parks, golf courses, cemetaries, as well as along beaver ponds and brooks.	No	Habitat not present within Study Area.	MNRF, 2019
Wood Thrush	*Hylocichla mustelina*	S4B	THR	SC	THR	No	Nests mainly in second-growth and mature deciduous and mixed forests, with saplings and well developed understory layers. Prefers large forest mosiacs, but may also nest in small forest fragments.	Yes	Mature forest habitat is present within the Study Area.	MNRF, 2019
Rusty Blackbird	*Quiscale rouilleux*	S4B	SC	NAR	SC	No	Inhabits coniferous forest with wetlands nearby and use swamps, pond edges and agricultural field in the winter.	Yes	Ebird records have identified observation of Rusty Blackbird in the last 5 years.	MNRF 2019
Common Nighthawk	*Chordeiles minor*	S4B	SC	SC	THR	No	Prefers open areas with little to no ground vegetation, such as burned over areas, forest clearings, peat bogs and lakesshores, but can nest in cultivated fields, orchards, urban parks and along roads and railways.	Yes	1995 Golder Report documents records of common nighthawk within the study area	MNRF, 2019

Yellow-breasted Chat	*Icteria virens*	S1B	END	END	END	No	Generally prefer dense thickets around wood edges, riparian areas and in overgrown clearings.	No	Thickets not present within the Study Area.	MNRF, 2019
Eastern Wood-pewee	*Contopus virens*	S4B	SC	SC	SC	Yes	Wooded habitat including roadsides, woodlots, orchards, urban trees, and mature woodlands. Prefer deciduous forest near clearings and along forest edges.	Yes	Deciduous forest with little understory located within the study area. Observed as incidental observation.	MNRF 2017
Vascular Plants										
Bird's-foot Violet	*Viola pedata*	S1	END	END	END	No	Grows in open, disturbed well-drained, sandy sites and in Ontario is found in Black Oak Savannah habitats within deciduous forests.	No	Habitat not present within Study Area	MNRF, 2019
Broad Beech Fern	*Phegopteris hexagonoptera*	S3	SC	SC		No	Generally inhabits shady areas of beech, and maple forests where the soil is moist or wet.	Yes	Small pockets of wet habitat is present within the study area.	MNRF, 2019
Common Hoptree	*Ptelea trifoliata*	S3	SC	SC	THR	No	Generally grows in sandy soils in areas with a lot of natural disturbance- such as the outer edge of shoreline vegetation, sand spits and sand points.	No	No sand habitat present within the study area.	MNRF, 2019
Eastern Flowering Dogwood	*Cornus florida*	S2	END	END	END	No	Generally grows in deciduous and mixed forests, in the drier areas of its habitat, although it is occassionally found in slightly moist environments; Also frows around edges and hedgerows.	Yes	Suitable growing habitat is present within the study area.	MNRF, 2019
American Columbo	*Frasera caroliniensis*	S2	END	END	END	No	Mostly associated with open deciduous forested slopes, thickets, and clearings; grows in a variety of relatively stable habitats as well as on a wide variety of soils.	Yes	Suitable growing habitat is present within the study area.	MNRF, 2019
American Chestnut	*Castanea dentata*	S1/S2	END	END	END	No	Found in deciduous forest communities; this tree prefers arid forests with acid and sandy soils.	No	Acid soils not present within the study area.	MNRF, 2019
Red Mulberry	*Morus rubra*	S2	END	END	END	Yes	Grows in moist, forested habitats on both sandy and limestone-based loamy soils.	Yes	Found during field surveys.	MNRF, 2019
Butternut	*Jugland cinerea*	S3?	END	END	END	No	Prefers moist, well-drained soil and is often along streams, but can be found in well drained gravel sites specifically of limestone. Grows in sunny openings and near forest edges in rich, moist and well drained soils.	Yes	Well drained soil present around the within the study area. One individual observed during vegetation inventory.	MNRF 2017, SARA 2017
Fish										
Eastern Sand Darter	*Ammocrypta pellucida*	S2	THR	END	THR	No	Prefer sandy-bottomed streams and rivers	Yes	GRCA records of species present within the Grand River in close proximity to site.	MNRF, 2019
Northern Brooke Lamprey	*Ichthyomyzon fossor*	S3	SC	SC	SC	No	Generally inhabits small rivers and clear streams of varying sizes. Adults spawn in gravelly riffles.	No	Suitable aquatic habitat not present.	MNRF, 2019
Silver Shiner	*Notropis photogenis*	S2/S3	THR	THR	SC	No	Deep riffles or pools in medium to large streams with moderate to high gradients and prefer substrates from course boulder, gravel and pebbles to fine sand, mud and clay.	Yes	Suitable aquatic habitat present.	MNRF, 2018
Black Redhorse	*Moxostoma duquesnei*	S2	THR	THR		No	Present in pool and riffle areas of medium sized rivers and streams usually less than 2m deep. Few aquatic plants, moderate to fast current and sandy or gravel bottom are typical characteristics of habitat.	Yes	MNRF and GRCA records of species within study area in the Grand River.	MNRF, 2018
Herpetofauna										
Eastern Hog-nosed Snake	*Heterodon platirhinos*	S3	THR	THR	THR	No	Prefer sandy, well drained habitats such as beaches and dry forests. Found in Ontario in the Carolinian Region and Great Lakes-St. Lawrence Region.	No	Species not found within this local geographic region.	MNRF, 2018
Blanding's Turtle	*Emydoidea blandingii*	S3	END	THR	THR	No	Occur in freshwater lakes, permanent or temporary pools, slow-flowing streams, marshes and swamps. They prefer shall marshes that is rich in nutrients, organic soil and dense vegetation. Adults are generally found in open or partially vegetated sites, and juveniles prefer areas that contain thick aquatic vegetation including sphagnum, water lilies and algae. They dig their nest in a variety of loose substrates, including sand, organic soil,gravel and cobblestone. Overwintering occurs in permanent pools that average about 1 m in depth or slow-flowing streams.	No	Grand River is only aquatic system present and is not considered Blandings Turtle habitat.	MNRF, 2019
Eastern Ribbonsnake	*Thamnophis sauritus*	S4	SC	SC	SC	No	Generally occurs along the edges of shallow ponds, streams, marshes, swamps or bogs bordered by dense vegetation that provides cover. Abundant exposure to sunlight is also required and adjacent upland areas may be used for nesting.	Yes	Suitable habitat exists for species within the study area.	MNRF, 2019
Northern Map Turtle	*Graptemys geographica*	S3	SC	SC	SC	No	Inhabits both lakes and rivers, showing a preference for slow moving currents, muddy bottoms and abundant aquatic vegetation. These tutles needs suitable basking sites (such as rocks and logs) and exposure to the sun for at least part of the day.	Yes	Suitable habitat exists for species within the study area.	MNRF, 2019
Queensnake	*Regina septemvittata*	S2	END	END	END	No	Require a permanent body of water, flowing or still, with a temperature remaining at or above 18 C throughout most of the active season;abundant cover, such as flat rocks submerged and/or on the bank; and an abundance of crayfish. Other important habitat features may include rocky, gravelly, or slate stream-bed substrates, swift to moderate current and woodland surroundings.	No	Suitable habitat does not exist within study area.	MNRF, 2019
Spiny Softshell	*Apalone spinifera*	S2	END	END	THR	No	Generally prefers marshy creeks, swift flowing rivers, lakes, impoundments, bays, marshy lagoons, ditches and ponds near rivers.	No	Suitable habitat does not exist within study area.	MNRF, 2019
Snapping Turtle	*Chelydra serpentina serpentina*	S3	SC	SC	SC	No	Any freshwater habitat, but typically found in slow-moving water with soft mud or sand bottom and abundant vegetation.	Yes	Appropiate habitat present within the study area. Not observed during surveys.	MNRF 2017, Ontario Nature 2017
Molluscs										
Round Pigtoe	*Pleurobema sintoxia*	S1	END	END	END	No	Occurs in small rivers in areas of moderate flow on substrates of gravel, cobble and boulder. In large rivers, they are found in mud, sand and gravel at varying depths.	Yes	MNRF and GRCA records of species within study area in the Grand River.	MNRF, 2019
Rainbow Mussel	*Villosa iris*	S2/S3	SC	SC	END	No	Small to medium-sized rivers with a moderate to strong current and sand, rocky or gravel bottoms. Found in or near riffle areas and long vegetation in water less than 1 metre deep.	Yes	GRCA records of species within study area in the Grand River.	MNRF, 2018
Wavy-rayed Lampmussel	*Lampsilis fasciola*	S1	SC	THR	SC	No	Small to medium rivers with clear water. Lives in shallow riffle areas with clean gravel or sand bottoms.	Yes	GRCA records of species within study area in the Grand River.	MNRF, 2018
Insect										
Monarch Butterfly	Danaus plexippus	S2N/S4B	END	SC	SC	No	Exist primarily whereever milkweed and wildflowers exist; abandoned farmland, along roadsides and other open spaces.	Yes	Open habitat along pathway and river present and milkweed was observed during vegetation survey.	MNRF, 2019
Nine-spotted Lady Beetle	Coccinella novaemnotata	SH	END	END		No	Lives in a wide variety of areas including agricultural areas, suburban gardens, parks, conifer forests, deciduous forests, prairie grasslands, meadows, riparian areas and isolated natural areas.	Yes	Suitable habitat exists within the study area.	MNRF, 2019
Rapids Clubtail	Gomphus quadicolor	S1	END	END	END	No	Clear, cool, medium to large rivers with wooded shorelines, gravel shallows and muddy pools. Adult females inhabit shoreline forests, moving to the rapids when ready to mate. They nymphs live in these quiet, muddy, downstream pools where thet spend most of their time buried just below the sediment in the bottom of the pool.	Yes	Suitable habitat exists within the Grand River within the study area.	MNRF, 2019
Rusty-patched Bumble Bee	Bombus affinis		END	END	END	No	Generally inhabits a a range of diverse habitats including mixed farmland, sand dunes, marshes, urban and wooded areas. It usually nests underground in abandoned rodent burrows.	Yes	Suitable habitat exists within the study area.	MNRF, 2019

SAR Sutiable Habitat

Common Name	Scientific Name	S-Rank	COSEWIC	ESA/COSSARO	SARA	Source
Mammals						
Little Brown Myotis	*Myotis lucifungus*	S5	END	END	END	MNRF
Northern Myotis	*Myotis septentrionalis*	S3	END	END	END	MNRF
Tri-coloured Bat	*Perimyotis subflavus*	S3?	END	END	END	MNRF
Small-footed Myotis	*Myotis leibii*	S2/S3?	END	END		MNRF
Birds						
Bank Swallow	*Riparia riparia*	S4B	THR	THR	THR	MNRF
Barn Swallow	*Hirundo rustica*	S4B	THR	THR	THR	MNRF
Cerulean Warbler	*Setophaga cerulea*	S3B	END	THR	END	MNRF
Chimney Swift	*Chaetura pelagica*	S4B, S4N	THR	THR	THR	MNRF
Bald Eagle	*Haliaeetus laeucocephalus*	S2/S4		SC		MNRF
Common Nighthawk	*Chordeiles minor*	S4B	SC	SC	THR	Golder Report
Rusty Blackbird	*Quiscale rouilleux*	S4B	SC	NAR	SC	Ebird
Peregrine Falcon	*Falco peregrinus*	S3B		SC	SC	Ebird
Wood Thrush	*Hylocichla mustelina*	S4B	THR	SC	THR	MNRF
Eastern Wood-pewee	*Contopus virens*	S4B	SC	SC	SC	MNRF
Vascular Plants						
Broad Beech Fern	*Phegopteris hexagonoptera*	S3	SC	SC	SC	NHIC/MNRF
Eastern Flowering Dogwood	*Cornus florida*	S2	END	END	END	NHIC/MNRF
American Columbo	*Frasera caroliniensis*	S2	END	END	END	MNRF
Red Mulberry	*Morus rubra*	S2	END	END	END	Golder Report/ERI
Butternut	*Jugland cinerea*	S3?	END	END	END	MNRF
Fish						
Eastern Sand Darter	*Ammocrypta pellucida*	S2	THR	END	THR	NHIC/MNRF
Silver Shiner	*Notropis photogenis*	S2/S3	THR	THR	SC	MNRF
Black Redhorse	*Moxostoma duquesnei*	S2	THR	THR		MNRF
Herpetofauna						
Northern Map Turtle	*Graptemys geographica*	S3	SC	SC	SC	MNRF
Eastern Ribbonsnake	*Thamnophis sauritus*	S4	SC	SC	SC	MNRF
Snapping Turtle	*Chelydra serpentina*	S3	SC	SC	SC	MNRF
Molluscs						
Round Pigtoe	*Pleuribema sintoxia*	S1	END	END	END	NHIC/MNRF/DFO
Rainbow Mussel	*Villosa iris*	S2/S3	SC	SC	END	MNRF
Wavy-rayed Lampmussel	*Lampsilis fasciola*	S1	SC	THR	SC	MNRF
Insects						
Monarch Butterfly	Danaus plexippus	S2N/S4B	END	SC	SC	MNRF
Nine-spotted Lady Beetle	Coccinella novaemnotata	SH	END	END		MNRF
Rapids Clubtail	Gomphus quadicolor	S1	END	END	END	MNRF
Rusty-patched Bumble Bee	Bombus affinis		END	END	END	MNRF

Attachment B

Significant Wildlife Habitat Screening

Significant Wildlife Habitat Assessment

	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	**Habitat Criteria and Information Sources**	**Defining Criteria**	**Assessment Details**
Wildlife Habitat: Waterfowl Stopover and Staging Areas (Terrestrial)					
Rationale: Habitat important for migrating waterfowl	American Black Duck Blue-winged Teal Gadwall Green-winged Teal Northern Shoveler Tundra Swan American Wigeon Northern Pintail	CUM1 CUT1 - Plus eveidence of annual spring flooding from melt water or run-off within these Ecosites. - Fields with seasonal flooding and waste grain in the Long Point, Rondeau, Pt. Pelee, Lake St. Clair, Grand Bend areas may be important for Tundra Swans.	Fields with sheet water during Spring (mid March to May). * Field flooding during spring melt and run-off provides important invertebrate foraging habitat for migrating waterfowl. *Agricultural fields with waste grains are commonly used by waterfowl, these are not considered SWH unless they have spring sheet water available. <u>Information Sources:</u> Anecdotal information from the landowners or local naturalist clubs may be good information in determinging occurrrence * Reports and other information available from Conservation Authorities *Sites documented through waterfowl planning processes *Field Naturalists Clubs *Ducks Unlimited *Natural Heritage Information Center (NHIC) Waterfowl Concentration Area	Studies carried out and verified prescence of annual concentration of any listed species, eveluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects. * Any mixed aggregations of 100 or more individuals required. *The area of flooded field ecosite habitat plus a 100-300m radius buffer dependent on local site conditions and adjacent land use is the significant wildlife habitat *Annual use of habitat is documented from information sources or field studies (annual use can be based on studies or determined by past surveys with species numbers and dates). *SWH MISTcxlix Index #7 provides development effects and mitigation measures.	**SWH type not present**
	Wildlife Species	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes	**Habitat Criteria and Information Sources**	**Defining Criteria**	**Assessment Details**
Wildlife Habitat: Waterfowl Stopover and Staging Areas (Aquatic)					
Rationale: Important for local and migrant waterfowl populations during the spring or fall migration or both periods combined. Sites identified are usually only one of a few in the eco-district.	Canada Goose Cackling Goose Snow Goose American Black Duck Northern Pintail Northern Shoveler American Wigeon Gadwall Green-winged Teal Blue-winged Teal Hooded Merganser Common Merganser Lesser Scaup Greater Scaup Long-tailed Duck Surf Scoter White-winged Scoter Black Scoter Ring-necked duck Common Goldeneye Bufflehead Redhead Ruddy Duck Red-breasted Merganser Brant Canvasback Ruddy Duck	MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7	• Ponds, marshes, lakes, bays, coastal inlets, and watercourses used during migration. Sewage treatment ponds and storm water ponds do not qualify as a reservoir managed as a large wetland or pond/lake does qualify. • These habitats have an abundant food supply (mostly aquatic invertebrates and vegetation in shallow water) <u>Information Sources:</u> • Environment Canada • Naturalist clubs often are aware of staging/stopover areas. • OMNRF Wetland Evaluations indicate presence of locally and regionally significant waterfowl staging. • Sites documented through waterfowl planning processes (eg. EHJV implementation plan) • Ducks Unlimited projects • Element occurrence specification by Nature Serve: http://www.natureserve.org • Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area	Studies carried out and verified presence of: • Aggregations of 100 Ⓔ or more of listed species for 7 daysⒺ, results in > 700 waterfowl use days • Areas with annual staging of ruddy ducks, canvasbacks, and redheads are SWH cxlix • The combined area of the ELC ecosites and a 100m radius area is the SWH cxlviii • Wetland area and shorelines associated with sites identified within the SWHTG cxlviii Appendix K cxlix are significant wildlife habitat. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"ccxi • Annual Use of Habitat is Documented from Information Sources or Field Studies (Annual can be based on completed studies or determined from past surveys with species numbers and dates recorded). • SWH MISTcxlix Index #7 provides development effects and mitigation measures.	**SWH type not present**
	Wildlife Species	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes	**Habitat Criteria and Information Sources**	**Defining Criteria**	**Assessment Details**
Wildlife Habitat: Shorebird Migratory Stopover Area					
Rationale: High quality shorebird stopover habitat is extremely rare and typically has a long history of use.	Greater Yellowlegs Lesser Yellowlegs Marbled Godwit Hudsonian Godwit Black-bellied Plover American GoldenPlover Semipalmated Plover Solitary Sandpiper Spotted Sandpiper Semipalmated Sandpiper Pectoral Sandpiper White-rumped Sandpiper Baird's Sandpiper Least Sandpiper Purple Sandpiper Stilt Sandpiper Short-billed Dowitcher Red-necked Phalarope Whimbrel Ruddy Turnstone Sanderling Dunlin	BBO1 BBO2 BBS1 BBS2 BBT1 BBT2 SDO1 SDS2 SDT1 MAM1 MAM2 MAM3 MAM4 MAM5	• Shorelines of lakes, rivers and wetlands, including beach areas, bars and seasonally flooded, muddy and un-vegetated shoreline habitats. • Great Lakes coastal shorelines, including groynes and other forms of armour rock lakeshores, are extremely important for migratory shorebirds in May to mid-June and early July to October. • Sewage treatment ponds and storm water ponds do not qualify as a SWH. <u>Information Sources:</u> • Western hemisphere shorebird reserve network. • Canadian Wildlife Service (CWS) Ontario Shorebird Survey. • Bird Studies Canada • Ontario Nature • Local birders and naturalist clubs • Natural Heritage Information Centre (NHIC) Shorebird Migratory Concentration Area	Studies confirming: • Presence of 3 or more of listed species and > 1000Ⓔshorebird use days during spring or fall migration period. (shorebird use days are the accumulated number of shorebirds counted per day over the course of the fall or spring migration period) Whimbrel stop briefly (<24hrs) during spring migration, any site with >100Ⓔ Whimbrel used for 3 years or more is significant. • The area of significant shorebird habitat includes the mapped ELC shoreline ecosites plus a 100m radius area cxlviii • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"ccxi • SWH MISTcxlix Index #8 provides development effects and mitigation measures.	**SWH type not present.**
	Wildlife Species	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes	**Habitat Criteria and Information Sources**	**Defining Criteria**	**Assessment Details**
Wildlife Habitat: Raptor Wintering Area					
Rationale: Sites used by multiple species, a high number of individuals and used annually are most significant.	Rough-legged Hawk Red-tailed Hawk Northern Harrier American Kestrel Snowy Owl Special Concern: Short-eared Owl Bald Eagle	Hawks/Owls: Combination of ELC Community Series; need to have present one Community Series from each land class; Forest: FOD, FOM, FOC. Upland: CUM; CUT; CUS; CUW. Bald Eagle: Forest community Series: FOD, FOM, FOC, SWD, SWM or SWC on shoreline areas adjacent to large rivers or adjacent to lakes with open water (hunting area).	• The habitat provides a combination of fields and woodlands that provide roosting, foraging and resting habitats for wintering raptors. • Raptor wintering (hawk/owl)sites need to be > 20 ha cxlviii, cxlix with a combination of forest and upland.xvi, xvii, xviii, xix, xx, xxi. • Least disturbed sites, idle/fallow or lightly grazed field/meadow (>15ha) with adjacent woodlands cxlix • Field area of the habitat is to be wind swept with limited snow depth or accumulation. • Eagle sites have open water and large trees and snags available for roosting cxlix <u>Information Sources:</u> • OMNRF Ecologist or Biologist • Naturalist clubs • Natural Heritage Information Centre (NHIC) Raptor Winter Concentration Area • Data from Bird Studies Canada • Results of Christmas Bird Counts • Reports and other information available from Conservation Authorities	Studies confirm the use of these habitats by: • One or more Short-eared Owls or; One of more Bald Eagles or; At least10 individuals and two of the listed hawk/owl species Ⓔ • To be significant a site must be used regularly (3 in 5 years) cxlix for a minimum of 20 days by the above number of birds Ⓔ. • The habitat area for an Eagle winter site is the shoreline forest ecosites directly adjacent to the prime hunting area Ⓔ • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"ccxi • SWH MISTcxlix Index #10 and #11 provides development effects and mitigation measures.	**Candidate SWH.**
	Wildlife Species	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes	**Habitat Criteria and Information Sources**	**Defining Criteria**	**Assessment Details**
Wildlife Habitat: Bat Hibernacula					
Rationale: Bat hibernacula are rare habitats in all Ontario landscapes	Big Brown Bat Tri-coloured Bat	Bat Hibernacula may be found in these ecosites: CCR1 CCR2 CCA1 CCA2 (Note: buildings are not considered to be SWH)	• Hibernacula may be found in caves, mine shafts, underground foundations and Karsts. • Active mine sites should not be considered as SWH • The locations of bat hibernacula are relatively poorly known. <u>Information Sources</u> • OMNRF for possible locations and contact for local experts • Natural Heritage Information Centre (NHIC) Bat Hibernaculum • Ministry of Northern Development and Mines for location of mine shafts. • Clubs that explore caves (eg. Sierra Club) • University Biology Departments with bat experts.	• All sites with confirmed hibernating bats are SWH Ⓔ. • The area includes 200m radius around the entrance of the hibernaculum cxlviii, ccvii, Ⓔ for most development types and 1000m for wind farms ccv. Studies are to be conducted during the peak swarming period (Aug. – Sept.). Surveys should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines for Wind Power Projects"ccv. • SWH MISTcxlix Index #1 provides development effects and mitigation measures.	**SWH type not present**.
	Wildlife Species	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes	**Habitat Criteria and Information Sources**	**Defining Criteria**	**Assessment Details**
Wildlife Habitat: Bat Maternity Colonies					
Rationale: Known locations of forested bat maternity colonies are extremely rare in all Ontario landscapes.	Big Brown Bat Silver-haired Bat	Maternity colonies considered SWH are found in forested Ecosites. All ELC Ecosites in ELC Community Series: FOD FOM SWD SWM	• Maternity colonies can be found in tree cavities, vegetation and often in buildlings xxii, xxv, xxvi, xxvii, xxxi (buildings are not considered to be SWH). • Maternity roosts are not found in caves and mines in Ontarioxxii. • Maternity colonies located in Mature deciduous or mixed forest standsccix, ccx, ccv with >10/ha large diameter (>25cm dbh) wildlife treesccvii • Female Bats prefer wildlife tree (snags) in early stages of decay, class 1-3 ccxiv or class 1 or 2 ccxii . • Silver-haired Bats prefer older mixed or deciduous forest and form maternity colonies in tree cavities and small hollows. Older forest areas with at least 21 snags/ha are preferredccx, lxiv <u>Information Sources:</u> • OMNRF for possible locations and contact for local experts • University Biology Departments with bat experts	• Maternity Colonies with confirmed use by; • >10 Big Brown Bats Ⓔ • >5 Adult Female Silverhaired Bats Ⓔ • The area of the habitat includes the entire woodland or a forest stand ELC Ecosite or an Ecoelement containing the maternity colonies Ⓔ. • Evaluation methods for maternity colonies should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines forWind Power Projects" ccv. • SWH MISTcxlix Index #12 provides development effects and mitigation measures.	Wooded areas (FOD7-4) is present within the study area. Potential for bat roosting trees to be present. Targeted bat surveys were not completed within the study area. A bat cavity tree assessment should be completed prior to removal of any trees. **Candidate SWH**
	Wildlife Species	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes	**Habitat Criteria and Information Sources**	**Defining Criteria**	**Assessment Details**
Wildlife Habitat: Bat Migratory Stopover Area					
Rationale: Stopover areas for long distance migrant bats are important during fall migration. Hoary Bat Eastern Red Bat Silver-haired Bat	Hoary Bat, Eastern Red Bat, Silver-haired Bat	No specific ELC types.	• Long distance migratory bats typically migrate during late summer and early fall from summer breeding habitats throughout Ontario to southern wintering areas. Their annual fall migration may concentrate these species of bats at stopover areas. • This is the only known bat migratory stopover habitats based on current information. Information Sources • OMNRF for possible locations and contact for local experts • University of Waterloo, Biology Department	• Long Point (42°35'N, 80°30'E, to 42°33'N, 80°03'E) has been identified as a significant stop-over habitat for fall migrating Silver-haired Bats, due to significant increases in abundance, activity and feeding that was documented during fall migration ccxv. • The confirmation criteria and habitat areas for this SWH are still being determined. • SWH MIST cxlix Index #38 provides development effects and mitigation measures	SWH type not present. **Not SWH.**
	Wildlife Species	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes	**Habitat Criteria and Information Sources**	**Defining Criteria**	**Assessment Details**
Wildlife Habitat: Turtle Wintering Areas					
Rationale: Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant.	Midland Painted Turtle Special Concern: Northern Map Turtle Snapping Turtle	Snapping and Midland Painted Turtles; ELC Community Classes; SW, MA, OA and SA, ELC Community Series; FEO and BOO Northern Map Turtle; Open Water areas such as deeper rivers or streams and lakes with current can also be used as over-wintering habitat	• For most turtles, wintering areas are in the same general area as their core habitat. Water has to be deep enough not to freeze and have soft mud substrates. • Over-wintering sites are permanent water bodies, large wetlands, and bogs or fens with adequate Dissolved Oxygen cix, cx, cxi, cxii • Man-made ponds such as sewage lagoons or storm water ponds should not be considered SWH. <u>Information Sources:</u> • EIS studies carried out by Conservation Authorities. • Field Naturalists Clubs • OMNRF Ecologist or Biologist • Natural Heritage Information Centre (NHIC)	• Presence of 5 over-wintering Midland Painted Turtles is significantⒺ. • One or more Northern Map Turtle or Snapping Turtle over-wintering within a wetland is significantⒺ. • The mapped ELC ecosite area with the over wintering turtles is the SWH. If the hibernation site is within a stream or river, the deepwater pool where the turtles are over wintering is the SWH. • Over wintering areas may be identified by searching for congregations (Basking Areas) of turtles on warm, sunny days during the fall (Sept. – Oct.) or spring (Mar– May) cvii. Congregation of turtles is more common where wintering areas are limited and therefore significant cix, cx, cxi, cxii. • SWH MISTcxlix Index #28 provides development effects and mitigation measures for turtle wintering habitat.	Permanent waterbodies (Grand River) present within study area. **Candidate SWH**.
	Wildlife Species	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes	**Habitat Criteria and Information Sources**	**Defining Criteria**	**Assessment Details**
Wildlife Habitat: Reptile Hibernaculum					
Rationale: Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant.	**<u>Snakes</u>**: Eastern Gartersnake Northern Watersnake Northern Red-bellied Snake Northern Brownsnake Smooth Green Snake Northern Ring-necked Snake **<u>Special Concern</u>**: Milksnake Eastern Ribbonsnake	For all snakes, habitat may be found in any ecosite other than very wet ones. Talus, Rock Barren, Crevice, Cave, and Alvar sites may be directly related to these habitats. Observations or congregations of snakes on sunny warm days in the spring or fall is a good indicator.	• For snakes, hibernation takes place in sites located below frost lines in burrows, rock crevices and other natural or naturalized locations. The existence of features that go below frost line; such as rock piles or slopes, old stone fences, and abandoned crumbling foundations assist in identifying candidate SWH. • Areas of broken and fissured rock are particularly valuable since they provide access to subterranean sites below the frost linexliv, l, li, lii, cxii . • Wetlands can also be important over-wintering habitat in conifer or shrub swamps and swales, poor fens, or depressions in bedrock terrain with sparse trees or shrubs with sphagnum moss or sedge hummock ground cover. <u>Information Sources:</u> • In spring, local residents or landowners may have observed the emergence of snakes on their property (e.g. old dug wells). • Reports and other information available from Conservation Authorities. • Field Naturalist Clubs • University herpetologists • Natural Heritage Information Centre (NHIC)	Studies confirming: • Presence of snake hibernacula used by a minimum of five individuals of a snake sp. or; individuals of two or more snake spp. • Congregations of a minimum of five individuals of a snake sp. or; individuals of two or more snake spp. near potential hibernacula (eg. foundation or rocky slope) on sunny warm days in Spring (Apr/May) and Fall (Sept/Oct) Ⓔ • <u>Note</u>: If there are Special Concern Species present, then site is SWH • <u>Note</u>: Sites for hibernation possess specific habitat parameters (e.g. temperature,humidity, etc.) and consequently are used annually, often by many of the same individuals of a local population (i.e. strong hibernation site fidelity). Other critical life processes (e.g. mating) often take place in close proximity to hibernacula. The feature in which the hibernacula is located plus a 30 m radius area is the SWH Ⓔ • SWH MISTcxlix Index #13 provides development effects and mitigation measures for snake hibernacula.	Old railroad and slope with rock offers potential reptile hibernaculum sites. **Candidate SWH**.

	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
Wildlife Habitat: Colonially- Nesting Bird Breeding Habitat (Bank and Cliff)					
Rationale: Historical use and number of nests in a colony make this habitat significant. An identified colony can be very important to local populations. All swallow population are declining in Ontario.	Cliff Swallow Northern Roughwinged Swallow (this species is not colonial but can be found in Cliff Swallow colonies)	Eroding banks, sandy hills, borrow pits, steep slopes, and sand piles Cliff faces, bridge abutments, silos, barns. Habitat found in the following ecosites: CUM1 CUT1 CUS1 BLO1 BLS1 BLT1 CLO1 CLS1 CLT1	• Any site or areas with exposed soil banks, undisturbed or naturally eroding that is not a licensed/permitted aggregate area. • Does not include man-made structures (bridges or buildings) or recently (2 years) disturbed soil areas, such as berms, embankments, soil or aggregate stockpiles. • Does not include a licensed/permitted Mineral Aggregate Operation. Information Sources: • Reports and other information available from Conservation Authorities. • Ontario Breeding Bird Atlas • Bird Studies Canada; NatureCounts http://www.birdscanada.org/birdmon/ • Field Naturalist Clubs.	Studies confirming: • Presence of 1 or more nesting sites with 8cxlix or more cliff swallow pairs and/or rough-winged swallow pairs during the breeding season. • A colony identified as SWH will include a 50m radius habitat area from the peripheral nestsccvii • Field surveys to observe and count swallow nests are to be completed during the breeding season. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"ccxi • SWH MISTcxlix Index #4 provides development effects and mitigation measures	Smaller banks along the Grand River observed, but no nests, or speciies documentation. **Not SWH.**
	Wildlife Species	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes	**Habitat Criteria and Information Sources**	**Defining Criteria**	**Assessment Details**
Wildlife Habitat: Colonially- Nesting Bird Breeding Habitat (Trees/Shrubs)					
Rationale; Large colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Great Blue Heron Black-crowned Night Heron Great Egret Green Heron	SWM2 SWM3 SWM5 SWM6 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7 FET1	• Nests in live or dead standing trees in wetlands, lakes, islands, and peninsulas. Shrubs and occasionally emergent vegetation may also be used. • Most nests in trees are 11 to 15 m from ground, near the top of the tree. Information Sources • Ontario Breeding Bird Atlas ccv, colonial nest records. • Ontario Heronry Inventory 1991 available from Bird Studies Canada or NHIC (OMNRF). • Natural Heritage Information Centre (NHIC) Mixed Wader Nesting Colony • Aerial photographs can help identify large heronries. • Reports and other information available from Conservation Authorities. • MNRF District Offices. • Field Naturalist Clubs.	Studies confirming: • Presence of 2© or more active nests of Great Blue Heron or other listed species. • The habitat extends from the edge of the colony and a minimum 300m radius or extent of the Forest Ecosite containing the colony or any island<15.0ha with a colony is the SWH cc, ccvii • Confirmation of active heronries are to be achieved through site visits conducted during the nesting season (April to August) or by evidence such as the presence of fresh guano, dead young and/or eggshells • SWH MISTcxlix Index #5 provides development effects and mitigation measures.	**SWH type not present**
	Wildlife Species	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes	**Habitat Criteria and Information Sources**	**Defining Criteria**	**Assessment Details**
Wildlife Habitat: Colonially- Nesting Bird Breeding Habitat (Ground)					
Rationale: Colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Herring Gull Great Black-backed Gull Little Gull Ring-billed Gull Common Tern Caspian Tern Brewer's Blackbird	Any rocky island or peninsula (natural or artificial) within a lake or large river (two-lined on a 1;50,000 NTS map). Close proximity to watercourses in open fields or pastures with scattered trees or shrubs (Brewer's Blackbird) MAM1 – 6 MAS1 – 3 CUM CUT CUS	• Nesting colonies of gulls and terns are on islands or peninsulas associated with open water or in marshy areas. • Brewers Blackbird colonies are found loosely on the ground in or in low bushes in close proximity to streams and irrigation ditches within farmlands. Information Sources • Ontario Breeding Bird Atlas, rare/colonial species records. • Canadian Wildlife Service • Reports and other information available from Conservation Authorities. • Natural Heritage Information Centre (NHIC) Colonial Waterbird Nesting Area • MNRF District Offices. • Field Naturalist Clubs.	Studies confirming: • Presence of > 25 active nests for Herring Gulls or Ring-billed Gulls, >5 active nests for Common Tern or >2 active nests for Caspian Tern©. • Presence of 5 or more pairs for Brewer's Blackbird©. • Any active nesting colony of one or more Little Gull, and Great Black-backed Gull is significant©. • The edge of the colony and a minimum 150m radius area of habitat, or the extent of the ELC ecosites containing the colony or any island <3.0ha with a colony is the SWH cc, ccvii • Studies would be done during May/June when actively nesting. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"ccxi • SWH MISTcxlix Index #6 provides development effects and mitigation measures.	**SWH type not present**
	Wildlife Species	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes	**Habitat Criteria and Information Sources**	**Defining Criteria**	**Assessment Details**
Wildlife Habitat: Migratory Butterfly Stopover Areas					
Rationale: Butterfly stopover areas are extremely rare habitats and are biologically important for butterfly species that migrate south for the winter	Painted Lady Red Admiral Special Concern Monarch	Combination of ELC Community Series; need to have present one Community Series from each landclass: Field: CUM CUT CUS Forest: FOC FOD FOM CUP Anecdotally, a candidate site for butterfly stopover will have a history of butterflies being observed.	A butterfly stopover area will be a minimum of 10 ha in size with a combination of field and foresthabitat present, and will be located within 5 km of Lake Erie or Lake Ontario cxlix. • The habitat is typically a combination of field and forest, and provides the butterflies with a location to rest prior to their long migration south xxxii, xxxiii, xxxiv, xxxv, xxxvi. • The habitat should not be disturbed, fields/meadows with an abundance of preferred nectar plants and woodland edge providingshelter are requirements for this habitat cxlviii, cxlix. • Staging areas usually provide protection from the elements and are often spits of land or areas with the shortest distance to cross the Great Lakes xxxvii, xxxviii, xxxix, xl, xli. Information Sources: • MNRF District Offices • Natural Heritage Information Centre (NHIC) • Agriculture Canada in Ottawa may have list of butterfly experts. • Field Naturalist Clubs • Toronto Entomologists Association	Studies confirm: • The presence of Monarch Use Days (MUD) during fall migration (Aug/Oct)xliii. MUD is based on the number of days a site is used by Monarchs, multiplied by the number of individuals using the site. Numbers of butterflies can range from 100-500/dayxxxvii, significant variation can occur between years and multiple years of sampling should occur xl, xlii. • Observational studies are to be completed and need to be done frequently during the migration period to estimate MUD. • MUD of >5000 or >3000 with the presence of Painted Ladies or Red Admiral's is to be considered significant.© • SWH MIST cxlix Index #16 provides development effects and mitigation measures.	Not within 5 km of Lake Ontario. Milkweed and Monarchs recorded on site. **SWH type not present.**
		ELC Ecosite Codes	**Habitat Criteria and Information Sources**	**Defining Criteria**	**Assessment Details**
Wildlife Habitat: Landbird Migratory Stopover					
Rationale: Sites with a high diversity of species as well as high numbers are most significant.	All migratory songbirds. Canadian Wildlife Service Ontario website: http://www.ec.gc.ca/nature/default.asp?lang=En&n=421B7A9D-1 All migrant raptors species: Ontario Ministry of Natural Resources: Fish and Wildlife Conservation Act, 1997. Schedule 7: Specially Protected Birds (Raptors)	All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD	• Woodlots >5 ha© in size and within 5 km iv, v, vi, vii, viii, ix, x, xi, xii, xiii, xiv, xv of Lake Erie and Lake Ontario. If woodlands are rare in an area of shoreline, woodland fragments 2-5ha can be considered for this habitat© • If multiple woodlands are located along the shoreline those Woodlands <2km from Lake Erie and Lake Ontario are more significant cxlix • Sites have a variety of habitats; forest, grassland and wetland complexes cxlix. • The largest sites are more significant cxlix • Woodlots and forest fragments are important habitats to migrating birdsccxviii, these features located along the shore and located within 5km of Lake Erie and Lake Ontario are Candidate SWH cxlviii. Information Sources: • Bird Studies Canada • Ontario Nature • Local birders and field naturalist clubs • Ontario Important Bird Areas (IBA) Program	Studies confirm: • Use of the habitat by >200 birds/day and with >35 spp with at least 10 bird spp. recorded on at least 5 different survey dates©. This abundance and diversity of migrant bird species is considered above average and significant. • Studies should be completed during spring (Mar to May) and fall (Aug to Oct) migration using standardized assessment techniques. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"ccxi • SWH MIST cxlix Index #9 provides development effects and mitigation measures.	Not within 5 km of Lake Ontario. **SWH type not present**
	Wildlife Species	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes	**Habitat Criteria and Information Sources**	**Defining Criteria**	**Assessment Details**
Wildlife Habitat: Deer Winter Congregation Areas					
Rationale: Deer movement during winter in the southern areas of Ecoregion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands to reduce or avoid the impacts of winter conditions cxlviii.	White-tailed Deer	All Forested Ecosites with these ELC Community Series; FOC FOM FOD SWC SWM SWD Conifer plantations much smaller than 50 ha may also be used.	• Woodlots >100 ha in size or if large woodlots are rare in a planning area woodlots>50ha© • Deer movement during winter in the southern areas of Ecoregion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands cxlviii. • Large woodlots > 100ha and up to 1500 ha are known to be used annually by densities of deer that range from 0.1-1.5 deer/ha ccxxiv. • Woodlots with high densities of deer due to artificial feeding are not significant©. Information Sources • MNRF District Offices. • LIO/NRVIS	Studies confirm: • Deer management is an MNRF responsibility, deer winter congregation areas considered significant will be mapped by MNRF cxlviii. • Use of the woodlot by whitetailed deer will be determined by MNRF, all woodlots exceeding the area criteria are significant, unless determined not to be significant by MNRF © • Studies should be completed during winter (Jan/Feb) when >20cm of snow is on the ground using aerial survey techniquesccxxiv , ground or road surveys. or a pellet count deer density surveyccxxv. • SWH MIST cxlix Index #2 provides development effects and mitigation measures.	**SWH type not present**
Rare Vegetation Community					
	ELC Ecosite Codes	**Habitat Description**	**Detailed Information and Sources**	**Defining Criteria**	**Assessment Details**
Cliffs and Talus Slopes					
Rationale: Cliffs and Talus Slopes are extremely rare habitats in Ontario.	Any ELC Ecosite within Community Series: TAO CLO TAS CLS TAT CLT	A Cliff is vertical to near vertical bedrock >3m in height. A Talus Slope is rock rubble at the base of a cliff madeup of coarse rocky debris	Most cliff and talus slopes occur along the Niagara Escarpment. Information Sources: • The Niagara Escarpment Commission hasdetailed information on location of these habitats. • OMNRF Districts • Natural Heritage Information Centre (NHIC) has location information available on their website • Field Naturalist Clubs • Conservation Authorities	• Confirm any ELC Vegetation Type for Cliffs or Talus Slopes lxxviii • SWH MISTcxlix Index #21 provides development effects and mitigation measures.	**SWH type not present.**
Sand Barren					
Rationale: Sand barrens are rare in Ontario and support rare species. Most Sand Barrens have been lost due to cottage development and forestry	ELC Ecosites: SBO1 SBS1 SBT1 Vegetation cover varies from patchy and barren to continuous meadow (SBO1), thicketlike (SBS1), or more closed and treed (SBT1). Tree cover always < 60%.	Sand Barrens typically are exposed sand, generally sparsely vegetated and caused by lack of moisture, periodic fires and erosion. Usually located within other types of natural habitat such as forest or savannah. Vegetation can vary from patchy and barren to tree covered, but less than 60%.	A sand barren area >0.5ha in size©. Information Sources: • OMNRF Districts. • Natural Heritage Information Centre (NHIC) has location information available on their website. • Field Naturalist Clubs • Conservation Authorities	• Confirm any ELC Vegetation Type for Sand Barrens lxxviii • Site must not be dominated by exotic or introduced species (<50% vegetative cover are exotic sp.)©. • SWH MISTcxlix Index #20 provides development effects and mitigation measures.	**SWH type not present.**
Rare Vegetation Community					
	ELC Ecosite Codes	**Habitat Description**	**Detailed Information and Sources**	**Defining Criteria**	**Assessment Details**
Alvar					
Rationale: Alvars are extremely rare habitatas in Ecoregion 7E.	ALO1 ALS1 ALT1 FOC1 FOC2 CUM2 CUS2 CUT2-1 CUW2 Five Alvar Indicator Species: 1) Carex crawei 2) Panicum philadelphicum 3) Eleocharis compressa 4) Scutellaria parvula 5) Trichostema brachiatum These indicator species are very specific to Alvars within Ecoregion 7E ©cxlix	An alvar is typically a level, mostly unfractured calcareous bedrock feature with a mosaic of rock pavements and bedrock overlain by a thin veneer of soil. The hydrology of alvars is complex, with alternating periods of inundation and drought. Vegetation cover varies from sparse lichen-moss associations to grasslands and shrublands and comprising a number of characteristic or indicator plants. Undisturbed alvars can be phyto- and zoogeographically diverse, supporting many uncommon or are relict plant and animals species. Vegetation cover varies from patchy to barren with a less than 60% tree cover lxxviii.	An Alvar site > 0.5 ha in size lxxv. Alvar is particularly rare in Ecoregion 7E where theonly known sites are found in the western islands of Lake Erie.cxcix Information Sources: • Alvars of Ontario (2000), Federation of Ontario Naturalists lxxvi. • Ontario Nature – Conserving Great Lakes Alvarsccviii. • Natural Heritage Information Centre (NHIC) has location information available on their website. • OMNRF Staff. • Field Naturalist Clubs. • Conservation Authorities.	• Field studies that identify four of the five© Alvar Indicator Species lxxv, cxlix at a Candidate Alvar site is Significant. • Site must not be dominated byexotic or introduced species (<50% vegetative cover are exotic sp.). • The alvar must be in excellent condition and fit in with surrounding landscape with few conflicting land uses lxxv • SWH MISTcxlix Index #17 provides development effects and mitigation measures.	**SWH type not present.**

Rare Vegetation Community					
	ELC Ecosite Codes	**Habitat Description**	**Detailed Information and Sources**	**Defining Criteria**	**Assessment Details**
Old Growth Forest					
Rationale: Due to historic logging practices and land clearance for agriculture, old growth forest is rare in Ecoregion 7E.	Forest Community Series: FOD FOC FOM SWD SWC SWM	Old Growth forests are characterized by heavy mortality or turnover of overstorey trees resulting in a mosaic of gaps that encourage development of a multi-layered canopy and an abundance of snags and downed woody debris.	Woodland area is >0.5ha. Information Sources: • OMNRF Forest Resource Inventory mapping • OMNRF Districts. • Field Naturalist Clubs • Conservation Authorities • Sustainable Forestry Licence (SFL) companies will possibly know locations through field operations. • Municipal forestry departments	Field Studies will determine: • If dominant trees species of the are >140 years old, then the area containing these trees is Significant Wildlife Habitat cxlviii • The forested area containing the old growth characteristics will have experienced no recognizable forestry activities cxlviii (cut stumps will not be present) • The area of forest ecosites combined or an eco-element within an ecosite that contain the old growth characteristics is the SWH. • Determine ELC vegetation types for the forest forest area containing the old growth characteristics lxxviii • SWH MISTcxlix Index #23 provides development effects and mitigation measures.	**SWH type not present.**

Rare Vegetation Community					
	ELC Ecosite Codes	**Habitat Description**	**Detailed Information and Sources**	**Defining Criteria**	**Assessment Details**
Savannah					
Rationale: Savannahs are extremely rare habitats in Ontario.	TPS1 TPS2 TPW1 TPW2 CUS2	A Savannah is a tallgrass prairie habitat that has tree cover between 25 – 60%lxxix, lxxx, lxxxi, lxxxii, lxxxiii. In ecoregion 7E, known Tallgrass Prairie and savannahremnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario).	No minimum size to site © Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. Information Sources • Natural Heritage Information Centre (NHIC) has location data available on their website. • OMNRF Districts. • Field Naturalists Clubs. • Conservation Authorities.	Field studies confirm one or more of the Savannah indicator species listed in cxlix Appendix N should be present ©. Note: Savannah plant spp. list from Ecoregion 7E should be usedcxlviii. • Area of the ELC Ecosite is the SWH. • Site must not be dominated by exotic or introduced species (exotic sp.). • SWH MISTcxlix Index #18 provides development effects and mitigation measures.	**SWH type not present.**

Rare Vegetation Community					
	ELC Ecosite Codes	**Habitat Description**	**Detailed Information and Sources**	**Defining Criteria**	**Assessment Details**
Tallgrass Prairie					
Rationale: Tallgrass Prairies are extremely rare habitats in Ontario.	TPO1 TPO2	A Tallgrass Prairie has ground cover dominated by prairie grasses. An open Tallgrass Prairie habitat has < 25% tree cover lxxix, lxxx, lxxxi, lxxxii, lxxxiii . In ecoregion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario).	No minimum size to site ©. Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. Information Sources: • OMNRF Districts. • Natural Heritage Information Centre (NHIC) has location information available on their website. • Field Naturalists Clubs. • Conservation Authorities.	Field studies confirm one or more of the Prairie indicator species listed in cxlix Appendix N should be present ©. Note: Prairie plant spp. list from Ecoregion 7E should be usedcxlviii • Area of the ELC Ecosite is the SWH. • Site must not be dominated by exotic or introduced species (<50% vegetative cover are exotic sp.). • SWH MISTcxlix Index #19 provides development effects and mitigation measures.	**SWH type not present.**
Other Rare Vegetation Communities					
Rationale: Plant communities that often contain rare species which depend on the habitat for survival.	Provincially Rare S1, S2 and S3 vegetation communities are listed in Appendix M of the SWHTGcxlviii . Any ELC Ecosite Code that has a possible ELC Vegetation Type that is Provincially Rare is Candidate SWH.	Rare Vegetation Communities may include beaches, fens, forest, marsh, barrens, dunes and swamps.	ELC Ecosite codes that have the potential to be a rare ELC Vegetation Type as outlined in appendix M cxlviii. The OMNRF/NHIC will have up to date listing for rare vegetation communities. Information Sources • Natural Heritage Information Centre (NHIC) has location information available on their website. • OMNRF Districts. • Field Naturalists Clubs. • Conservation Authorities.	Field studies should confirm if an ELC Vegetation Type is a rare vegetation community based on listing within Appendix M of SWHTGcxlviii. • Area of the ELC Vegetation Type polygon is the SWH. • SWH MIST cxlix Index #37 provides development effects and mitigation measures.	**SWH type not present.**

	Wildlife Species	**ELC Ecosite Codes**	**Habitat Criteria amd Information Sources**	**Defining Criteria**	**Assessment Details**
Specialized Wildlife Habitat: Waterfowl Nesting Area					
Rationale: Important to local waterfowl populations, sites with greatest number of species and highest number of individuals are significant.	American Black Duck Northern Pintail Northern Shoveler Gadwall Blue-winged Teal Green-winged Teal Wood Duck Hooded Merganser Mallard	All upland habitats located adjacent to these wetland ELC Ecosites are Candidate SWH: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SWT1 SWT2 SWD1 SWD2 SWD3 SWD4 Note: includes adjacency to Provincially Significant Wetlands	A waterfowl nesting area extends 120 m cxlix from a wetland (> 0.5 ha) or a wetland (>0.5ha) and any small wetlands (0.5ha) within 120m or a cluster of 3 or more small (<0.5 ha) wetlands within 120 m of each individual wetland where waterfowl nesting is known to occur cxlix. • Upland areas should be at least 120 m wide so that predators such as racoons, skunks, and foxes have difficulty finding nests. • Wood Ducks and Hooded Mergansers utilize large diameter trees (40cm dbh) in woodlands for cavity nest sites. Information Sources: • Ducks Unlimited staff may know the locations of particularly productive nesting sites. • OMNRF Wetland Evaluations for indication of significant waterfowl nesting habitat. • Reports and other information available from Conservation Authorities.	Studies confirmed: • Presence of 3 or more nesting pairs for listed species excluding Mallards©, or; • Presence of 10 or more nesting pairs for listed species including Mallards©. • Any active nesting site of an American Black Duck is considered significant. • Nesting studies should be completed during the spring breeding season (April - June). Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"ccxi • A field study confirming waterfowl nesting habitat will determine the boundaryof the waterfowl nesting habitat for the SWH, this may be greater or less than 120 m cxlviii from the wetland and will provide enough habitat for waterfowl to successfully nest. • SWH MISTcxlix Index #25 provides development effects and mitigation measures.	**SWH type not present.**

	Wildlife Species	**ELC Ecosite Codes**	**Habitat Criteria amd Information Sources**	**Defining Criteria**	**Assessment Details**
Specialized Wildlife Habitat: Bald Eagle and Osprey Nesting, Foraging and Perching Habitat.					
Rationale: Nest sites are fairly uncommon in Ecoregion 7E and are used annually by these species. Many suitable nesting locations may be lost due to increasing shoreline development pressures and scarcity of habitat.	Osprey Special Concern: Bald Eagle	ELC Forest Community Series: FOD, FOM, FOC, SWD, SWM and SWC directly adjacent to riparian areas – rivers, lakes, ponds and wetlands	Nests are associated with lakes, ponds, rivers or wetlands along forested shorelines, islands, or on structures over water. • Osprey nests are usually at the top a tree whereas Bald Eagle nests are typically in super canopy trees in a notch within the tree's canopy. • Nests located on man-made objects are not to be included as SWH (e.g. telephone poles and constructed nesting platforms). Information Sources • Natural Heritage Information Centre (NHIC) compiles all known nesting sites for Bald Eagles in Ontario. • MNRF values information (LIO/NRVIS) will list known nesting locations. Note: data from NRVIS is provided as a point anddoes not represent all the habitat. • Nature Counts, Ontario Nest Records Scheme data. • OMNRF District. • Check the Ontario Breeding Bird Atlas ccv or Rare Breeding Birds in Ontario for species documented • Reports and other information available from Conservation Authorities. • Field Naturalists clubs	Studies confirm the use of these nests by: • One or more active Osprey or Bald Eagle nests in an areacxlviii . • Some species have more than one nest in a given area and priority is given to the primary nest with alternate nests included within the area of the SWH. • For an Osprey, the active nest and a 300 m radius around the nest or the contiguous woodland stand is the SWH ccvii, maintaining undisturbed shorelines with large trees within this area is important cxlviii. • For a Bald Eagle the active nest and a 400-800 m radius around the nest is the SWH. cvi, ccvii Area ofthe habitat from 400-800m is dependant on site lines from the nest to the development and inclusion of perching and foraging habitat cvi • To be significant a site must be used annually. When found inactive, the site must be known to be inactive for > 3 years or suspected of not being used for >5 years before being considered not significant. ccvii • Observational studies todetermine nest site use,perching sites and foraging areas need to be done from early March to mid August. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"ccxi • SWH MISTcxlix Index #26 provides development effects and mitigation measures. effects and	No evidence of Bald Eagle or Osprey nests were observed during field surveys. Records of bald eagle within the study area are historical adnd likley habitat being used as foraging. **Not SWH.**

	Wildlife Species	**ELC Ecosite Codes**	**Habitat Criteria amd Information Sources**	**Defining Criteria**	**Assessment Details**
Specialized Wildlife Habitat: Woodland Raptor Nesting Habitat					
Rationale: Nests sites for these species are rarely identified; these area sensitive habitats are often used annually by these species.	Northern Goshawk Cooper's Hawk Sharp-shinned Hawk Red-shouldered Hawk Barred Owl Broad-winged Hawk	May be found in all forested ELC Ecosites. May also be found in SWC, SWM,SWD and CUP3	All natural or conifer plantation woodland/forest stands >30ha with >4ha of interior habitat lxxxviiii, lxxxix, xc, xci, xciii, xciv, xcv,xcvi, cxxxiii. Interior habitat determined with a 200m buffercxlviii • Stick nests found in a variety ofintermediate-aged to mature conifer, deciduous or mixed forests within tops or crotches of trees. Species such as Coopers hawk nest along forest edges sometimes on peninsulas or small off-shore islands. • In disturbed sites, nests may be used again, or a new nest will be in close proximity to old nest. Information Sources • OMNRF Districts. • Check the Ontario Breeding Bird Atlas ccv or Rare Breeding Birds in Ontario for species documented. • Check data from Bird Studies Canada. • Reports and other information available from Conservation Authorities.	Studies confirm: • Presence of 1 or more active nests from species list is considered significantcxlviii. • Red-shouldered Hawk andNorthern Goshawk – A 400m radius around the nest or 28 ha area of habitat is the SWH ccvii. (the 28 ha habitat area would be applied where optimal habitat is irregularly shaped around the nest) • Barred Owl – A 200m radius around the nest is the SWH ccvii. • Broad-winged Hawk and Coopers Hawk,– A 100m radius around the nest is the SWHccvii. • Sharp-Shinned Hawk – A 50m radius around the nest is the SWHccvii. • Conduct field investigations from early March to end of May. The use of call broadcasts can help in locating territorial (courting/nesting) raptors and facilitate the discovery of nests by narrowing down the search area. • SWH MIST cxlix Index #27 provides development effects and mitigation measures.	Forest habitat found within the study area, but not large enough (<30ha) to support Woodland Raptor Nesting. No raptor or nests of the outlined species were observed during breeding bird survey or incidentally. **Not SWH**.

	Wildlife Species	**ELC Ecosite Codes**	**Habitat Criteria amd Information Sources**	**Defining Criteria**	**Assessment Details**
Specialized Wildlife Habitat: Turtle Nesting Area					
Rationale: These habitats are rare and when identified will often be the only breeding site for local populations of turtles.	Midland Painted Turtle Special Concern Species: Northern Map Turtle Snapping Turtle	Exposed mineral soil (sand or gravel) areas adjacent (<100m) cxlviii or within the following ELC Ecosites: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 BOO1 FEO1	• Best nesting habitat for turtles are close to water and away from roads and sites less prone to lossof eggs by predation from skunks, raccoons or other animals. • For an area to function as a turtlenesting area, it must provide sand and gravel that turtles are able to dig in and are located in open, sunny areas. Nesting areas on the sides of municipal or provincial road embankments and shoulders are not SWH. • Sand and gravel beaches adjacent to undisturbed shallow weedy areas of marshes, lakes, and rivers are most frequently used. Information Sources: • Use Ontario Soil Survey reports and maps to help find suitable substrate for nesting turtles (welldrained sands and fine gravels). • Check the Ontario Herpetofaunal Summary Atlas records or other similar atlases for uncommon turtles; location information may help to find potential nesting habitat for them. • Natural Heritage Information Centre (NHIC) • Field Naturalist Clubs	Studies confirm: • Presence of 5 or more nesting Midland PaintedTurtles© • One or more Northern Map Turtle or Snapping Turtle nesting is a SWH©. • The area or collection of sites within an area of exposed mineral soils where the turtles nest, plus a radius of 30-100m around the nesting area dependant on slope, riparian vegetation and adjacent land use is the SWH.cxlviii • Travel routes from wetland to nesting area are to be considered within the SWH as part of the 30-100m area of habitat.cxlix • Field investigations should be conducted in prime nesting season typically late spring to early summer. Observational studies observing the turtles nesting is a recommended method. • SWH MIST cxlix Index #28 provides development effects and mitigation measures for turtle nesting habitat.	**Candidate SWH**

	Wildlife Species	**ELC Ecosite Codes**	**Habitat Criteria amd Information Sources**	**Defining Criteria**	**Assessment Details**
Specialized Wildlife Habitat: Seeps and Springs					
Rationale: Seeps/Springs are typical of headwater areas and are often at the source of coldwater streams.	Wild Turkey Ruffed Grouse Spruce Grouse White-tailed Deer Salamander spp.	Seeps/Springs are areas where ground water comes to the surface. Often they are found within headwater areas within forested habitats. Any forested Ecosite within the headwater areas of a stream could have seeps/springs.	Any forested area (withheadwaters of a stream or river system cxvii, cxlix. • Seeps and springs are important feeding and drinking areas especially in the winter will typically support a variety of plant and animal species cxix, cxx, cxxi, cxxii, cxiii, cxiv. Information Sources • Topographical Map. • Thermography. • Hydrological surveys conducted by Conservation Authorities and MOE. • Field Naturalists Clubs and landowners. • Municipalities and Conservation Authorities may have drainage maps and headwater areas mapped.	Field Studies confirm: • Presence of a site with 2 or more© seeps/springs should be considered SWH. • The area of a ELC forest ecosite or an ecoelement within ecosite containing the seeps/springs is the SWH. The protection of the recharge area considering the slope, vegetation, height of trees and groundwater condition need to be considered in delineation the habitat cxlviii. • SWH MIST cxlix Index #30 provides development effects and mitigation measures	**SWH type not present**

Specialized Wildlife Habitat: Amphibian Breeding Habitat (Woodland)					
Rationale: These habitats are extremely important to amphibian biodiversity within a landscape and often	Eastern Newt Blue-spotted Salamander Spotted Salamander Gray Treefrog Spring Peeper Western Chorus Frog Wood Frog	All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD Breeding pools within the woodland or the shortest distance from forest habitat are more significant because they are more likely to be used due to reduced risk to migrating amphibians	• Presence of a wetland, pond or woodland pool (including vernal pools) >500m2 (about 25m diameter) ccvii within or adjacent (within 120m) to a woodland (no minimum size).clxxxii, lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx Some small wetlands may not be mapped and may be important breeding pools for amphibians. • Woodlands with permanent ponds or those containing water in most years until mid-July are more likely to be used as breeding habitat cxlviii Information Sources: • Ontario Herpetofaunal Summary Atlas (or other similar atlases) for records • Local landowners may also provide assistance as they may hear spring-time choruses of amphibians on their property. • OMNRF Districts and wetland evaluations • Field Naturalist clubs • Canadian Wildlife Service Amphibian Road Call Survey • Ontario Vernal Pool Association: http://www.ontariovernalpools.org	Studies confirm; • Presence of breeding population of 1 or more of the listed newt/salamander species or 2 or more of the listed frog species with at least 20 individuals (adults or eggs masses) lxxi or 2 or more of the listed frog species with Call Level Codes of 3©. • A combination of observational study and call count surveys cviii will berequired during the spring (March-June) when amphibians are concentrated around suitable breeding habitat within or near the woodland/wetlands. • The habitat is the wetland area plus a 230m radius of woodland arealxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx, lxxi . If a wetland area is adjacent to a woodland, a travel corridor connecting the wetland to the woodland is to be included in the habitat. • SWH MIST cxlix Index #14 provides development effects and mitigation measures.	**SWH type not present**
	Wildlife Species	**ELC Ecosite Codes**	**Habitat Criteria amd Information Sources**	**Defining Criteria**	**Assessment Details**
Specialized Wildlife Habitat: Amphibian Breeding Habitat (Wetland)					
Rationale: Wetlands supporting breeding for these amphibian species are extremely important and fairly rare within Central Ontario landscapes.	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Treefrog Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	ELC Community Classes SW, MA, FE, BO, OA and SA. Typically these wetland ecosites will be isolated (>120m) from woodland ecosites, however larger wetlands containing predominantly aquatic species (e.g. Bull Frog) maybe adjacent to woodlands.	• Wetlands>500m2 (about 25m diameter) ccvii ,supporting high species diversity are significant; some small or ephemeral habitats may not be identified on MNRF mapping and could be important amphibian breeding habitats clxxxii . • Presence of shrubs and logs increase significance of pond for some amphibian species because of available structure for calling, foraging, escape and concealment from predators. • Bullfrogs require permanentwater bodies with abundant emergent vegetation. **Information Sources**: • Ontario Herpetofaunal Summary Atlas (or other similar atlases) • Canadian Wildlife Service Amphibian Road Surveys and Backyard Amphibian Call Count. • OMNRF Districts and wetland evaluations. • Reports and other information available from Conservation Authorities.	Studies confirm: • Presence of breeding population of 1 or more of the listed newt/salamander species or 2 or more of the listed frog/toad species with at least 20 individuals (adults or eggs masses) lxxi or 2 or more of the listed frog/toad species with Call Level Codes of 3©.or; Wetland with confirmed breeding Bullfrogs are significant©.• The ELC ecosite wetlandarea and the shoreline are the SWH. • A combination of observational study and call count surveys cviii will be required during the spring (March-June) when amphibians are concentrated around suitable breeding habitat within or near the wetlands. • If a SWH is determined for Amphibian Breeding Habitat (Wetlands) then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule. • SWH MIST cxlix Index #15 provides development effects and mitigation measures.	**Not SWH**.
Specialized Wildlife Habitat: Woodland Area-Sensitive Bird Breeding Habitat					
Rationale: Large, natural blocks of mature woodland habitat within the settled areas of Southern Ontario are important habitats for area sensitive interior forest song birds	Yellow-bellied Sapsucker Red-breasted Nuthatch Veery Blue-headed Vireo Northern Parula Black-throated Green Warbler Blackburnian Warbler Black-throated Blue Warbler Ovenbird Scarlet Tanager Winter Wren Pileated Woodpecker **Special Concern**: Cerulean Warbler Canada Warbler	All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD	• Habitats where interior forest breeding birds are breeding, typically large mature (>60 yrs old) forest stands or woodlots >30 ha. cv, cxxxi, cxxxii, cxxxiii, cxxxiv, cxxxv, cxxxvi, cxxxvii, cxxxviii, cxxxix, cxl, cxli, cxlii, cxliii, cxliv, cxlv, cxlvi, cl, cli, clii, cliii, cliv, clv, clvi, clvii, clviii, clix, • Interior forest habitat is at least 200 m from forest edge habitat. clxiv Information Sources • Local birder clubs. • Canadian Wildlife Service (CWS) for the location of forest bird monitoring. • Bird Studies Canada conducted a 3-year study of 287 woodlands to determine the effects of forest fragmentation on forest birds and to determine what forests were of greatest value to interior species • Reports and other information available from Conservation Authorities.	Studies confirm: • Presence of nesting or breeding pairs of 3 or more of the listed wildlife species. © • Note: any site with breeding Cerulean Warblers or Canada Warblers is to be considered SWH.© • Conduct field investigations in spring and early summer when birds are singing and defending their territories. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"ccxi • SWH MIST cxlix Index #34 provides development effects and mitigation measures.	Forest habitat present within the study area. Multiple species within the woodland found during breeding bird surveys and recent ebird records, but not confirmed breeding. **Candidate SWH.**
	Wildlife Species	**ELC Ecosite Codes**	**Habitat Criteria amd Information Sources**	**Defining Criteria**	**Assessment Details**
Specialized Wildlife Habitat: Marsh Breeding Bird Habitat					
Rationale: Wetlands for these bird species are typically productive and fairly rare in Southern Ontario landscapes.	American Bittern Virginia Rail Sora Common Moorhen American Coot Pied-billed Grebe Marsh Wren Sedge Wren Common Loon Green Heron Trumpeter Swan **Special Concern**: Black Tern Yellow Rail	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SAS1 SAM1 SAF1 FEO1 BOO1 For Green Heron: All SW, MA and CUM1 sites.	• Nesting occurs in wetlands. • All wetland habitat is to be considered as long as there is shallow water with emergent aquatic vegetation present cxxiv. • For Green Heron, habitat is at the edge of water such as sluggish streams, ponds and marshes sheltered by shrubs and trees. Less frequently, it may be found in upland shrubs or forest a considerable distance from water. Information Sources • OMNRF District and wetland evaluations. • Field Naturalist clubs • Natural Heritage Information Centre (NHIC) Records. • Reports and other information available from Conservation Authorities. • Ontario Breeding Bird Atlas.	Studies confirm: • Presence of 5 or more nesting pairs of Sedge Wren or Marsh Wren or breeding by any combination of 4 or more of the listed species ©. • Note: any wetland with breeding of 1 or more Black Terns, Trumpeter Swan, Green Heron or Yellow Rail is SWH ©. • Area of the ELC ecosite is the SWH. • Breeding surveys should be done in May/June when these species are actively nesting in wetland habitats. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"ccxi • SWH MIST cxlix Index #35 provides development effects and mitigation measures	**SWH type not present.**
Specialized Wildlife Habitat: Open Country Bird Breeding Habitat					
Rationale: This wildlife habitat is declining throughout Ontario and North America. Species such as the Upland Sandpiper have declined significantly the past 40 years based on CWS (2004) trend records.	Upland Sandpiper Grasshopper Sparrow Vesper Sparrow Northern Harrier Savannah Sparrow Special Concern Short-eared Owl	CUM1 CUM2	• Large grassland areas (includes natural and cultural fields and meadows) >30 ha clx, clxi, clxii, clxiii, clxiv, clxv, clxvi, clxvii, clxviii, clxix. • Grasslands not Class 1 or 2 agricultural lands, and not being actively used for farming (i.e. no row cropping or intensive hay or livestock pasturing in the last 5 years) ©. • Grassland sites considered significant should have a history of longevity, either abandoned fields, mature hayfields and pasturelands that are at least 5 years or older. • The Indicator bird species are area sensitive requiring larger grassland areas than the common grassland species. **Information Sources**: • Agricultural land classification maps, Ministry of Agriculture. • Local bird clubs. • Ontario Breeding Bird Atlas • EIS Reports and other information available from Conservation Authorities.	Field Studies confirm: • Presence of nesting or breeding of 2 or more of the listed species. © • A field with 1 or more breeding Short-eared Owls is to be considered SWH. • The area of SWH is the contiguous ELC ecosite field areas. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"ccxi • SWH MIST cxlix Index #32 provides development effects and mitigation measures	**SWH type not present.**
	Wildlife Species	**ELC Ecosite Codes**	**Habitat Criteria amd Information Sources**	**Defining Criteria**	**Assessment Details**
Specialized Wildlife Habitat: Shrub/Early Successional Bird Breeding Habitat					
Rationale: This wildlife habitat is declining throughout Ontario and North America. The Brown Thrasher has declined significantly over the past 40 years based on CWS (2004) trend records.	Indicator Spp: Brown Thrasher Clay-coloured Sparrow Common Spp. Field Sparrow Black-billed Cuckoo Eastern Towhee Willow Flycatcher Special Concern: Yellowbreasted Chat Golden-winged Warbler	CUT1 CUT2 CUS1 CUS2 CUW1 CUW2 Patches of shrub ecosites can be complexed into a larger habitat for some bird species	Large field areas succeeding to shrub and thicket habitats>10ha clxiv in size. • Shrub land or early successional fields, not class 1 or 2 agricultural lands, not being actively used for farming (i.e. no rowcropping, haying or livestock pasturing in the last 5 years) ©. • Shrub thicket habitats (>10 ha) are most likely to support and sustain a diversity of these species clxxiii. • Shrub and thicket habitat sites considered significant should have a history of longevity, either abandoned fields or pasturelands. **Information Sources**: • Agricultural land classification maps, Ministry of Agriculture. • Local bird clubs. • Ontario Breeding Bird Atlas • Reports and other information available from Conservation Authorities.	Field Studies confirm: • Presence of nesting or breeding of 1 of the indicator species and at least 2 of the common species. © • A habitat with breeding Yellowbreasted Chat or Golden-winged Warbler is to be considered as Significant Wildlife Habitat. © • The area of the SWH is the contiguous ELC ecosite field/thicket area. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"ccxi • SWH MIST cxlix Index #33 provides development effects and mitigation measures.	**SWH type not present.**
Specialized Wildlife Habitat: Terrestrial Crayfish					
Rationale: Terrestrial Crayfish are only found within SW Ontario in Canada and their habitats are very rare. Ccii	Chimney or Digger Crayfish; (Fallicambarus fodiens) Devil Crayfish or Meadow Crayfish;(Cambarus Diogenes)	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 MAS1 MAS2 MAS3 SWD SWT SWM CUM1 with inclusions of above meadow marsh ecosites can be used by terrestrial crayfish.	Wet meadow and edges of shallow marshes (no minimum size) should be surveyed for terrestrial crayfish. • Constructs burrows in marshes, mudflats, meadows, the ground can'tbe too moist. Can often be found far from water. • Both species are a semiterrestrial burrower which spends most of its life within burrows consisting of a network of tunnels. Usually the soil is not too moist so that the tunnel is well formed. **Information Sources**: • Information sources from "Conservation Status of Freshwater Crayfishes" by Dr. Premek Hamr for the WWF and CNF March 1998	Studies Confirm: • Presence of 1 or more individuals of species listed or their chimneys (burrows) in suitable meadow marsh, swamp or moist terrestrial sites cci • Area of ELC ecosite or an ecoelement area of meadow marsh or swamp within the larger ecosite area is the SWH. • Surveys should be done April to August in temporary or permanent water. Note the presence of burrows or chimneys are often the only indicator of presence, observance or collection of individuals is very difficult cci • SWH MIST cxlix Index #36 provides development effects and mitigation measures.	**SWH type not present.**
	Wildlife Species	**ELC Ecosite Codes**	**Habitat Criteria amd Information Sources**	**Defining Criteria**	**Assessment Details**
Specialized Wildlife Habitat: Special Concern and Rare Wildlife Species					
Rationale: These species are quite rare or have experienced significant population declines in Ontario.	All Special Concern and Provincially Rare (S1-S3, SH) plant and animal species. Lists of these species are tracked by the Natural Heritage Information Centre (NHIC).	All plant and animal element occurrences (EO) within a 1 or 10km grid. Older element occurrences were recorded prior to GPS being available, therefore location information may lack accuracy	When an element occurrence is identified within a 1 or 10 km grid for a Special Concern or provincially Rare species; linking candidate habitat on the site needs to be completed to ELC Ecosites lxxviii Information Sources: • Natural Heritage Information Centre (NHIC) will have Special Concern and Provincially Rare (S1-S3, SH) species lists with element occurrences data. • NHIC Website "Get Information" : http://nhic.mnr.gov.on.ca • Ontario Breeding Bird Atlas • Expert advice should be sought as many of the rare spp. have little information available about their requirements.	Studies Confirm: • Assessment/inventory of the site for the identified special concern or rare species needs to be completed during the time of year when the species is present or easily identifiable. • The area of the habitat to the finest ELC scale that protects the habitat form and function is the SWH, this must be delineated through detailed field studies. The habitat needs be easily mapped and cover an important life stage component for a species e.g. specific nesting habitat or foraging habitat. • SWH MIST cxlix Index #37 provides development effects and mitigation measures.	See below.
Special Concern and Rare Wildlife Species: Birds					
Broad Beech Fern (*Phegopteris hexagonoptera*)		Found in rich soils in deciduous forests, often in areas dominated by maple and beech and gows in full shade.		Not found during vegetation surveys. **Not SWH**.	
Special Concern and Rare Wildlife Species: Birds					
Common Nighthawk (*Chordeiles minor*)		Open areas with little to no ground vegetation, like forest clearings, rock barrens, and nest in cultivated fields, orchards and along gravel roads and railways.		Documented in 1995 Golder Report within the Study Area. **Candidate SWH**.	
Rusty Blackbird (*Euphagus carolinus*)		Prefers coniferous forests with wetlands nearby including bogs, marches and during the winter is found in wet woodlands, pond edges and agricultural fields.		Ebird records of species. Likely using surrounding agricultural fields. **Not SWH**.	
Wood Thrush (*Hylocichla mustelina*)		Lives in mature deciduous and mixed forests with well developed undergrowth and tall trees for singing perches.		**Not SWH.**	
Peregrine Falcon (*Falco peregrius*)		Nest on tall steep cliffs ledges close to large bodies of water.		Ebird records of species present within the study area. Likely foraging. **Candidate SWH.**	
Bald Eagle (*Haliaeetus leucocephalus*)		Nest in a variety of habitats and forest types near lake lakes or rivers. Nest in trees such as pines and poplars.		Ebird Records of species. Likely part of foraging habitat. **Not SWH.**	
Eastern Wood-Pewee (*Contopus virens*)		Open, deciduous, mixed or coniferous forest;predominated by oak with little understorey; forest clearings, edges; farm woodlots, parks (OMNR 2000)		Deciduous mixed woods found within study area. Observed during breeding bird surveys completed in 2019. **SWH.**	
Special Concern and Rare Wildlife Species: Reptiles					
Northern Map Turtle (*Grapyemys geographica*)		Inhabits rivers and lakeshores with basking rocks and and fallen trees. Requires high quality water.		Not observed during reptile basking habitat, but suitable habitat exists. **Candidate SWH.**	
Ribbonsnake (*Thamnophis sauritus*)		Found close to water in marshes.		Not observed during field surveys. **Candidate SWH.**	
Snapping Turtle (*Chelydra serpentina*)		Any freshwater habitat, but typically found in slow-moving water with soft mud or sand bottom and abundant vegetation.		Observed during reptile basking surveys and Grand River provides habitat for Snapping turtle. **SWH.**	
Special Concern and Rare Wildlife Species: Mussel					
Rainbow Mussel (Villosa iris)		Small to medium-sized rivers with a moderate to strong current and sand, rocky or gravel bottoms. Found in or near riffle areas and long vegetation in water less than 1 metre		Grand River has suitable habitat, and historical records have been found of the species. **Not SWH.**	
Special Concern and Rare Wildlife Species: Insects					
Monarch (*Danaus plexippus*)		Open areas with milkweed species (*Asclepias sp*.) (MNRF 2000)		Open areas present with the study area. Common milkweed (Asclepias sp.) observed within the study area, but will not be impacted by the project. **SWH**.	
	Wildlife Species	**ELC Ecosite Codes**	**Habitat Criteria amd Information Sources**	**Defining Criteria**	**Assessment Details**
Specialized Wildlife Habitat: Amphibian Movement Corridors					
Rationale: Movement corridors for amphibians moving from their terrestrial habitat to breeding habitat can be extremely important for local populations.	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Treefrog Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	Corridors may be found in all ecosites associated with water. • Corridors will be determined based on identifying the significant breeding habitat for these species in Table 1.1	Movement corridors between breeding habitat and summer habitat clxxiv, clxxv, clxxvi, clxxvii, clxxviii, clxxix, clxxx, clxxxi. • Movement corridors must be determined when Amphibian breeding habitat is confirmed as SWH from Table 1.2.2 (Amphibian Breeding Habitat –Wetland) of this Schedule ©. Information Sources: • MNRF District Office. • Natural Heritage Information Centre (NHIC). • Reports and other information available from Conservation Authorities. • Field Naturalist Clubs.	• Field Studies must be conducted at the time of year when species are expected to be migrating or entering breeding sites. • Corridors should consist of native vegetation, with several layers of vegetation. • Corridors unbroken by roads, waterways or bodies, and undeveloped areas are most significant cxlix • Corridors should have at least 15m of vegetation on both sides of waterwaycxlix or be up to 200m widecxlix of woodland habitat and with gaps <20mcxlix . • Shorter corridors are more significant than longer corridors, however amphibians must be able to get to and from their summer and breeding habitatcxlix. • SWH MIST cxlix Index #40 provides development effects and mitigation measures	**SWH type not present**
	Wildlife Species	**ELC Ecosite Codes**	**Habitat Criteria amd Information Sources**	**Defining Criteria**	**Assessment Details**
EcoDistrict					
Bat Migratory Stopover Area Rationale: Stopover areas for long distance migrant bats are important during fall migration. Hoary Bat Eastern Red Bat Silver-haired Bat	No specific ELC types.		• Long distance migratory bats typically migrate during late summer and early fall from summer breeding habitats throughout Ontario to southern wintering areas. Their annual fall migration may concentrate these species of bats at stopover areas. • This is the only known bat migratory stopover habitats based on current information. Information Sources • OMNRF for possible locations and contact for local experts • University of Waterloo, Biology Department	• Long Point (42°35'N, 80°30'E, to 42°33'N, 80°03'E) has been identified as a significant stop-over habitat for fall migrating Silver-haired Bats, due to significant increases in abundance, activity and feeding that was documented during fall migration ccxv. • The confirmation criteria and habitat areas for this SWH are still being determined. • SWH MIST cxlix Index #38 provides development effects and mitigation measures	Study Area is not located appropriate habitat. **Not SWH**.

Attachment C

Agency Consultation

Ministry of
Natural Resources
And Forestry

Guelph District
1 Stone Road West
Guelph, Ontario
N1G 4Y2

Ministère des
Richesses naturelles
et des Forets

Telephone: (519) 826-4955
Facsimile: (519) 826-4929

September 24, 2018

Matt Welsh
City of Brantford
100 Wellington St
Brantford, ON
mwelsh@brantford.ca

RE: MNRF Preliminary Comments
Colborne Street (East) Slope Stabilization
Notice of Study Commencement
Municipal Class Environmental Assessment, Schedule C
City of Brantford

Dear Mr. Welsh,

The Ministry of Natural Resources and Forestry (MNRF), Guelph District Office, can confirm receipt of the Notice of Study Commencement for the Colborne Street (East) Slope Stabilization in the City of Brantford. The Notice describes that the project is being completed in accordance with the requirements of the Municipal Class Environmental Assessment (EA) Schedule C under the *Environmental Assessment Act*.

We understand that the EA will examine slope stability in the study area, approximately 1200 metres along Colborne Street between Linden Avenue and Johnson Road, including the embankment extending to the Grand River. The study will also evaluate and develop concepts to improve, manage or mitigate slope stability concerns.

The MNRF appreciates the opportunity to review the Notice, and we can offer the following preliminary comments on the EA for the project team's consideration.

MNRF Comments:

<u>WETLANDS</u>

The Ministry notes that there are no provincially significant wetlands (PSWs) OR evaluated non-provincially significant wetlands within the study area.

<u>AREAS OF NATURAL AND SCIENTIFIC INTEREST</u>

The Ministry notes that there are no Areas of Natural and Scientific Interest (ANSIs) within the study area.

FISHERIES

The MNRF notes that the following fish species have been documented in the area:

- Black Redhorse, Blackside Darter, Bluntnose Minnow, Common Carp, Golden Redhorse, Greater Redhorse, Greenside Darter, Johnny Darter, Johnny Darter/Tesselated Darter, Logperch, Mimic Shiner, Mooneye, ,Northern Hog Sucker, Rainbow Darter, Rock Bass, Round Goby, Shorthead Redhorse, Smallmouth Bass, Spotfin Shiner, White Sucker

SPECIES AT RISK

There are records in the area for the following species at risk (SAR) and provincially tracked species (S1-S3):

Species at Risk

- Barn Swallow *Hirundo rustica* Threatened
- Wood Thrush *Hylocichla mustelina* Special Concern
- Eastern Sand Darter *Ammocrypta pellucida* Endangered
- Black Redhorse *Moxostoma duquesnei* Threatened
- Silver Shiner *Notropis photogenis* Threatened
- Round Pigtoe *Pleurobema sintoxia* Endangered

Provincially Tracked Species

- Mucket*Actinonaias ligamentina*
- Elktoe *Alasmidonta marginata*
- Mucket*Actinonaias ligamentina*
- Elktoe *Alasmidonta marginata*
- Black Sandshell *Ligumia recta*
- Brindled Madtom *Noturus miurus*
- Greater Redhorse *Moxostoma valenciennesi*

Threatened and Endangered Species receive both individual species and habitat protection under the *Endangered Species Act, 2007* (ESA). SAR habitat prescribed under regulation is listed in Ont. Reg. 242/08 (https://www.ontario.ca/laws/regulation/080242).

Please be advised that because the province has not been surveyed comprehensively for the presence of listed species, the absence of a record does not necessarily indicate the absence of SAR from an area. To determine the presence of SAR for a given study area, the District's recommended approach is as follows:

I. Habitat Inventory

The Ministry recommends undertaking a comprehensive botanical inventory of the entire area that may be subject to direct and indirect impacts from the proposed activity. The vegetation communities should be classified as per the "Ecological Land Classification (ELC) for Southern Ontario" system, to either the "Ecosite" or "Vegetation Type" level. For aquatic habitats in the study area, we recommend that you collect data on the physical characteristics of the waterbodies and inventory the riparian zone vegetation, so that these habitats can be classified as per the Aquatic Ecosites described in the ELC manual.

II. Potential SAR within the Study Area

A list of SAR that have the potential to occur in the area can be produced by cross-referencing the ecosites described during the habitat inventory with the habitat descriptions of SAR known to occur within the planning area. The list of SAR known to occur in the **City of Brantford** is attached for your reference. The species-specific COSEWIC status reports (https://www.canada.ca/en/environment-climate-change/services/committee-status-endangered-wildlife.html) are a good source of information on habitat needs and will be helpful in determining the suitability of the study areas ecosites for a given species.

Please note that the Species at Risk in Ontario (SARO) List is a living document that is periodically amended as a result of species assessment and re-assessments conducted by the Committee on the Status of Species at Risk in Ontario (COSSARO). The SARO List can be accessed on the following webpage: https://www.ontario.ca/environment-and-energy/species-risk-ontario-list.

COSSARO also maintains a list of species to be assessed in the future. It is recommended that you take COSSARO's list of anticipated assessments into consideration, especially when the proposed start date of an activity is more than 6 months away, or the project will be undertaken over a period greater than 6 months. This list can be viewed at: https://www.ontario.ca/page/how-comment-protecting-species-risk.

III. SAR Surveys

The Ministry recommends that each potential SAR identified under Step II is surveyed for, regardless of whether or not the species has been previously recorded in the area. The survey report should describe how each SAR was surveyed for, and provide a rationale for why certain species were not afforded a survey (e.g., habitat within the study area is not suitable for a specific SAR). Please note that some targeted surveys may require provincial authorizations (e.g., ESA permit or Wildlife Scientific Collector's Permit).

ADDITIONAL INFORMATION

Natural heritage features (e.g. wetlands, ANSIs) can be viewed for a given study area through the MNRF's "Make a Map" web application: https://www.ontario.ca/page/make-natural-heritage-area-map. Digital data layers can be obtained through the Land Information Ontario (LIO) geowarehouse https://www.ontario.ca/page/land-information-ontario.

Additionally, the MNRF recommends contacting the municipality and the conservation authority to determine if they have any additional information or records of interest for the study area.

Please be advised that it is your responsibility to comply with all other relevant provincial or federal legislation, municipal by-laws, other MNRF approvals or required approvals from other agencies. If your investigations reveal the presence of Threatened or Endangered species, please contact the MNRF at esa.guelph@ontario.ca for further direction.

PUBLIC LANDS ACT (PLA) & LAKES AND RIVERS IMPROVEMENT ACT (LRIA)

Please note that an approval may be required under the PLA or LRIA depending on what type of works are being proposed as part of this EA. Once more information becomes available, MNRF will be in a better position to provide more specific comments.

Closing

We hope the above preliminary comments will help to inform the EA. It would also be appreciated if the project team could notify the MNRF when any updates to the EA become available.

Please contact the undersigned if further comment or clarification is required.

Regards,

TMcKenna

Tara McKenna, District Planner
Ministry of Natural Resources, Guelph District
1 Stone Road West
Guelph, ON, N1G 4Y2
Phone: (519) 826-4926

cc: Graham Buck, MNRF
Jennifer Harvard, MNRF

From: Tony Zammit <tzammit@grandriver.ca>
Sent: August 1, 2018 5:04 PM
To: Kierian Keele
Cc: Ashley Graham
Subject: RE: Brantford Colborne Street Slope Stabalization

Hi Kierian,

It was nice to catch up with you and the rest of the group Monday morning.

Unfortunately, the GRCA does not have detailed ELC data for the rail trail property and I've only just started a species list for this area. We've mapped the woodland as 'Deciduous Forest' but this is based on airphoto interpretation only.

As I mentioned on site, neither the GRCA nor the MNRF has identified any wetland within your study area (assuming you are excluding the areas on the south side of the river), and I didn't see any wetland vegetation in the swales along the north edge of the trail. You might find small wetland inclusions around stormwater outfalls and in seepage zones, and possibly along the river's edge.

The entire study area is regulated by the GRCA owing to the presence of steep slopes, a watercourse, and associated floodplain. The presence of any wetland will not affect this.

A warm water fish community is present within the oxbow section of the Grand River. Species documented here include smallmouth bass, rock bass, greenside darter, golden redhorse, greater redhorse (S3), blackside darter, mimic shiner, mooneye, white sucker, rainbow darter, northern hog sucker, shorthead redhorse, common carp, bluntnose minnow, logperch, johnny darter/tesselated darter.

The oxbow also contains provincially and federally-listed aquatic species at risk, including black redhorse (provincially threatened), eastern sand darter (provincially endangered and federally threatened), round pigtoe (provincially and federally endangered), and wavy-rayed lampmussel (provincially threatened, special concern federally).

According to the NHIC, there are records of snapping turtle, northern map turtle, pignut hickory, broad beech fern, and other provincially rare species within the general vicinity.

I recommend that you contact the MNRF Guelph District Office to obtain a complete list of species at risk and species of conservation concern, and to confirm survey requirements.

Regards,

Tony

Anthony E. Zammit, M.E.S.|Watershed Ecologist
Grand River Conservation Authority
400 Clyde Road, Box 729, Cambridge, Ontario N1R 5W6
Tel: 519-621-2763 x2246 | Mobile: 519-240-0714
tzammit@grandriver.ca | www.grandriver.ca

From: Kierian Keele [mailto:kierian.keele@ecosystemrecovery.ca]
Sent: Wednesday, August 1, 2018 3:50 PM
To: Tony Zammit
Subject: Brantford Colborne Street Slope Stabalization

Hi Tony,

In the meeting earlier this week you mentioned GRCA may have some ELC mapping data and fish records for the local study area. Is it possible to receive this data? I've looked on the web based make a map layers, and did not see any ELC/vegetation data. If there are any other resources you are aware of that would be helpful, please let me know.

Thank you,

Kierian

Kierian Keele, B.Sc.
Environmental Scientist, Certified Arborist
Tel: (519) 621-1500
Cell: (519) 998-0475

Ecosystem Recovery Inc.
80 Courtland Ave. East, Unit 2
Kitchener, Ontario, N2G 2T8
Tel: (519) 621-1500 | Fax: (226) 240-1080
www.ecosystemrecovery.ca

Brantford

Date Generated: September-14-18

Bird	SARO	Protection	Habitat Information	Timing Windows	Survey Protocol
Acadian Flycatcher *Empidonax virescens*	END	Species Protection and General Habitat Protection	Generally requires large areas of mature, undisturbed forest; avoids the forest edge; often found in well wooded swamps and ravines.	Migrate South before Winter	Follow Breeding Bird Survey Protocol
Bald Eagle *Haliaeetus leucocephalus*	SC	N/A	Prefers deciduous and mixed-deciduous forest; and habitat close to water bodies such as lakes and rivers. They roost in super canopy trees such as Pine.	Breed and Nest - April or May Some Migrate South when waterbodies freeze over	Follow Breeding Bird Survey Protocol
Bank Swallow *Riparia riparia*	THR	Species Protection and General Habitat Protection	It nests in a wide variety of naturally and anthropogenically created vertical banks, which often erode and change over time including aggregate pits and the shores of large lakes and rivers.	Migrate South before Winter	Follow Breeding Bird Survey Protocol. Colony and Roost information should be recorded and submitted using Bird Studies Canada's Ontario Bank Swallow Project data forms (2010).
Barn Swallow *Hirundo rustica*	THR	Species Protection and General Habitat Protection	Prefers farmland; lake/river shorelines; wooded clearings; urban populated areas; rocky cliffs; and wetlands. They nest inside or outside buildings; under bridges and in road culverts; on rock faces and in caves etc.	Migrate South before Winter	Follow Breeding Bird Survey Protocol
Bobolink *Dolichonyx oryzivorus*	THR	Species Protection and General Habitat Protection	Generally prefers open grasslands and hay fields. In migration and in winter uses freshwater marshes and grasslands	Migrate South for the Winter	Contact MNR Guelph District Management Biologist to obtain a copy of the protocol
Canada Warbler *Cardellina canadensis*	SC	N/A	Generally prefers wet coniferous, decidiuous and mixed forest types, with a dense shrub layer. Nests on the ground, on logs or hummocks, and uses dense shrub layer to conceal the nest.	Arrive in Early May Migrate South for the Winter	Follow Breeding Bird Survey Protocol

Cerulean Warbler *Setophaga cerulea*	THR	Species Protection and General Habitat Protection	Generally found in mature deciduous forests with an open understorey; also nests in older, second-growth deciduous forests.	Migrate South for the Winter	Follow Breeding Bird Survey Protocol
Chimney Swift *Chaetura pelagica*	THR	Species Protection and General Habitat Protection	Historically found in deciduous and coniferous, usually wet forest types, all with a well developed, dense shrub layer; now most are found in urban areas in large uncapped chimneys	Nesting - Late April to Mid-May Migrate South in September or Early October	Chimney Swift Monitoring Protocol. Bird Studies Canada, March 2009
Eastern Meadowlark *Sturnella magna*	THR	Species Protection and General Habitat Protection	Generally prefers grassy pastures, meadows and hay fields. Nests are always on the ground and usually hidden in or under grass clumps.	Migrate South for the Winter	Contact MNR Guelph District Management Biologist to obtain a copy of the protocol
Eastern Wood-Pewee *Contopus virens*	SC	N/A	Associated with deciduous and mixed forests. Within mature and intermediate age stands it prefers areas with little understory vegetation as well as forest clearings and edges.	Migrate South for the Winter	Follow Breeding Bird Survey Protocol
Golden-winged Warbler *Vermivora chrysoptera*	SC	N/A	Generally prefer areas of early successional vegetation, found primarily on field edges, hydro or utility right-of-ways, or recently logged areas.	Migrate South for the Winter	Follow Breeding Bird Survey Protocol
Louisiana Waterthrush *Seiurus motacilla*	THR	Species Protection and General Habitat Protection	Generally inhabits mature forests along steeply sloped ravines adjacent to running water. It prefers clear, cold streams and densely wooded swamps	Migrate South for the Winter	Follow Breeding Bird Survey Protocol or Marsh Monitoring Protocol
Northern Bobwhite *Colinus virginianus*	END	Species Protection and General Habitat Protection	Generally inhabits a variety of edge and grassland type - habitats including non-intensively farmed agricultural lands.	Active Year Round	Follow Breeding Bird Survey Protocol

Peregrine Falcon *Falco peregrinus*	SC	N/A	Generally nest on tall, steep cliff ledges adjacent to large waterbodies; some birds adapt to urban environments and nest on ledges of tall buildings, even in densely populated downtown areas.	Active Year Round - Lay Eggs around Easter Hatching occurs around Mother's Day Young fledge around Father's	Visit ideal habitat locations and listen/look for individuals in the vicinity.
Red-Headed Woodpecker *Melanerpes erythrocephalus*	SC	N/A	Generally prefer open oak and beech forests, grasslands, forest edges, orchards, pastures, riparian forests, roadsides, urban parks, golf courses, cemeteries, as well as along beaver ponds and brooks	Active from May to September	Follow Breeding Bird Survey Protocol
Wood Thrush *Hylocichla mustelina*	SC	N/A	Nests mainly in second-growth and mature deciduous and mixed forests, with saplings and well-developed understory layers. Prefers large forest mosaics, but may also nest in small forest fragments.	Migrate South for the Winter Arrive in Ontario in mid to late spring	Follow Breeding Bird Survey Protocol
Yellow-breasted Chat *Icteria virens*	END	Species Protection and General Habitat Protection	Generally prefer dense thickets around wood edges, riparian areas, and in overgrown clearings	Migrate South for the Winter Arrive in Ontario Early May	Follow Breeding Bird Survey Protocol

Fish	SARO	Protection	Habitat Information	Timing Windows	Survey Protocol
Black Redhorse *Moxostoma duquesnei*	THR	Species Protection and General Habitat Protection	Generally lives in moderately sized rivers and streams, with generally moderate to fast currents	Active Year Round	For information please contact your local MNRF office, CA or DFO
Eastern Sand Darter *Ammocrypta pellucida*	END	Species Protection and Habitat Regulation	Generally prefer sandy-bottomed streams and rivers	Active Year Round	For information please contact your local MNRF office, CA and DFO
Northern Brook Lamprey *Ichthyomyzon fossor*	SC	N/A	Generally inhabits small rivers and clear streams of varying sizes. Adults spawn in gravelly riffles.	Active Year Round	For information please contact your local MNRF office, CA and/or DFO

Silver Shiner *Notropis photogenis*	THR	Species Protection and General Habitat Protection	Generally prefer moderate to large, deep, relatively clear streams with swift currents, and moderate to high gradients	Spawning occurs in May and June	For information please contact your local MNRF office, CA and/or DFO
Insect	**SARO**	**Protection**	**Habitat Information**	**Timing Windows**	**Survey Protocol**
Monarch Butterfly *Danaus plexippus*	SC	N/A	Exist primarily wherever milkweed and wildflowers exist; abandoned farmland, along roadsides, and other open spaces	Usually migrate south in late September and October	Watch for adults along roadsides and in open fields. Caterpillars feed on milkweeds: Common milkweed grows in open disturbed habitats (fields, roadsides, etc) and swamp milkweed grows in wet habitats (along streams, lakes, marshes) Adults can be spotted from a distance; caterpillars must be looked for carefully on the host plant.
Nine-spotted Lady Beetle *Coccinella novemnotata*	END	Species Protection and General Habitat Protection	The Nine-spotted Lady Beetle is able to live in a wide variety of areas including agricultural areas, suburban gardens, parks, coniferous forests, deciduous forests, prairie grasslands, meadows, riparian areas, and isolated natural areas.		
Rapids Clubtail *Gomphus quadricolor*	END	Species Protection and Habitat Regulation	Clear, cool, medium to large rivers with wooded shorelines, gravel shallows and muddy pools. Adult females inhabit shoreline forests, moving to the rapids when ready to mate. The nymphs live in these quiet, muddy, downstream pools where they spend most of their time buried just below the surface of the sediment in the bottom of the pool.	Adults live about three to four weeks, emerging and flying from mid-May to mid-July, while larvae may live two or more years	Watch for adults flying above water or perched on vegetation.
Rusty-patched Bumble Bee *Bombus affinis*	END	Species Protection and General Habitat Protection	Generally inhabits a range of diverse habitats including mixed farmland, sand dunes, marshes, urban and wooded areas. It usually nests underground in abandoned rodent burrows	Active from early Spring to late Fall	Contact MNRF Guelph District Management Biologist to obtain a copy of the protocol
Mammal	**SARO**	**Protection**	**Habitat Information**	**Timing Windows**	**Survey Protocol**

American Badger *Taxidea taxus*	END	Species Protection and Habitat Regulation	Generally prefers open habitats, whether natural (grasslands) or man-made (agricultural fields, road right-of-ways, golf courses).	Breed: Late Summer Semi-dormant over Winter	Determine if soils are suitable (sandy or loamy) Dens and Woodchuck burrows should be surveyed for use
Eastern Small-footed Myotis *Myotis leibii*	END	Species Protection and General Habitat Protection	Overwintering habitat: Caves and mines that remain above 0 degrees Celsius Maternal Roosts: primarily under loose rocks on exposed rock outcrops, crevices and cliffs, and occasionally in buildings, under bridges and highway overpasses and under tree bark.	Hibernates in caves and mines during winter	Contact MNRF Guelph District Management Biologist to obtain a copy of the protocol
Little Brown Myotis *Myotis lucifugus*	END	Species Protection and General Habitat Protection	Overwintering habitat: Caves and mines that remain above 0 degrees Celsius Maternal Roosts: Often associated with buildings (attics, barns etc.). Occasionally found in trees (25-44 cm dbh).	Hibernates during winter	Contact MNRF Guelph District Management Biologist to obtain a copy of the protocol
Northern Myotis *Myotis septentrionalis*	END	Species Protection and General Habitat Protection	Overwintering habitat: Caves and mines that remain above 0 degrees Celsius Maternal Roosts: Often asssociated with cavities of large diameter trees (25-44 cm dbh). Occasionally found in structures (attics, barns etc.)	Hibernates during winter	Contact MNRF Guelph District Management Biologist to obtain a copy of the protocol
Tri-colored Bat *Perimyotis subflavus*	END	Species Protection and General Habitat Protection	Overwintering habitat: Caves and mines that remain above 0 degrees Celsius Maternal Roosts: Can be in trees or dead clusters of leaves or arboreal lichens on trees. May also use barns or similar structures.	Hibernates during winter	Contact MNRF Guelph District Management Biologist to obtain a copy of the protocol

Mollusc	SARO	Protection	Habitat Information	Timing Windows	Survey Protocol

Rainbow *Villosa iris*	SC	N/A	Most abundant in shallow, welloxygenated reaches of small- to medium-sized rivers and sometimes lakes, on substrates of cobble, gravel, sand and occasionally mud.	Active Year Round	Please reference: Mackie, G, T.J Morris, and D Ming. "Protocol for the Detection and Relocation of Freshwater Mussel Species at Risk in Ontario Great Lakes Area (OGLA)." Fisheries and Oceans Canada. (2008): Print.
Round Pigtoe *Pleurobema sintoxia*	END	Species Protection and General Habitat Protection	Generally occur in small rivers in areas of moderate flow on substrates of gravel, cobble and boulder. In larger rivers, they are found in mud, sand and gravel at varying depths.	Active Year Round	Please reference: Mackie, G, T.J Morris, and D Ming. "Protocol for the Detection and Relocation of Freshwater Mussel Species at Risk in Ontario Great Lakes Area (OGLA)." Fisheries and Oceans Canada. (2008): Print.
Wavy-rayed Lampmussel *Lampsilis fasciola*	THR	Species Protection and Habitat Regulation	Generally inhabit clear rivers and streams of a variety of sizes, where the water flow is steady and the substrate is stable	Active Year Round	Please reference: Mackie, G, T.J Morris, and D Ming. "Protocol for the Detection and Relocation of Freshwater Mussel Species at Risk in Ontario Great Lakes Area (OGLA)." Fisheries and Oceans Canada. (2008): Print.
Plant	**SARO**	**Protection**	**Habitat Information**	**Timing Windows**	**Survey Protocol**
American Chestnut *Castanea dentata*	END	Species Protection and General Habitat Protection	Found in deciduous forest communities; this tree prefers arid forests with acid and sandy soils.	Flowers occur in Late Spring and Early Summer	Walk slowly and systematically in grid fashion, pausing to scan for plants every 5 meters Use a plant field guide to distinguish from similar species Perform detailed floristic inventory Look for distinictive fruits on the ground
American Columbo *Frasera caroliniensis*	END	Species Protection and General Habitat Protection	Most commonly associated with open deciduous forested slopes, thickets and clearings; grows in a variety of relatively stable habitats as well as on a wide variety of soils.	Germination and development of the rosette begin in early spring Flowers open in May Fruit production continues	Walk slowly and systematically in grid fashion, pausing to scan for plants every 5 meters Use a plant field guide to distinguish from similar species Look for spikes from last years flowers
Bird's-foot Violet *Viola pedata*	END	Species Protection and General Habitat Protection	Generally grows in open, disturbed, well-drained, sandy sites, and, in Ontario, is found in Black Oak savannah habitats within deciduous forests	Flowers from mid-May until mid-June an sometimes again from the end of September to mid-October	Searches for this species should only be done in the spring, when the species is most visible Walk slowly and systematically in grid fashion, pausing to scan for plants every 1 meters Use a plant field guide to distinguish from similar species

Broad Beech Fern *Phegopteris hexagonoptera*	SC	N/A	Generally inhabits shady areas of beech and maple forests where the soil is moist or wet	The frond of the Broad Beech Fern appears towards the end of May	Walk slowly and systematically in grid fashion, pausing to scan for plants every 5 meters Use a plant field guide to distinguish from similar species
Butternut *Juglans cinerea*	END	Species Protection and General Habitat Protection	Generally grows in rich, moist, and well-drained soils often found along streams. It may also be found on well-drained gravel sites, especially those made up of limestone. It is also found, though seldomly, on dry, rocky and sterile soils. In Ontario, the Butternut generally grows alone or in small groups in deciduous forests as well as in hedgerows	Flowers from April to June. Fruits reach maturity during the month of September or October	Walk slowly and systematically in grid fashion through suitable habitat pausing every 30 meters for a detailed scan of trees within sight. Areas with dense foliage or many saplings will require a more intensive survey to detect sapling butternut. Use Butternut Health Assessment Protocol if planning on removing trees.
Common Hoptree *Ptelea trifoliata*	SC	N/A	Generally grows in sandy soils in areas with a lot of natural disturbance - such as the outer edge of shoreline vegetation, sand spits, and sand points.	Flowering occurs in early summer Fruiting occurs in July	Walk slowly and systematically in grid fashion, pausing to scan for plants every 5 meters Use a plant field guide to distinguish from similar species
Eastern Flowering Dogwood *Cornus florida*	END	Species Protection and Habitat Regulation	Generally grows in deciduous and mixed forests, in the drier areas of its habitat, although it is occasionally found in slightly moist environments; Also grows around edges and hedgerows	Flowering occurs in mid-May, just as the leaves begin to develop. Fruit turns red at the end of summer.	Walk slowly and systematically in grid fashion, pausing to scan for plants every 5 meters Use a plant field guide to distinguish from similar species Easiest to detect during Spring when in flower Also look for distinctive bark
Reptile	**SARO**	**Protection**	**Habitat Information**	**Timing Windows**	**Survey Protocol**

Blanding's Turtle *Emydoidea blandingii*	THR	Species Protection and General Habitat Protection	Generally occur in freshwater lakes, permanent or temporary pools, slow-flowing streams, marshes and swamps. They prefer shallow water that is rich in nutrients, organic soil and dense vegetation. Adults are generally found in open or partially vegetated sites, and juveniles prefer areas that contain thick aquatic vegetation including sphagnum, water lilies and algae. They dig their nest in a variety of loose substrates, including sand, organic soil, gravel and cobblestone. Overwintering occurs in permanent pools that average about one metre in depth, or in slow-flowing streams.	Eggs are laid in June, with hatchlings emerging in late September and early October.	Contact MNR Guelph District Management Biologist to obtain a copy of the protocol
Eastern Hog-nosed Snake *Heterodon platirhinos*	THR	Species Protection and General Habitat Protection	Generally prefer habitats with sandy, well-drained soil and open vegetative cover, such as open woods, brushland, fields, forest edges and disturbed sites. The species is often found near water.	Mating occurs in spring and in August and early September. Eggs are laid in June. Hatching occurs in late August or early September	In early spring, look for individuals near ideal hibernation sites During egg-laying period (June), look for nesting females in sandy areas in early morning and late evening. Rest of the season, survey intensively and systematically by flipping rocks
Eastern Ribbonsnake *Thamnophis sauritus*	SC	N/A	Generally occur along the edges of shallow ponds, streams, marshes, swamps, or bogs bordered by dense vegetation that provides cover. Abundant exposure to sunlight is also required, and adjacent upland areas may be used for nesting.	Hibernate: October - April Mating: Early Spring Hatching: Early Fall (September)	Contact MNRF Guelph District Management Biologist to obtain a copy of the protocol
Northern Map Turtle *Graptemys geographica*	SC	N/A	Generally inhabits both lakes and rivers, showing a preference for slow moving currents, muddy bottoms, and abundant aquatic vegetation. These turtles need suitable basking sites (such as rocks and logs) and exposure to the sun for at least part of the day.	Active: At night Hibernate: October - April Hatching: Late August - Early September	Scan shoreline in spring and partially submerged logs/rocks in summer for basking turtles Be aware that map turtles do not allow as close of approach as other turtles before leaving a basking site Snorkel in desired aquatic habitat

Queensnake *Regina septemvittata*	END	Species Protection and Habitat Regulation	Generally require a permanent body of water, flowing or still, with a temperature remaining at or above 18.3°C throughout most of the active season; abundant cover, such as flat rocks submerged and/or on the bank; and an abundance of crayfish. Other important habitat features may include rocky, gravelly, or slate stream-bed substrates, swift to moderate current, and woodland surroundings.	Active: May - October	Contact MNRF Guelph District Management Biologist to obtain a copy of the protocol
Snapping Turtle *Chelydra serpentina*	SC	N/A	Generally inhabit shallow waters where they can hide under the soft mud and leaf litter. Nesting sites usually occur on gravely or sandy areas along streams. Snapping Turtles often take advantage of man-made structures for nest sites, including roads (especially gravel shoulders), dams and aggregate pits.	Nesting: Late May and June Hibernate: October - April	Scan offshore rocks and logs for basking turtles (10am-2pm) Snorkel in desired aquatic habitat Nesting Season: Search known or preferred nesting habitat areas for females
Spiny Softshell *Apalone spinifera*	END	Species Protection and General Habitat Protection	Generally prefer marshy creeks, swift-flowing rivers, lakes, impoundments, bays, marshy lagoons, ditches and ponds near rivers	Lay eggs in June or July Hibernate over winter	Best time to survey is during nesting season when females are active laying eggs Visual searches should be conducted in appropriate habitat

Attachment D

Flora Species

Common Name	Scientific Name	SRANK	ESR Report Totals	MAS3	CUM1	CUT1	CGL_2	FOD7-4	ERI Observations
Wild Carrot	*Daucus carota*	SNA	x		x	x		x	x
English Ivy	*Hedera helix*	SNA			x		x		x
Cow Parsnip	*Heracleum maximum*	S5						x	x
Wild Parsnip	*Pastinaca sativa*	SNA			x	x			x
Jack-in-the-pulpit	*Arisaema triphyllum*	S5						x	x
Lesser Duckweed	*Lemna minor*	S5	x	x					x
Annual Ragweed	*Ambrosia artemisiifolia*	S5	x		x	x		x	x
Great Ragweed	*Ambrosia trifida*	S5			x	x		x	x
Common Burdock	*Arctium minus*	SNA	x		x	x			x
Bidens species	*Bidens sp.*				x		x		x
Spotted Knapweed	*Centaurea stoebe*	SNA			x				x
Chicory	*Cichorium intybus*	SNA			x	x	x		x
Canada Thistle	*Cirsium arvense*	SNA	x		x				x
Bull Thistle	*Cirsium vulgare*	SNA	x		x	x			x
Annual Fleabane	*Erigeron annuus*	S5	x		x	x	x		x
Canada Horseweed	*Erigeron canadensis*	S5			x				x
Philadelphia Fleabane	*Erigeron philadelphicus*	S5	x		x	x	x	x	x
White Snakeroot	*Eupatorium rugosum*		x		x			x	x
Grass-leaved Goldenrod	*Euthamia graminifolia*	S5			x			x	x
Flat-top Fragrant Goldenrod	*Euthamia graminifolia*	S5						x	x
Spotted Joe Pye Weed	*Eutrochium maculatum var. maculatum*	S5		x		x		x	x
Hawkweed species	*Hieracium sp.*		x		x				x
Tall Hawkweed	*Hieracium piloselloides Vill.*		x		x				x
Tall Blue Lettuce	*Lactuca biennis*	S5	x		x	x			x
Oxeye Daisy	*Leucanthemum vulgare*	SNA	x		x				x
Black-eyed Susan	*Rudbeckia hirta*	S5			x		x		x
Eastern Tall Goldenrod	*Solidago altissima var. altissima*	S5	x		x	x	x	x	x
Canada Goldenrod	*Solidago canadensis var. canadensis*	S5	x	x	x	x	x	x	x
Giant Goldenrod	*Solidago gigantea*	S5	x		x				x
Early Goldenrod	*Solidago juncea*	S5	x	x	x	x	x	x	x
Field Sow-thistle	*Sonchus arvensis ssp. arvensis*	SNA	x		x	x		x	x
Heart-leaved Aster	*Symphyotrichum cordifolium*	S5	x		x		x	x	x
New England Aster	*Symphyotrichum novae-angliae*	S5	x		x	x	x	x	x
Common Tansy	*Tanacetum vulgare*	SNA	x		x	x	x	x	x
Common Dandelion	*Taraxacum officinale*	SNA	x		x		x		x
Yellow Goat's-beard	*Tragopogon dubius*	SNA	x		x				x
Colt's-foot	*Tussilago farfara*	SNA	x		x	x	x	x	x
Moss	*Bryophyta sp.*		x					x	x
Great Blue Lobelia	*Lobelia siphilitica*	S5			x			x	x
Garlic Mustard	*Alliaria petiolata*	SNA	x		x	x	x	x	x
Black Mustard	*Brassica nigra*	SNA	x		x			x	x
Flixweed	*Descurainia sophia*	SNA	x		x				x
Dame's Rocket	*Hesperis matronalis*	SNA	x		x	x		x	x

Common Name	Scientific Name	SRANK	ESR Report Totals	MAS3	CUM1	CUT1	CGL_2	FOD7-4	ERI Observations
Bouncing-bet	*Saponaria officinalis*	SNA						x	x
Bladder Campion	*Silene vulgaris*	SNA	x		x	x			x
Eunoymus species	*Eunoymus sp.*				x			x	x
Running Strawberry Bush	*Euonymus obovatus*	S4			x			x	x
Alternate-leaved Dogwood	*Cornus alternifolia*	S5			x			x	x
Gray Dogwood	*Cornus racemosa*	S5	x	x	x	x		x	x
Red-osier Dogwood	*Cornus sericea*	S5	x	x	x	x		x	x
Quack Grass	*Agropyron repens*		x		x		x		x
Redtop	*Agrostis gigantea*	SNA	x		x	x		x	x
Smooth Brome	*Bromus inermis*	SNA	x		x	x			x
Sedge species	*Carex sp.*			x	x				x
Bebb's Sedge	*Carex bebbii*	S5			x				x
Woodland Sedge	*Carex blanda*	S5	x		x				x
Awl-fruited Sedge	*Carex stipata*	S5	x		x			x	x
Orchard Grass	*Dactylis glomerata*	SNA	x		x	x	x	x	x
Poverty Oatgrass	*Danthonia spicata*	S5			x				x
Crabgrass species	*Digitaria sp.*				x				x
Large Barnyard Grass	*Echinochloa crus-galli*	SNA			x	x			x
Red Fescue	*Festuca rubra ssp. rubra*	SNA	x		x		x		x
Reed Canary Grass	*Phalaris arundinacea var. arundinacea*	S5	x		x	x		x	x
Common Timothy	*Phleum pratense*	SNA	x		x	x	x	x	x
European Reed	*Phragmites australis ssp. australis*	SNA	x		x				x
Grass species	*Poa sp.*			x	x	x	x	x	x
Canada Bluegrass	*Poa compressa*	SNA	x		x	x		x	x
Kentucky Bluegrass	*Poa pratensis ssp. pratensis*	SNA	x		x		x		x
Common Teasel	*Dipsacus fullonum*	SNA	x		x	x		x	x
Honeysuckle species	*Lonicera sp.*				x	x		x	x
Trumpet Honeysuckle	*Lonicera sempervirens*	SNA			x	x			x
Tartarian Honeysuckle	*Lonicera tatarica*	SNA	x		x	x		x	x
Black Elderberry	*Sambucus nigra*	SNA			x				x
Highbush Cranberry	*Viburnum opulus ssp. trilobum*	S5	x					x	x
Field Horsetail	*Equisetum arvense*	S5	x	x	x	x		x	x
Nodding Spurge	*Euphorbia nutans*	S4	x					x	x
American Groundnut	*Apios americana*	S5			x	x		x	x
Honey-locust	*Gleditsia triacanthos f. inermis*						x		x
Kentucky Coffee-tree	*Gymnocladus dioicus*	S2					x		x
Everlasting Pea	*Lathyrus latifolius*	SNA			x		x		x
Birds-foot Trefoil	*Lotus corniculatus*	SNA	x		x	x	x		x
Black Medic	*Medicago lupulina*	SNA	x		x		x		x
White Sweet-clover	*Melilotus albus*	SNA	x		x	x			x
Alsike Clover	*Trifolium hybridum*	SNA			x	x			x
Red Clover	*Trifolium pratense*	SNA	x		x	x		x	x
Tufted Vetch	*Vicia cracca*	SNA			x	x			x

Common Name	Scientific Name	SRANK	ESR Report Totals	MAS3	CUM1	CUT1	CGL_2	FOD7-4	ERI Observations
Culivated Birch	*Betula fruiticosa*		x		x				x
Paper Birch	*Betula papyrifera*	S5			x				x
Bur Oak	*Quercus macrocarpa*	S5	x		x			x	x
Northern Red Oak	*Quercus rubra*	S5			x				x
Ostrich Fern	*Matteuccia struthiopteris*	S5						x	x
Sensitive Fern	*Onoclea sensibilis*	S5						x	x
Common Milkweed	*Asclepias syriaca*	S5	x		x	x		x	x
Periwinkle	*Vinca minor*	SNA			x		x	x	x
Herb-Robert	*Geranium robertianum*	S5						x	x
Spotted Jewelweed	*Impatiens capensis*	S5	x		x				x
Pale Jewelweed	*Impatiens pallida*	S4						x	x
Creeping Wood-sorrel	*Oxalis corniculata*	SNA	x					x	x
Upright Yellow Wood-sorrel	*Oxalis stricta*	S5	x					x	x
London Plane-tree	*Platanus x acerifolia*						x		x
Bitternut Hickory	*Carya cordiformis*	S5			x			x	x
Black Walnut	*Juglans nigra*	S4?	x		x	x		x	x
Corn Gromwell	*Buglossoides arvensis*	SNA	x		x	x			x
Common Viper's Bugloss	*Echium vulgare*	SNA			x				x
Common Motherwort	*Leonurus cardiaca*	SNA	x		x	x		x	x
Wild Bergamot	*Monarda fistulosa var. fistulosa*	SU	x					x	x
True Forget-me-not	*Myosotis scorpioides*	SNA			x				x
Catnip	*Nepeta cataria*	SNA	x			x		x	x
Common Self-heal	*Prunella vulgaris ssp. vulgaris*	SNA	x		x	x	x		x
White Vervain	*Verbena urticifolia L.*				x	x		x	x
European Chives	*Allium schoenoprasum var. schoenoprasum*	SNA			x				x
Clintonia species	*Clintonia sp.*				x			x	x
European Lily-of-the-valley	*Convallaria majalis*	SNA			x			x	x
Orange Daylily	*Hemerocallis fulva*	SNA	x		x				x
Large False Solomon's Seal	*Maianthemum racemosum*	S5	x	x				x	x
Tulip Tree	*Liriodendron tulipifera*	S4					x		x
Magnolia Tree (horticuture)	*Magnolia sp.*				x		x		x
American Basswood	*Tilia americana*	S5					x	x	x
Little-leaf Linden	*Tilia cordata*	SNA					x		x
Enchanter's Nightshade	*Circaea quadrisculata*		x		x	x		x	x
Willowherb species	*Epilobium sp.*							x	x
Purple Loosestrife	*Lythrum salicaria*	SNA	x		x	x		x	x
Common Evening Primrose	*Oenothera biennis*	S5	x		x			x	x
Greater Celandine	*Chelidonium majus*	SNA	x		x			x	x
Eastern Red Cedar	*Juniperus virginiana*	S5	x			x	x		x
Norway Spruce	*Picea abies*	SNA			x		x	x	x
White Spruce	*Picea glauca*	S5					x		x
Blue Spruce	*Picea pungens*	SNA			x				x
Red Pine	*Pinus resinosa*	S5						x	x

Common Name	Scientific Name	SRANK	ESR Report Totals	MAS3	CUM1	CUT1	CGL_2	FOD7-4	ERI Observations
Eastern White Pine	*Pinus strobus*	S5			x				x
Scots Pine	*Pinus sylvestris*	SNA			x			x	x
Eastern White Cedar	*Thuja occidentalis*	S5	x		x		x	x	x
Heart-leaved Plantain	*Plantago cordata*	S1			x				x
English Plantain	*Plantago lanceolata*	SNA			x	x	x		x
Common Plantain	*Plantago major*	SNA			x	x	x		x
Smartweed species	*Persicaria sp.*				x			x	x
Japanese Knotweed	*Reynoutria japonica*	SNA	x			x		x	x
Sheep Sorrel	*Rumex acetosella*	SNA			x				x
Curly Dock	*Rumex crispus*	SNA	x		x	x		x	x
Creeping Jennie	*Lysimachia nummularia*	SNA	x		x		x		x
Autumn Olive	*Elaeagnus umbellata*	SNA	x		x	x		x	x
Virginia Virgin's-bower	*Clematis virginiana*	S5	x		x	x	x		x
Canada Moonseed	*Menispermum canadense*	S4	x					x	x
Tall Buttercup	*Ranunculus acris*	SNA	x		x	x			x
Inserted Virginia Creeper	*Parthenocissus inserta*		x		x	x	x	x	x
Virginia Creeper	*Parthenocissus quinquefolia*	S4?	x		x	x	x	x	x
Common Buckthorn	*Rhamnus cathartica*	SNA	x		x	x		x	x
Riverbank Grape	*Vitis riparia*	S5	x		x	x		x	x
Hooked Agrimony	*Agrimonia gryposepala*	S5			x				x
Downy Serviceberry	*Amelanchier arborea*	S5						x	x
Hawthorn species	*Crataegus sp.*		x		x			x	x
American Woodland Strawberry	*Fragaria vesca ssp. americana*	S5			x	x		x	x
Wild Strawberry	*Fragaria virginiana ssp. virginiana*	SU	x		x	x		x	x
White Avens	*Geum canadense*	S5	x		x	x		x	x
Common Apple	*Malus pumila*	SNA				x		x	x
Common Crabapple	*Malus pumila*	SNA	x		x			x	x
Sulphur Cinquefoil	*Potentilla recta*	SNA	x		x	x		x	x
Black Cherry	*Prunus serotina*	S5			x		x	x	x
Choke Cherry	*Prunus virginiana*	S5	x		x			x	x
Currant species	*Ribes sp.*							x	x
Swamp Red Currant	*Ribes triste*	S5	x		x			x	x
Dog Rose	*Rosa canina*	SNA	x		x	x		x	x
Multiflora Rose	*Rosa multiflora*	SNA	x		x	x		x	x
Allegheny Blackberry	*Rubus allegheniensis*	S5	x		x			x	x
Wild Red Raspberry	*Rubus idaeus ssp. strigosus*	S5	x		x	x		x	x
Black Raspberry	*Rubus occidentalis*	S5			x			x	x
Purple-flowering Raspberry	*Rubus odoratus*	S5			x				x
Swedish Whitebeam	*Sorbus intermedia*	SNA			x				x
Three-flowered Bedstraw	*Galium triflorum*	S5	x		x	x		x	x
White Poplar	*Populus alba*	SNA	x		x				x
Eastern Cottonwood	*Populus deltoides ssp. deltoides*	S5	x		x	x		x	x
Large-toothed Aspen	*Populus grandidentata*	S5	x					x	x

Common Name	Scientific Name	SRANK	ESR Report Totals	MAS3	CUM1	CUT1	CGL_2	FOD7-4	ERI Observations
Trembling Aspen	*Populus tremuloides*	S5			x				x
Willow species	*Salix sp.*							x	x
White Willow	*Salix alba*	SNA	x	x	x	x		x	x
Peach-leaved Willow	*Salix amygdaloides*	S5	x					x	x
Weeping Willow	*Salix babylonica*		x					x	x
Pussy Willow	*Salix discolor*	S5			x			x	x
Sandbar Willow	*Salix interior*	S5	x	x	x			x	x
Manitoba Maple	*Acer negundo*	S5	x		x	x		x	x
Norway Maple	*Acer platanoides*	SNA	x		x		x		x
Red Maple	*Acer rubrum*	S5	x		x				x
Silver Maple	*Acer saccharinum*	S5			x				x
Sugar Maple	*Acer saccharum*	S5	x		x	x		x	x
Tree-of-heaven	*Ailanthus altissima*	SNA			x				x
Staghorn Sumac	*Rhus typhina*	S5	x		x	x	x	x	x
Eastern Poison Ivy	*Toxicodendron radicans var. radicans*	S5	x	x	x	x			x
Northern Catalpa	*Catalpa speciosa*	SNA	x		x	x		x	x
White Ash	*Fraxinus americana*	S4	x		x			x	x
Green Ash	*Fraxinus pennsylvanica*	S4	x		x	x		x	x
European Privet	*Ligustrum vulgare*	SNA	x		x		x	x	x
Butter-and-eggs	*Linaria vulgaris*	SNA	x		x	x			x
Lousewort species	*Pedicularis sp.*							x	x
Common Lilac	*Syringa vulgaris*	SNA	x		x			x	x
Common Mullein	*Verbascum thapsus*	SNA	x		x	x		x	x
Common Speedwell	*Veronica officinalis*	SNA	x		x		x		x
Virginia Waterleaf	*Hydrophyllum virginianum*	S5						x	x
Spotted Phlox	*Phlox maculata*	SNA			x				x
Bittersweet Nightshade	*Solanum dulcamara*	SNA	x	x	x	x	x	x	x
Canadian Yew	*Taxus canadensis*	S4			x				x
Common St. John's-wort	*Hypericum perforatum*	SNA	x		x			x	x
Narrow-leaved Cattail	*Typha angustifolia*	SNA	x	x				x	x
Common Hackberry	*Celtis occidentalis*	S4			x			x	x
Wood Nettle	*Laportea canadensis*	S5						x	x
Red Mulberry	*Morus rubra*	S2	x		x	x		x	x
American Elm	*Ulmus americana*	S5						x	x
Slippery Elm	*Ulmus rubra*	S5	x	x	x			x	x
European Stinging Nettle	*Urtica dioica ssp. dioica*	SNA	x		x	x		x	x
Wild Mock-cucumber	*Echinocystis lobata*	S5				x		x	x
Violet species	*Viola sp.*				x	x		x	x
			123	**16**	**167**	**0**	**29**	**96**	**16**

Attachment E

Amphibian and Reptile Species

Common Name	Scientific Name	SRANK	MNRF	COSEWIC	SARA	Locally Significant	NHIC	Reptile Atlas	ERI Observations
Turtles	***Cryptodeira***								
Snapping Turtle	*Chelydra serpentina*	S3	SC	SC	Schedule 1		x	x	x
Midland Painted Turtle	*Chrysemys picta marginata*	S4						x	x
Northern Map Turtle	*Graptemys geographica*	S3	SC	SC	Schedule 1		x	x	
Red-eared Slider	*Trachemys scripta elegans*	SNA						x	x
Snakes	***Squamata***								
Milksnake	*Lampropeltis triangulum*	S4	NAR	SC	Schedule 1			x	
DeKay's Brownsnake	*Storeria dekayi*	S5	NAR	NAR				x	
Red-bellied snake	*Storeria occipitomaculata*	S5						x	
Eastern Gartersnake	*Thamnophis sirtalis sirtalis*	S5						x	
Salamanders	***Caudata***								
Blue-spotted Salamander	*Ambystoma laterale*	S4						x	
Red-spotted Newt	*Notophthalmus viridescens viridescens*	S5						x	
Eastern Red-backed Salamander	*Plethodon cinereus*	S5						x	
Frogs and Toads	***Anura***								
American Toad	*Anaxyrus americanus*	S5						x	x
Gray Treefrog	*Hyla versicolor*	S5						x	x
American Bullfrog	*Lithobates catesbeianus*	S4						x	
Green Frog	*Lithobates clamitans*	S5						x	
Northern Leopard Frog	*Lithobates pipiens*	S5	NAR	NAR				x	
Spring Peeper	*Pseudacris crucifer*	S5						x	
						0	**2**	**17**	**5**

Attachment F

Breeding Bird Survey

Brantford Colborne 1824 -Breeding Bird Survey #1

Station	Common Name	Scientific Name	OB	PO	PB	CONF	#	Notes
Station 1	Baltimore Oriole	*Icterus galbula*		S			1	calling
June 14, 2019	Hermit Thrush	*Catharus guttatus*		S			1	calling
7:26 am - 7:36 am	Blue Jay	*Cyanpcitta cristata*		S			1	calling, male, visual
	House Wren	*Troglodytes aedon*		S			1	calling
	Common Grackle	*Quiscalus quiscula*			P		3	calling
	Rose-breasted Grosbeak	*Pheucticus ludovicianus*		S			1	calling, visual
	Ovenbird	*Seiurus aurocapilla*		S			1	calling
	American Goldfinch	*Spinus tritis*		H			1	
	Northern Cardinal	*Cardinalis cardinalis*		S			2	calling, male
	Song Sparrow	*Melospiza melodia*		S			1	calling
	Carolina Wren	*Thyrothorus ludovicianus*		S			1	calling
Station 2	Blue Jay	*Cyanpcitta cristata*		S			1	calling
June 14, 2019	Common Grackle	*Quiscalus quiscula*		H			2	visual
7:44 am - 7:54 am	Eastern Phoebe	*Sayornis phoebe*		S			1	calling
	Rose-breasted Grosbeak	*Pheucticus ludovicianus*		S			1	calling
	Hermit Thrush	*Catharus guttatus*		S			1	calling
	Song Sparrow	*Melospiza melodia*		S			1	calling
	Yellow Warbler	*Setophaga petechai*		S			1	calling
	Northern Cardinal	*Cardinalis cardinalis*		S			2	calling
	Least Flycatcher	*Empidonax minimus*		S			1	calling
	Red-eyed Vireo	*Vireo olivaceus*		S			1	calling
	European Starling	*Sturnus vulgaris*			P		5	visual
Station 3	Chipping Sparrow	*Spizella passerina*		S			1	calling
June 14, 2019	Common Grackle	*Quiscalus quiscula*			P		3	calling
8:00 am - 8:10 am	Northern Cardinal	*Cardinalis cardinalis*		S			1	calling
	American Robin	*Turdus migratorius*			A		2	alarm call, male
	Downy Woodpecker	*Picoides pubescens*		S			1	calling
	Eastern Phoebe	*Sayornis phoebe*		S			1	calling
	European Starling	*Sturnus vulgaris*			P		4	male and female foraging
	Red-winged Blackbird	*Agelaius phoeniceus*		H			1	female
	Blue-gray Gnatcatcher	*Polioptila caerulea*		H			1	calling
	Eastern Wood-pewee	*Contopus virens*		S			1	calling
	Baltimore Oriole	*Icterus galbula*		S			1	calling
	Rose-breasted Grosbeak	*Pheucticus ludovicianus*		S			1	calling

Station	Common Name	Scientific Name	OB	PO	PB	CONF	#	Notes
	Golden-crowned Kinglet	*Regulus satrapa*		S			1	calling
	Nashville Warbler	*Oreothlypis ruficapilla*		S			1	calling
	Gnatcatchers	*Polioptilidae*		S			1	calling
	Hawks, Kites,Eagles & Allies	*Accipiter sp.*		S			1	calling
Station 4	American Robin	*Turdus migratorius*			A		6	agitated
June 14, 2019	Baltimore Oriole	*Icterus galbula*			P		1	calling, male and female together
8:15 am - 8:25 am	Downy Woodpecker	*Picoides pubescens*		H				hammering
	Song Sparrow	*Melospiza melodia*					1	calling
	Common Grackle	*Quiscalus quiscula*			P		5	calling
	Red-winged Blackbird	*Agelaius phoeniceus*		S			1	calling
	American Redstart	*Setophaga ruticilla*		S			1	calling
	Barn Swallow	*Hirundo rustica*		H			3	flying
	Easter Wood-Pewee			S			1	calling
	Mallard	*Anas platyrhynchos*		S			1	calling
	Gray Catbird	*Dumetella carolinsis*			P		2	pair flying together
	Mourning Dove	*Zenaida macroura*			P		2	flying
	Tree Swallow	*Tachycineta bicolor*		H			2	flying
	Red-eyed Vireo	*Vireo olivaceus*		S			1	call
	American Goldfinch	*Spinus tritis*		S			1	pair, flying male and female
Station 5	American Robin	*Turdus migratorius*		S			2	call
June 14, 2019	Belted Kingfisher	*Megaceryle alcyon*		H			1	flying
8:35 am - 8:45 am	Red-winged Blackbird	*Agelaius phoeniceus*		S			1	calling
	House Wren	*Troglodytes aedon*		S			1	calling
	Hermit Thrush	*Catharus guttatus*		S			1	calling
	Canada Goose	*Branta canadensis*		H			1	swimming
	Song Sparrow	*Melospiza melodia*		S			2	calling
	Blue Jay	*Cyanpcitta cristata*		S			1	calling
	Tree Swallow	*Tachycineta bicolor*		S			1	calling
	Common Grackle	*Quiscalus quiscula*		S			1	calling
	Baltimore Oriole	*Icterus galbula*		S			1	calling
	Ovenbird	*Seiurus aurocapilla*		S			1	calling in distance
	Tree Swallow	*Tachycineta bicolor*		H			3	flying
	Brown-headed Cowbird	*Molothrus ater*		S			1	calling

Brantford Colborne 1824 -Breeding Bird Survey #2

Station	Common Name	Scientific Name	OB	PO	PB	CONF	#	Notes
Station 1	Carolina Wren	*Thyrothorus ludovicianus*		S			1	calling
July 4, 2019	White-breasted Nuthatch	*Sitta carolinensis*		S			1	calling
8:00 am - 8:10 am	American Goldfinch	*Spinus tritis*		S			3	calling
	Black-capped Chickadee	*Poecile atricapillus*		S			2	calling
	Downy Woodpecker	*Picoides pubescens*		S			1	visual, flying, calling , male
	Blue Jay	*Cyanpcitta cristata*		S			1	visual, calling
	Baltimore Oriole	*Icterus galbula*		S			1	calling
	Tufted Titmouse	*Baeolophus bicolor*		S			1	calling
	Gray Catbird	*Dumetella carolinsis*		S			2	calling
	House Finch	*Haemorhous mexicanus*		S			1	calling
	American Robin	*Turdus migratorius*		S			1	calling
Station 2	Downy Woodpecker	*Picoides pubescens*		H			2	flying around
July 4, 2019	American Robin	*Turdus migratorius*		H			4	calling, visual, male
8:15 am - 8:25 am	Dark-eyed Junco	*Junco hyemalis*		S			2	calling
	Baltimore Oriole	*Icterus galbula*		S			1	calling
	Eastern Wood-pewee	*Contopus virens*		S			1	calling
	Blue Jay	*Cyanpcitta cristata*		S			1	calling
	Indigo Bunting	*Passerina cyanea*		S			1	calling
	Gray Catbird	*Dumetella carolinsis*		S			1	visual, male, calling
	Black-capped Chickadee	*Poecile atricapillus*		S			2	calling
	Brown-headed Cowbird	*Molothrus ater*		S			1	calling
	Common Grackle	*Quiscalus quiscula*		S			4	calling, visual
	Song Sparrow	*Melospiza melodia*		S			2	calling
	Ruby-crowned Kinglet	*Regulus calendula*		S			1	calling
	House Wren	*Troglodytes aedon*		S			1	calling
	Northern Cardinal	*Cardinalis cardinalis*		S			1	calling
	European Starling	*Sturnus vulgaris*		H			1	visual
Station 3	Song Sparrow	*Melospiza melodia*		S			2	calling
July 4, 2019	Carolina Wren	*Thyrothorus ludovicianus*		S			1	calling
8:30 am - 8:40 am	House Wren	*Troglodytes aedon*		S			1	calling
	Downy Woodpecker	*Picoides pubescens*		S			1	calling
	American Robin	*Turdus migratorius*				NY	2	calling, agitated nest
	Red-winged Blackbird	*Agelaius phoeniceus*		S			1	calling

Station	Common Name	Scientific Name	OB	PO	PB	CONF	#	Notes
	Blue Jay	*Cyanpcitta cristata*			A		3	calling, agitated
	Northern Cardinal	*Cardinalis cardinalis*		S			1	visual, male
	Common Grackle	*Quiscalus quiscula*		H			3	visual
	Song Sparrow	*Melospiza melodia*		S			1	calling
	Northern Flicker	*Colaptes auratus*		S			1	calling
	Tufted Titmouse	*Baeolophus bicolor*		S			1	calling
	Baltimore Oriole	*Icterus galbula*		S			1	calling
	Red-eyed Vireo	*Vireo olivaceus*		S			1	calling
	Red-winged Blackbird	*Agelaius phoeniceus*		S			1	calling
	Spotted Sandpiper	*Actitis macularius*		H			1	visual, on shore
	House Finch	*Haemorhous mexicanus*		S			1	calling
	European Starling	*Sturnus vulgaris*		H			4	visual
	Indigo Bunting	*Passerina cyanea*		S			1	calling
	Rose-breasted Grosbeak	*Pheucticus ludovicianus*		S			1	call
	Least Flycatcher	*Empidonax minimus*		S			1	calling
	Chipping Sparrow	*Spizella passerina*		S			1	calling
	Dark-eyed Junco	*Junco hyemalis*		S			2	calling
	Ruby-crowned Kinglet	*Regulus calendula*		S			1	calling
	Yellow Warbler	*Setophaga petechai*		S			4	calling
Station 4	Song Sparrow	*Melospiza melodia*		S			3	calling
July 4, 2019	Black-capped Chickadee	*Poecile atricapillus*		S			3	calling
8:45 am - 8:55 am	Blue Jay	*Cyanpcitta cristata*		S			3	calling
	Common Grackle	*Quiscalus quiscula*			P		4	calling
	American Goldfinch	*Spinus tritis*			P		5	calling
	Yellow Warbler	*Setophaga petechai*		S			1	calling
	Baltimore Oriole	*Icterus galbula*		S			1	calling
	Cedar Waxwing	*Bombycilla cedrorum*		S			2	calling
	Nashville Warbler	*Oreothlypis ruficapilla*		S			4	calling
	Dark-eyed Junco	*Junco hyemalis*		S			1	calling
	American Crow	*Corvus brachyrhynchos*		S			5	calling
	Red-winged Blackbird	*Agelaius phoeniceus*		S			1	calling
	Song Sparrow	*Melospiza melodia*		S			1	calling
	Belted Kingfisher	*Megaceryle alcyon*		S			1	visual
	American Robin	*Turdus migratorius*		H			1	visual
	Indigo Bunting	*Passerina cyanea*		S			1	calling
	House Finch	*Haemorhous mexicanus*		S			1	calling

Station	Common Name	Scientific Name	OB	PO	PB	CONF	#	Notes
	Warbling Vireo	*Vireo gilvus*		S			1	calling
	Chestnut-sided Warbler	*Setophaga pensylvanica*		S			1	calling
Station 5	Song Sparrow	*Melospiza melodia*		S			4	calling
July 4, 2019	Blue Jay	*Cyanpcitta cristata*			P		10	calling/playing
9:10 am - 9:20 am	Red-winged Blackbird	*Agelaius phoeniceus*			P		8	female, male
	Baltimore Oriole	*Icterus galbula*		S			1	calling
	Downy Woodpecker	*Picoides pubescens*			A		2	aggitated call
	Chipping Sparrow	*Spizella passerina*		S			1	calling
	White-breasted Nuthatch	*Sitta carolinensis*		S			1	calling
	American Robin	*Turdus migratorius*		H			1	male, visual
	Red-bellied Woodpecker	*Melanerpes carolinus*		S			1	calling
	American Crow	*Corvus brachyrhynchos*		S			1	calling
	Rose-breasted Grosbeak	*Pheucticus ludovicianus*		S			1	calling
	Chipping Sparrow	*Spizella passerina*		S			1	calling
	Golden-crowned Kinglet	*Regulus satrapa*		S			2	calling
	White-throated Sparrow	*Zonotrichia albicollis*		S			1	calling
	House Wren	*Troglodytes aedon*		S			1	calling
	Northern Cardinal	*Cardinalis cardinalis*		H			1	male, visual
	Eastern Wood-pewee	*Contopus virens*		S			1	calling
	Black-capped Chickadee	*Poecile atricapillus*		S			1	calling
	Blue-gray Gnatcatcher	*Polioptila caerulea*		S			1	calling
	White-breasted Nuthatch	*Sitta carolinensis*		S			1	calling
	Great Crested Flycatcher	*Myiarchus crinitus*		S			1	calling

Attachment G

Bird Species

Common Name	Scientific Name	SRANK	MNRF	COSEWIC	SARA	OBBA	Locally Significant	NHIC	Ebird	ERI Observations
Hawks, Kites,Eagles & Allies	***Accipitridae***									
Cooper's Hawk	*Accipiter cooperii*	S4	NAR	NAR		CONF			x	
Red-tailed Hawk	*Buteo jamaicensis*	S5		NAR		CONF			x	x
Bald Eagle	*Haliaeetus leucocephalus*	S2N/S4B		NAR					x	
Larks	***Alaudidae***									
Horned Lark	*Eremophila alpestris*	S5B				PROB			x	x
Kingfishers	***Alcedinidae***									
Belted Kingfisher	*Megaceryle alcyon*	S4B/S5B				CONF			x	x
Swifts	***Apodidae***									
Chimney Swift	*Chaetura pelagica*	S4B/S4N	THR	THR	Schedule 1	CONF			x	
Ducks, Geese & Swans	***Anatidae***									
Mallard	*Anas platyrhynchos*	S5				CONF			x	x
American Black Duck	*Anas rubripes*	S4							x	
Canada Goose	*Branta canadensis*	S5				CONF			x	x
Cackling Goose	*Branta hutchiinsii*	S4M							x	
Common Merganser	*Bucephala clangula*	S5B/S5N				CONF			x	
Hooded Merganser	*Lophodytes cucullatus*	S5B, S5N							x	
Common Merganser	*Mergus merganser*	S5B,S5N							x	
Herons and Bitterns	***Ardeidae***									
Great Blue Heron	*Ardea herodias*	S4				CONF			x	x
Waxwings	***Bombycillidae***									
Cedar Waxwing	*Bombycilla cedrorum*	S5B				CONF			x	x
Cardinals, Grosbeaks & Allies	***Cardinalidae***									
Northern Cardinal	*Cardinalis cardinalis*	S5				CONF			x	x
Indigo Bunting	*Passerina cyanea*	S4B				CONF			x	x
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	S4B				CONF			x	x
Vultures	***Cathartidae***									
Turkey Vulture	*Cathartes aura*	S5B				CONF			x	x

Common Name	Scientific Name	SRANK	MNRF	COSEWIC	SARA	OBBA	Locally Significant	NHIC	Ebird	ERI Observations
Creepers	***Certhiiddae***									
Brown Creeper	*Certhia americana*	S5B							x	
Plovers	***Charadriidae***									
Killdeer	*Charadrius vociferus*	S5B/S5N				CONF			x	
Pigeons & Doves	***Columbidae***									
Rock Pigeon	*Columba livia*	SNA				CONF			x	
Mourning Dove	*Zenaida macroura*	S5				CONF			x	x
Crows & Jays	***Corvidae***									
American Crow	*Corvus brachyrhynchos*	S5B/S4N				CONF			x	x
Common Raven	*Corvus corax*	S5							x	
Blue Jay	*Cyanpcitta cristata*	S5				CONF			x	x
New World Sparrows & Allies	***Emberizidae***									
Dark-eyed Junco	*Junco hyemalis*	S5B							x	x
Song Sparrow	*Melospiza melodia*	S5B/S4N				CONF			x	x
House Sparrow	*Passer domesticus*	SNA								x
Eastern Towhee	*Pipilo erythrophthalmus*	S4B				POSS			x	x
American Tree Sparrow	*Spizella arborea*	S4B							x	
Chipping Sparrow	*Spizella passerina*	S5B/S4N				CONF			x	x
Tree Swallow	*Tachycineta bicolor*	S4B				CONF			x	x
White-throated Sparrow	*Zonotrichia albicollis*	S5B							x	x
White-crowned Sparrow	*Zonotrichia leucophrys*	S4B							x	
Carcaras & Falcons	***Falconidae***									
Peregrine Falcon	*Falco peregrinus*	S3B		SC					x	
Finches & Allies	***Fringillidae***									
House Finch	*Haemorhous mexicanus*	SNA				CONF			x	x
American Goldfinch	*Spinus tritis*	S5B/S4N				CONF			x	x
Swallows	***Hirundinidae***									
Barn Swallow	*Hirundo rustica*	S4B	THR	THR	No Schedule	CONF			x	x
Bank Swallow	*Riparia riparia*	S4B	THR	THR		CONF			x	
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	S4B				CONF			x	

Common Name	Scientific Name	SRANK	MNRF	COSEWIC	SARA	OBBA	Locally Significant	NHIC	Ebird	ERI Observations
New World Blackbird	***Icteridae***									
Red-winged Blackbird	*Agelaius phoeniceus*	S4/S5				CONF			x	x
Rusty Blackbird	*Euphagus carolinus*	S4B	NAR	SC	Schedule 1				x	
Baltimore Oriole	*Icterus galbula*	S4B				CONF			x	x
Brown-headed Cowbird	*Molothrus ater*	S4B				CONF			x	x
Common Grackle	*Quiscalus quiscula*	S5B/S4N				CONF			x	x
Gulls, Terns & Skimmers	***Laridae***									
Herring Gull	*Larus argentatus*	S5B,S5N							x	
Ring-billed Gull	*Larus delawarensis*	S5B/S4N							x	x
Great Black-backed Gull	*Larus marinus*	S2B							x	
Mockingbirds, Thrashers & Allies	***Mimidae***									
Gray Catbird	*Dumetella carolinsis*	S4B				CONF			x	x
Brown Thrasher	*Toxostoma rufum*	S4B				CONF			x	
Chickadees and Titmice	***Paridae***									
Black-capped Chickadee	*Poecile atricapillus*	S5				CONF			x	x
Tufted Titmouse	*Baeolophus bicolor*	S4							x	x
Wood Warblers	***Parulidae***									
Wilson's Warbler	*Cardellina pusilla*	S4B							x	
Northern Flicker	*Colaptes auratus*	S4B							x	x
Mourning Warbler	*Geothlypis philadelphia*	S4B							x	
Common Yellowthroat	*Geothylupis trichas*	S5B				PROB				x
Black-and-white Warbler	*Mniotilta varia*	S5B							x	
Nashville Warbler	*Oreothlypis ruficapilla*	S5B							x	x
Ovenbird	*Seiurus aurocapilla*	S4B								x
Bay-breasted Warbler	*Setophaga castanea*	S5B							x	
Yellow Rumped Warbler	*Setophaga coronata*	S5B							x	
Blackburnian Warbler	*Setophaga fusca*	S5B							x	
Chestnut-sided warbler	*Setophaga pensylvanica*	S5B								x
Yellow Warbler	*Setophaga petechai*	S5B				CONF			x	x
Pine Warbler	*Setophaga pinus*	S5B							x	
American Redstart	*Setophaga ruticilla*	S5B				PROB			x	x
Blackpoll Warbler	*Setophaga striata*	S4B							x	
Sparrows	***Passeridae***									
House Sparrow	*Passer domesticus*	SNA				CONF			x	

Common Name	Scientific Name	SRANK	MNRF	COSEWIC	SARA	OBBA	Locally Significant	NHIC	Ebird	ERI Observations
Cormorants	***Phalacrocoracidae***									
Double-crested Cormorant	*Phalacrocorax auritus*	S5B		NAR					x	
Patridges, Grouse, Turkeys	***Phasianidae***									
Wild Turkey	*Meleagris gallopavo*	S5				CONF			x	
Woodpeckers	***Picidae***									
Hairy Woodpecker	*Leuconotopicus villosus*	S5							x	
Red-bellied Woodpecker	*Melanerpes carolinus*	S4				CONF			x	
Downy Woodpecker	*Picoides pubescens*	S5				CONF			x	x
Yellow-bellied Sapsucker	*Sphyrapicus varius*	S5B							x	
Gnatcatchers	***Polioptilidae***									
Blue-gray Gnatcatcher	*Polioptila caerulea*	S4B				POSS			x	x
Railes, Gallinules & Coots	***Rallidae***									
American Coot	*Fulica americana*	S4B	NAR	NAR					x	
Kinglets	***Regulidae***									
Ruby-crowned Kinglet	*Regulus calendula*	S4B							x	x
Golden-crowned Kinglet	*Regulus satrapa*	S5B							x	x
Sandpipers, Phalaropes &Allies	***Scolopacidae***									
Spotted Sandpiper	*Actitis macularius*	S5				CONF			x	x
Nutchatches	***Sittidae***									
Red-breasted Nuthatch	*Sitta canadensis*	S5							x	
White-breasted Nuthatch	*Sitta carolinensis*	S5				CONF			x	x
Typical Owls	***Strigidae***									
Screech Owl	*Megascops asio*	S4	NAR	NAR		CONF			x	
Starlings	***Sturnidae***									
European Starling	*Sturnus vulgaris*	SNA				CONF			x	x
Wrens	***Troglodytidae***									
Carolina Wren	*Thyrothorus ludovicianus*	S4				PROB			x	x
House Wren	*Troglodytes aedon*	S5B				CONF			x	x

Common Name	Scientific Name	SRANK	MNRF	COSEWIC	SARA	OBBA	Locally Significant	NHIC	Ebird	ERI Observations
Winter Wren	*Troglodytes hiemalis*	S5B							x	
Thrushes	***Turdidae***									
Veery	*Catharus fuscescens*	S4B								x
Hermit Thrush	*Catharus guttatus*	S5B							x	x
American Robin	*Turdus migratorius*	S5B				CONF			x	x
Tyrant Flycatchers	***Tyrannidae***									
Eastern Wood-pewee	*Contopus virens*	S4B	SC	SC	No Schedule	PROB			x	x
Least Flycatcher	*Empidonax minimus*	S4B				CONF			x	x
Great Crested Flycatcher	*Myiarchus crinitus*	S4B				CONF			x	x
Eastern Phoebe	*Sayornis phoebe*	S5B/S4N				CONF			x	x
Eastern Kingbird	*Tyrannus tyrannus*	S4B				CONF			x	
Vireos	***Vireonidae***									
Warbling Vireo	*Vireo gilvus*	S5B				CONF			x	x
Red-eyed Vireo	*Vireo olivaceus*	S5B				CONF			x	x
Blue-headed Vireo	*Vireo solitarius*	S5B							x	x
							0	**0**	**93**	**58**

Attachment H

Butterfly Species

COMMON NAME	SCIENTIFIC NAME	SRANK	MNRF	COSEWIC	SARA	NHIC	TEA ATLAS	ERI OBSERVATIONS
Celastrina sp.	*Azure sp.*	-					x	
Satyrium calanus	*Banded Hairstreak*	S4					x	
Papilio polyxenes	*Black Swallowtail*	S5					x	
Poanes viator	*Broad-winged Skipper*	S4					x	
Pieris rapae	*Cabbage White*	SNA					x	
Colias philodice	*Clouded Sulphur*	S5					x	
Junonia coenia	*Common Buckeye*	SNA					x	
Pyrgus communis	*Common Checkered Skipper*	SNA					x	
Coenonympha tullia	*Common Ringlet*	S5					x	
Pholisora catullus	*Common Sootywing*	S4					x	
Polites origenes	*Crossline Skipper*	S4					x	
Papilio cresphontes	*Eastern Giant Swallowtail*	S5					x	
Cupido comyntas	*Eastern Tailed Blue*	S5					x	
Papilio glaucus	*Eastern Tiger Swallowtail*	S5					x	
Thymelicus lineola	*European Skipper*	SNA					x	
Pyrgus communis	*Fiery Skipper*	SNA					x	
Feniseca tarquinius	*Harvester*	S4					x	
Satyrium caryaevorus	*Hickory Hairstreak*	S4					x	
Erynnis juvenalis	*Juvenal's Duskywing*	S5					x	
Ancyloxypha numitor	*Least Skipper*	S5					x	
Megisto cymela	*Little Wood-Satyr*	S5					x	
Danaus plexippus	*Monarch*	S2N,S4B	SC	END	SC		x	
Nymphalis antiopa	*Mourning Cloak*	S5					x	
Wallengrenia egeremet	*Northern Broken-Dash*	S5					x	
Phyciodes cocyta	*Northern Crescent*	S5					x	
Colias eurytheme	*Orange Sulphur*	S5					x	
Vanessa cardui	*Painted Lady*	S5					x	
Phyciodes tharos	*Pearl Crescent*	S4					x	
Polites peckius	*Peck's Skipper*	S5					x	
Polygonia interrogationis	*Question Mark*	S5					x	
Vanessa atalanta	*Red Admiral*	S5					x	
Limenitis arthemis astyanax	*Red-spotted Purple*	S5					x	
Epargyreus clarus	*Silver-spotted Skipper*	S4					x	
Polites themistocles	*Tawny-edged Skipper*	S5					x	
Euphyes bimacula	*Two-spotted Skipper*	S4					x	
Euptoieta claudia	*Variegated Fritillary*	SNA					x	
Limenitis archippus	*Viceroy*	S5					x	
Erynnis baptisiae	*Wild Indigo Duskywing*	S4					x	
					Total	**0**	**38**	**0**

	Legend
COSEWIC	***SRANK***
NAR Not at Risk	*S1 Critically Imperiled*
SC Special Concern	*S2 Imperiled*
T Threatened	*S3 Vulnerable*
E Endangered	*S4 Apparently Secure*
XT Extirpated	*S5 Secure*
DD Data Deficient	*SU Unrankable*
	SNA Unranked
	SX Presumed Extirpated
	SH Possibly Extirpated
	S#? Rank Uncertain
SARA Schedule	*COSSARO*
Schedule 1 Officially protected under SARA	*NAR Not at Risk*
Schedule 2 Threatened/Endangered; may be reassessed for consideration for inclusion to Schedule 1	*SC Special Concern*
Schedule 3 Special concern; may be reassessed for consideration for inclusion to Schedule 1	*THR Threatened*
	END Endangered
	EXP Extirpated
	DD Data Deficient

Attachment I

Mammal Species

Common Name	Scientific Name	SRANK	MNRF	COSEWIC	SARA	Locally Significant	NHIC	ESR Report	Mammals of Brantford	ERI Observations
Deer and Bison	**Artiodactyla**									
White-tailed Deer	*Odocoileus virginianus*	S5							x	
Carnivores	**Carnivora**									
Coyote	*Canis latrans*	S5							x	
Striped Skunk	*Mephitis mephitis*	S5							x	
American Mink	*Mustela vison*	S4							x	
Northern Raccoon	*Procyon lotor*	S5							x	
Mountain Lion or Cougar	*Puma concolor*	SU							x	
American Badger	*Taxidea taxus*	S2		END, SC					x	
Red Fox	*Vulpes vulpes*	S5							x	
Bats	**Chiroptera**									
Big Brown Bat	*Eptesicus fuscus*	S4							x	
Little Brown Myotis	*Myotis lucifugus*	S4	END	END	Schedule 1				x	
Northern Myotis	*Myotis septentrionalis*	S3	END	END	Schedule 1				x	
Oppossums	**Didelphimorphia**									
Virginia Opossum	*Didelphis virginiana*	S4							x	
Shrews and Moles	**Insectivora**									
Northern Short-tailed Shrew	*Blarina brevicausa*	S5							x	
Star-nosed Mole	*Condylura cristata*	S5							x	
Rabbits and Hares	**Lagomorphia**									
European Hare	*Lepus europaeus*	SNA							x	
Eastern Cottontail	*Sylvilagus floridanus*	S5							x	x
Rodents	**Rodentia**									
Beaver	*Castor canadensis*	S5							x	x
Woodchuck	*Marmota monax*	S5							x	
Meadow Vole	*Microtus pennsylvanicus*	S5							x	
House Mouse	*Mus musculus*	SNA							x	
Muskrat	*Ondatra zibethicus*	S5							x	x
White-footed Mouse	*Peromyscus leucopus*	S5							x	
Deer Mouse	*Peromyscus maniculatus*	S5						x	x	
Norway Rat	*Rattus norvegicus*	SNA							x	
Eastern Grey Squirrel	*Sciurus carolinensis*	S5							x	x
Eastern Chipmunk	*Tamias striatus*	S5							x	x
Red Squirrel	*Tamiasciurus hudsonicus*	S5							x	x
					Total	**0**	**0**	**1**	**27**	**6**

Attachment J

Molluscs Species

Common Name	Scientific Name	SRANK	COSEWIC	SARA	SARO_STATUS	NHIC	MNRF Report	GRCA Record
Mucket	*Actinonaias ligamentina*	S3					x	
Elktoe	*Alasmidonta marginata*	S3					x	
Wabash Pigtoe	*Fusconaia flava*	S2S3						
Wavy-rayed Lampmussel	*Lampsilis fasciola*	S1	SC	SC	THR			x
Black Sandshell	*Ligumia recta*	S3					x	
Round Pigtoe	*Pleurobema sintoxia*	S1	END	END	END		x	x
						Total	4	2

Attachment K

Photo Log

 Photo of private property bank treatment along the Grand River	 Photo looking east along the Grand River
 Photo looking west along the Grand River	 Photos of typical bank along the Grand River
 Photo of organic shallow marsh habitat	 Organic shallow marsh habitat with duckweed covering water surface.

Shallow portion of the Grand River

View downstream of the Grand River during aquatic assessment.

View of the Grand River


View of the open habitat along the Grand Rivers banks

View of mineral cultural thicket influenced by disturbance


Old building foundation remnants in the mineral cultural thicket.

Successional thicket habitat at top of slope


Old building foundation remnants overlooking deciduous forest (FOD7-4)

Mineral cultural meadow along Colborne Street


Mineral cultural meadow along Colborne Street


View from top of slope looking towards deciduous forest


Walking pathway along the former railway

 View of understorey of deciduous forest	 Dense undergrowth in deciduous forest
 View near grand river on lower slope of the study area	 Informal walking trail in deciduous forest
 Dense forest understory in deciduous forest	 Dense forest understory in deciduous forest

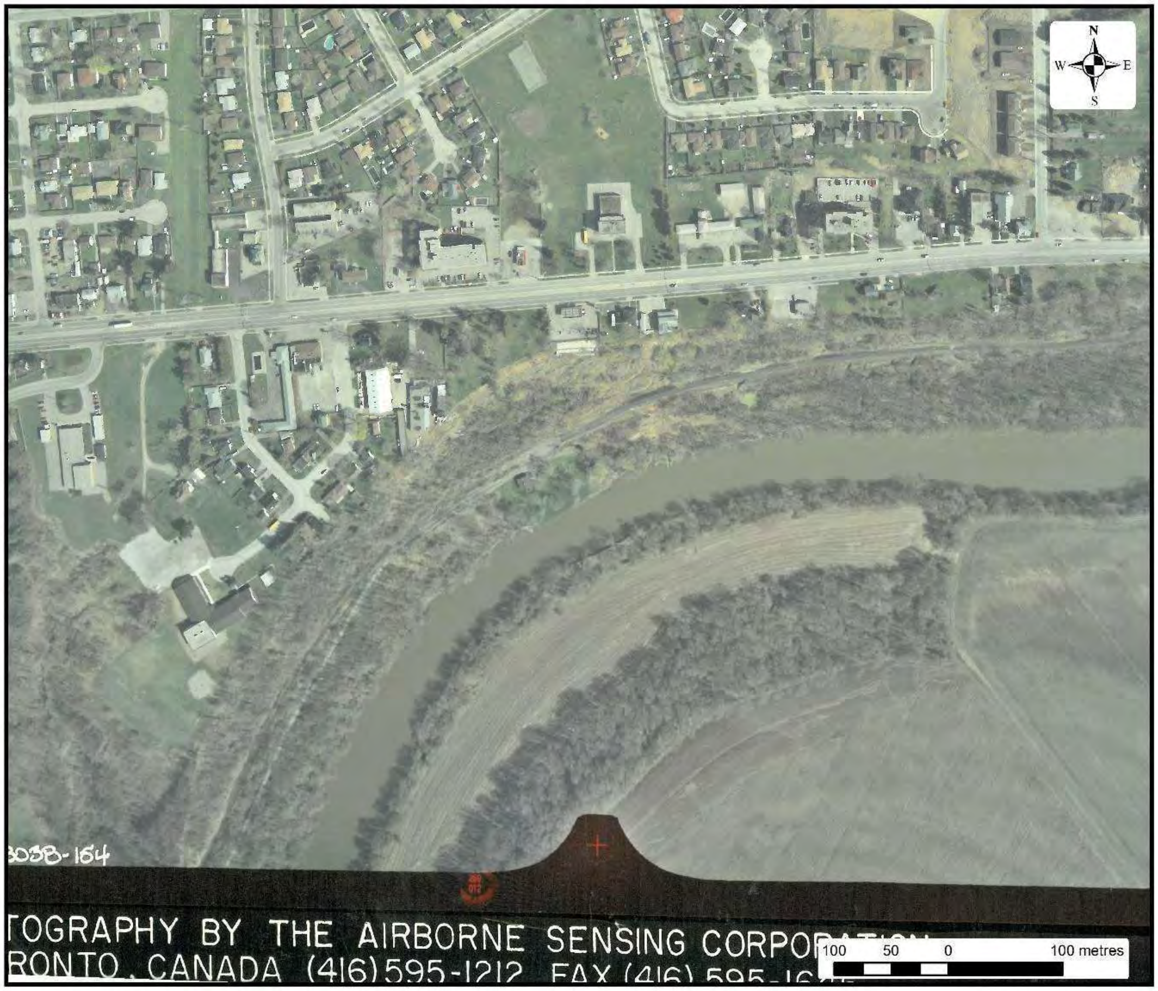
 Walking trail	 Walking trail and private property driveway
 View of private property from walking trail	 Bridge at east extent of study area

Appendix C

Historic Aerial Imagery

1965 Aerial Image (City of Brantford)

1986 Aerial Image (City of Brantford)



1993 Aerial Image (City of Brantford)

2006 Aerial Image (SWOOP)

2006 Aerial Image (SWOOP)

Appendix D

ARA Cultural Heritage and Archaeology Report

ARCHAEOLOGY | HERITAGE | OUTREACH | EDUCATION

Stage 1 Archaeological Assessment
Colborne Street Slope Stabilization Project
City of Brantford
Parts of Lot 26, Eagle's Nest Tract and
Grand River Navigation Company, Eagle's Nest Tract
Geographic Township of Brantford
Brant County, Ontario

Prepared for
Ecosystem Recovery Inc.,
80 Courtland Ave. East, Unit 2
Kitchener, ON N2G 2T8
Tel: (519) 621-1500

Licensed under
D.H. Knight
MTCS Licence #P089
PIF #P089-0115-2018
ARA File #2018-0170

10/09/2019

Original Report

EXECUTIVE SUMMARY

Under a contract awarded in July 2018, Archaeological Research Associates Ltd. carried out a Stage 1 assessment of lands with the potential to be impacted by the proposed Colborne Street Slope Stabilization project in the City of Brantford, Ontario. The Colborne Street Landslide Area, situated between Colborne Street and the north bank of the Grand River, and between Calvin Street in the west and Johnson Road in the east, has been subject to various studies and monitoring efforts since a major landslide in 1986. The objectives of the slope stabilization project are to conduct a comprehensive assessment of site processes and conditions, to identify the associated hazard areas and elements (e.g., homes, road) at risk, to assess risk for future failure, and to identify remedial measures/alternatives to mitigate the risk for the purpose of projective public heath and safety. The project is being carried out as a Schedule 'C' Municipal Class Environmental Assessment. The majority of the study area is identified as having archaeological potential in the *City of Brantford Waterfront Master Plan* (TPP 2010). This report documents the background research and potential modelling involved in the assessment, and presents conclusions and recommendations pertaining to archaeological concerns within the project lands.

The Stage 1 assessment was conducted in November 2018 under Project Information Form #P089-0115-2018. The investigation encompassed the entirety of the slope monitoring area, comprising slope zones A, B1–B3, C1–C2 and D. All field observations were made from accessible public areas; accordingly, no permissions were required for property access. At the time of assessment, the study area comprised various city-owned and private properties fronting Colborne Street and Calvin Street, part of the Hamilton-Brantford Rail Trail (former Toronto, Hamilton & Buffalo Railway) and treed areas along the north bank of the Grand River.

The Stage 1 assessment determined that the study area comprised a mixture of areas of archaeological potential and areas of no archaeological potential. Although some of the areas of archaeological potential were likely impacted by past construction activities, the integrity of the soils and the depth of any past disturbances must be empirically evaluated. Archaeological Research Associates Ltd. recommends that all identified areas of archaeological potential that could be impacted by the project be subject to a Stage 2 property assessment in accordance with Section 2.1 of the *Standards and Guidelines for Consultant Archaeologists* (MTC 2011:28–39). It is understood that a preferred solution has not yet been identified, and that the extent of any project impacts remains undetermined.

The identified areas of no archaeological potential do not require additional assessment. Given that there are outstanding archaeological concerns within the subject lands, no ground alterations or development of any kind may occur until the Stage 2 assessment is complete, a recommendation that the lands require no further archaeological assessment is made, and the associated report is entered into the Ontario Public Register of Archaeological Reports.

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GLOSSARY OF ABBREVIATIONS

ARA – Archaeological Research Associates Ltd.
EA – Environmental Assessment
MTCS – Ministry of Tourism, Culture and Sport
PIF – Project Information Form
PIN – Property Index Number
PTP – Positive Test Pit
S&Gs – Standards and Guidelines for Consultant Archaeologists

PERSONNEL

Project Director: P.J. Racher (#P007)
Licence Holder: D. Knight (#P089)
Project Manager: S. Bolstridge (#R471)
Field Director: S. Clarke (#R446)
Cartographers: A. Bailey (#R1069), K. Brightwell (#R341)
Researcher: S. Clarke (#R446)
Report Writer: R. Stark
Editor: C.J. Gohm

1.0 PROJECT CONTEXT

1.1 Development Context

Under a contract awarded in July 2018, ARA carried out a Stage 1 assessment of lands with the potential to be impacted by a proposed Colborne Street Slope Stabilization project in the City of Brantford, Ontario. The Colborne Street Landslide Area, situated between Colborne Street and the north bank of the Grand River, and between Calvin Street in the west and Johnson Road in the east, has been subject to various studies and monitoring efforts since a major landslide in 1986. The objectives of the slope stabilization project are to conduct a comprehensive assessment of site processes and conditions, to identify the associated hazard areas and elements (e.g., homes, road) at risk, to assess risk for future failure, and to identify remedial measures/alternatives to mitigate the risk for the purpose of projective public heath and safety. The project is being carried out as a Schedule 'C' Municipal Class EA. The majority of the study area is identified as having archaeological potential in the *City of Brantford Waterfront Master Plan* (TPP 2016). This report documents the background research and potential modelling involved in the assessment, and presents conclusions and recommendations pertaining to archaeological concerns within the project lands.

The subject study area consists of a roughly rectangular parcel of land with a total area of 17.5 ha (Map 1). This parcel is generally bounded by Colborne Street to the north, Johnson Road to the east, the Grand River along the south and the terminus of Calvin Street in the west. In legal terms, the study area falls on part of Lot 26, Eagle's Nest Tract and part of Grand River Navigation Company, Eagle's Nest Tract in the Geographic Township of Brantford, Brant County.

The Stage 1 assessment was conducted in November 2018 under PIF #P089-0115-2018. The investigation encompassed the entirety of the slope monitoring area, comprising slope zones A, B1–B3, C1–C2 and D. All field observations were made from accessible public areas; accordingly, no permissions were required for property access. In compliance with the objectives set out in Section 1.0 of the *S&Gs* (MTC 2011:13–23), this investigation was carried out in order to:

- Provide information concerning the geography, history and current land condition of the study area;
- Determine the presence of known archaeological sites in the study area;
- Present strategies to mitigate project impacts to such sites, if they are located;
- Evaluate in detail the archaeological potential of the study area; and
- Recommend appropriate strategies for Stage 2 archaeological assessment, if some or all of the study area has archaeological potential.

The MTCS is asked to review the results and recommendations presented in this report and express their satisfaction with the fieldwork and reporting through a *Letter of Review and Entry into the Ontario Public Register of Archaeological Reports*.

1.2 Historical Context

After a century of archaeological work in southern Ontario, scholarly understanding of the historic usage of the area has become very well-developed. With occupation beginning in the Palaeo-Indian period approximately 11,000 years ago, the greater vicinity of the study area comprises a complex chronology of Indigenous and Euro-Canadian histories. Section 1.2.1 summarizes the region's settlement history, whereas Section 1.2.2 documents the study area's past and present land uses. Multiple previous archaeological reports containing relevant background information were obtained during the research component of the study. These reports are summarized in Section 1.3.3, and the references (including title, author and PIF number) appear in Section 7.0.

1.2.1 Settlement History

1.2.1.1 Pre-Contact

The Pre-Contact history of the region is lengthy and rich, and a variety of Indigenous groups inhabited the landscape. Archaeologists generally divide this vibrant history into three main periods: Palaeo-Indian, Archaic and Woodland. Each of these periods comprise a range of discrete sub-periods characterized by identifiable trends in material culture and settlement patterns, which are used to interpret past lifeways. The principal characteristics of these sub-periods are summarized in Table 1.

Table 1: Pre-Contact Settlement History
(Wright 1972; Ellis and Ferris 1990; Warrick 2000; Munson and Jamieson 2013)

Sub-Period	Timeframe	Characteristics
Early Palaeo-Indian	9000–8400 BC	Gainey, Barnes and Crowfield traditions; Small bands; Mobile hunters and gatherers; Utilization of seasonal resources and large territories; Fluted projectiles
Late Palaeo-Indian	8400–7500 BC	Holcombe, Hi-Lo and Lanceolate biface traditions; Continuing mobility; Campsite/Way-Station sites; Smaller territories are utilized; Non-fluted projectiles
Early Archaic	7500–6000 BC	Side-notched, Corner-notched (Nettling, Thebes) and Bifurcate traditions; Growing diversity of stone tool types; Heavy woodworking tools appear (e.g., ground stone axes and chisels)
Middle Archaic	6000–2500 BC	Stemmed (Kirk, Stanly/Neville), Brewerton side- and corner-notched traditions; Reliance on local resources; Populations increasing; More ritual activities; Fully ground and polished tools; Net-sinkers common; Earliest copper tools
Late Archaic	2500–900 BC	Narrow Point (Lamoka), Broad Point (Genesee) and Small Point (Crawford Knoll) traditions; Less mobility; Use of fish-weirs; True cemeteries appear; Stone pipes emerge; Long-distance trade (marine shells and galena)
Early Woodland	900–400 BC	Meadowood tradition; Crude cord-roughened ceramics emerge; Meadowood cache blades and side-notched points; Bands of up to 35 people
Middle Woodland	400 BC–AD 600	Saugeen tradition; Stamped ceramics appear; Saugeen projectile points; Cobble spall scrapers; Seasonal settlements and resource utilization; Post holes, hearths, middens, cemeteries and rectangular structures identified
Middle/Late Woodland Transition	AD 600–900	Princess Point tradition; Cord roughening, impressed lines and punctate designs on pottery; Adoption of maize horticulture at the western end of Lake Ontario; Oval houses and 'incipient' longhouses; First palisades; Villages with 75 people
Late Woodland (Early Iroquoian)	AD 900–1300	Glen Meyer tradition; Settled village-life based on agriculture; Small villages (0.4 ha) with 75–200 people and 4–5 longhouses; Semi-permanent settlements
Late Woodland (Middle Iroquoian)	AD 1300–1400	Uren and Middleport traditions; Classic longhouses emerge; Larger villages (1.2 ha) with up to 600 people; More permanent settlements (30 years)

Sub-Period	Timeframe	Characteristics
Late Woodland (Late Iroquoian)	AD 1400–1600	Pre-Contact Neutral tradition; Larger villages (1.7 ha); Examples up to 5 ha with 2,500 people; Extensive croplands; Also hamlets, cabins, camps and cemeteries; Potential tribal units; Fur trade begins ca. 1580; European trade goods appear

Although Iroquoian-speaking populations tended to leave a much more distinctive mark on the archaeological record and are therefore emphasized in the Late Woodland entries above, it must be understood that Algonquian-speaking populations were also present in southern Ontario. Archaeological evidence directly associated with the Anishinaabeg remains elusive, particularly when compared to sites associated with the more sedentary agriculturalists. Many artifact scatters in southern Ontario were likely camps, chipping stations or processing areas associated with the more mobile Anishinaabeg, utilized during their travels along the local drainage basins while making use of seasonal resources.

1.2.1.2 Post-Contact

The arrival of European explorers and traders at the beginning of the 17th century triggered widespread shifts in Indigenous lifeways and set the stage for the ensuing Euro-Canadian settlement process. Documentation for this period is abundant, ranging from the first sketches of Upper Canada and the written accounts of early explorers to detailed township maps and lengthy histories. The Post-Contact period can be effectively discussed in terms of major historical events, and the principal characteristics associated with these events are summarized in Table 2.

Table 2: Post-Contact Settlement History
(Smith 1846; Sutherland 1869; Coyne 1895; Lajeunesse 1960; Johnston 1964; Mika 1972; Ellis and Ferris 1990; Surtees 1994; AO 2015)

Historical Event	Timeframe	Characteristics
Early Exploration	Early 17th century	Brûlé explores southern Ontario in 1610; Champlain travels through in 1613 and 1615/1616, encountering a variety of Indigenous groups (including both Iroquoian-speakers and Algonquian-speakers); European goods begin to replace traditional tools
Increased Contact and Conflict	Mid- to late 17th century	Conflicts between various First Nations during the Beaver Wars result in numerous population shifts; European explorers continue to document the area, and many Indigenous groups trade directly with the French and English; ‘The Great Peace of Montreal’ treaty established between roughly 39 different First Nations and New France in 1701
Fur Trade Development	Early to mid-18th century	Growth and spread of the fur trade; Peace between the French and English with the Treaty of Utrecht in 1713; Ethnogenesis of the Métis; Hostilities between French and British lead to the Seven Years’ War in 1754; French surrender in 1760
British Control	Mid-18th century	*Royal Proclamation* of 1763 recognizes the title of the First Nations to the land; Numerous treaties arranged by the Crown; First acquisition is the Seneca surrender of the west side of the Niagara River in August 1764
Loyalist Influx	Late 18th century	United Empire Loyalist influx after the American Revolutionary War (1775–1783); British develop interior communication routes and acquire additional lands; ‘Between the Lakes Purchase’ orchestrated by Haldimand in 1784 to obtain lands for Six Nations (the Haldimand Tract); *Constitutional Act* of 1791 creates Upper and Lower Canada

Historical Event	Timeframe	Characteristics
County Development	Late 18th to early 19th century	Became part of York County's 'West Riding', Norfolk County and Lincoln County's 'First Riding' in 1792; Additional lands acquired in the second 'Between the Lakes Purchase' in 1792; Brant surrenders Blocks 1–6 of the Haldimand Tract to the Crown in 1798; Part of York County's 'West Riding', Oxford County and Haldimand County in 1798; Part of Halton County, Oxford County and Wentworth County in 1816; Brant County created after the abolition of the district system in 1849
Township Formation	Late 18th to early 19th century	Brant leased some of the Six Nation's holdings to European families in 1787; First settlers located along Fairchild Creek in the east, including I. Fairchild, J. Filer, I. Whiting and Major Westbrook; In 1810, only J. Stalts and E. Burrell lived in the area that would become the Town of Brantford; T. Perrin was the first pioneer in the western part of the township; Town plot for Brantford surrendered to the Crown in April 1830; Surveyed by L. Burwell in Summer 1830; Brant's leased lands resulted in a very irregular township layout
Township Development	Mid-19th to early 20th century	In 1841, the population of the Township of Brantford was 5,199; By 1846, a total of 23,486 ha had been taken up, with 17,107 ha under cultivation; Contained six grist mills and six saw mills at that time; Population reached 6,904 by 1861; Traversed by the Buffalo, Brantford & Goderich Railway (1854/1856), the Harrisburg & Brantford Railway (1871), the Brantford, Norfolk & Port Burwell Railway (1876), the Brantford, Waterloo & Lake Erie Railway (1889), the Toronto, Hamilton & Buffalo Railway (1895), the Brantford & Hamilton Electric Railway (1908) and the Lake Erie & Northern Railway (1916); Principal settlements at Mt. Pleasant, Mt. Vernon, Paris, Cainsville, Langford and Brantford

1.2.2 Past and Present Land Use

During Pre-Contact and Early Contact times, the vicinity of the study area would have comprised a mixture of coniferous trees, deciduous trees and open areas. Indigenous communities would have managed the landscape to some degree. Following the 'Between the Lakes Purchase' in 1784, Six Nations Loyalists settled along the Grand River. The greater vicinity of the study area comprised part of the Indigenous village known as Cayuga or Cayuga Heights, later renamed as Cainsville (Reville 1920:334). Euro-Canadian settlers also began to arrive ca. 1787, when Joseph Brant issued leases to a number of European families. With less than 2,000 Six Nations members living in the Haldimand Tract and the imminent death of the fur trade, Brant realized that he would need the assistance of European settlers to bring new technologies to his people and transform them into successful agriculturalists (Johnston 1964:xlii-xliii).

Indigenous title to the remainder of the Township of Brantford was gradually extinguished and Euro-Canadian settlers continued to clear the forests for agricultural and settlement purposes. The Hamilton Road (later Colborne Street) was opened in 1810, and it was rehabilitated as a corduroy road to facilitate the transportation of troops and supplies in 1812. Parts of this road would subsequently be either planked or gravelled (Mika 1972:xv). The town plot of Brantford was surrendered in April 1830, and that community developed into one of the most thriving commercial and manufacturing towns in the province. The Grand River Navigation Company was chartered in 1832, and the canal was laid out in 1840 to facilitate the shipping of produce and goods (Mika 1972:xii; Irwin & Burnham 1867:116). The 'Grand Canal Opening' occurred in November 1848, at which time the canal was fully navigable from Brantford to Dunnville (Lefler 2017).

Cainsville was established by the Grand River Navigation Company at the former site of Cayuga Heights in 1837. The village, named after leading citizen Peter Cain, prospered as a result of the canal—barges were towed by horses, the Messmore scows towed coal and plaster, and the Leonard Coal Wharf was located near the headgates of the canal. Industries such as cheese, potash, match and soap factories dotted the village (Lefler 2017). Cainsville was also an important post village on the Hamilton and Brantford stage road and a station of the Buffalo, Brantford & Goderich Railway (later Buffalo & Lake Huron Railway and then Grand Trunk Railway). By 1869, the village had a population of 150 and contained two churches (Wesleyan Methodist and Church of England), a school house, two hotels, two stores and a post office, three wagon shops, three blacksmith shops and a shoe shop (Sutherland 1869:134).

Below Cainsville along the banks of the Grand River was formerly a location of black settlement known as Bunnell's Landing, commemorated with a plaque once situated along the Toronto, Hamilton & Buffalo Railway north of Colborne Street (Meens 2004:D7). This plaque has been missing since at least 2016 (Mulkewich 2017). Early settler Joseph Thomas is said to have returned from a visit to the United States in 1809, bringing with him an enslaved husband and wife to his property on the north side of Colborne Street. The remains of these two unnamed individuals were encountered and exhumed during the construction of the Brantford & Hamilton Electric Railway (Reville 1920:258–259).

In order to gain a general understanding of the study area's past land uses, one patent plan, four historic settlement maps, one topographic map and two aerial images were examined during the research component of the study. Specifically, the following resources were consulted:

- The *Brantford Township* Patent Plan (No Date) (AO 2015);
- G.C. Tremaine's *Map of the County of Brant, Canada West* (1859) (OHCMP 2018);
- O. Robinson's *Plan of Part of the Township of Brantford* (1859) (Library and Archives Canada)
- *Brantford Township East of River* from Page & Smith's *Illustrated Historical Atlas of the County of Brant, Ont.* (1875) (McGill University 2001);
- The *Village of Cainsville* from Page & Smith's *Illustrated Historical Atlas of the County of Brant, Ont.* (1875) (Mika 1972);
- A topographic map from 1916 (OCUL 2018); and
- Aerial images from 1951 and 1954 (University of Toronto 2018)

The limits of the study area are shown on georeferenced versions of the consulted historical resources in Map 2–Map 9.

The *Brantford Township* Patent Plan, initiated on a copy of one of the original survey plans and updated with patent information until the records were transferred to the Archives of Ontario, does not indicate a patentee for the subject parcel (Map 2). The plan depicts a number of patentees to the north and northwest, however, as well as the approximate alignment of Colborne Street. South of the Grand River is depicted a steam boat landing associated with the staging grounds of the lock and canal system of the Grand River Navigation Company. No indication of development in what would become Cainsville is apparent, though it is known that by 1836 the village's namesake, Peter Cain, had set up the British American Hotel and the village had been laid out by

1837. North and east of the subject study area were lands belonging to the New England Company and to the Grand River Navigation Company. Large portions of the oxbow lands south of the Grand River are listed as having been patented to Robert R. Bown.

G.C. Tremaine's *Map of the County of Brant, Canada West* (1859) indicates that the northeastern part of the study area fell within the historic limits of Cainsville. Within this area was also a church. The remainder of the study area, save for small portions in the west and northwest, was occupied by a tow path. This tow path would have been utilized as part of the Grand River Navigation Company network to facilitate the transfer of watercraft from the Grand River to the lock and canal system pictured southwest of the subject study area. Lands associated with the Oneida Mission School appear in the northwest, and in the west was part of a parcel occupied by Bown, perhaps the same R.R. Bown, Esq. that is indicated on the oxbow lands south of the Grand River (Map 3). The lands around the subject property were well settled by this time. The Buffalo, Brantford & Goderich Railway appears to the north, which opened to Brantford in 1854 and Paris in 1856. The Mohawk Paper Mills is depicted along the canal to the southwest, and Bow Park and the ferry across the Grand River on the oxbow lands appears to the south.

O. Robinson's *Plan of Part of the Township of Brantford* (1859) illustrates the various parcel divisions in the area and clarifies the limits of Bown's property and the Oneida Mission lots (i.e., the School House lot, the Dwelling house lot and the School lot). The early road alignment is also depicted, as well as an allowance for a narrow travelled road along the north bank of the Grand River (Map 4).

Brantford Township East of River from Page & Smith's *Illustrated Historical Atlas of the County of Brant, Ont.* (1875) indicates that the northeastern part of the study area continued to fall within the historic limits of Cainsville. The Grand Truck Railway appears to the north, but by this time, the tow path no longer appears (although perhaps it was just not specifically indicated, as part of the study area to the west still belonged to the Grand River Navigation Company). The property of Bown is depicted further east than in the 1859 Tremaine's map, and a schoolhouse is depicted in the northwest (Map 5).

The detailed *Village of Cainsville* (1875) from the same atlas provides a much clearer picture of the occupation. This map illustrates an array of subdivided parcels, as well as the Brantford & Hamilton Road (Colborne Street) to the north, the original Brantford & Ancaster Road to the west, the Grand River to the south and the locks of the Grand River Navigation Company to the southwest (Map 6). Additional background research was carried out to gain a better understanding of the occupation of the study area during the mid-19th century, and the nature of the occupations are summarized in Table 3

Table 3: Cainsville Lot Summary
(CWI n.d.a)

Lot	Ca. mid-1800s
K	Coal Wharf
L	No information
M	No information
N	No information

Lot	Ca. mid-1800s
Oneida Mission Lot	Lot divided into 50 acre lots running north from the river, west half rented to Mr. Hildred for $50/year, house is old and barn and outhouse are poor, Hildred notes he will leave soon; east half rented to Mordue for $70/year, extended lease; front of the two lots 10 acres total (excluding the 2 acre school lot), good land but badly farmed and not manured, south of the Brantford & Hamilton Road (Colborne Street), land would be good for villa lots; farm immediately adjoining the Oneida Mission Lot is excellent, suggests that Oneida Mission Lot be farmed as well (NEC 1872:32); later Robinson Estate
1	No information
2	No information
3	Church
4	No information
5	No information
6	McMullen-Tinker
7	No information
8	No information
9	Cement Block Houses
10	Cement Block/Warbrick (constructed ca. 1860)
11	Warbrick/Grantham-Carriages
12	No information
13	John O'Hare-Shoemaker
14	Foulger General Store
15	Duncan Tailor Shop

The historic topographic map from 1916 provides evidence of relatively dense settlement along Colborne Street, with numerous stone and wooden structures as well as rail line cuttings and embankments associated with the Grand Trunk Railway. By this time Colborne Street had become a metalled road (Map 7). It is also seems as if the prominence of Cainsville had diminished by this time, whereas Brantford was expanding to the west. The Grand River Navigation Company canal is no longer connected to the Grand River, though the remnants of the navigation system can still be seen along with Mohawk Lake and associated Mohawk Park and athletic grounds. By this time, a pontoon bridge crossed the Grand River in the area of the former locks. The oxbow lands have become part of Bow Park Farm, and no structures appear north of the Bow Park Farm area.

By 1954, the subject study area was primarily residential. The railway corridor continues to bisect the study area and residential structures can be seen fronting Colborne Street along the length of the study area (Map 9). The oxbow lands south of the Grand River appear to have primarily been utilized for agriculture at this time. In 1986, a landslide event occurred within the project lands, affecting almost 40 properties at Cainsville and destroying the Toronto, Hamilton & Buffalo Railway downslope from Colborne Street (Maus n.d.). Following the landslide, the rail line was removed, and the rail bed has since functioned as the Hamilton-Brantford Rail Trail. At the time of assessment, the primary use of the study area was residential and recreational.

1.3 Archaeological Context

The Stage 1 assessment (property inspection) was conducted on November 6, 2018 under PIF #P089-0115-2018. The limits of the study area were confirmed using georeferenced aerial imagery showing artificial and natural formations in relation to the project lands.

The archaeological context of any given study area must be informed by 1) the condition of the property as found (Section 1.3.1), 2) a summary of registered or known archaeological sites located within a minimum 1 km radius (Section 1.3.2) and 3) descriptions of previous archaeological fieldwork carried out within the limits of, or immediately adjacent to the subject lands (Section 1.3.3).

1.3.1 Condition of the Property

The study area lies within the deciduous forest, which is the southernmost forest region in Ontario and is dominated by agricultural and urban areas. This region generally has the greatest diversity of tree and vegetation species, while at the same time having the lowest proportion of forest. It has most of the tree and shrubs species found in the Great Lakes–St. Lawrence forest (e.g., white pine, red pine, hemlock, white cedar, yellow birch, sugar and red maples, basswood and red oak), and also contains black walnut, butternut, tulip, magnolia, black gum, many types of oaks, hickories, sassafras and red bud (MNRF 2018).

Physiographically, the study area lies within the region known as the Norfolk Sand Plain, which is a wedge-shaped plain stretching from the Niagara Escarpment southwesterly to the north shore of Lake Erie. The sands and silts of this region were deposited as a delta in glacial Lakes Whittlesey and Warren, which was built from west to east as the glacier withdrew (Chapman and Putnam 1984:153–154). The soils within the study area were not classified during the Ontario Soil Survey, and were designated as part of Brantford's 'Urban Land' (Acton 1989:Sheet 3). 'Urban Land' designations are intended to accommodate concentrations of urban-related space including built-up areas, parks, golf courses, railway yards, land-fill sites, etc. (Acton 1989:40).

In terms of local watersheds, the study area falls within the Lower Middle Grand drainage basin, which is under the jurisdiction of the Grand River Conservation Authority (GRCA 2018). Specifically, the study area is situated along the north bank of the Grand River, 97 m south of a tributary of Fairchild Creek, 128 m north of an unnamed wetland, 171 m north of a tributary of the Grand River and 231 m north of the Grand River Navigation Company Canal.

At the time of assessment, the study area comprised various city-owned and private properties fronting Colborne Street and Calvin Street, part of the Hamilton-Brantford Rail Trail (former Toronto, Hamilton & Buffalo Railway) and treed areas along the north bank of the Grand River. Field conditions were ideal during the assessment, with high ground surface visibility. No unusual physical features were encountered that affected the results of the Stage 1 assessment.

1.3.2 Registered or Known Archaeological Sites

The Ontario Archaeological Sites Database and the Ontario Public Register of Archaeological Reports were consulted to determine whether any registered or known archaeological resources occur within a 1 km radius of the study area. The available MTCS search facility returned a total of 43 registered archaeological sites located within at least a 1 km radius (the facility returns sites in a rectangular area, rather than a radius, potentially resulting in returns located beyond the specified distance). In terms of other known resources (e.g., Isolated Non-Diagnostic Find Spots, Leads or unreported deposits), no unregistered sites were identified within a 1 km radius. The sites are summarized in Table 4.

Table 4: Registered or Known Archaeological Sites

Borden No. / ID No.	Site Name (Identifier)	Time Period	Affinity	Site Type	Distance from Study Area
AgHb-1	Porteous	Woodland, Middle	Indigenous	Village	> 1 km
AgHb-13	Popple	Paleo-Indian	Indigenous	Scatter	300 m–1 km
AgHb-14	Oxbow Flats 1	Woodland, Middle	Indigenous	Other, camp/village, burials	50 m–300 m
AgHb-15	Oxbow Flats 2	Woodland	Indigenous	Unspecified	> 1 km
AgHb-18	Cooper	Post-Contact, Woodland, Late	Euro-Canadian, Iroquoian	Camp/campsite, village	50 m–300 m
AgHb-19	Cooper Cemetery	Post-Contact	Neutral	Cemetery	50 m–300 m
AgHb-34	Bow Park	Archaic, Woodland, Middle	Indigenous	Village	50 m–300 m
AgHb-131	Rogers Ossuary	Woodland, Late	Indigenous	Ossuary	> 1 km
AgHb-215	Waste Not	Woodland, Late	Iroquoian	Midden, village	> 1 km
AgHb-228	Crosby	Paleo-Indian, Late	Indigenous	Scatter	> 1 km
AgHb-229	Stills	Archaic, Early	Indigenous	Scatter	> 1 km
AgHb-230	Nash	Paleo-Indian, Late	Indigenous	Scatter	> 1 km
AgHb-231	Brantford Northeast Industrial Park 4	Post-Contact, Pre-Contact	Indigenous, Euro-Canadian	Homestead, scatter	> 1 km
AgHb-269	Cayuga Heights	Post-Contact	Indigenous, Euro-Canadian	Scatter	300 m–1 km
AgHb-270	-	Pre-Contact	Indigenous	Scatter	300 m–1 km
AgHb-271	-	Pre-Contact	Indigenous	Scatter	300 m–1 km
AgHb-272	-	Pre-Contact	Indigenous	Scatter	300 m–1 km
AgHb-273	-	Pre-Contact	Indigenous	Scatter	300 m–1 km
AgHb-278	AgHb-278-P1	Archaic, Early, Archaic, Middle, Pre-Contact, Woodland, Early	Indigenous	Scatter, camp / campsite	300 m–1 km
AgHb-279	-	Archaic, Middle	Indigenous	Findspot	300 m–1 km
AgHb-280	AgHb-280-P4	Archaic, Early, Archaic, Middle, Pre-Contact	Indigenous	Scatter	300 m–1 km
AgHb-285	-	Pre-Contact	Indigenous	Camp/campsite, scatter	300 m–1 km
AgHb-286	-	Archaic, Late	Indigenous	Camp/campsite, scatter	300 m–1 km
AgHb-287	-	Post-Contact	Euro-Canadian	Homestead	300 m–1 km
AgHb-288	-	Pre-Contact, Woodland, Middle	Indigenous	Camp/campsite, scatter	300 m–1 km
AgHb-289	-	Post-Contact, Pre-Contact	Indigenous, Euro-Canadian	Camp/campsite	300 m–1 km
AgHb-290	-	Pre-Contact	Indigenous	Scatter	300 m–1 km
AgHb-504	-	-	-	-	> 1 km
AgHb-531	-	Archaic, Middle	Indigenous	Findspot	300 m–1 km
AgHb-532	-	Archaic, Middle	Indigenous	Findspot	300 m–1 km
AgHb-533	-	Archaic, Middle, Paleo-Indian, Late, Woodland	Indigenous	Camp / campsite, scatter	300 m–1 km
AgHb-534	-	Pre-Contact	Indigenous	Camp / campsite	300 m–1 km
AgHb-535	-	Archaic, Middle	Indigenous	Findspot	300 m–1 km
AgHb-536		Paleo-Indian, Late	Hi-Lo	Scatter	300 m–1 km
AgHb-537	-	Pre-Contact	Indigenous	Scatter	300 m–1 km
AgHb-538	-	Pre-Contact	Indigenous, Euro-Canadian	Secondary deposit	300 m–1 km
AgHb-539	-	Pre-Contact	Indigenous	Scatter	300 m–1 km

Borden No. / ID No.	Site Name (Identifier)	Time Period	Affinity	Site Type	Distance from Study Area
AgHb-557	-	Pre-Contact	Indigenous	Scatter	300 m–1 km
AgHb-558	-	Archaic, Middle	Indigenous	Findspot	300 m–1 km
AgHb-559	-	Pre-Contact	Indigenous	Scatter	300 m–1 km
AgHb-560	-	Pre-Contact	Indigenous	Scatter	300 m–1 km
AgHb-561	-	Pre-Contact	Indigenous	Scatter	300 m–1 km
AgHb-614	Eagle's Nest 1	Pre-Contact	Indigenous	Possible chipping station, scatter	50 m–300 m

None of these archaeological sites are located within or immediately adjacent to the project lands; accordingly, they have no potential to traverse the study area. AgHb-14, AgHb-18, AgHb-19, AgHb-34 and AgHb-614 are all located within 300 m of the study area, however, and must be considered as relevant features of archaeological potential. The remaining sites represent more distant archaeological resources.

1.3.3 Previous Archaeological Work

A review of available archaeological management plans and/or other archaeological potential mapping was undertaken to inform the assessment process. Specifically, the *City of Brantford Waterfront Master Plan* (TPP 2010) was reviewed for information that could influence the choice of fieldwork techniques or recommendations. The associated map indicates that nearly the entire study area has archaeological potential (Map 10).

Reports documenting assessments conducted within the subject lands and assessments that resulted in the discovery of archaeological sites that could extend into the subject lands were also sought during the research component of the study. In order to ensure that all relevant past work was identified, an investigation was launched to identify reports involving assessments within 50 m of the study area. The investigation determined that there are multiple available reports documenting previous archaeological fieldwork within the specified distance, and several site forms were also analyzed (Map 12; SD Map 1–SD Map 3). The relevant results and recommendations are summarized below as required by Section 7.5.8 Standards 4–5 of the *S&Gs* (MTC 2011:126).

1.3.3.1 Archaeological Survey of Canada and Rescue Excavations

Four archaeological sites were documented in proximity to the subject study area as part of the Archaeological Survey of Canada and rescue excavations along the eroding slope of the Grand River. These sites include AgHb-14, AgHb-18, AgHb-19 and AgHb-34, but the majority of the associated reports were not available at the time of writing. The assessment summaries provided herein were derived from the extant site forms created when the respective sites were identified and registered, as well as one subsequent study (Warrick 1983). From the obtained forms, the following summaries can be provided:

- Oxbow Flats 1 (AgHb-14): this site was first identified in 1974 as part of the National Museums of Canada’s Archaeological Survey of Canada, being located on Lots 12 and 13, Oxbow Tract within the oxbow of the Grand River below the town of Cainsville. The site was associated with the Princess Point manufacturing tradition and contained a number of burials, lithic materials and Indigenous ceramics, being located along the ridge that marks the path of the spring flood in the area between Johnson Road and Blossom Avenue. Site photography and surface collection was undertaken on five subsequent occasions at this site: 1981 (Licence 81-61), 1985 (Licence 85-46), 1986 (Licence 86-57), 1988 (Licence 88-59) and 1990 (Licence 90-033). The site has been significantly damaged as a result of periodic flooding of the Grand River.

- The Cooper Site (AgHb-18): this site was first documented on a sand plateau overlooking the oxbow of the Grand River as part of a rescue excavation in 1979 (Licence 81-44), being identified in the backyard of the Cooper residence near an eroding bank. This village site was identified based on the presence of various subsoil features, lithic artifacts, Indigenous ceramics and a series of overlapping longhouses. The affiliation of this site is attributed as Glen Meyer/Middleport to Early Historic. Subsequent archaeological assessment and monitoring was undertaken at this site in 1989 under Licence 89-143B for Ministry of Transportation property at Highway 2/53 (now Colborne Street).
- Cooper Cemetery (AgHb-19): this site was first documented at the south end of the Cooper laneway as part of a rescue excavation in 1980 (Licence 80-F-0394). The site was identified based on the presence of multiple extended articulated burials and several satellite burial pits, along with various trade goods, from which an affiliation with the Neutral tradition was inferred.
- Bow Park (AgHb-34): this site was first documented in 1981 under License 81-61 on Lot 13, Oxbow Tract, along the oxbow of the Grand River in proximity to County Road 4 outside of Brantford. Based on the presence of Princess Point ceramics, lithic debitage, and various lithic scrapers, the site was determined to be the remains of a village.

1.3.3.2 Grand River Valley Slope Failure Area Project

Between May and June 1994, Stage 1 and 2 assessments were conducted for the Grand River Valley Slope Failure Area along Colborne Street, from west of Calvin Street to east of Johnson Road under licence #94-004 (Golder 1995). The assessed area overlaps in its entirety with the subject study area. The Stage 1 assessment identified two areas of archeological potential that required Stage 2 assessment. These two areas, both located below the "bench area," were test pitted, but no materials of CHVI were recovered.

The level of disturbance within the assessed areas was identified as having removed a significant amount of CHVI from the project lands. Specifically, the lower slope had been, and continues to be, subject to significant erosion from variation in the level of the Grand River and associated flooding. Accordingly, in situ archaeological potential was found to be significantly diminished in these areas. The "bench area," which encompassed the former Toronto, Hamilton & Buffalo Railway corridor, occupied the area with the highest potential for the recovery of archaeological materials. The presence of significant disturbance in this area did not result in the identification of any cultural remains, nor were there any historical references to possible heritage features in this area, ultimately making this area of low CHVI.

Lastly, the top of the slope was known to have been utilized extensively throughout the history of this region. This area too had been subject to substantial disturbance in the form of landscaping and construction, and as such was found to be of little further CHVI. Areas identified along the top of the slope that retained significant potential for further CHVI included the Grantham residential property and business operations, and the former Anglican Church cemetery established on the rear of Lot 3. The assessment report recommended that 1) if 1019 Colborne Street East Bow Park View is to be demolished, demolition should be monitored by a licensed archaeologist, and 2) if further work is to be undertaken along the rear of Lot 3, monitoring is to be undertaken by a licensed archaeologist (Golder 1995a).

1.3.3.3 Calvin Street Stage 1 Assessment

A Stage 1 archaeological assessment was conducted for 7 Calvin Street under PIF #P219-0034-2017 (Amec Foster Wheeler 2017). This assessment was undertaken in support of a proposed addition to the northern end of an existing school building associated with the Brantford Christian School, and the assessed area is located immediately northwest of the subject study area. The assessed area had been utilized since 1963 as a Christian school and paved parking lot. It was determined that archaeological potential had been comprehensively removed from the subject lands as a result of deep disturbance related to construction of the extant building and associated parking lot. It was recommended that the assessed area required no further archaeological assessment. All areas outside of the assessed area would require archaeological assessment before further development could be undertaken.

1.3.3.4 Eagle's Nest Site 1 (AgHb-614)

Between 2017 and 2018, Stage 1 and 2 (PIF #P027-0308-2017), Stage 3 (PIF #P027-0314-2017) and Stage 4 (PIF #P027-0327-2017) archaeological assessments were carried out in an area west of Calvin Street on Lot 25, Eagle's Nest (SJA 2017a, b, 2018). The investigation identified a Pre-Contact lithic scatter with a minor Post-Contact component, suggestive of a dump site, which was registered as Eagle's Nest 1 (AgHb-614). The associated reports are currently awaiting review at the MTCS. As Stage 4 mitigation of development impacts has been completed, this site is no longer of archaeological concern and does not retain any further CHVI.

1.3.3.5 *1042 Colborne Street Stage 1*

In 2018, a Stage 1 assessment was conducted on lands with the potential to be impacted by a proposed multi-unit residential conversion at 1042 Colborne Street under PIF #P007-0886-2018 (ARA 2018). The assessed area is located north of the subject study area within what was the historic community of Cainsville. The assessment addressed lands on which residential units were planned within an existing three-storey structure in the south as well as within a two-storey addition over an existing one-storey building in the north. The Stage 1 assessment determined that the study area comprised a mixture of areas of archaeological potential and areas of no archaeological potential. It was recommended that the identified areas of archaeological potential be subject to a Stage 2 property assessment. The project was subsequently cancelled.

2.0 STAGE 1 BACKGROUND STUDY

2.1 Background

The Stage 1 assessment involved background research to document the geography, history, previous archaeological fieldwork and current land condition of the study area. This desktop examination included research from archival sources, archaeological publications and online databases. It also included the analysis of a variety of historic maps and aerial images. The results of the research conducted for the background study are summarized below.

With occupation beginning approximately 11,000 years ago, the greater vicinity of the study area comprises a complex chronology of Pre-Contact and Post-Contact histories (Section 1.2). Artifacts associated with Palaeo-Indian, Archaic, Woodland and Early Contact traditions are well-attested in the City of Brantford, and Euro-Canadian archaeological sites dating to pre-1900 and post-1900 contexts are likewise common. The presence of 43 registered archaeological sites in the vicinity of the study area demonstrates the desirability of this locality for early settlement (Section 1.3.2). The investigation confirmed that none of the identified archaeological sites could extend into the subject lands. Background research identified one previous assessment within the study area (Section 1.3.3).

The natural environment of the study area would have been attractive to both Indigenous and Euro-Canadian populations as a result of proximity to the Grand River and its tributaries. The soils were likely well-drained and would have been ideal for agriculture, and the diverse local vegetation would also have encouraged settlement throughout Ontario's lengthy history. Euro-Canadian populations would have been particularly drawn to Colborne Street, Garden Avenue, Old Onondaga Road and Johnson Road (all of which were historically-surveyed thoroughfares), as well as the Toronto, Hamilton & Buffalo Railway, the Buffalo, Brantford & Goderich Railway and the community of Cainsville.

In summary, the background study included an up-to-date listing of sites from the Ontario Archaeological Sites Database (within at least a 1 km radius), the consideration of previous local archaeological fieldwork (within at least a 50 m radius), the analysis of historic maps (at the most detailed scale available) and the study of aerial images. A review of an archaeological management plan was also carried out. ARA therefore confirms that the standards for background research set out in Section 1.1 of the *S&Gs* (MTC 2011:14–15) were met.

2.2 Field Methods (Property Inspection)

In order to gain first-hand knowledge of the geography, topography and current condition of the study area, a property inspection was conducted on November 6, 2018 (Image 1–Image 12). Environmental conditions were ideal during the inspection, with partly cloudy skies, a high of 9°C and excellent lighting. ARA therefore confirms that fieldwork was carried out under weather and lighting conditions that met the requirements set out in Section 1.2 Standard 2 of the *S&Gs* (MTC 2011:16).

The study area was subjected to random spot-checking in accordance with the requirements set out in Section 1.2 of the *S&Gs* (MTC 2011:15–17). Specifically, the inspection utilized the Hamilton-Brantford Rail Trail and began in the west in proximity to Calvin Street and moved in an eastward direction to the area of Johnson Road. At Johnson Road, the assessment returned in an westward direction along Colborne Street proceeding to Clara Crescent before terminating at the end of Calvin Street. The inspection confirmed that all surficial features of archaeological potential (e.g., the historic roadways) were present where they were previously identified and did not result in the identification of any additional features of archaeological potential not visible on mapping (e.g., relic water channels, patches of well-drained soils, etc.).

The inspection determined that parts of the study area were disturbed by past construction activities. No natural features (e.g., permanently wet lands, sloped lands, overgrown vegetation, heavier soils than expected, etc.) or other significant built features (e.g., landscapes, plaques, monuments, cemeteries, etc.) that would affect assessment strategies were identified.

2.3 Analysis and Conclusions

In addition to relevant historical sources and the results of past archaeological assessments, the archaeological potential of a property can be assessed using its soils, hydrology and landforms as considerations. Section 1.3.1 of the *S&Gs* (MTC 2011:17–18) recognizes the following features or characteristics as indicators of archaeological potential: previously identified sites, water sources (past and present), elevated topography, pockets of well-drained sandy soil, distinctive land formations, resource areas, areas of Euro-Canadian settlement, early transportation routes, listed or designated properties, historic landmarks or sites, and areas that local histories or informants have identified with possible sites, events, activities or occupations.

The Stage 1 assessment resulted in the identification of several features of archaeological potential in the vicinity of the study area (Map 11; SD Map 1). The closest and most relevant indicators of archaeological potential (i.e., those that would directly affect survey interval requirements) include three primary water sources (the Grand River, a tributary of the Grand River and a tributary of Fairchild Creek), one secondary water source (an unnamed wetland), four historic roadways (Colborne Street, Garden Avenue, Old Onondaga Road West and Johnson Road), three historic railways (the Buffalo & Lake Huron Railway, the Toronto, Hamilton & Buffalo Railway and the Brantford & Hamilton Electric Railway), one feature of industry (the Grand River Navigation Company Canal), multiple historic structure localities (e.g., 3 churches, 2 school houses and 1 grist mill), the historic community of Cainsville, and five registered archaeological sites (AgHb-14, AgHb-18, AgHb-19, AgHb-34 and AgHb-614).

Background research identified potential for deeply buried archaeological resources within the slope, although no specific targets were identified. None of the consulted records indicated that there was a cemetery within the project lands, but an earlier report noted a personal communication suggesting that a cemetery was located at the rear of Lot 3 (Golder 1995:18).

Although proximity to a feature of archaeological potential is a significant factor in the potential modelling process, current land conditions must also be considered. Section 1.3.2 of the *S&Gs* (MTC 2011:18) emphasizes that 1) quarrying, 2) major landscaping involving grading below topsoil, 3) building footprints and 4) sewage/infrastructure development can result in the removal of archaeological potential, and Section 2.1 of the *S&Gs* (MTC 2011:28) states that 1) permanently wet areas, 2) exposed bedrock and 3) steep slopes (> 20°) can also be considered as having no archaeological potential.

Areas previously assessed and not recommended for further work also require no further assessment, and many such areas were identified within the project lands under licence #94-004 (Golder 1995). ARA disagrees with the recommendations made in this report (i.e., that the bulk of the lands have no further archaeological concerns) and feels that further assessment and/or monitoring is warranted for the majority of the study area. The previous assessment was conducted over 20 years ago, and scholarly understanding of site formation processes along the Grand River has increased considerably since that time. A site immediately adjacent to the study is known to be an ossuary, for example, which itself indicates that there is potential for human remains to be present within the subject lands. The local landscape would have been particularly attractive for Indigenous settlement, and both Pre-Contact and Post-Contact materials have been documented in deeply buried cultural layers at other locations along Colborne Street. ARA realizes that landslide events have altered the landscape greatly over the years, but also recognizes that these events inhibit the evaluation of original surface conditions, meaning that soils or archaeological materials could be buried under a large amount of displaced material. There is also the possibility that the soil layers that have eroded down the hill contain human remains. Empirical evaluation is therefore required to confirm that the study area has no further archaeological concerns.

The *City of Brantford Waterfront Master Plan* (TPP 2010) indicates that the entire study area, save for a small portion in the area of Clara Crescent and Calvin Street, has archaeological potential (Map 10). However, it should be noted that this modelling was not the result of a property-specific assessment and therefore does not fully account for land-use history and current conditions. ARA's visual inspection, coupled with the analysis of historical sources and digital environmental data, resulted in the identification of two areas of no archaeological potential within the study area. Specifically, deep land alterations have resulted in the removal of archaeological potential from the railway underpass at Colborne Street in the area of Johnson Road and the extant Brantford Christian School at the terminus of Calvin Street. These areas had clearly been impacted by past earth-moving/construction activities, resulting in the disturbance of the original soils to a significant depth and severe damage to the integrity of any archaeological resources.

The remainder of the assessed area has potential for Indigenous and Euro-Canadian archaeological materials. Specifically, the areas of archaeological potential include the Grand River bank slope; grassed and treed areas, which include several residential properties along Colborne Street, Clara Crescent and Calvin Street; and the Hamilton-Brantford Rail Trail and surrounding lands. Although it is possible that several of these areas, namely the more developed lands, were deeply disturbed during past construction activities, empirical evidence would be required to confirm that potential has been removed. It is unclear if the construction methods involved general grading and/or major landscaping, or if fill materials were simply laid over extant areas of potential.

The Stage 1 assessment determined that the study area comprises a mixture of areas of archaeological potential and areas of no archaeological potential. At the time of assessment, 98.28% (17.20 ha) of the study area had archaeological potential and fell within non-agricultural lands located < 300 m from a feature of archaeological potential; 1.13% (0.20 ha) was possibly disturbed by previous construction activities but retains archaeological potential until such time as disturbance can be confirmed and 0.59% (0.10 ha) was identified as disturbed. The potential modelling results are depicted in Map 12. The slope monitoring area ('study area') is depicted as a layer in this map.

3.0 RECOMMENDATIONS

The Stage 1 assessment determined that the study area comprises a mixture of areas of archaeological potential and areas of no archaeological potential. Although some of the areas of archaeological potential were likely impacted by past construction activities, the integrity of the soils and the depth of any past disturbances must be empirically evaluated. ARA recommends that all identified areas of archaeological potential that could be impacted by the project be subject to a Stage 2 property assessment in accordance with Section 2.1 of the *S&Gs* (MTC 2011:28–39). It is understood that a preferred solution has not yet been identified, and that the extent of any project impacts remains undetermined.

The grassed and treed areas extending along the top of the slope from Calvin Street in the west to Johnson Road in the east as well as the parkland area around Beach Road at the base of the slope must be assessed using the test pit survey method. A survey interval of 5 m will be required due to the proximity of the lands to the identified features of archaeological potential. Given the likelihood that the soils within two vacant lots along Colborne Street have been impacted by past construction activities, a combination of visual inspection and test pit survey should be utilized to confirm the extent of disturbance in accordance with Section 2.1.8 of the *S&Gs* (MTC 2011:38). If disturbance cannot be confirmed, then a test pit survey interval of 5 m must be maintained. Each test pit must be excavated into at least the first 5 cm of subsoil, and the resultant pits must be examined for stratigraphy, potential features and/or evidence of fill. The soil from each test pit must be screened through mesh with an aperture of no greater than 6 mm and examined for archaeological materials. If archaeological materials are encountered, all PTPs must be documented and intensification may be required.

Although the area of the slope has potential for deeply buried archaeological resources, no key defining historic elements/targets (i.e., structures) were identified. Regardless, the potential for buried artifacts and even human remains cannot be dismissed out of hand. Accordingly, archaeological monitoring must be undertaken by a licensed archaeologist for all construction and/or stabilization activities associated with the project. Monitoring must be carried out in accordance with Section 2.1.7 Standard 4 of the *S&Gs* (MTC 2011:37–38). A contingency plan must be developed with the proponent and contractors outlining the procedures, documentation and time requirements in the event that archaeological resources are exposed.

The identified areas of no archaeological potential do not require additional assessment. Given that there are outstanding archaeological concerns within the subject lands, no ground alterations or development of any kind may occur until the Stage 2 assessment is complete, a recommendation that the lands require no further archaeological assessment is made, and the associated report is entered into the Ontario Public Register of Archaeological Reports.

4.0 ADVICE ON COMPLIANCE WITH LEGISLATION

Section 7.5.9 of the *S&Gs* requires that the following information be provided for the benefit of the proponent and approval authority in the land use planning and development process (MTC 2011:126–127):

- 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. 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 MTCS, 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* 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 archaeological 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 Archaeology Reports referred to in Section 65.1 of the *Ontario Heritage Act*.
- 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*.
- The *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 requires that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Consumer Services.

5.0 IMAGES

Image 1: Area of Potential
(November 6, 2018; Facing Southwest)

Image 2: Area of Potential
(November 6, 2018; Facing Northeast)

Image 3: Area of Potential
(November 6, 2018; Facing Northeast)

Image 4: Area of Potential
(November 6, 2018; Facing Southwest)

Image 5: Area of Potential
(November 6, 2018; Facing East)

Image 6: Area of Potential
(November 6, 2018; Facing Northeast)

Image 7: Area of Potential
(November 6, 2018; Facing East)

Image 8: Area of Potential
(November 6, 2018; Facing Southwest)

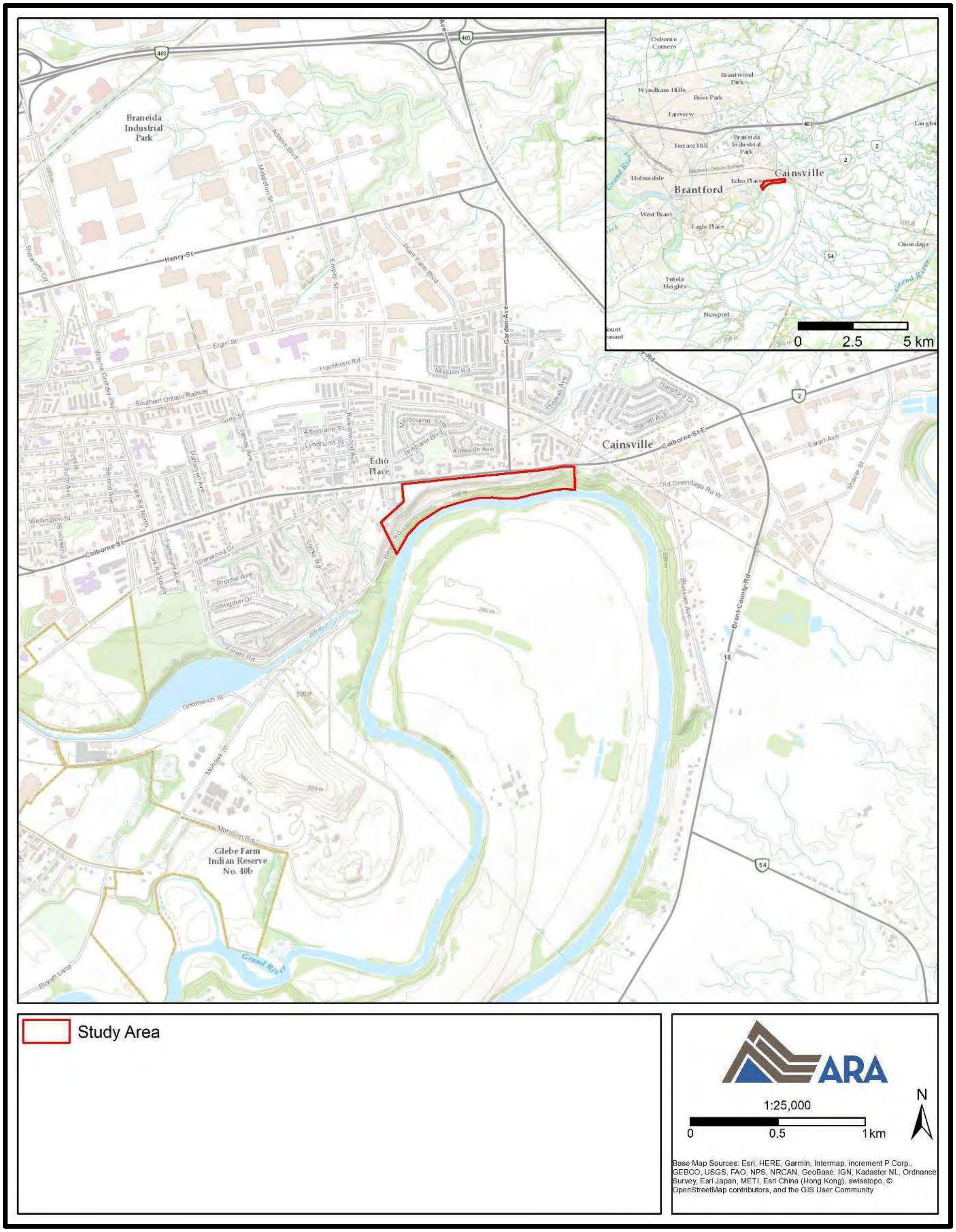
Image 9: Area of Potential
(November 6, 2018; Facing East)

Image 10: Area of Potential
(November 6, 2018; Facing Southeast)

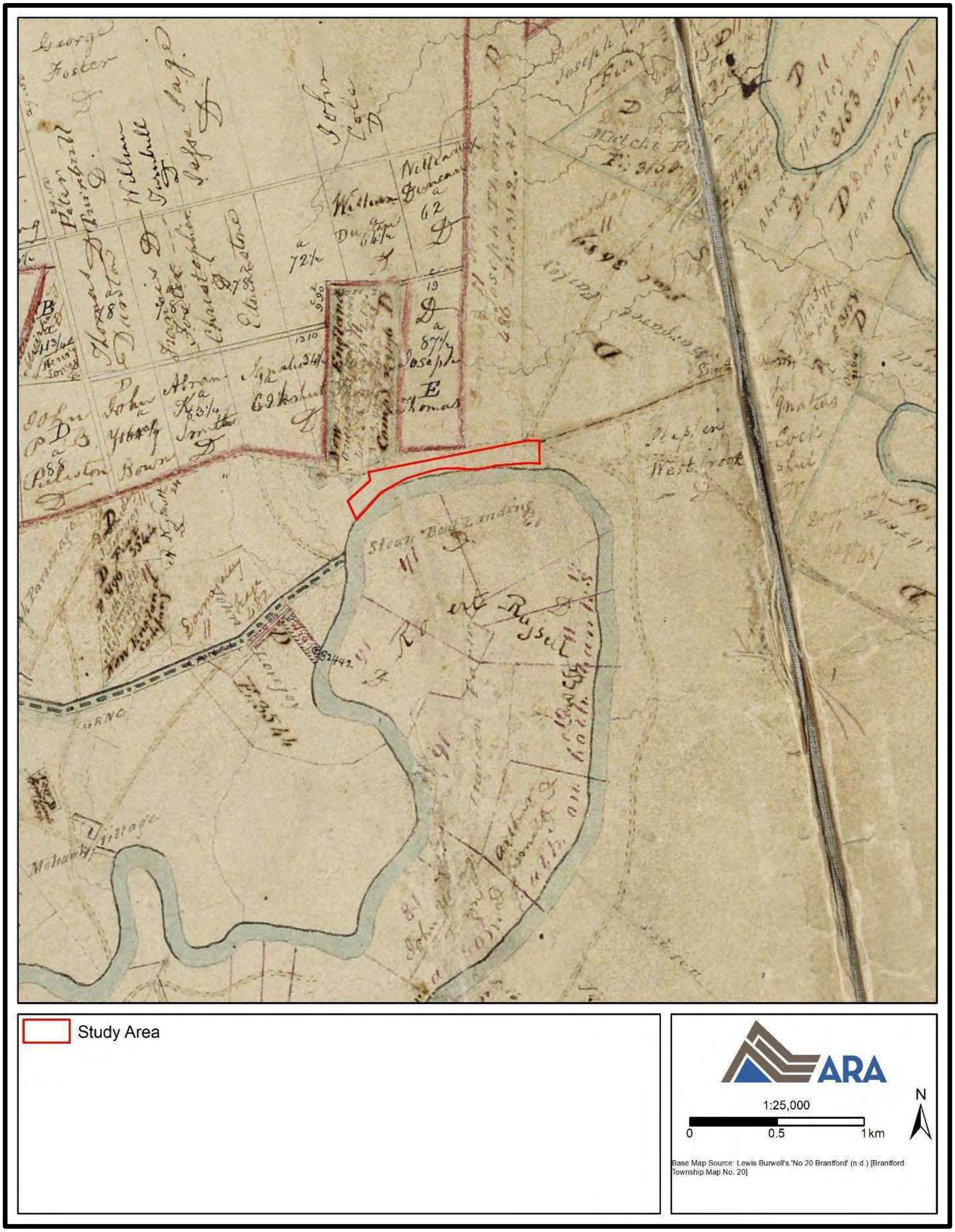
Image 11: Area of Potential
(November 6, 2018; Facing Southwest)

Image 12: Disturbed Lands
(November 6, 2018; Facing Southwest)

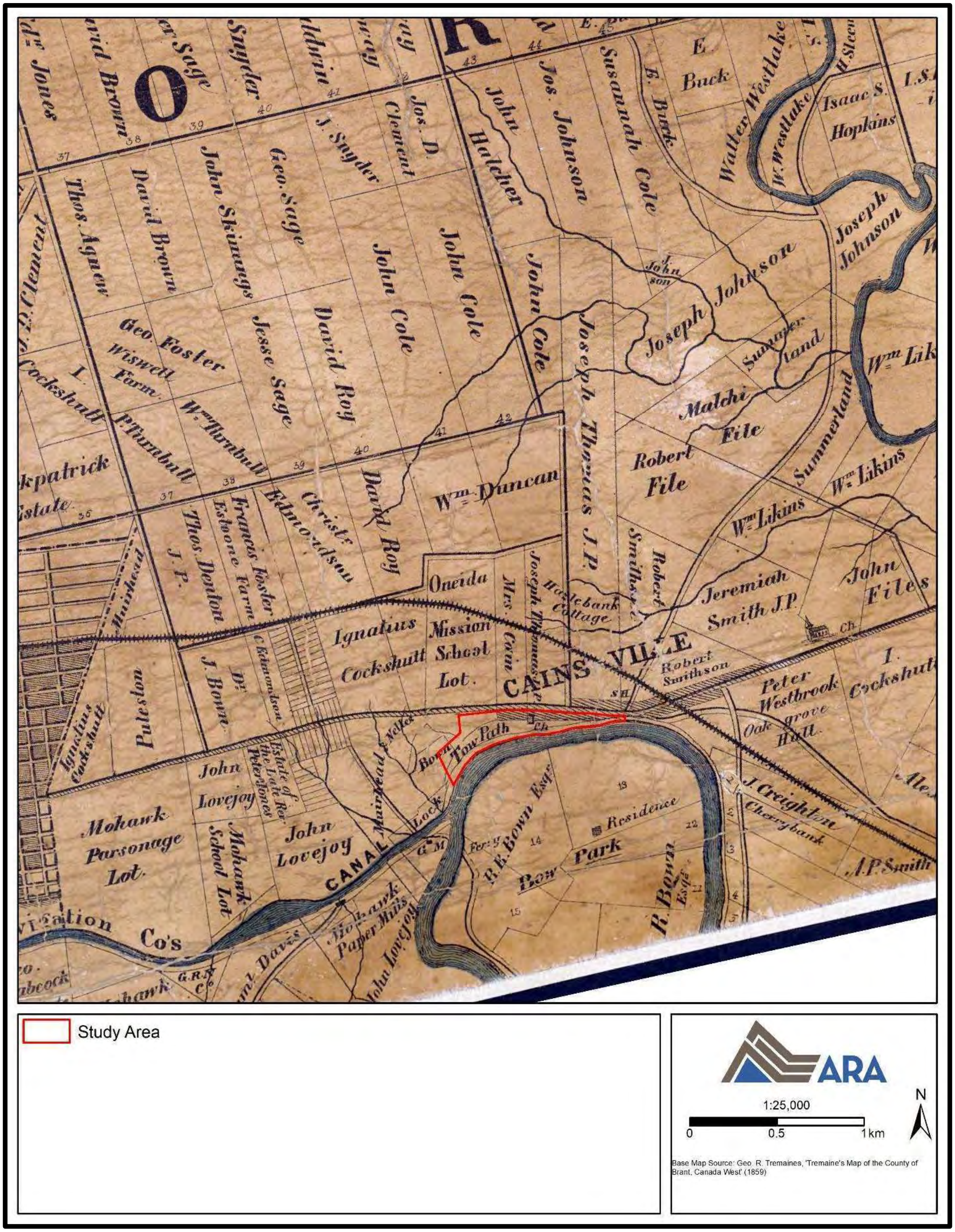
6.0 MAPS



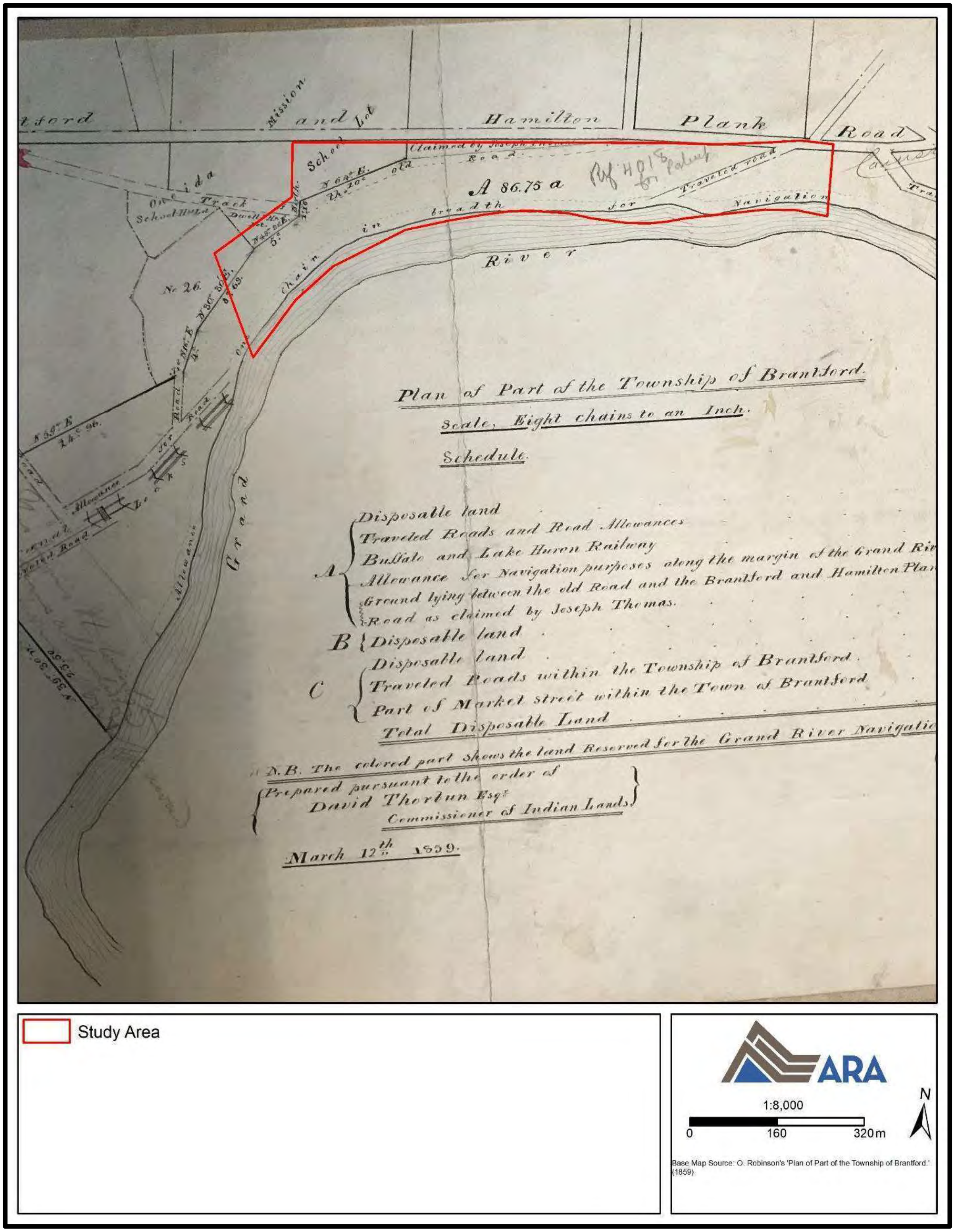
Map 1: Location of the Study Area
(Produced under licence using ArcGIS® software by Esri, © Esri)



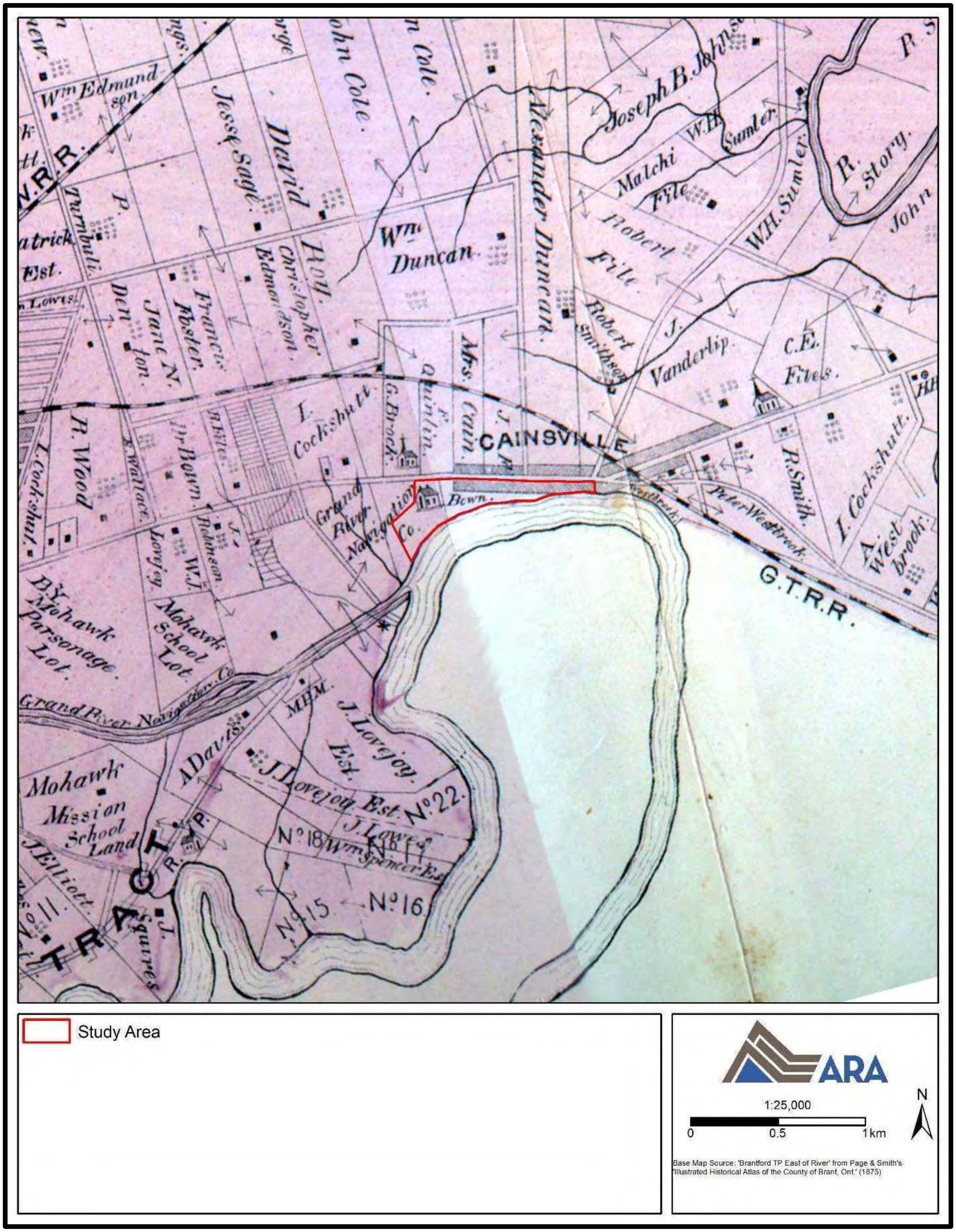
Map 2: *Brantford Township* Patent Plan (No Date)
(Produced under licence using ArcGIS® software by Esri, © Esri; AO 2015)



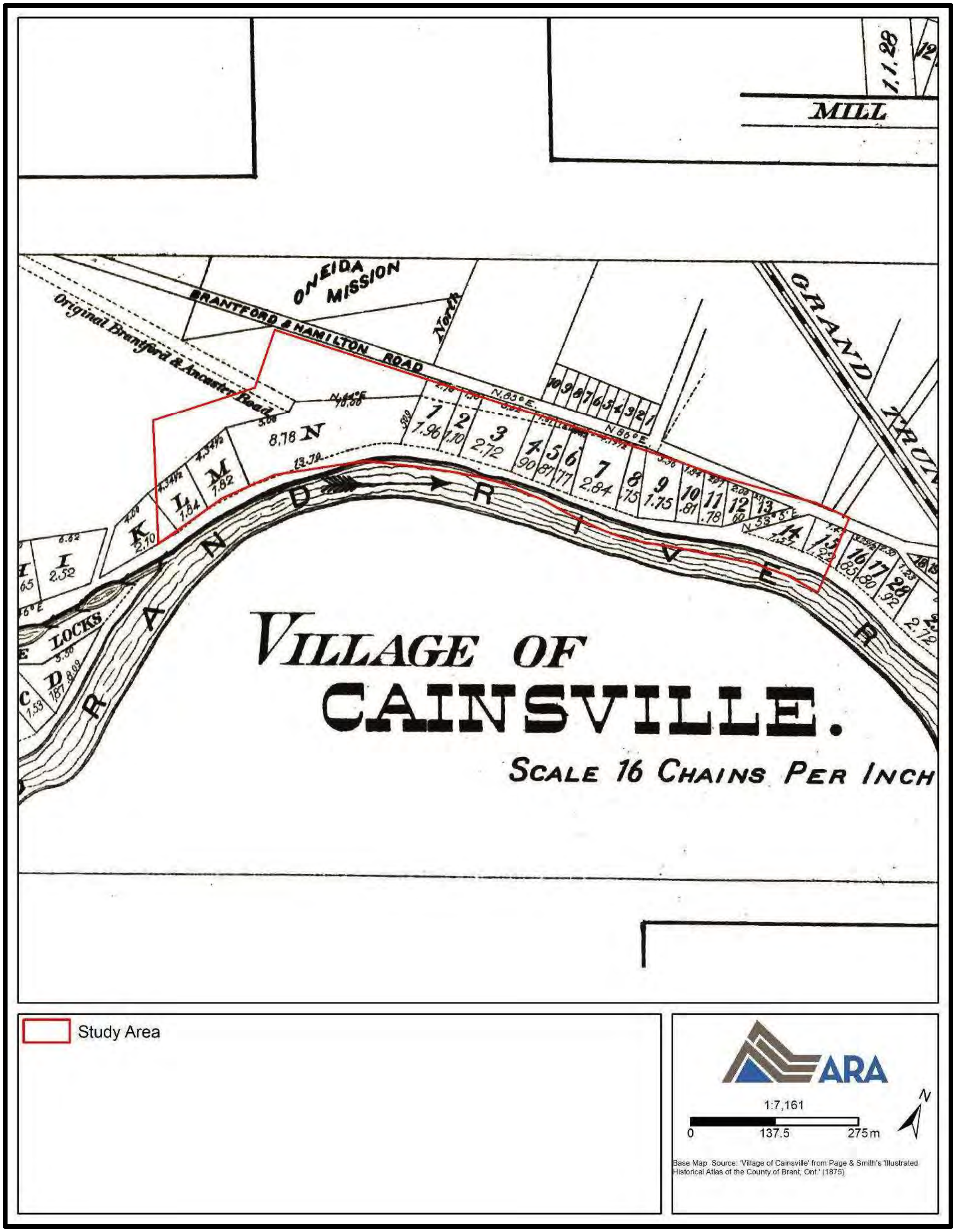
Map 3: G.C. Tremaine's *Map of the County of Brant, Canada West* (1859)
(Produced under licence using ArcGIS® software by Esri, © Esri; OHCMP 2018)



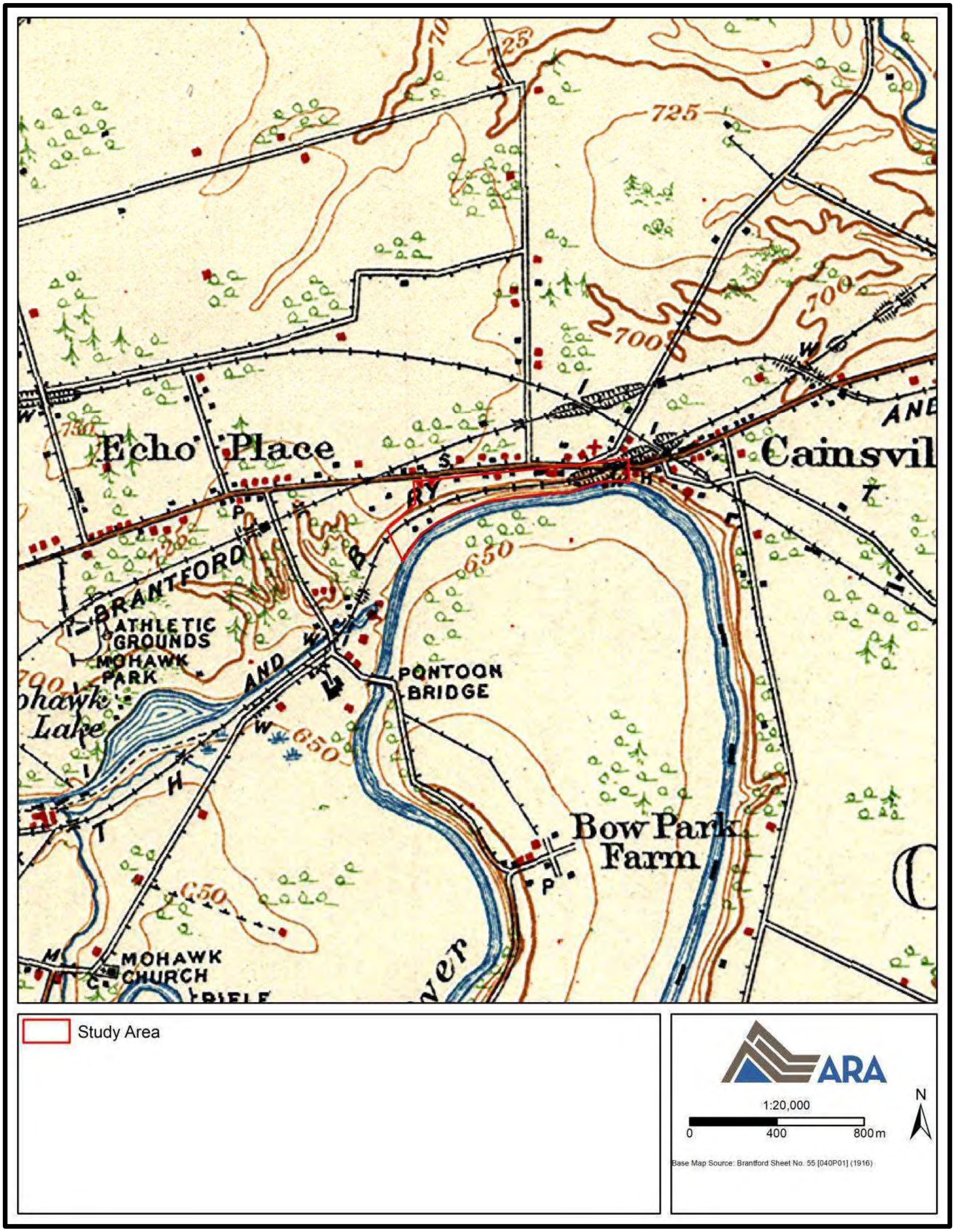
Map 4: O. Robinson's *Plan of Part of the Township of Brantford* (1859)
(Produced under licence using ArcGIS® software by Esri, © Esri; Library and Archives Canada)



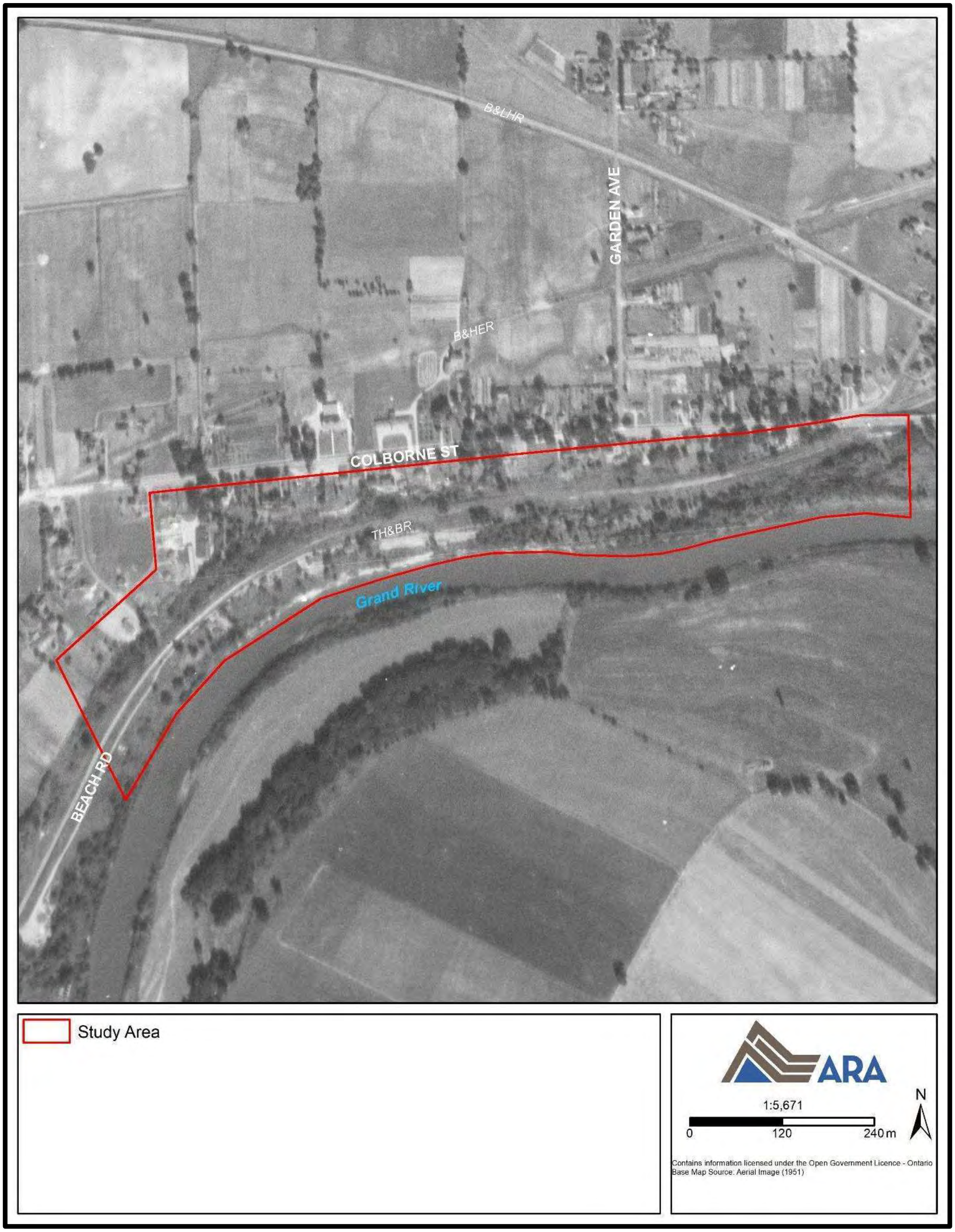
Map 5: ***Brantford Township East of River*** **from Page & Smith's** ***Illustrated Historical Atlas of the County of Brant, Ont.*** **(1875)**
(Produced under licence using ArcGIS® software by Esri, © Esri; McGill University 2001)



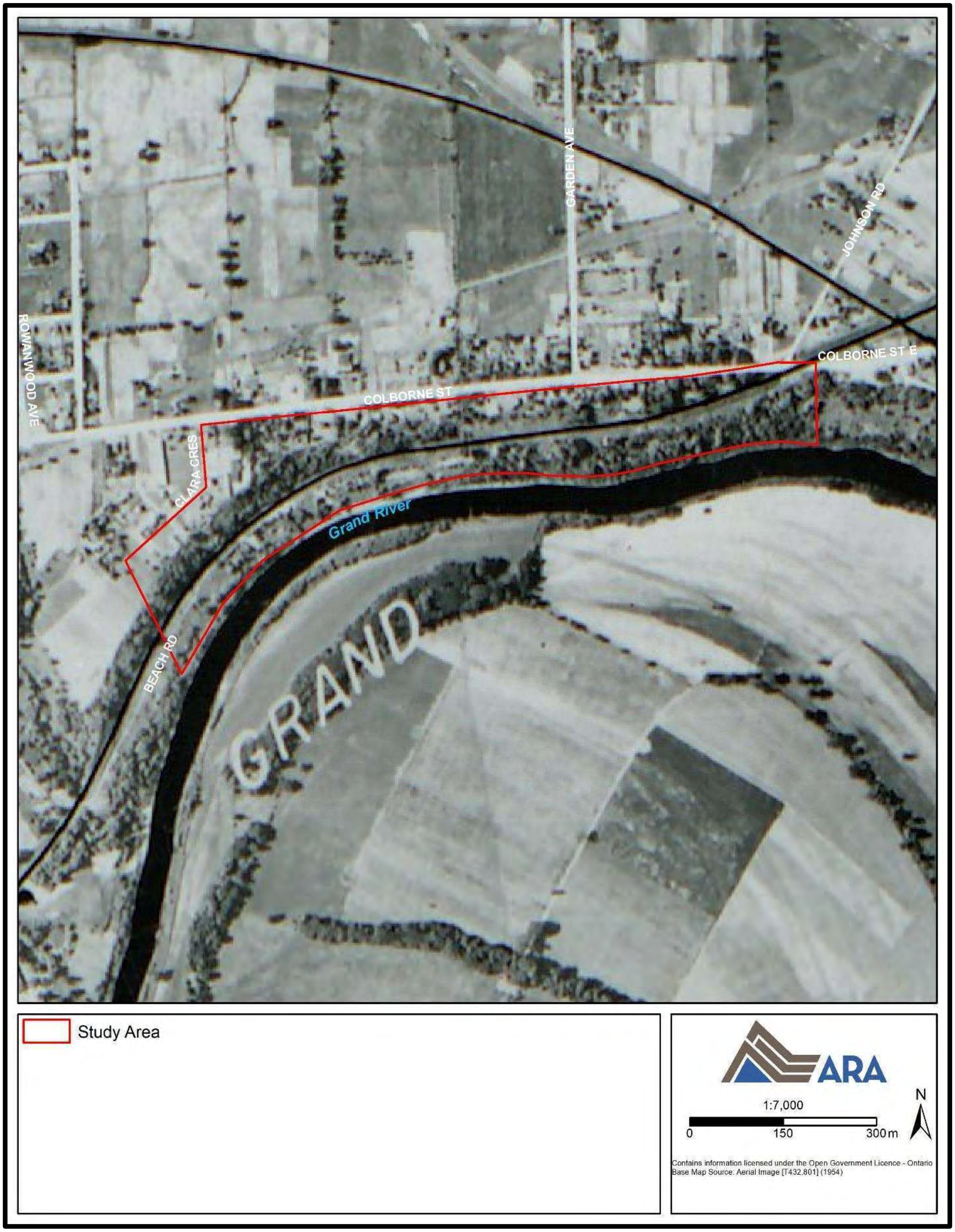
Map 6: The *Village of Cainsville* from Page & Smith's *Illustrated Historical Atlas of the County of Brant, Ont.* (1875)
(Produced under licence using ArcGIS® software by Esri, © Esri; Mika 1972)



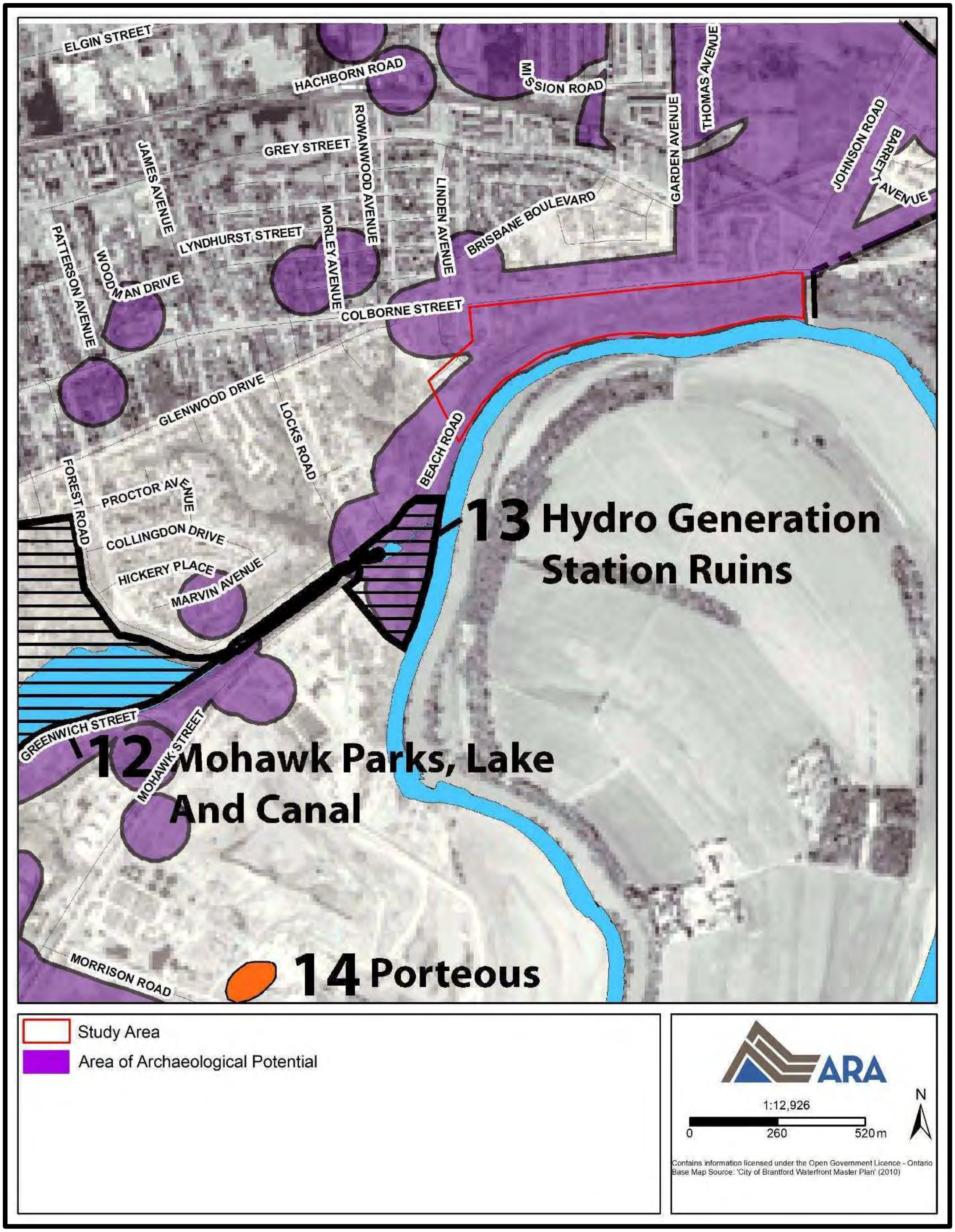
Map 7: Topographic Map (1916)
(Produced under licence using ArcGIS® software by Esri, © Esri; University of Toronto 2018)



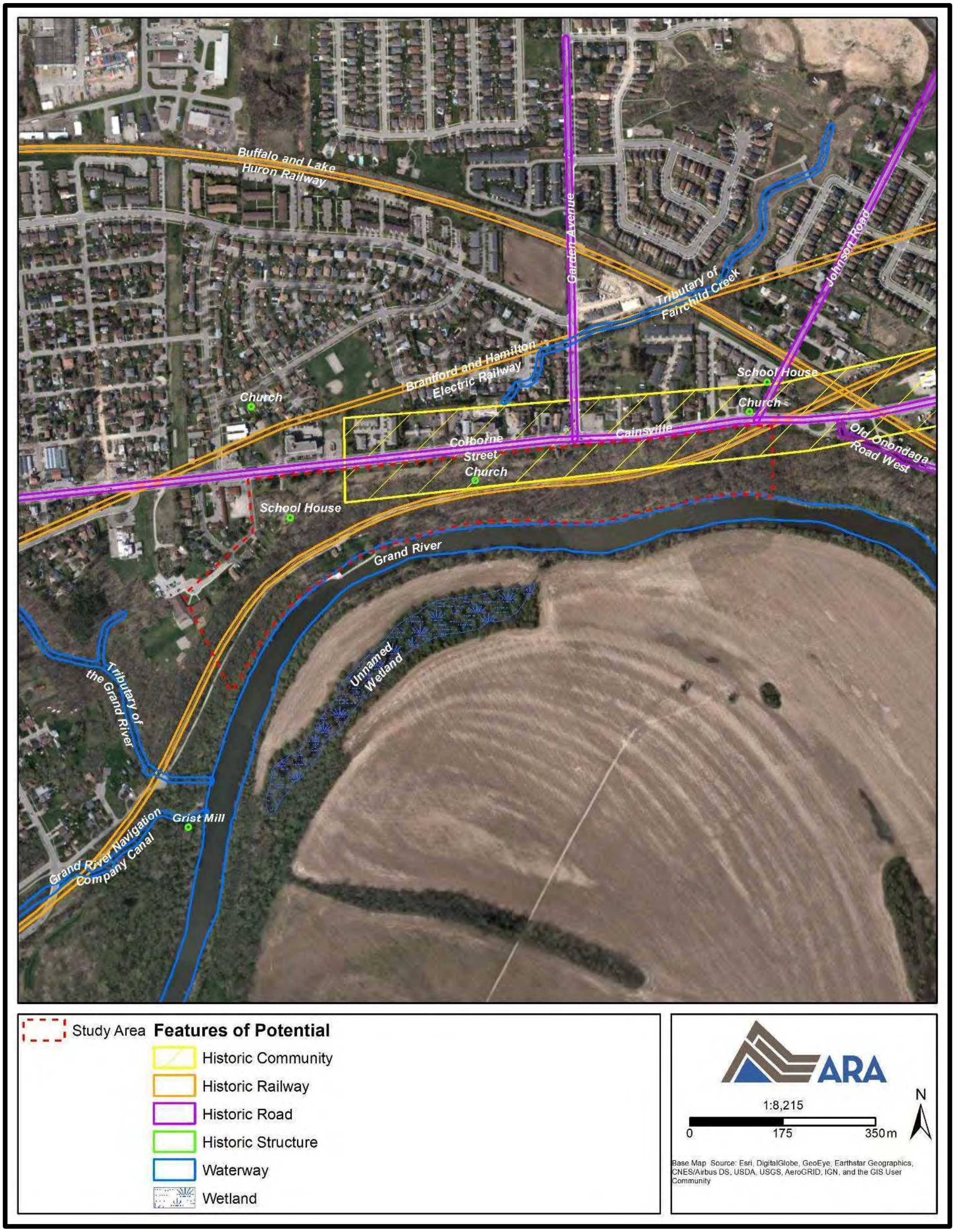
Map 8: Aerial Image (1951)
(Produced under licence using ArcGIS® software by Esri, © Esri; Natural Resources Canada)



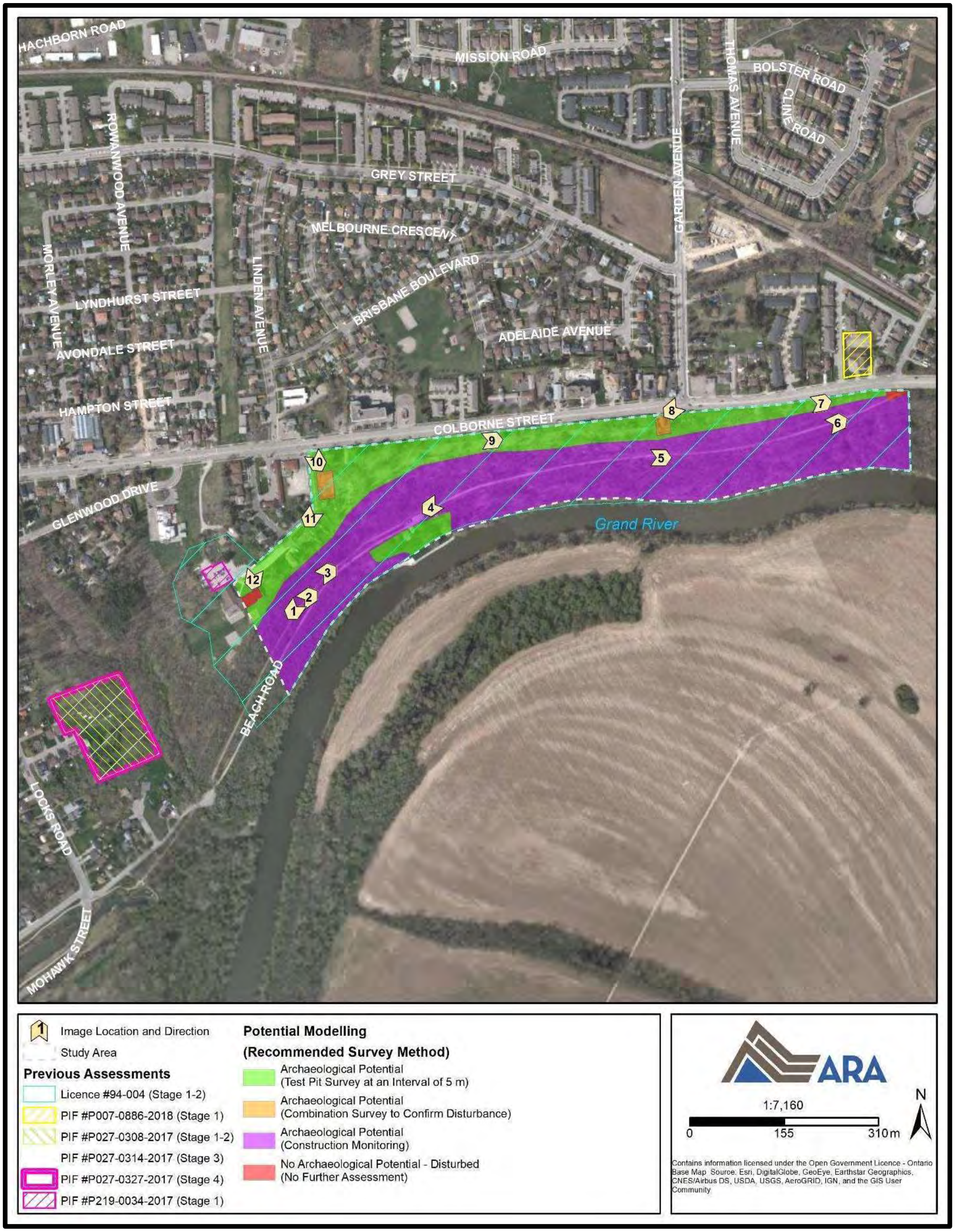
Map 9: Aerial Image (1954)
(Produced under licence using ArcGIS® software by Esri, © Esri; University of Toronto 2018)



Map 10: ***City of Brantford Waterfront Master Plan***
(Produced under licence using ArcGIS® software by Esri, © Esri; TPP 2010)



Map 11: Features of Potential
(Produced under licence using ArcGIS® software by Esri, © Esri)



Map 12: Potential Modelling and Recommendations
(Produced under licence using ArcGIS® software by Esri, © Esri)

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ARCHAEOLOGY | HERITAGE | OUTREACH | EDUCATION

Built Heritage and Cultural Heritage Landscape Assessment
Colborne Street Slope Stabilization
City of Brantford
Part of Lot 26, Eagles Nest Concession
Grand River Navigation, Eagles Nest Concession
Geographic Township of Brantford
Former Brant County

Prepared for
Ecosystem Recovery Inc.
80 Courtland Ave. East, Unit 2
Kitchener, ON N2G 2T8
Phone: (519) 621-1500
Email: wolfgang.wolter@ecosystemrecovery.ca

By
Archaeological Research Associates Ltd.
219-900 Guelph Street
Kitchener, ON N2H 5Z6
Tel: (519) 804-2291 Fax: (519) 286-0493
www.arch-research.com

HR-135-2018
ARA File #2018-0171

13/12/2018

Original Report

EXECUTIVE SUMMARY

Under a contract initiated in October 2018, Archaeological Research Associates Ltd. (ARA) was retained by Ecosystem Recovery Inc. to complete a Built Heritage and Cultural Heritage Landscape Assessment of structures and landscapes with the potential to be impacted by the proposed slope stabilization project along a section of Colborne Street to the Grand River from west of Johnson Road to Clara Crescent, extending along the TransCanada Trail to Locks Road and located in the City of Brantford and Township of Cainsville, part of Lot 26, Eagles Nest Concession and Grand River Navigation, Eagles Nest Concession, Geographic Township of Brantford, Former Brant County.

According to the Terms of Reference in the Request for Proposal (RFP) 18-47, "the proposed project will be completed as a Schedule "C" Municipal Class Environmental Assessment (Class EA) in accordance with the requirements set out in the latest revision of the *Municipal Class Environmental Assessment* document. Alternative solutions shall be identified and evaluated for possible slope stabilization to reduce risk to public health and safety and to support future land use within the Landslide Area".

The project location consists of an approximately 1 km (total approximate area is 17.5 ha) along Colborne Street from south of the road to the banks of the Grand River in the City of Brantford. The project location comprises part of Lot 26, Eagles Nest and GR & River Navigation Co. Eagles Nest in the Geographic Township of Brantford.

The approach for the Built Heritage and Cultural Heritage Landscape Assessment has specific tasks required for the EA process, and they include:

- Background research concerning the project context and historical context of the heritage assessed area;
- Consultation with the City of Brantford and the County of Brant planners responsible for heritage matters;
- Identification of any designated or recognized properties within the limits of the heritage assessed area;
- On-site inspection and creation of an inventory of all properties with potential Built Heritage Resources (BHR) and Cultural Heritage Landscapes (CHL) within, adjacent and in proximity to the project location;
- A description of the location and nature of potential cultural heritage resources;
- Evaluation of each potential cultural heritage resource against the criteria set out in Ontario Regulation 9/06, and 10/06, where applicable, for determining cultural heritage value or interest (CHVI);
- Evaluation of potential project impacts; and
- Provision of suggested strategies for the future conservation of identified cultural heritage resources.

A windshield survey of the heritage assessed area was conducted, and all potential cultural heritage resources noted were evaluated against the criteria of Ontario Regulation 9/06. Of those, the following were identified within the study area as having potential cultural heritage value or interest (CHVI): 1059 Colborne Street (BHR 1), 1057 Colborne Street (BHR 2), 1053 Colborne Street (BHR 3), 1047 Colborne Street (BHR 4), Beach Road House and Mill (BHR 5), Colborne Street Pedestrian Underpass (BHR 6), Colborne Street Rail Bridge (BHR 7), 1042 Colborne Street (BHR 8), 1036 Colborne Street (BHR 9), 1024 Colborne Street (BHR 10), 1020 Colborne Street (BHR 11), 1022 Colborne Street (BHR 12), 29 Clara Crescent (BHR 13), 968 Colborne Street (BHR 14), 21 Johnson Road (BHR 15), 13 Johnson Road (BHR 16). Five CHLs were identified in the study area: View to the Bow Park Farm (CHL 1), Grand River (CHL 2), Buffalo & Lake Huron Railway (B&LHR) (CHL 3), Part of the Trans Canada Trail (CHL 4), Mohawk Canal Locks (CHL 5).

As a result of this Built Heritage Resource and Cultural Heritage Landscape Assessment, the following mitigation strategies are recommended to address the identified potential adverse impacts:

- That during the planning and design phases, cultural heritage resources be avoided where possible and any construction staging areas be located on lands located well away from any of the candidate BHRs and CHLs.
- That during the design phases, the removal of mature trees, specifically on BHR 5, as well as on the slope or along south side of Colborne Street (i.e., potentially impacting CHLs 1, 2 and 4), should be avoided where possible. For any trees that cannot be saved during construction, replacement with similar trees should be examined.
- That the CHL that falls within the project location (TransCanada Trail, CHL 4) be maintained during the detailed design phase and that it be returned to its pre-construction condition.
- That the adjacent Bow Park Farm look-out (CHL 1) be maintained during the detailed design phase and that it be returned to its pre-construction condition.
- That stabilization infrastructure should be integrated into the landscape in a sympathetic manner, including the use of materials that are visually compatible (i.e., natural materials such as stone or wood and/or colours).
- That consideration should be given to the type of construction techniques and machinery used in close proximity to cultural heritage resources - BHRs 5, 6 and 7, to minimize any vibration impacts.
- That once a preferred alternative has been selected and design work has begun, a Heritage Impact Assessment (HIA) report should be undertaken to confirm the anticipated impacts outlined in this report, evaluate any additional impact of the proposed design, as well as outline avoidance/mitigation measures to minimize the impact. The HIA may outline mitigation measures including additional landscaping that may be required to minimize visual impacts or design approaches may be suggested. Mitigation measures may be discussed with planners at the County and the City.
- That public consultation may result in additional potential cultural heritage resources being identified. These potential cultural heritage resources should be reviewed by a qualified heritage consultant to: 1) determine their CHVI, 2) evaluate potential project

impacts, and 3) suggest strategies for future conservation of any candidate cultural heritage resources.

- That previously-unrecognized cultural heritage resources with CHVI discussed in this assessment may be worthy of inclusion on a Municipal Heritage Register.
- That this Built Heritage and Cultural Heritage Landscape Assessment should be provided to staff/planners at the City of Brantford and County of Brant.

The EA process includes preliminary studies, an examination of alternatives and selection of a preferred alternative prior to the development of preliminary and detailed designs. Impacts to cultural heritage resources should be considered during all phases of the EA process. Further, these preliminary mitigation recommendations are subject to review and confirmation during the detailed design phase, in consideration of the more detailed understanding of design and project constraints.

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GLOSSARY OF ABBREVIATIONS

ARA – Archaeological Research Associates Ltd.
BHR – Built Heritage Resource
CHER – Cultural Heritage Evaluation Report
CHVI – Cultural Heritage Value or Interest
CHL – Cultural Heritage Landscape
EA – Environmental Assessment
MCL – (Former) Ministry of Culture
MTC – (Former) Ministry of Tourism and Culture
MTCS – Ministry of Tourism, Culture and Sport
OHT – Ontario Heritage Trust
O. Reg. – Ontario Regulation
PPS – Provincial Policy Statement

PERSONNEL

Senior Review: P.J. Racher, M.A. CAHP
Project Director: K. Jonas Galvin M.A, CAHP
Project Manager: J. McDermid, B.A
Site Visit: J. McDermid, S. Clarke, B.A.
Historical Research: S. Clarke
Photography: J. McDermid
Cartographer: K. Brightwell (GIS)
Technical Writers: P. Young M.A., CAHP, L. Benjamin, M.A.E.S., CHAP, K. Jonas Galvin and J. McDermid

1.0 PROJECT CONTEXT

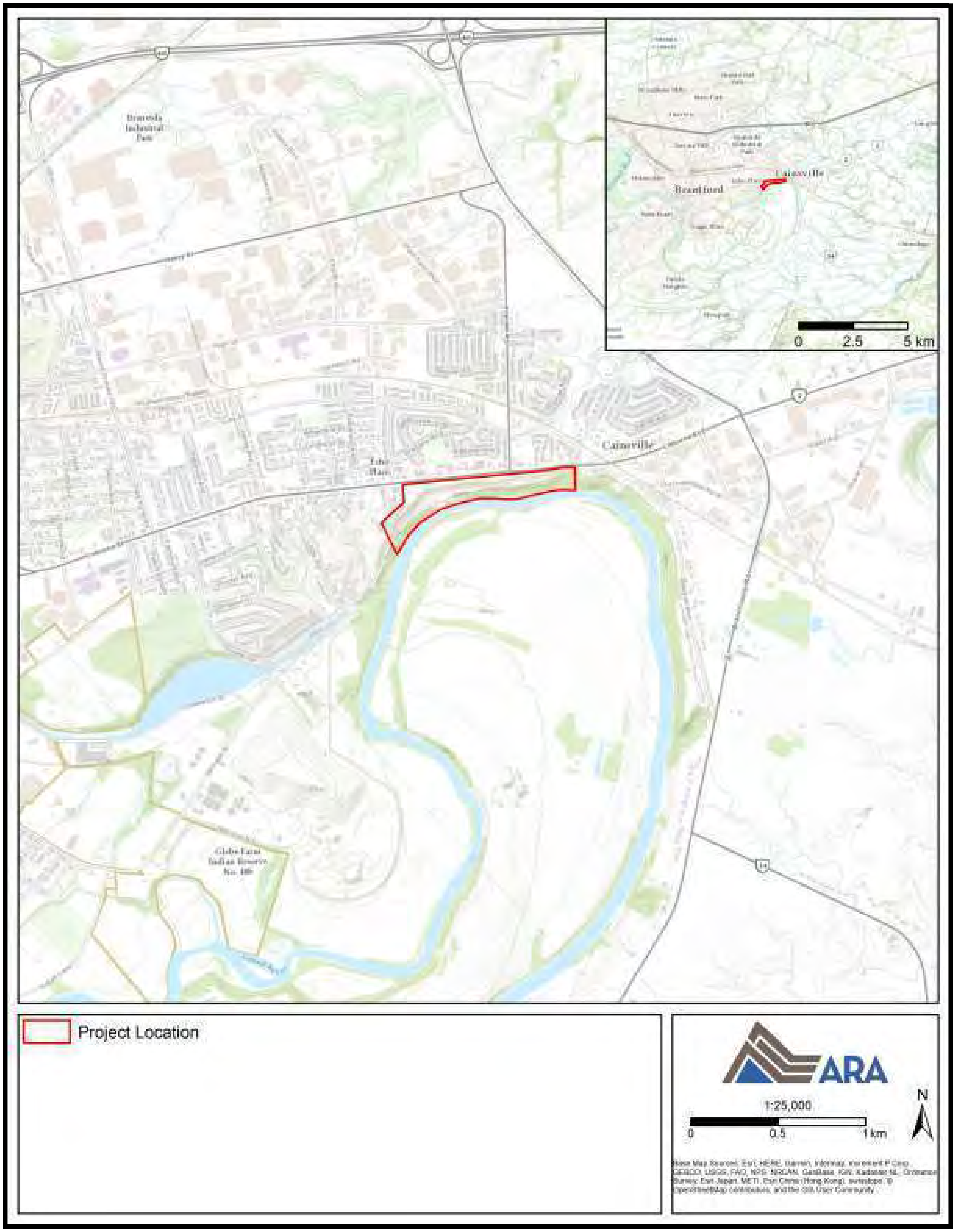
Under a contract initiated in October 2018, Archaeological Research Associates Ltd. (ARA) was retained by Ecosystem Recovery Inc. to complete a Built Heritage and Cultural Heritage Landscape Assessment of structures and landscapes with the potential to be impacted by the proposed slope stabilization project along a section of Colborne Street to the Grand River from west of Johnson Road to Clara Crescent, extending along the TransCanada Trail to Locks Road and located in the City of Brantford and Township of Cainsville, Lot 26, Eagles Nest Concession and Grand River Navigation, Eagles Nest Concession, Geographic Township of Brantford, Former Brant County.

According to the Terms of Reference in the Request for Proposal (RFP) 18-47 (City of Brantford 2018a:2), “the proposed project will be completed as a Schedule “C” Municipal Class Environmental Assessment (Class EA) in accordance with the requirements set out in the latest revision of the *Municipal Class Environmental Assessment* document. Alternative solutions shall be identified and evaluated for possible slope stabilization to reduce risk to public health and safety and to support future land use within the Landslide Area”.

The project location consists of an approximately 1 km (total approximate area is 17.5 ha) along Colborne Street from south of the road to the banks of the Grand River in the City of Brantford. The project location comprises parts of Lot 26, Eagles Nest and GR & River Navigation Co. Eagles Nest in the Geographic Township of Brantford (see Map 1).

The purpose of this assessment is to identify and evaluate the cultural heritage resources within and immediately adjacent to the project location that may be impacted by the Municipal Class EA that is being conducted in relation to the Colborne Street Slope Stabilization project. This assessment was conducted in accordance with the aims of the *Environmental Assessment Act*, R.S.O. 1990, *Provincial Policy Statement* (2014), *Ontario Heritage Act*, R.S.O. 1990, c. O.18, and *City of Brantford Official Plan* (2018b). As some properties that are adjacent to the project location are located within the County of Brant, the *County of Brant Official Plan* (2012) is also relevant.

All notes, photographs and records pertaining to the heritage assessment are currently housed in ARA’s processing facility located at 1480 Sandhill Drive – Unit 3, Ancaster, Ontario. Subsequent long-term storage will occur at the same location.



Map 1: Project Location in the City of Brantford and County of Brant (former Village of Cainsville)
(Produced by ARA under licence using ArcGIS® software by Esri, © Esri)

2.0 METHOD

The framework for this assessment report is provided by provincial environmental and planning legislation and policies as well as the regional Official Plan and guidelines. Within the *Environmental Assessment* (EA) *Act,* the environment is described as *"any building, structure, machine or other device or thing made by humans."* An Environmental Assessment is a study that evaluates both the potential positive and/or negative effects of a project on the environment. This study is conducted as part of a streamlined self-assessment EA process called a Class EA that applies to routine projects grouped into classes for the Municipal Class EA (MCEA). The classes range from A (minor undertakings) to C (construction of new large facilities). The Municipal Class EA applies to municipal infrastructure undertakings including roads, water and wastewater projects.

The *PPS* 2014 promotes the conservation of cultural heritage resources through polices in Section 2.6, such as policy 2.6.1 that states: "Significant built heritage resources and significant cultural heritage landscapes shall be conserved" (2014:29).

The *Official Plan of the City of Brantford* provides for the wise management of cultural heritage resources, a principal goal of the Official Plan is "to promote and build on the distinctive character and locational advantages of Brantford through the responsible utilization of our natural, cultural and economic resources to meet the evolving needs of the community in an efficient and sensitive manner" (2018b:6-2). And under 6.2.10 the Cultural Heritage and Archaeology goal is to "sustain, conserve and enhance significant built environments" with the objective of "identify, inventory and conserve lands, cultural heritage landscapes, buildings, structures and sites of historic, architectural and archaeological values" (City of Brantford 2018b:6-6). The *Official Plan* also states that: "the City shall seek to conserve cultural heritage resources" (2018b:9-1).

The *County of Brant Official Plan* (2012) also provides for the conservation of cultural heritage resources, noting in Section 1.11.2.8.2 that an objective is to "To ensure that built heritage resources, cultural heritage landscapes, and archaeological sites are conserved, promoted, and restored (where feasible), in order to maintain their economic and social benefits" (2012:1-18).

Through careful analysis of the heritage values and attributes of an identified resource, coupled with an analysis of project impacts and an outline of potential mitigation measures, the aims of the *Environmental Assessment Act* and the *Official Plans* can be met.

2.1 Key Concepts

The following concepts require clear definition in advance of the methodological overview; proper understanding is fundamental for any discussion pertaining to cultural heritage resources:

- **Cultural Heritage Value or Interest** (CHVI), also referred to as Heritage Value, is identified if a property meets one of the criteria outlined in O. Reg. 9/06, namely historic or associate value, design or physical value and/or contextual value. Provincial significance is defined under *O. Reg*. 10/06 of the *Ontario Heritage Act* (*OHA*).

- **Built Heritage Resource** (BHR) is defined in the *PPS* as: "a building, structure, monument, installation or any manufactured remnant that contributes to a property's cultural heritage value or interest as identified by a community, including an Aboriginal community. Built heritage resources are generally located on property that has been designated under Parts IV or V of the *OHA*, or included on local, provincial and/or federal registers" (MMAH 2014:39).

- **Cultural Heritage Landscape** (CHL) is defined in the *PPS* as: "a defined geographical area that may have been modified by human activity and is identified as having cultural heritage value or interest by a community, including an Aboriginal community. The area may involve features such as structures, spaces, archaeological sites or natural elements that are valued together for their interrelationship, meaning or association. Examples may include, but are not limited to, heritage conservation districts designated under the *Ontario Heritage Act*; villages, parks, gardens, battlefields, mainstreets and neighbourhoods, cemeteries, trailways, viewsheds, natural areas and industrial complexes of heritage significance; and areas recognized by federal or international designation authorities (i.e., a National Historic Site or District designation, or a UNESCO World Heritage Site)" (MMAH 2014:40).

It is recognized that the heritage value of a CHL is often derived from its association with historical themes that characterize the development of human settlement in an area (Scheinman 2006). In Ontario, typical themes that may carry heritage value within a community include, but are not limited to: 1) Pre-Contact habitation, 2) early European exploration, 3) early European and First Nations contacts, 4) pioneer settlement, 5) development of transportation networks, agriculture and rural life, 6) early industry and commerce, and/or 7) urban development. Individual CHLs may be related to a number of these themes simultaneously.

The *Operational Guidelines for the Implementation of the World Heritage Convention* defines several types of CHLs: 1) designed and created intentionally by man, 2) organically evolved landscapes that fall into two-subcategories (relic/fossil or continuing), and 3) associative cultural landscapes (UNESCO 2008:86). The (former) Ministry of Culture (MCL) *Information Sheet #2 Cultural Heritage Landscapes* (MCL 2006c) repeats these definitions to describe landscapes in Ontario.

- **Conserved** means "the identification, protection, management and use of built heritage resources, cultural heritage landscapes and archaeological resources in a manner that ensures their cultural heritage value or interest is retained under the *Ontario Heritage Act*. This may be achieved by the implementation of recommendations set out in a conservation plan, archaeological assessment, and/or heritage impact assessment. Mitigative measures and/or alternative development approaches can be included in these plans and assessments" (MMAH 2014:40).

- **Heritage Attributes** are defined in the *Ontario Heritage Act* as: "the principal features or elements that contribute to a protected heritage property's cultural heritage value or interest, and may include the property's built or manufactured elements, as well as natural landforms, vegetation, water features, and its visual setting (including significant views or vistas to or from a protected heritage property means, in relation to real property, and to the buildings and structures on the real property, the attributes of the property, buildings and structures that contribute to their cultural heritage value or interest" (Government of Ontario 2009).

- **Protected Heritage Property** signifies "property designated under Parts IV, V or VI of the *Ontario Heritage Act*; property subject to a heritage conservation easement under Parts II or IV of the *Ontario Heritage Act*; property identified by the Province and prescribed public bodies as provincial heritage property under the Standards and Guidelines for Conservation of Provincial Heritage Properties; property protected under federal legislation, and UNESCO World Heritage Sites" (MMAH 2014:47).

- **Significant** in reference to cultural heritage is defined as: "resources that have been determined to have cultural heritage value or interest for the important contribution they make to our understanding of the history of a place, an event, or a people" (MMAH 2014:49).

Official Plan of the City of Brantford (2018b) also contains definitions for:

- "built heritage resource" means the whole or part of one or more buildings, structures, monuments, installations or remains that have been identified as being historically and/or architecturally significant and are valued by the City;

- "cultural heritage landscape" means a defined geographic area of heritage significance which has been modified by human activities. Such an area is significant to the understanding of a people or place and is valued by the City;

- "cultural heritage resource" means artifacts such as art, literature, music, handicrafts, tools, equipment, furnishings, communications, documents, music and folklore which are significant to the understanding of a people or place and are valued by the City

2.2 Types of Recognition

BHRs and CHLs are broadly referred to as cultural heritage resources. A variety of types of recognition exist to commemorate and/or protect cultural heritage resources in Ontario.

The National Historic Sites program commemorates important sites, people or events that had a nationally significant effect on, or illustrate a nationally important aspect of, the history of Canada. The Minister of Canadian Heritage, on the advice of the Historic Sites and Monuments Board of Canada (HSMBC), makes recommendations to the program. Another form of recognition at the federal level is the Canadian Heritage Rivers System program. It is a federal program to recognize and conserve rivers with outstanding natural, cultural and recreational heritage. It is important to note that neither of these federal commemoration programs offer protection from alteration or destruction.

The Ontario Heritage Trust (OHT) operates the Provincial Plaque Program, which has over 1,250 provincial plaques recognizing key people, places and events that have shaped the province (OHT 2018). Additionally, properties owned by the province may be recognized as a "provincial heritage property" (MTCS 2010). A cultural heritage resource may also be protected through an OHT or municipal easement. In addition, many municipal heritage committees and historical societies provide plaques for local places of interest.

Under *Section 27* of the *OHA*, a municipality must keep a Municipal Heritage Register. A Register lists designated properties (those protected by municipal by-law as Part IV (individual properties) or Part V (Heritage Conservation Districts) designations under the *OHA*, as well as other properties of cultural heritage value or interest in the municipality. Properties on this Register that are not formally designated are commonly referred to as "listed." Listed properties are flagged for planning purposes and are afforded a 60-day delay in demolition, if a demolition request is received by the municipality.

2.3 Approach

The *Guideline for Preparing the Cultural Heritage Resource Component of Environmental Assessments* indicates a need to describe the "affected environment," which is defined as "a spatially defined area within which land will be altered as a result of the proponent's development" (MCL 1992:3). As such, ARA completes in-depth research and an evaluation of any potential cultural heritage resource within the project area. ARA's business practice also considers a larger study area that considers abutting properties. This ensures that every BHR and CHL that may be subject to potential indirect project impacts are identified.

A combination of background research, consultation with the local community and field survey is essential to identify and effectively evaluate properties with potential BHRs and CHLs in a meaningful and objective format. Properties identified as potential BHRs and CHLs through the above-mentioned research, consultation and survey may be considered candidate cultural heritage resources once they have been evaluated against the regulations under the *Ontario Heritage Act* (i.e., O. Reg. 9/06 and O. Reg. 10/06). See Section 2.4 Evaluation of Significance below for a discussion of the OHA Regulations.

2.3.1 Historical Research

Background information is obtained from aerial photographs, historical maps (i.e., illustrated atlases), archival sources (i.e., historical publications and records), published secondary sources (online and print) and local historical organizations. Given that research is constrained to sources in the public record and conducted in a limited time frame there is the possibility that additional historical information exists but may not have been identified.

2.3.2 Consultation

Consultation with the local community is essential for determining the community value of cultural heritage resources. At project commencement, ARA contacts the relevant local and regional municipalities to inquire about: 1) protected properties in the study area, 2) properties with other types of recognition in the study area, 3) previous studies relevant to the current study, and 4) other heritage concerns regarding the study area or project area. Where possible, information is also sought directly from the MTCS and OHT.

2.3.3 Field Survey

The field survey component of an assessment involves the collection of primary data through systematic photographic documentation of all potential cultural heritage resources within the study area, as identified through historical research and consultation. Generally, potential cultural heritage resources are identified by applying a 40-year rolling timeline. This timeline is considered an industry best practice (i.e., MTO 2008). A construction date of 40 years does not, however, automatically attribute CHVI to a resource; rather it indicates that it should be flagged as a potential resource and evaluated for CHVI.

Additional cultural heritage resources may also be identified during the survey itself (candidate cultural heritage resources). Photographs capturing all properties with potential BHRs and CHLs are taken, as are general views of the surrounding landscape. The field survey also assists in confirming the location of each potential cultural heritage resource and helps to determine the relationship between resources. Given that such surveys are limited to areas of public access (i.e., roadways, intersections, non-private lands, etc.), there is always the possibility that obscured cultural heritage resources may be missed or that heritage attributes may be refined upon closer inspection.

2.4 Evaluation of Significance

2.4.1 Heritage Value

In order to objectively identify cultural heritage resources, O. Reg. 9/06 made under the *OHA* sets out three principal criteria with nine sub-criteria, which are municipal criteria, for determining CHVI (MCL 2006a:20-27). The criteria set out in the regulation were developed to identify and evaluate properties for municipal designation under the *OHA*. Best practices in evaluating properties that are not yet protected employ O. Reg. 9/06 to determine if they have CHVI. These criteria include: design or physical value, historical or associative value, and contextual value.

Design or Physical Value manifests when a feature:

- is a rare, unique, representative or early example of a style, type, expression, material or construction method;
- displays a high degree of craftsmanship or artistic value; or
- displays a high degree of technical or scientific achievement.

Historical or Associative Value appears when a resource:

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

- yields or has the potential to yield information that contributes to the understanding of a community or culture; or
- demonstrates or reflects work or ideas of an architect, builder, artist, designer or theorist who is significant to the community.

Contextual Value is implied when a feature:

- is important in defining, maintaining or supporting the character of an area;
- is physically, functionally, visually or historically linked to its surroundings; or
- is a landmark.

If a potential cultural heritage resource property (BHR or CHL) identified during this study is found to have the potential to meet any one of these criteria, it may then be considered a candidate cultural heritage resource. A candidate cultural heritage resource meeting the above criteria may be added to a Municipal Heritage Register as a property with CHVI that is either designated by municipal by-law or as a "listed" property (see Section 2.2 Types of Recognition). Additional work outside the scope of this report (i.e., Cultural Heritage Evaluation Report (CHER) or Heritage Impact Assessment (HIA) may be necessary to fully examine and evaluate a resources' CHVI.

2.4.2 Provincial Significance

Issued under the *OHA*, O. Reg. 10/06 outlines the criteria to determine if a property is of provincial significance. To be considered a "heritage property of provincial significance" a site must meet one or more of the following criteria:

- The property represents or demonstrates a theme or pattern in Ontario's history;
- The property yields, or has the potential to yield, information that contributes to an understanding of Ontario's history;
- The property demonstrates an uncommon, rare or unique aspect of Ontario's cultural heritage;
- The property is of aesthetic, visual or contextual importance to the province;
- The property demonstrates a high degree of excellence or creative, technical or scientific achievement at a provincial level in a given period;
- The property has a strong or special association with the entire province or with a community that is found in more than one part of the province. The association exists for historic, social, or cultural reasons or because of traditional use;
- The property has a strong or special association with the life or work of a person, group or organization of importance to the province or with an event of importance to the province; or
- The property is located in unorganized territory and the Minister determines that there is a provincial interest in the protection of the property. O. Reg. 10/06, s. 1 (2).

The determination that a property warrants evaluation against O. Reg. 10/06 is based on background research, consultation with the local community, field survey and the extensive experience of ARA staff.

2.5 Evaluation of Impacts

Any potential project impacts on identified BHRs or CHLs must be evaluated, including direct and indirect impacts Ministry of Culture's *InfoSheet #5: Heritage Impact Assessments and Conservation Plans* (2006b:3) provides an overview of several major types of negative impacts, including but not limited to:

- Destruction of any, or part of any, significant heritage attributes;
- Alteration that is not sympathetic, or is incompatible, with the historic fabric and appearance;
- 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 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; and
- Land disturbances such as a change in grade that alters soils, and drainage patterns that adversely affect an archaeological resource.

The above direct and indirect impacts are primarily negative impacts but there may also be positive effects as a result of an EA project. For example, more recent infrastructure may be removed to restore the original views to cultural heritage resources.

2.6 Mitigation Strategies

If potential impacts on identified heritage resources are determined, proposed conservation or mitigative/avoidance measures must be recommended.

The MTC's *InfoSheet #5: Heritage Impact Assessments and Conservation Plans* (2006b:3) lists several specific methods of minimizing or avoiding a negative impact on a cultural heritage resource, including but not limited to:

- Alternative development approaches;
- Isolating development and site alteration from significant built and natural features and vistas;
- Design guidelines that harmonize mass, setback, setting, and materials;
- Limiting height and density;
- Allowing only compatible infill and additions;
- Reversible alterations; and
- Buffer zones, site plan control, and other planning mechanisms.

Strategies also may be developed to enhance positive environmental effects as a result of an EA undertaking.

2.7 Summary of Approach

The approach outlined herein is supported by the best practices, guidelines and policies of the following:

- The *Provincial Policy Statement* (2014);
- The *Ontario Heritage Act* (R.S.O. 1990);
- *Environmental Assessment Act* (R.S.O. 1990);
- *Guideline for Preparing the Cultural Heritage Resource Component of Environmental Assessments* (MCL 1992);
- The *Ontario Heritage Tool Kit* series (MCL 2006a);
- *The Official Plan of the City of Brantford* (2018b); and
- *The County of Brant Official Plan* (2012).

The Built Heritage and Cultural Heritage Landscape Assessment for the Colborne Street Slope Stabilization Class EA was overseen by P.J. Racher, M.A., CAHP. It was directed by K. Jonas Galvin, M.A, CAHP and managed by J. McDermid, B.A. The field survey was completed by J. McDermid and Sarah Clarke, B.A. and the historic research was completed by S. Clarke. Technical writing was undertaken by the staff listed above as well as by P. Young M.A., CAHP and L. Benjamin, M.A.E.S., CHAP. Curriculum Vitae for key personnel can be found in Appendix B.

3.0 HISTORICAL CONTEXT

The study area has strong associations with Indigenous communities, and the heritage resources considered in this report can be associated with both Pre-Contact and Post-Contact cultural developments. Accordingly, the Pre-Contact period of Indigenous occupation of the study area and the history of the initial settlement and growth during the colonial period in Brant County are of direct relevance to the present study.

3.1 Pre-Contact

The Pre-Contact history of the region is lengthy and rich, and a variety of Indigenous groups inhabited the landscape. Archaeologists generally divide this vibrant history into three main periods: Palaeo-Indian, Archaic and Woodland. Each of these periods comprise a range of discrete sub-periods characterized by identifiable trends in material culture and settlement patterns, which are used to interpret indigenous lifeways. The principal characteristics of these sub-periods are summarized in Table 1.

Table 1: Pre-Contact Settlement History
(Wright 1972; Ellis and Ferris 1990; Warrick 2000; Munson and Jamieson 2013)

Sub-Period	Timeframe	Characteristics
Early Palaeo-Indian	9000–8400 BC	Gainey, Barnes and Crowfield traditions; Small bands; Mobile hunters and gatherers; Utilization of seasonal resources and large territories; Fluted projectiles
Late Palaeo-Indian	8400–7500 BC	Holcombe, Hi-Lo and Lanceolate biface traditions; Continuing mobility; Campsite/Way-Station sites; Smaller territories are utilized; Non-fluted projectiles
Early Archaic	7500–6000 BC	Side-notched, Corner-notched (Nettling, Thebes) and Bifurcate traditions; Growing diversity of stone tool types; Heavy woodworking tools appear (i.e., ground stone axes and chisels)
Middle Archaic	6000–2500 BC	Stemmed (Kirk, Stanly/Neville), Brewerton side- and corner-notched traditions; Reliance on local resources; Populations increasing; More ritual activities; Fully ground and polished tools; Net-sinkers common; Earliest copper tools
Late Archaic	2500–900 BC	Narrow Point (Lamoka), Broad Point (Genesee) and Small Point (Crawford Knoll) traditions; Less mobility; Use of fish-weirs; True cemeteries appear; Stone pipes emerge; Long-distance trade (marine shells and galena)
Early Woodland	900–400 BC	Meadowood tradition; Crude cord-roughened ceramics emerge; Meadowood cache blades and side-notched points; Bands of up to 35 people
Middle Woodland	400 BC–AD 600	Saugeen tradition; Stamped ceramics appear; Saugeen projectile points; Cobble spall scrapers; Seasonal settlements and resource utilization; Post holes, hearths, middens, cemeteries and rectangular structures identified
Middle/Late Woodland Transition	AD 600–900	Gradual transition between Saugeen and Algonkian lifeways; Princess Point tradition emerges elsewhere (i.e., within the drainages around the western end of Lake Ontario, Grand River and the north shore of Lake Erie)
Late Woodland (Early Iroquoian)	AD 900–1300	Glen Meyer tradition; Settled village-life based on agriculture; Small villages (0.4 ha) with 75–200 people and 4–5 longhouses; Semi-permanent settlements
Late Woodland (Middle Iroquoian)	AD 1300–1400	Uren and Middleport traditions; Classic longhouses emerge; Larger villages (1.2 ha) with up to 600 people; More permanent settlements (30 years)
Late Woodland (Late Iroquoian)	AD 1400–1600	Pre-Contact Neutral tradition; Larger villages (1.7 ha); Examples up to 5 ha with 2,500 people; Extensive croplands; also hamlets, cabins, camps and cemeteries; Potential tribal units; Fur trade begins circa1580; European trade goods appear

3.2 Post-Contact

The arrival of European explorers and traders at the beginning of the 17th century triggered widespread shifts in Indigenous lifeways and set the stage for the ensuing Euro-Canadian settlement process. Documentation for this period is abundant, ranging from the first sketches of Upper Canada and the written accounts of early explorers to detailed township maps and lengthy histories. The Post-Contact period can be effectively discussed in terms of major historical events, and the principal characteristics associated with these events are summarized in Table 2.

Table 2: Post-Contact Settlement History
(Smith 1846; Sutherland 1869; Coyne 1895; Lajeunesse 1960; Johnston 1964; Mika 1972; Ellis and Ferris 1990; Surtees 1994; AO 2015)

Historical Event	Timeframe	Characteristics
Early Contact	Early 17th century	Brûlé explores the area in 1610; Champlain visits in 1613 and 1615/1616; Iroquoian-speakers (Huron, Petun and Neutral) and Algonkian-speakers (Anishinabeg) encountered; European goods begin to replace traditional tools
Five Nations Invasion	Mid-17th century	Haudenosaunee (Five Nations) invade circa 1650; Neutral, Huron and Petun Nations are defeated/removed; vast Iroquoian hunting territory established in the second half of the 17th century; Explorers continue to document the area
Anishnabeg Influx	Late 17th to early 18th century	Ojibway, Odawa and Potawatomi expand into Haudenosaunee lands in the late 17th century; Nanfan Treaty between Haudenosaunee and British in 1701; Anishnabeg occupy the area and trade directly with the French and English
Fur Trade Development	Early to mid-18th century	Growth and spread of the fur trade; Peace between the French and English with the Treaty of Utrecht in 1713; Ethnogenesis of the Métis; Hostilities between French and British lead to the Seven Years' War in 1754; French surrender in 1760
British Control	Mid-18th century	*Royal Proclamation* of 1763 recognizes the title of the First Nations to the land; Numerous treaties arranged by the Crown; First acquisition is the Seneca surrender of the west side of the Niagara River in August 1764
Loyalist Influx	Late 18th century	United Empire Loyalist influx after the American Revolutionary War (1775–1783); British develop interior communication routes and acquire additional lands; 'Between the Lakes Purchase' orchestrated by Haldimand in 1784 to obtain lands for Six Nations (the Haldimand Tract); *Constitutional Act* of 1791 creates Upper and Lower Canada
County Development	Late 18th to early 19th century	Became part of York County's 'West Riding', Norfolk County and Lincoln County's 'First Riding' in 1792; Additional lands acquired in the second 'Between the Lakes Purchase' in 1792; Brant surrenders Blocks 1–6 of the Haldimand Tract to the Crown in 1798; Part of York County's 'West Riding', Oxford County and Haldimand County in 1798; Part of Halton County, Oxford County and Wentworth County in 1816; Brant County created after the abolition of the district system in 1849
Township Formation	Late 18th to early 19th century	Brant leased some of the Six Nation's holdings to European families in 1787; First settlers located along Fairchild Creek in the east, including I. Fairchild, J. Filer, I. Whiting and Major Westbrook; In 1810, only J. Stalts and E. Burrell lived in the area that would become the Town of Brantford; T. Perrin was the first pioneer in the western part of the township; Town plot for Brantford surrendered to the Crown in April 1830; Surveyed by L. Burwell in Summer 1830; Brant's leased lands resulted in a very irregular township layout
Township Development	Mid-19th to early 20th century	In 1841, the population of the Township of Brantford was 5,199; By 1846, a total of 23,486 ha had been taken up, with 17,107 ha under cultivation; Contained six grist mills and six saw mills at that time; Population reached 6,904 by 1861; Traversed by the Buffalo, Brantford & Goderich Railway (1854/1856), the Harrisburg & Brantford Railway (1871), the Brantford, Norfolk & Port Burwell Railway (1876), the Brantford, Waterloo & Lake Erie Railway (1889), the Toronto, Hamilton & Buffalo Railway (1895), the Brantford & Hamilton Electric Railway (1908) and the Lake Erie & Northern Railway (1916); Principal settlements at Mt. Pleasant, Mt. Vernon, Paris, Cainsville, Langford and Brantford

3.3 Village of Cainsville

Following the 'Between the Lakes Purchase' (also known as the Haldimand Grant) in 1784, Six Nations Loyalists settled along the Grand River. The greater vicinity of the project location comprised part of the Indigenous village known as Cayuga or Cayuga Heights (Reville 1920:334). Euro-Canadian settlers began to arrive circa 1787, when Joseph Brant issued leases to a number of European families. With less than 2,000 Six Nations members living in the Haldimand Tract and the imminent death of the fur trade, Brant realized that he would need the assistance of European settlers to bring new technologies to his people and transform them into successful agriculturalists (Johnston 1964: xlii-xliii).

Indigenous title to the remainder of the Township of Brantford was gradually extinguished. and Euro-Canadian settlers continued to clear the forests for agricultural and settlement purposes. The Hamilton Road (later Colborne Street) was opened in 1810, and it was rehabilitated as a corduroy road to facilitate the transportation of troops and supplies in 1812. Parts of this road would subsequently be either planked or gravelled (Mika 1972: xv). The town plot of Brantford was surrendered in April 1830, and that community developed into one of the most thriving commercial and manufacturing towns in the province. The Grand River Navigation Company was chartered in 1832, and the canal was laid out in 1840 to facilitate the shipping of produce and goods (Mika 1972: xii; Irwin & Burnham 1867:116). Three locks were constructed in Brantford at modern Locks Road by 1848. The 'Grand Canal Opening' occurred in November 1848, making the Grand River fully navigable from Brantford to Dunnville (Lefler 2017).

Cainsville was established by the Grand River Navigation Company at the former site of Cayuga Heights in 1837. The village, named after leading citizen Peter Cain, prospered as a result of the canal—barges were towed by horses, the Messmore scows towed coal and plaster, and the Leonard Coal Wharf was located near the headgates of the canal. Industries such as cheese, potash, match and soap factories dotted the village (Lefler 2017). Cainsville was also an important post village on the Hamilton and Brantford stage road and a station of the Buffalo, Brantford & Goderich Railway (later Buffalo & Lake Huron Railway and then Grand Trunk Railway). By 1869, the village had a population of 150 and contained two churches (Wesleyan Methodist and Church of England), a school house, two hotels, two stores and a post office, three wagon shops, three blacksmith shops and a shoe shop (Sutherland 1869:134).

Below Cainsville along the banks of the Grand River was formerly a location of black settlement known as Bunnell's Landing, commemorated with a plaque once situated along the TH&B rail line north of Colborne Street (Meens 2004:D7). This plaque has been missing since at least 2016 (Mulkewich 2017). Early settler Joseph Thomas is said to have returned from a visit to the United States in 1809, bringing with him an enslaved husband and wife to his property on the north side of Colborne Street (Map 2). The remains of these two unnamed individuals were encountered and exhumed during the construction of the Brantford and Hamilton Electric Rail Line (Reville 1920:258–259).

The Village of Cainsville remained part of the Township of Brantford until 1955, at which point all lands west of the CPR line at Cainsville and north of the Grand River were annexed to the

City of Brantford (EPWI n.d:155). The Cainsville lands east of the rail line remain part of the County of Brant.

In 1986 a landslide event occurred within the project location, affecting almost 40 properties along the bank of the Grand River at Cainsville and destroying the TH&B rail line down slope from Colborne Street (Maus n.d.). Following the landslide, the TH&B line was removed and the rail bed has since functioned as a pedestrian trail.

3.4 Project Location

In an attempt to reconstruct the historic land uses of the project areas and study areas, ARA examined five historical maps that documented past residents, structures (i.e., homes, businesses and public buildings) and features between the mid-19th and early 20th centuries, and one aerial image from the mid-20th century. Specifically, the resources outlined in Table 3 were consulted.

Table 3: Historic Maps and Aerials Consulted

Year	Map Title	Reference
n.d.	Brantford Township (20) Patent Plan	Burwell
1859	Map of the County of Brant, Canada West	Tremaine
1875	Brantford Township East of River, Brant County	McGill University
1875	Cainsville, Ontario	Page & Smith
1916	Brantford Sheet No. 55 [040P01]	OCUL
1951	Aerial Photo	NAPL

During Pre-Contact and Early Contact times, the vicinity of the project location would have comprised a mixture of coniferous trees, deciduous trees and open areas. Indigenous communities would have managed the landscape to some degree. During the early 19th century, Euro-Canadian settlers arrived in the area and began to clear the forests for agricultural and settlement purposes. The vicinity of the project location was well-settled for the remainder of the Euro-Canadian period, being located east of the City of Brantford and within the Village of Cainsville.

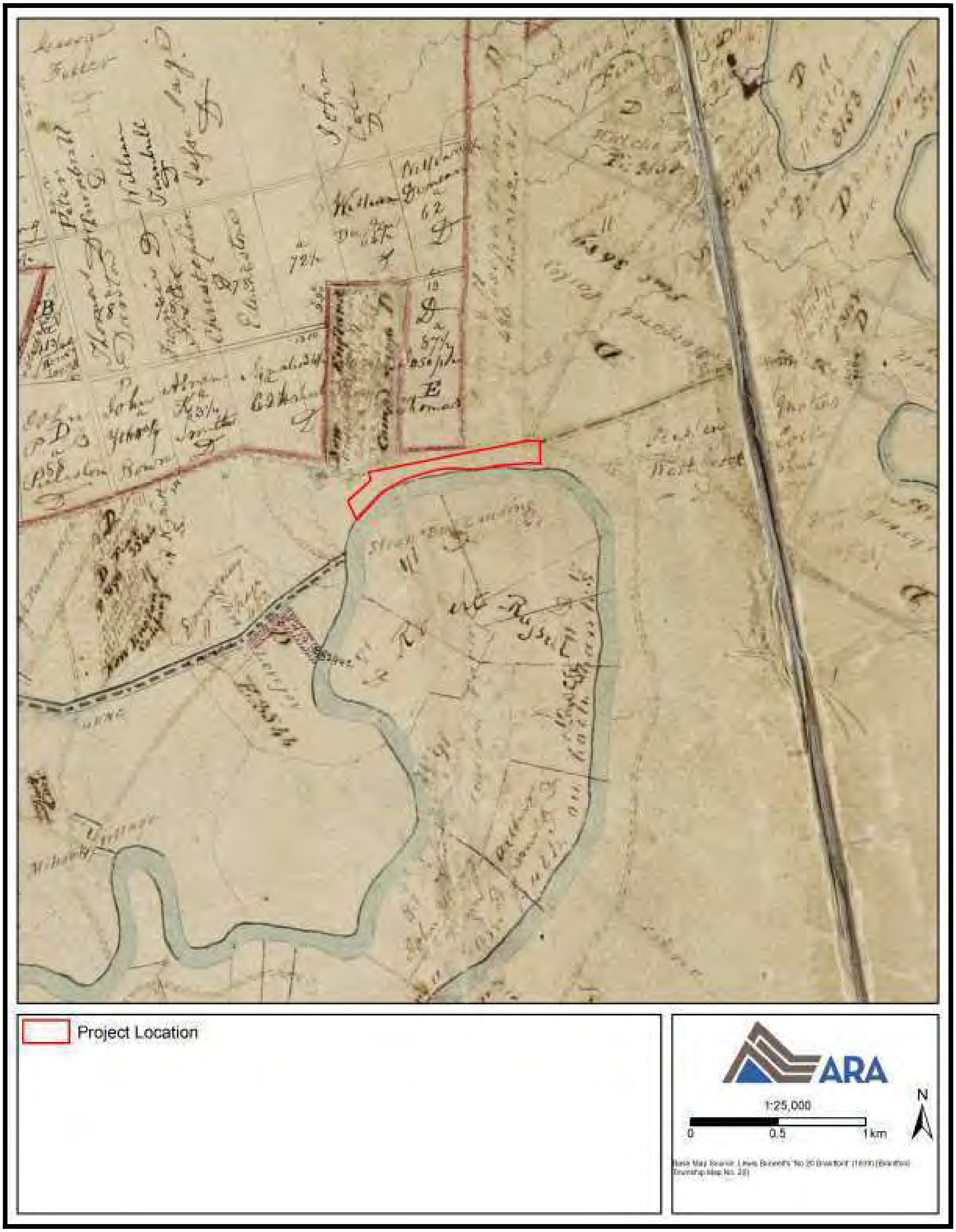
The *Brantford Township* Patent Plan, initiated on a copy of one of the original survey plans and updated with patent information until the records were transferred to the Archives of Ontario, indicates that the project location was traversed along its north boundary by an early alignment of modern Colborne Street (see Map 2). A tributary of Fairchild Creek appears to the north, and the oxbow of the Grand River is clearly illustrated to the south. The outlet of the canal to the Grand River is indicated to the west, and a "steam boat landing" is noted within the oxbow lands. No structures or other features appear in the vicinity of the study area.

G.C. Tremaine's *Map of the County of Brant, Canada West* (1859) indicates that the project location fell within the historic limits of Cainsville, at which time the Cainsville Methodist Church was situated therein. A schoolhouse is illustrated in the vicinity of the subject lands, as is a tow path relating to the Grand River Navigation Company canal (see Map 3). The Buffalo, Brantford & Goderich Railway appears to the north, which opened to Brantford in 1854 and Paris in 1856.

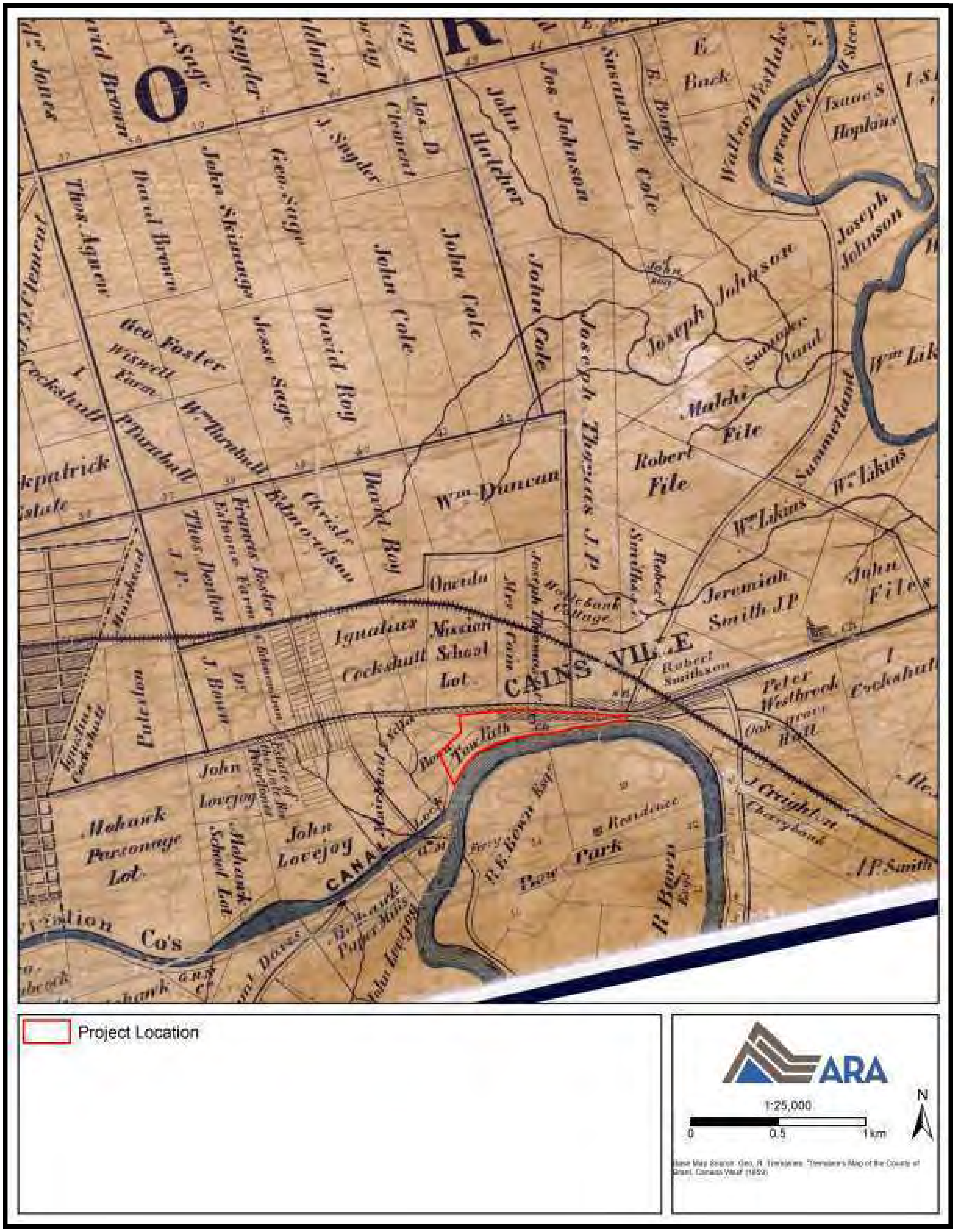
Brantford Township East of River from Page & Smith's *Illustrated Historical Atlas of the County of Brant, Ont.* (1875) indicates that the project location continued to fall within the historic limits of Cainsville, and the western extent of the lands were under the ownership of John Young Bown and the Grand River Navigation Company with a schoolhouse structure indicated (see Map 4). Alexander Duncan occupied the remainder of Lot 1, North of Road to Hamilton, and the Duncan farmstead was located well north of the study area. The *Village of Cainsville* (1875) depicts land subdivisions within the project location, although land owners/occupants are not indicated (see Map 5). Additionally, the former alignment of the Brantford and Ancaster Road (later Brantford and Hamilton) is indicated to the west of the project location and the Grand Trunk Railroad line to the east.

A topographic map from 1916 indicates structures within the project location just south of Colborne Street and just north of the Grand River, which is crossed by the TH&B railway east–west. To the southwest of the project location is a 'pontoon bridge' which facilitated a river crossing from the south end of Locks Road to the Bow Park farmlands (see Map 6).

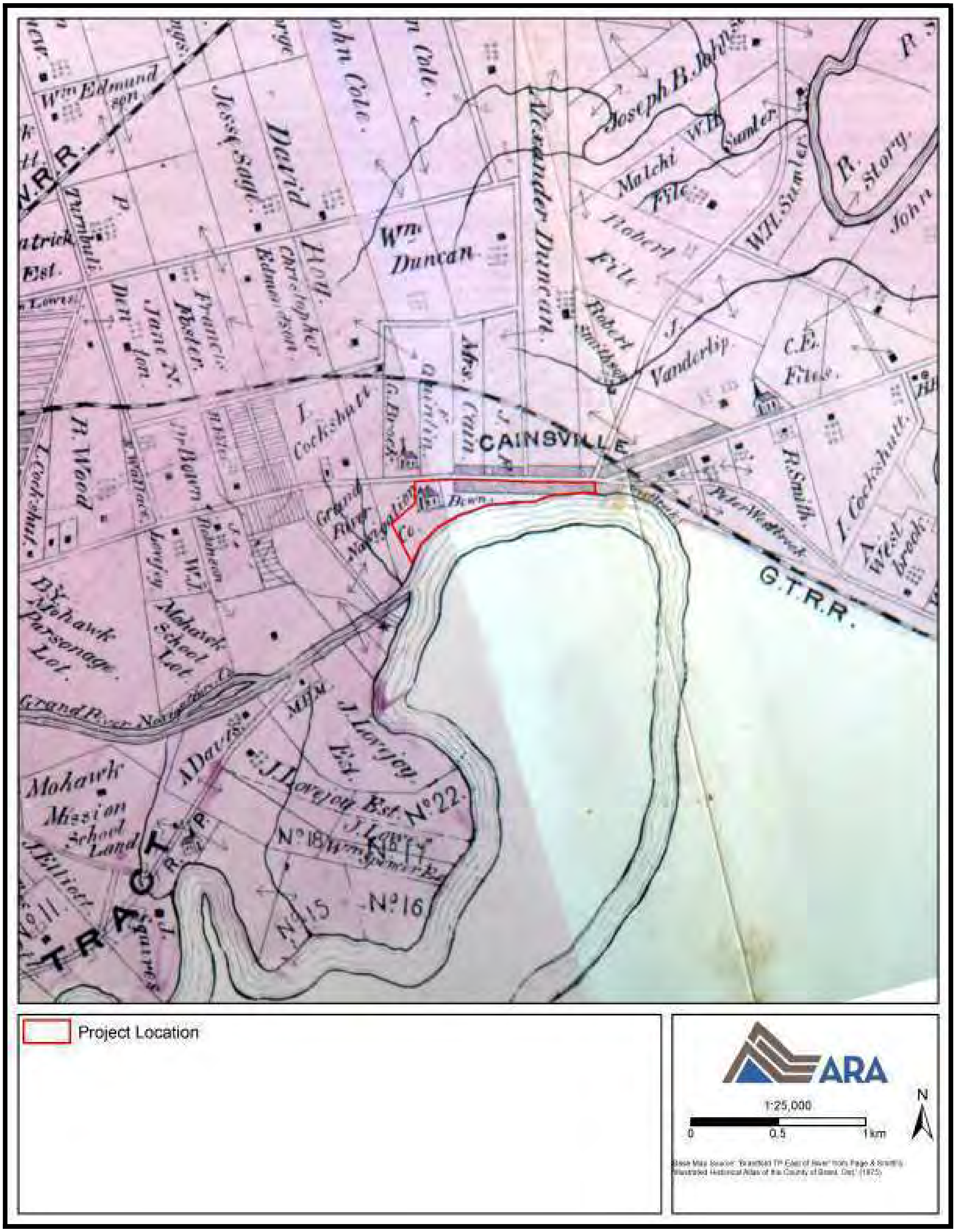
An aerial photo from 1951 depicts the extent of development within the project location. Residential properties front onto Colborne Street and an industrial operation is seen on the east side of Clara Crescent, just south of Colborne Street. The south part of the project location comprises the TH&B rail line and Beach Road, along with some residential properties south of the rail line and north of the Grand River (see Map 7).



Map 2: Detail of Burwell's *Brantford Township* (No Date) Map, Showing the Project Location
(Produced under licence using ArcGIS® software by Esri, © Esri; Burwell 1851)

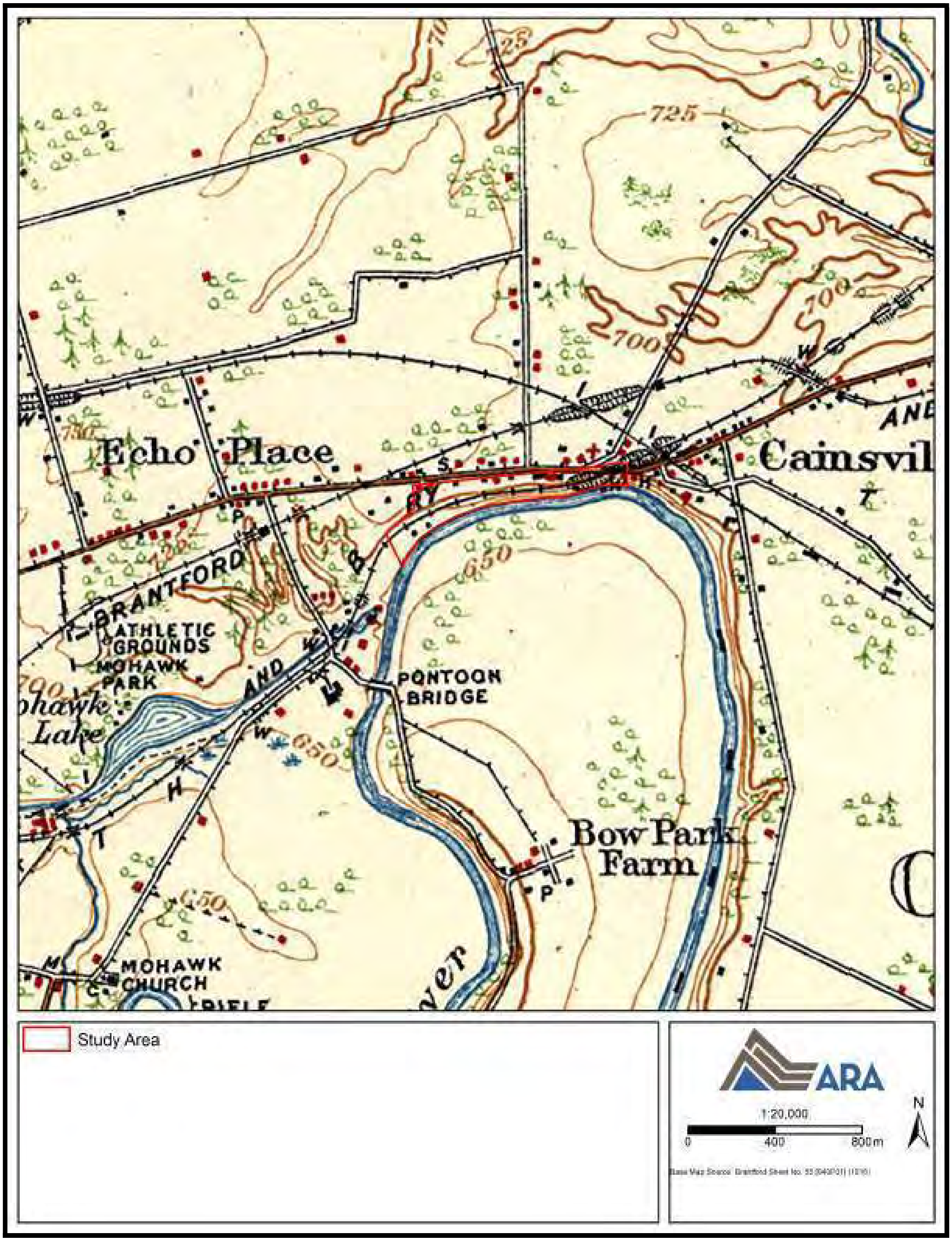


Map 3: Detail from G.C. Tremaine's *Map of the County of Brant, Canada West* (1859), Showing Project Location
(Produced under licence using ArcGIS® software by Esri, © Esri; OHCMP 2018)

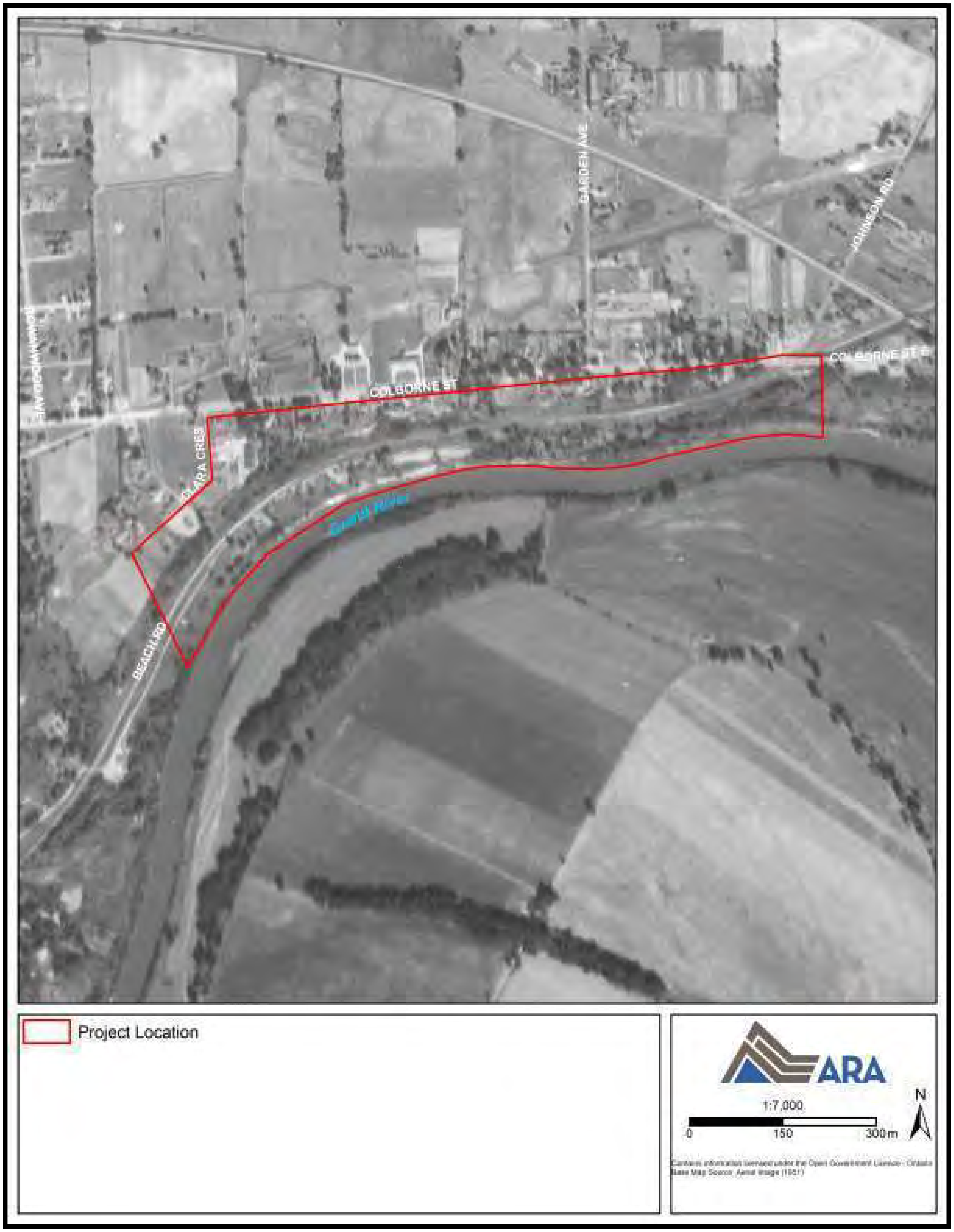


Map 4: Page & Smith's *Brantford Township East of River* (1875), Showing Project Location
(Produced under licence using ArcGIS® software by Esri, © Esri; McGill University 2001)

Map 5: The *Village of Cainsville* from Page & Smith's *Illustrated Historical Atlas of the County of Brant, Ont.* (1875) over aerial, Showing Project Location
(Produced under licence using ArcGIS® software by Esri, © Esri; Page & Smith 1875:32)



Map 6: Topographic Map (1916), Showing the Project Location
(Produced under licence using ArcGIS® software by Esri, © Esri; OCUL 2018)



Map 7: Historic Aerial Image (1951), Showing Project Location
(Produced under licence using ArcGIS® software by Esri, © Esri; NAPL 1951)

4.0 HERITAGE CONTEXT

To determine whether any previously-identified properties with CHVI are located within, adjacent to or in proximity to the limits of the study area, ARA consulted a number of heritage groups and online heritage resources as well as completed a field survey.

4.1 Consultation

The former Ministry of Culture's current list of Heritage Conservation Districts was consulted. No designated districts were identified in the study area (MTCS 2018). The list of properties designated by the MTCS under Section 34.5 of the *OHA* was consulted. No properties in the study area are listed. Parks Canada *Directory of Federal Heritage Designations* was searched, none are recognized as National Historic Sites (Parks Canada 2018). The OHT *Plaque Database* was searched and confirmed the commemoration of the Honourable George Brown (1818-1880) with an OHT plaque (OHT 2018).

The provincial plaque commemorates Hon. George Brown. In addition to describing his role in as a leading architect of Confederation as well as his other political career high points, the plaque also describes its location in the small parkette as a point from which to view the Bow Park. Brown's Bow Park Farm is located in the large Brantford oxbow of the Grand River, where he developed a major enterprise for raising pure-bred cattle. This plaque is included in CHL 1(see CHL1 in Appendix A).

After a search the City of Brantford's Heritage Inventory (currently undergoing review to become a Municipal Heritage Register), the following properties located within the study area including: 909, 997, 1019, and 1025 Colborne Street. In addition, there were several properties on the inventory that are adjacent to the study area: 904, 948, 950, 968, 1000, 1036, 1042 and 1044 Colborne Street, 13 and 21 Johnson Road. There were additional properties remaining on the Heritage Inventory that would have been within our study area however, these were either lost in the landslide or demolished afterwards.

The County of Brant has a list of designated properties posted online but does not appear to have a Municipal Heritage Register with additional "listed" properties (2018). None of the properties identified within the County of Brant as part of this project are designated. Ecosystem Recovery Inc. provided a contact at the County of Brant, the Development Services Clerk. ARA staff reached out to this individual via email on November 23rd and a clarification email on November 26th. At the time of writing this report, no response had been received.

ARA also reached out the Deputy Clerk/Manager of Legislative Services at the Corporation of the City of Brantford via email on November 23rd, 2018 to inquire about any heritage interests the City or Municipal Heritage Committee may have related to the study area. The Deputy Clerk forwarded our request to the City Planner on November 23rd, 2018. The City of Brantford's Intermediate Planner, Long Range Planning provided a response on December 3rd 2018 indicating that there are no properties within or adjacent to the study area that are recognized under the *Ontario Heritage Act* through listing on the Municipal Heritage Register or designation, or any other type of provincial or federal recognition in the study area; no known

Cultural Heritage Landscapes in or adjacent to the study area; and aside from some properties being included in the City Heritage Inventory (see Section 4.2), no other known heritage interests in the study area.

4.2 Field Survey

A field survey was conducted on November 6, 2018 to photograph and document the study area surroundings, and to record any local features that could enhance ARA's understanding of their setting in the landscape and contribute to the cultural heritage evaluation process. As noted in Method Section 2.3.3, properties with potential cultural heritage resources were examined during the field survey and those that were determined at that time not to possess heritage interest were eliminated. This type of preliminary investigation (a windshield survey) was appropriate given the scale of the study area. The heritage staff conducting the assessments reached conclusions regarding potential CHVI based on visual evidence and on their significant experience evaluating BHRs and CHLs using the criteria outlined in O. Reg. 9/06 and O. Reg. 10/06 of the *OHA*. A standardized checklist based on O. Reg. 9/06 was created for all properties with potential cultural heritage resources. This checklist aided in the evaluation process and was used to judge whether a given resource (BHR or CHL) possessed design or physical value, historical or associative value, or contextual value. Once evaluated these potential cultural heritage resources were considered candidate cultural heritage resources.

Initially, it was noted in Section 4.1 that the study area contains properties over 40 years old that are on the City of Brantford Heritage Inventory: 909, 997, 1019, and 1025 Colborne Street. All of these properties have been demolished. The adjacent properties on the inventory noted in Section 4.1 included 904, 948, 950, 968, 1000, 1036, 1042 and 1044 Colborne Street and 13 and 21 Johnson Road. Candidate cultural heritage resources that are included on the inventory were determined to be 968, 1036, 1042 Colborne Street as well as 13 and 21 Johnson Road. Additional candidate cultural heritage resources were evaluated. All potential cultural heritage resources are described in Appendix A.

5.0 HERITAGE ASSESSMENT

The Colborne Street Stabilization Municipal Class EA project is to involve an approximately 1 km length of Colborne Street from the existing road allowance to the Grand River. The following cultural heritage resources were identified within the study area as having potential CHVI: 1059 Colborne Street (BHR 1), 1057 Colborne Street (BHR 2), 1053 Colborne Street (BHR 3), 1047 Colborne Street (BHR 4), Beach Road House and Mill (BHR 5), Colborne Street Pedestrian Underpass (BHR 6), Colborne Street Rail Bridge (BHR 7), 1042 Colborne Street (BHR 8), 1036 Colborne Street (BHR 9), 1024 Colborne Street (BHR 10), 1020 Colborne Street (BHR 11), 1022 Colborne Street (BHR 12), 29 Clara Crescent (BHR 13), 968 Colborne Street (BHR 14), 21 Johnson Road (BHR 15), 13 Johnson Road (BHR 16). Five CHLs were identified in the study area: View to the Bow Park Farm (CHL 1), Grand River (CHL 2), Buffalo & Lake Huron Railway (B&LHR) (CHL 3), Part of the Trans Canada Trail (CHL 4), Mohawk Canal Locks (CHL 5).

A summary of the results of the evaluation of the BHRs and CHLs against the criteria set out in O. Reg. 9/06 (as no properties were deemed to require evaluation against O. Reg. 10/06) can be found in the information sheets in Appendix A. Information sheets containing the evaluations for each cultural heritage resource can be found in Appendix A.

The assessment determined that all sixteen BHRs and five CHLs met one or more of the O. Reg. 9/06 criteria. Accordingly, these can now be classified as candidate heritage properties - BHRs (BHR Nos. 1–16) and CHLs (CHL Nos. 1–5). The locations of all candidate BHRs and CHLs are illustrated on Map 8.

6.0 DEVELOPMENT PLAN

The Request for Proposal (RFP) 18-47 (City of Brantford 2018a) outlines the need for a Municipal Class EA and monitoring of lands that are considered to be a landslide area. In 1986, a major landslide occurred in the area located between Colborne Street and north bank of the Grand River bordered westerly by Calvin Street and easterly by Johnson Street in the City of Brantford. As a result, the goal of the EA is to develop “a management strategy for the Landslide area” (City of Brantford, Terms of Reference 2018a:3).

The Class EA will determine the factors affecting the slope instability. It is to provide “engineering solutions/alternatives to stabilize” the landslide area as well as to “mitigate risk for existing” and future infrastructure/development of these lands (City of Brantford 2018a, Terms of Reference: 2). At the time of writing, proposed alternatives and the preferred alternative have not yet been developed.

Map 8: Assessment Results
(Produced by ARA under licence using ArcGIS® software by Esri, © Esri)

7.0 ANALYSIS OF POTENTIAL IMPACTS

Municipal Class EA projects have the potential to affect cultural heritage resources. The MTC's *InfoSheet #5: Heritage Impact Assessments and Conservation Plans* (MCL 2006b:3) provides a list of potential impacts to consider when evaluating any proposed development. Outlined in Section 2.0, impacts can be classified as either direct or indirect. Direct impacts (those that physically affect the heritage resources themselves) include, but are not limited to: initial project staging, excavation/levelling operations, construction of access roads and renovations or repairs over the life of the project.

Indirect impacts include but are not limited to: alterations that are not compatible with the historic fabric and appearance of the area, the creation of shadows that alter the appearance of an identified heritage attribute, the isolation of a heritage attribute from its surrounding environment, the obstruction of significant views and vistas, and other less-tangible impacts.

As outlined in Section 2.3, ARA considers a larger study area as part of its business practice and evaluates cultural heritage resources located within the project location and on all adjacent properties to ensure that all potential direct and indirect impacts to resources are addressed. This project entails stabilizing the slope within the study area. Proposed alternatives as well as a preferred alternative and subsequent detailed designs would provide a better understanding of project impacts. However, as noted above, they have not yet been developed, therefore the potential impacts and mitigation options related to the project will be discussed at a high level.

If the preferred alternatives' engineering solutions are to take place at ground level or if there is to be a solution with minimal height (i.e., a low retaining wall), no shadows will be cast near any of the identified cultural heritage resources, nor none of the heritage attributes outlined in Appendix A will be isolated from their surrounding environment, context or significant relationship. No rezoning will occur. Archaeological and environmental impacts are to be addressed in separate environmental and archaeological reports.

The CHL that falls within the project location (TransCanada Trail, CHL 4) and the CHL that is immediately adjacent to the project location at the edge of the slope (Bow Park Farm look-out CHL 1) have the potential to be directly impacted by the design solutions.

The proposed stabilization will not result in direct or indirect impacts to significant views or vistas within, from, or of built and natural features associated with BHRs as views are not heritage attributes of the BHRs (see Appendix A). However, views and/or vistas are part of the CHVI of CHL 1, CHL 2, CHL 4. If a retaining wall is located above the Colborne Street grade, it would directly impact the view to Bow Park Farm (CHL 1), or if a wall is located along the slope from the road to the trail and/or down to the river, impacts may directly affect CHL 2 (the Grand River) and CHL 4 (the TransCanada Trail).

Construction activities related to possible slope stabilization solutions such as retaining wall(s), have the potential to create vibrations that could directly impact built cultural heritage resources located close the study area (BHR 6 and BHR 7). There is the potential to directly impact

Buffalo & Lake Huron Railway (B&LHR) (CHL 3), if the slope stabilization solutions result in alteration of the "at grade" railway crossing.

If mature trees/vegetation are to be impacted/removed during the slope stabilization project activities, (i.e., in the area along the south side of Colborne Street or on the slope itself), this may result in minor alterations to the natural setting of the trail (CHL 4) and of the Grand River (CHL 2) as well as views from Bow Park farm, CHL 1, across the river. The heavily treed lot of BHR 5 may also be directly impacted if trees are to be removed from this property.

The EA project and this associated report have the potential to have a positive impact on cultural heritage resource documentation in the Township. Previously recognized cultural heritage resources that are included on the City of Brantford's Heritage Inventory may now have more information, as well as some previously un-recognized cultural heritage resources (sixteen BHRs and five CHLs) discussed in this assessment may be worthy of inclusion on a Municipal Heritage Register.

8.0 RECOMMENDATIONS AND CONCLUSIONS

The heritage assessed area consists of an approximately 1 km (total approximate area is 17.5 ha) along Colborne Street from south of the road to the banks of the Grand River in the City of Brantford. The project location comprises part of Lot 26, Eagles Nest and GR & River Navigation Co. Eagles Nest in the Geographic Township of Brantford, as well as all adjacent properties. A windshield survey of the study area was conducted, and all potential cultural heritage resources noted were evaluated against the criteria of Ontario Regulation 9/06. Of those, the following were identified within the heritage assessed area as having potential cultural heritage value or interest (CHVI):

- BHR 1 – 1059 Colborne Street
- BHR 2 – 1057 Colborne Street
- BHR 3 – 1053 Colborne Street
- BHR 4 – 1047 Colborne Street
- BHR 5 – Beach Road House and Mill (just east of 11 Beach Road)
- BHR 6 – Colborne Street Pedestrian Underpass
- BHR 7 – Colborne Street Rail Bridge
- BHR 8 – 1042 Colborne Street (Cainsville United Church)
- BHR 9 – 1036 Colborne Street
- BHR 10 – 1024 Colborne Street
- BHR 11 – 1020 Colborne Street
- BHR 12 – 1022 Colborne Street
- BHR 13 – 29 Clara Crescent
- BHR 14 – 968 Colborne Street
- BHR 15 – 21 Johnson Road
- BHR 16 – 13 Johnson Road
- CHL 1 – View to Bow Park Farm
- CHL 2 – Grand River

- CHL 3 – Buffalo & Lake Huron Railway (B&LHR)
- CHL 4 – Part of the Trans Canada Trail
- CHL 5 – Mohawk Canal Locks

Preliminary potential negative impacts were identified including: removal of mature trees that contribute to the natural setting of BHR 5, CHLs 1, 2 and 4; construction of above grade features (i.e., retaining wall(s)) impacting views that are part of CHL 1, CHL 2, CHL 4; potential alterations of the “at grade” railway crossing impacting/altering CHL 3 and construction activities creating vibrations impacting BHR 6 and BHR 7. A potential positive impact may be the use of research completed in this report to determine that previously un-recognized cultural heritage resources may be worthy of inclusion on a Municipal Heritage Register.

As a result of this Built Heritage Resource and Cultural Heritage Landscape Assessment, the following mitigation strategies are recommended to address the identified potential adverse impacts:

- That during the planning and design phases, cultural heritage resources be avoided where possible and any construction staging areas be located on lands located well away from any of the candidate BHRs and CHLs.
- That during the design phases, the removal of mature trees, specifically on BHR 5, as well as on the slope or along south side of Colborne Street (i.e., potentially impacting CHLs 1, 2 and 4), should be avoided where possible. For any trees that cannot be saved during construction, replacement with similar trees should be examined.
- That the CHL that falls within the project location (TransCanada Trail, CHL 4) be maintained during the detailed design phase and that it be returned to its pre-construction condition.
- That the adjacent Bow Park Farm look-out (CHL 1) be maintained during the detailed design phase and that it be returned to its pre-construction condition.
- That stabilization infrastructure should be integrated into the landscape in a sympathetic manner, including the use of materials that are visually compatible (i.e., natural materials such as stone or wood and/or colours).
- That consideration should be given to the type of construction techniques and machinery used in close proximity to cultural heritage resources - BHRs 5, 6 and 7, to minimize any vibration impacts.
- That once a preferred alternative has been selected and design work has begun, a Heritage Impact Assessment (HIA) report should be undertaken to confirm the anticipated impacts outlined in this report, evaluate any additional impact of the proposed design, as well as outline avoidance/mitigation measures to minimize the impact. The HIA may outline mitigation measures including additional landscaping that may be required to minimize visual impacts or design approaches may be suggested. Mitigation measures may be discussed with planners at the County and the City.
- That public consultation may result in additional potential cultural heritage resources being identified. These potential cultural heritage resources should be reviewed by a qualified heritage consultant to: 1) determine their CHVI, 2) evaluate potential project impacts, and 3) suggest strategies for future conservation of any candidate cultural heritage resources.

- That previously-unrecognized cultural heritage resources with CHVI discussed in this assessment may be worthy of inclusion on a Municipal Heritage Register.
- That this Built Heritage and Cultural Heritage Landscape Assessment should be provided to staff/planners at the City of Brantford and County of Brant.

The EA process includes preliminary studies, an examination of alternatives and selection of a preferred alternative prior to the development of preliminary and detailed designs. Impacts to cultural heritage resources should be considered during all phases of the EA process. Further, these preliminary mitigation recommendations are subject to review and confirmation during the detailed design phase, in consideration of the more detailed understanding of design and project constraints.

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Appendix A: Identified Built Heritage Resources and Cultural Heritage Landscapes

BUILT HERITAGE RESOURCE NO. 1

Description of Property	
Street Address	1059 Colborne Street
Name	n/a
Recognition	None
Location	County of Brant (Cainsville)
Type of Property	Residential
Date(s)	After 1875
Description	• Example of a highly modified Edwardian residence • Two-and-a-half-storey house with a hip roof and large front dormer, now has a modified roof line • Buff brick • Set back from the road • Outbuildings on the property
Photo(s)	
Date of Photo(s)	November 6, 2018

Historic Photo(s)	 **Looking northeast**
Date of Historic Photo(s)	1966 (CWI n.d.a:75)

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method		
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area	✓	Important in defining the historic character of this section of Colborne Street in the former Village of Cainsville
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: two-and-a-half storey, buff brick building set back from

	the historic Colborne Street streetscape at the railway.
Reference Materials	
Source(s)	Cainsville Women's Institute (CWI) n.d.a. *Cainsville Tweedsmuir History*. Volume 1. Accessed at the Brant Museum and Archives, Brantford, Ontario.

BUILT HERITAGE RESOURCE NO. 2

Description of Property	
Street Address	1057 Colborne Street
Name	n/a
Recognition	None
Location	County of Brant
Type of Property	Residential
Date(s)	After 1875
Description	• Example of a vernacular house • Red brick cladding • One-and-a-half-storey three-bay building • Segmentally arched window and door openings with brick voussoirs and stone sills • Hip roof with a dormer in the façade and east elevation • One-storey rear addition • Situated set back the road • Roofline extends over the porch supported by half pillars on brick and cinderblock bases • Foundation hydrostone (it is unclear if the foundation is built of or clad with hydrostone), may be field stone under segmentally arched basement window openings
Photo(s)	
Date of Photo(s)	November 6, 2018

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Representative example of a vernacular residence.
	Displays a high degree of craftsmanship or artistic value		

	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area	✓	Important in defining the historic character of this section of Colborne Street in the former Village of Cainsville.
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: One-and-a-half-storey vernacular residence; square plan; three-bay façade; hip roof; covered porch; segmentally arched window and door openings; location and setback from Colborne Street.

BUILT HERITAGE RESOURCE NO. 3

Description of Property	
Street Address	1053 Colborne Street
Name	n/a
Recognition	None
Location	County of Brant
Type of Property	Residential
Date(s)	After 1875
Description	• Vernacular building with three-bay façade • Possible outbuilding associated with 1057 Colborne Street as both structures share the same property parcel • Red brick cladding • Low pitch front gable roof • Clear distinction in types of brick cladding, indicating the rear portion of the building was added later and with wood siding on the façade • Foundation appears to be the same hydrostone (again, unclear if it is clad in or built with hydrostone) as used in the neighbouring 1057 Colborne Street residence
Photo(s)	
Date of Photo(s)	November 6, 2018

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Representative example of a brick clad outbuilding associated with the neighbouring residence.
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative	Has direct associations with a theme, event, belief, person, activity, organization or		

Value	institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area	✓	Important in defining the historic character of this section of Colborne Street in the former Village of Cainsville.
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: brick outbuilding; location and setback from the road.

BUILT HERITAGE RESOURCE NO. 4

Description of Property	
Street Address	1047 Colborne Street
Name	n/a
Recognition	None
Location	County of Brant (Cainsville)
Type of Property	Residential
Date(s)	Circa 1872 (CWI n.d.a:7)
Description	• Representative example of an Edwardian building • Initially a hotel/tavern • Buff brick (now painted), hip roof with paired decorative brackets • Originally frame, bricked circa 1882 (CWI n.d.a:7) • Brick obtained from Langford, ON (east of Cainsville) (CWI n.d.a:7) • Balanced four-bay façade • Adorned wooden entryway surround with gable pediment and engaged pilasters with geometric decoration • Segmentally arched window openings with wood sills and brick voussoirs, rectangular door opening with rectangular window opening above • Rear one story portion that may have been the summer kitchen • Setback from the road
Photo(s)	

	
Date of Photo(s)	November 6, 2018
Historic Photo(s)	
Date of Historic Photo(s)	Circa 1967 (CWI n.d.a:71)

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Representative example of an Edwardian style building.
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or	Has direct associations with a theme, event, belief, person, activity, organization or		

Associative Value	institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area	✓	Important in defining the historic character of this section of Colborne Street in the former Village of Cainsville.
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: rectangular plan, hip roof, four-bay façade, brick clad, segmentally arched windows and wood sills, decorative gabled wooden door surround, paired decorative brackets, situation in Cainsville near the railway.
Reference Materials	
Source(s)	Cainsville Women's Institute (CWI) n.d.a. *Cainsville Tweedsmuir History*. Volume 1. Accessed at the Brant Museum and Archives, Brantford, Ontario.

BUILT HERITAGE RESOURCE NO. 5

Description of Property	
Street Address	Beach Road House and Mill (just east of 11 Beach Road)
Name	n/a
Recognition	None
Location	City of Brantford
Type of Property	Residential
Date(s)	Unknown

Description	• Representative example of a vernacular residence
	• Front gable roof with rectangular plan
	• Three bay façade, one storey
	• Set back a significant distance from the road on a heavily treed
	• Adjacent mill structure located on the same property to the east of the house
	  o Wood cladding
	  o Two storeys
	  o Rectangular plan
	  o Stone foundation that is built down to the ravine
	  o Obscured by trees

Photo(s)	

	
Date of Photo(s)	November 6, 2018

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Representative example of a one-storey vernacular residence and two-storey vernacular mill structure.
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area		
	Is physically, functionally, visually or historically linked to its surroundings	✓	The mill structure is functionally linked to its surroundings since it is located at a ravine.
	Is a landmark		

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes of the residence include: One-storey rectangular plan; front gable; three-bay façade, set back a significant distance from the road, mature trees.

	Key heritage attributes of the mill include: Wood cladding; two storeys; rectangular plan, stone foundation that is built down to the ravine, among mature trees.

BUILT HERITAGE RESOURCE NO. 6

Description of Property	
Street Address	Colborne Street
Name	Colborne Street Pedestrian Underpass
Recognition	None
Location	Underpass at the TransCanada Trail under Colborne Street at Johnson Road
Type of Property	Underpass tunnel
Date(s)	1957
Description	• Built in 1957 in anticipation of the construction of the Hamilton to Brantford section of Hwy 403 to accommodate and allow for more traffic as a result of the planned interchange • Was constructed to allow for the rail traffic to continue under the Colborne Street ROW • Current concrete structure was constructed in the location of the former wooden bridge
Photo(s)	 **Looking northeast**

Looking northeast

Looking southwest

Date of Photo(s)	November 6, 2018

Historic Photo(s)	 **Looking northwest**  . **Looking north**

	 **Former Colborne St. bridge before 1957 improvement (1956)**
Date of Historic Photo(s)	1956; 1957 (CWI n.d.a:171, 173)

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method		
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual	Is important in defining, maintaining or		

Value	supporting the character of an area		
	Is physically, functionally, visually or historically linked to its surroundings	✓	Physically, functionally and historically linked to its surroundings as the crossing has historically been used to provide passage below the road above, originally for the railway and today for trail users
	Is a landmark		

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: location over the former right of way for the Toronto, Hamilton & Buffalo Railway.
Reference Materials	
Source(s)	Cainsville Women's Institute (CWI) n.d.a. *Cainsville Tweedsmuir History*. Volume 1. Accessed at the Brant Museum and Archives, Brantford, Ontario.

BUILT HERITAGE RESOURCE NO. 7

Description of Property	
Street Address	Colborne Street Rail Bridge
Name	n/a
Recognition	None
Location	Railway bridge over the TransCanada Trail
Type of Property	Bridge
Date(s)	Circa 1908 (Mills 2010)
Description	• Early example of a rail bridge with square cut rough cast limestone abutments • Decorative capstones at railway level on either side of the track on both abutments • Rail bridge for the former Brantford and Hamilton Electric Railway, now the Buffalo and Lake Huron Railway which allowed the passage of below rail traffic of the former Toronto, Hamilton & Buffalo Railway • Former location of a plaque commemorating the early black Canadian settlement at Bunnell's Landing (plaque missing since circa 2015)
Photo(s)	 **Looking northeast**

	  **Looking southeast**
Date of Photo(s)	November 6, 2018

Historic Photo(s)	 **Looking northeast through former Colborne St. bridge at the CP rail bridge in the distance**
Date of Historic Photo(s)	1956 (CWI n.d.a:173)

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Early example of a rail bridge with square cut rough cast limestone abutments.
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual	Is important in defining, maintaining or		

Value	supporting the character of an area		
	Is physically, functionally, visually or historically linked to its surroundings	✓	Historically and physically linked to its surroundings as its use it to provide rail traffic access over the former rail line below, making the bridge also historically linked to its surrounding given its association with both historic railways.
	Is a landmark		

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: Historic location for former Brantford and Hamilton Electric Railway, now the Buffalo and Lake Huron Railway, also allowing for passage of below rail traffic of former Toronto, Hamilton & Buffalo Railway, square cut rough cast limestone abutments and decorative capstones.
Reference Materials	
Source(s)	Cainsville Women's Institute (CWI) n.d.a. *Cainsville Tweedsmuir History*. Volume 1. Accessed at the Brant Museum and Archives, Brantford, Ontario.

BUILT HERITAGE RESOURCE NO. 8

Description of Property	
Street Address	1042 Colborne Street
Name	Cainsville United Church
Recognition	City of Brantford Heritage Inventory
Location	City of Brantford
Type of Property	Church
Date(s)	1875

Description	• Excellent example of the Romanesque Revival style
	  o Architects were Mellish and Son
	  o Contractor was William (McKay) Taylor for woodwork and Charles Fisher for the brickwork (ARA 2018)
	  o Rectangular plan front gable church constructed with buff brick, symmetrical four bay elevations and a three-bay façade
	  o Façade features decorative brick elements, recessed window and door openings as well as engaged brick buttresses reminiscent of the Romanesque style towers
	  o Large arched entryway with a circular window above
	  o Each arched window opening has a segmentally arched lower level window opening below
	  o Arched window and door openings are recessed with red brick radiating voussoirs and stone sills
	  o Banded buff brick tower-like chimney at the rear
	  o Rear addition Fellowship Hall built in 1952
	• Prior to 1875, the Wesleyan Methodists had a church on the bank overlooking the Grand River, which was built in 1851 (ARA 2018)
	• An old school site on the north side of Colborne Street was ultimately obtained from Mr. A. Duncan for $300 (ARA 2018)
	• Cainsville Methodist Church opened in 1875, became the Cainsville United Church in 1925, Cainsville United Church closed in 1994, and the CityGate Church subsequently utilized the building for a short time
	• Fellowship hall on west elevation added in 1952
	• The building is currently not in use

Photo(s)	 

	
Date of Photo(s)	November 6, 2018
Historic Photo(s)	
Date of Historic Photo(s)	Circa 1966 (CWI n.d.b.:32)

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**

Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Good example of Romanesque Revival style church.
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area	✓	Important in defining the historic character of this section of Colborne Street in the former Village of Cainsville.
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: Rectangular plan front gable church constructed with buff brick, symmetrical four bay elevations and a three-bay façade, façade features decorative brick elements, recessed window and door openings as well as engaged brick buttresses, large arched entryway with a circular window above, arched window openings with segmentally arched lower level window openings below, arched window and door openings with red brick radiating voussoirs and stone sills and banded buff brick tower-like chimney at the rear.
Reference Materials	
Source(s)	Archaeological Research Associates (ARA) 2018 *Stage 1 Archaeological Assessment Proposed Multi-Unit Residential Conversion 1042 Colborne Street East, City of Brantford Part of Lot 1, North of Road to Hamilton Part of Joseph Thomas Grant Geographic Township of Brantford Former Brant County, Ontario*. Cainsville Women's Institute (CWI) n.d.b. *Cainsville Tweedsmuir History*. Volume 4. Accessed at the Brant Museum and Archives, Brantford, Ontario.

BUILT HERITAGE RESOURCE NO. 9

Description of Property	
Street Address	1036 Colborne Street
Name	n/a
Recognition	City of Brantford Heritage Inventory
Location	City of Brantford
Type of Property	Residential
Date(s)	1900 (City of Brantford Heritage Inventory); 1889 (CWI n.d.b.:33)
Description	• Good example of a residence constructed in the Queen Anne Style • Two-storey rectangular plan with a hip roof • Two-storey bay window on the façade flanked by entryways with a shed roof covered porch • Buff brick • Segmentally arched window openings with brick voussoirs • Rectangular first storey entryway door openings with large rectangular transom windows • Hip roofed projections from each side elevation • One-storey rear addition • Functioned as the Methodist (United) Church parsonage until 1956
Photo(s)	
Date of Photo(s)	November 6, 2018

Historic Photo(s)	
Date of Historic Photo(s)	Circa 1966 (CWI n.d.b.:33)

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Representative example of a Queen Anne style residence.
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area	✓	Important in defining the historic character of this section of Colborne Street in the former Village of Cainsville.
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: two-storey; buff brick; two-storey bay window; segmentally arched window openings with brick voussoirs; covered porch; hip roofed projection on each side elevation.
Reference Material	
Source	Cainsville Women's Institute (CWI) n.d.b. *Cainsville Tweedsmuir History*. Volume 4. Accessed at the Brant Museum and Archives, Brantford, Ontario.

BUILT HERITAGE RESOURCE NO. 10

Description of Property	
Street Address	1024 Colborne Street
Name	n/a
Recognition	None
Location	City of Brantford
Type of Property	Residential
Date(s)	Unknown
Description	• Example of a vernacular house with Tudor Revival elements • Tri-colour brick cladding • One-and-a-half-storey three-bay building • Rectangular plan • Side gable roof with two symmetrically placed gable dormers • Rectangular window and door openings with brick voussoirs • Two brick chimneys at each gable end
Photo(s)	
Date of Photo(s)	November 6, 2018

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Representative example of a Tudor Revival style house
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or		

	culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area	✓	Important in defining the historic character of this section of Colborne Street in the former Village of Cainsville.
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: One-and-a-half-storey Tudor Revival residence; rectangular plan; three-bay façade; side gable roof with two gable dormers; projecting gable entryway; gable roof outbuilding.

BUILT HERITAGE RESOURCE NO. 11

Description of Property	
Street Address	1020 Colborne Street
Name	n/a
Recognition	None
Location	City of Brantford
Type of Property	Residential
Date(s)	Unknown
Description	• Example of a Tudor Revival style house • Tri-colour brick cladding • One-and-a-half-storey three-bay building • Rectangular plan • Side gable roof with two symmetrically placed gable dormers • Rectangular window and door openings with brick voussoirs • Offset gable projection entryway
Photo(s)	
Date of Photo(s)	November 6, 2018

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Representative example of a Tudor Revival style house.
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative	Has direct associations with a theme, event, belief, person, activity,		

Value	organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area	✓	Important in defining the historic character of this section of Colborne Street in the former Village of Cainsville
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: One-and-a-half-storey Tudor Revival residence; rectangular plan; three-bay façade; side gable roof with two gable dormers, projecting gable entryway.

BUILT HERITAGE RESOURCE NO. 12

Description of Property	
Street Address	1022 Colborne Street
Name	n/a
Recognition	None
Location	City of Brantford
Type of Property	Residential
Date(s)	Unknown
Description	• Example of a Mid-Century Modern style house • Beige brick cladding • One-and-a-half-storey • Rectangular plan • Car port • Asymmetrical front gable roof • Rectangular window and door openings • Large irregular window above entryway
Photo(s)	
Date of Photo(s)	November 6, 2018

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Representative example of a Mid-Century Modern style house.
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		

	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area		
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: One-and-a-half-storey; rectangular plan; asymmetrical front gable roof; car port.

BUILT HERITAGE RESOURCE NO. 13

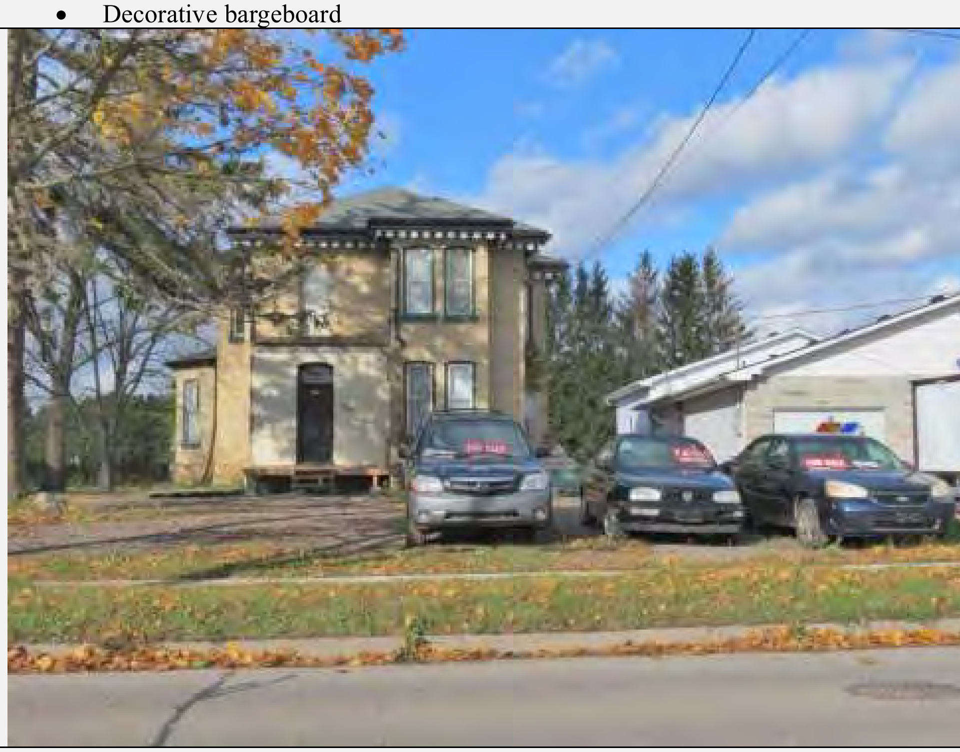
Description of Property	
Street Address	29 Clara Crescent
Name	n/a
Recognition	None
Location	City of Brantford
Type of Property	Residential
Date(s)	Unknown
Description	• Two-storey vernacular house • Rectangular plan • Symmetrical façade • Side gable roof • Centrally placed entryway • Rectangular window openings • Set back from the road on a rise in topography
Photo(s)	
Date of Photo(s)	November 6, 2018

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Representative example of a two-storey vernacular house with a rectangular plan.
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is		

	significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area		
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: two-storeys; side gable roof; rectangular plan.

BUILT HERITAGE RESOURCE NO. 14

Description of Property	
Street Address	968 Colborne Street
Name	n/a
Recognition	City of Brantford Heritage Inventory
Location	City of Brantford
Type of Property	Residential
Date(s)	1890 (City of Brantford Heritage Inventory)
Description	• Good example of a residence constructed in the Italianate style • Two-storey rectangular plan with a hip roof • Two-storey projection on façade with paired segmentally arched window openings • Buff brick cladding • Segmentally arched window openings with brick voussoirs • One-storey bay window on west elevation • Decorative bargeboard
Photo(s)	
Date of Photo(s)	November 6, 2018

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Representative example of an Italianate style residence.
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield		

	information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area	✓	Important in defining the historic character of this section of Colborne Street in the former Village of Cainsville.
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

RESULTS of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: two-storey house; decorative bargeboard; hip roof; buff brick cladding; two-storey projection on façade with paired segmentally arched window openings; segmentally arched window openings with brick voussoirs; one-storey bay window on west elevation.

BUILT HERITAGE RESOURCE NO. 15

Description of Property	
Street Address	21 Johnson Road
Name	n/a
Recognition	City of Brantford Heritage Inventory
Location	City of Brantford
Type of Property	Residential
Date(s)	1910 (City of Brantford Heritage Inventory)
Description	• Representative example of an Edwardian style residence • Two-storey structure with a hip roof • Red brick cladding • Two-bay façade with an offset entryway • Covered porch with hip roof supported by half pillars on brick bases • Segmentally arched window openings with brick voussoirs • Hydrostone foundation • Rear of house has been modified • Situated close to the road • Structure is of a similar design to 13 Johnston Road aside from the cladding
Photo(s)	
Date of Photo(s)	November 6, 2018

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Representative example of an Edwardian style residence.
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		

Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area	✓	One of several remaining structures representing the former Village of Cainsville, defining the heritage character of this portion of Colborne Street streetscape.
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: rectangular plan; hip roof; two-bay façade; segmentally arched windows; covered porch; brick chimney at rear; hydrostone foundation.

BUILT HERITAGE RESOURCE NO. 16

Description of Property	
Street Address	13 Johnson Road
Name	n/a
Recognition	City of Brantford Heritage Inventory
Location	City of Brantford
Type of Property	Residential
Date(s)	1910 (City of Brantford Heritage Inventory)
Description	• Representative example of an Edwardian style residence • Two-storey building with a hip roof • Hydrostone cladding and foundation • Hydrostone quoins • Two-bay façade with an offset entryway • Window and door openings are segmentally arched with stone voussoirs • Keystones with engraving on window and door openings • Covered porch with hip roof supported by half pillars on brick bases • Rear of house has been modified • Situated close to the road • This house is of a similar design to 21 Johnston Road aside from the cladding
Photo(s)	
Date of Photo(s)	November 6, 2018

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Representative example of an Edwardian style building.
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		

Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area	✓	One of several remaining structures representing the former Village of Cainsville, defining the heritage character of this portion of Colborne Street streetscape
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: rectangular plan; hip roof; two-bay façade; segmentally arched windows with stone voussoirs; keystones with engraving on window and door openings; hydrostone construction with quoining.

CULTURAL HERITAGE LANDSCAPE NO. 1

Description of Property	
Street Address	West of 1047 Colborne Street in the parkette
Name	Bow Park Farm, County of Brant
Recognition	Provincial Plaque; a cultural feature of the federally recognized Grand River, a Canadian Heritage River
Location	County of Brant (Cainsville). The lookout vantage point and plaque are located on the south side of Colborne Street across from Johnson Road. The farm itself is located at 140 Oxbow Road in the County of Brant.
Type of Landscape	Agricultural
Description	• The Bow Park Farm, County of Brant, is listed as a cultural feature/value that supports the Grand River (as well as the associated tributaries, the Nith, Speed, Eramosa and Conestogo Rivers) as a Canadian Heritage River under the category of “Riverside homesteads and farms” (GRCA 2013) • Bow Park Farm was established in 1866 by the Honourable George Brown, one of the Fathers of Confederation and founder of the Toronto Globe newspaper o Brown retired to Bow Park on the Grand River in 1866. From retirement until his death in 1880, Brown spent much time at "Bow Park" developing it as a major enterprise for raising pure-bred cattle, a notable pioneering agricultural venture in Ontario o This association is commemorated by the provincial plaque located at a grassy area on the south side of Colborne Street across from Johnson Road (GRCA 2013) • Named after the "bow" in the Grand River, the farm consists of 900 acres of sandy and rich alluvial river bottom soil. The farm became the agricultural centre for breeding shorthorn cattle, Clydesdale horses, sheep, pigs and poultry (GRCA 2013) • It had one of the largest and finest herds of shorthorn cattle in the world (GRCA 2013) • Farm workers were recruited from Scotland (GRCA 2013) • Was an international tourist attraction (GRCA 2013) • Through the 20th century, Canadian Canners used Bow Park as an experimental farm, producing vegetable seed varieties appropriate for the Canadian climate (GRCA 2013) • In 1978, Bow Park Farm was purchased by the Hilgendag family who produce top quality pedigreed wheat and soybean varieties with high-tech seed cleaning equipment (GRCA 2013) • The farm is located at 140 Oxbow Road in the County of Brant • Views from Cainsville provincial plaque location (at the former Cayuga Heights) to the agricultural landscape of Bow Park Farm located within the Oxbow of the Grand River

Photo(s)	 **View of the Bow Park Farm from Colborne Street (Provincial Plaque in foreground, looking south)**  **View of Bow Park Farm lands beyond the Grand River from the trail (looking south)**
Date of Photo(s)	November 6, 2018

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Representative of an agricultural landscape.
	Displays a high degree of craftsmanship or		

	artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community	✓	Bow Park Farm is directly associated with the Hon. George Brown, renowned Father of Confederation and noted cattle breeder.
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community	✓	Bow Park Farm is associated with the Hon. George Brown's major cattle raising enterprise, which was significant to the farming industry of the Brantford area.
Contextual Value	Is important in defining, maintaining or supporting the character of an area	✓	Contributes to the agricultural character of the area within the oxbow of the Grand River.
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI
Heritage Attributes	Key heritage attributes include: agricultural fields; location in the Brantford Oxbow of the Grand River; views to the forested Grand River valley and views to the farm from Colborne Street.
Reference Material	
Source	Grand River Conservation Authority 2013 *Heritage River Inventory – Grand Rover Watershed, Cultural Features and Values that support the Grand (including Speed, Eramosa, Nith and Conestogo Rivers) as a Canadian Heritage River.* Accessed online at: www.grandriver.ca/en/our-watershed/resources/Documents/Heritage-Inventory_As-of-March-13_2013.pdf

CULTURAL HERITAGE LANDSCAPE NO. 2

Description of Property	
Name	Grand River
Boundary	City of Brantford - The Grand River is continuous from the western limit of the municipal boundary at Hardy Road to the eastern extent at Colborne Street and Johnson Road (north end of the Brantford oxbow) where the river continues through the County of Brant eastward toward Lake Erie.
Recognition	Federally recognized Canadian Heritage River
Location	City of Brantford and County of Brant (Cainsville)
Type of Landscape	River
Description	According to *Canadian Heritage Rivers System: National River Conservation Program*: Farmland accounts for over 70 percent of the 6800 km2 Grand River watershed, which is the largest in southern Ontario. Although the river is not designated for its natural values, it provides habitat to thousands of species of birds, fish, animals and other wildlife including about 80 species at risk. The Grand River Forest is one of the few remaining Carolinian forests in Canada, containing species such as sycamore, sassafras, pignut hickory, and chinquapin oak. More than 90 species of fish are found in the river system, about half of all species in Canada. Close to 250 species of birds have been reported at Luther Marsh Wildlife Management Area (*Canadian Heritage Rivers System* 2017) Over 800 archeological sites tell the story of 11,000 years of human history within the Grand watershed. When Europeans arrived, the Neutral people controlled the territory of the Grand. Following the American Revolution, members of the Iroquois Confederacy were granted land in the watershed as a reward for their loyalty to the British Crown (*Canadian Heritage Rivers System* 2017). The Six Nations of the Grand River and the Mississaugas of the New Credit First Nation have a strong presence to this day (GRCA 2018). Loyalist settlers soon followed, along with Mennonites from Pennsylvania as well as Scottish immigrants. The Mohawk Chapel in Brantford and the Pioneer Memorial Tower in Kitchener are two national historic sites that recognize these settlers. Adaptive reuse of historical structures like mills and factories along the river has helped to preserve the Grand's built heritage in areas such as Elora, Fergus, Cambridge and Brantford and Paris (*Canadian Heritage Rivers System* 2017).

Photo(s)	 Photo taken looking North from the outlet of the former canal at Locks Street
Date of Photo(s)	November 6, 2018

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method		
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community	✓	Has been the ancestral home of Indigenous peoples for 10,000 years and has influenced the settlement of the watershed area.
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area	✓	The Grand River CHL is important in defining, maintaining and supporting the character of the municipality as it dominates the landscape and has influenced the area's development.
	Is physically, functionally, visually or historically linked to its surroundings	✓	The Grand River CHL is physically, functionally, visually and historically linked to its surroundings as it was a principle factor in influencing settlement patterns.
	Is a landmark	✓	The Grand River watershed is one of the best-known watersheds in southwestern Ontario and

			is federally recognized as a Canadian Heritage River. The Grand River CHL is a landmark in the community. The views to and from the river represent important scenic landscapes.

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Heritage attributes of the Grand River include: a well-defined river valley with alternating steep and shallow banks; meandering river with significant vegetation communities and associated wildlife habitat; and significant views to, from and within the watershed.
Reference Material	
Source	*Canadian Heritage Rivers System: National River Conservation Program* 2018 Grand River: Fact Sheet. Accessed online at: http://chrs.ca/the-rivers/grand/. Grand River Conservation Authority 2018 *Heritage River Designation.* Accessed online at: https://www.grandriver.ca/en/our-watershed/Heritage-River-Designation.aspx

CULTURAL HERITAGE LANDSCAPE NO. 3

Description of Property	
Street Address	n/a
Name	Buffalo & Lake Huron Railway (B&LHR)
Recognition	None
Location	City of Brantford and County of Brant
Type of Landscape	Rail line
Description	• According to the University of Toronto, this rail line was incorporated as the Buffalo & Brantford Joint Stock Railroad Company in 1851, was renamed Buffalo, Brantford & Goderich Railway Company in 1852. • This portion of the line was constructed in 1856 after being bankrupted and reconstituted in 1856 as the Buffalo & Lake Huron Railway Company. • Purchased and absorbed by the Grand Truck Railway in 1870 after 14 years of independent operation • In 1997, the Southern Ontario Railway (SOR) (now a subsidiary of RailAmerica) bought the line from CN • Currently operated as part of the SOR Hagersville subdivision (U of T 2009) • At grade crossing along Colborne Street near the border between the City of Brantford and the County of Brant (at Cainsville)
Photo(s)	 **Photo taken from Colborne Street E. looking northwest**
Date of Photo(s)	November 6, 2018

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	The Buffalo & Lake Huron Railway CHL is a representative and early example of railway construction.
	Displays a high degree of craftsmanship or artistic value		

	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area		
	Is physically, functionally, visually or historically linked to its surroundings	✓	The Buffalo & Lake Huron Railway CHL is physically, functionally, visually and historically linked to the surroundings due to its historic and continued function as a railway associated with the development of southwestern Ontario and the evolution of railway operation in the province.
	Is a landmark		

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: its original form and layout (i.e., length, width and construction methods); and its physical appearance and setting, specifically the views of the railway crossings and vistas along the trajectory of the historic route; and at grade crossing at Colborne Street East.

CULTURAL HERITAGE LANDSCAPE NO. 4

Description of Property	
Street Address	n/a
Name	Part of the Trans Canada Trail – Brock's Route 1812
Location	Adjacent to the Grand River
Recognition	None
Location	City of Brantford and County of Brant (Cainsville)
Type of Property	Recreation - Publicly Accessible Trail
Date(s)	Opened as a trail after the 1986 landslide
Description	• The Brock's Route portion of the Trans Canada Trail is made up of eight trail sections, giving hikers access from Lake Ontario to Lake Erie that follows the path that Isaac Brock walked from Hamilton to Port Dover during the War of 1812 • Trail was created from a portion of the Canadian Pacific Railway that first ran through the area in 1895 • Toronto, Hamilton & Buffalo Railway which was founded in 1884. In 1893, TH&BR stock was purchased by the following companies, giving them joint control over the railway: New York Central Railway (37%), Canadian Pacific Railway (27 %), Michigan Central Railway (18%), and the Canada Southern Railway (18%). The New York Central railroad became the Pennsylvania and New York Central Transportation Company in 1968. This company in turn was declared bankrupt in 1970 and merged into the Consolidated Rail Corporation in 1976. The following year, Conrail was forced to sell its stake in the TH&BR to the Canadian Pacific Railway. It disappeared as an independent company in 1987 • Corridor used as a trail after the 1986 landslide which rendered the railway unusable • The trail is designed for biking and walking • Pavilions, rest areas and local heritage signage are located along the trail
Photo(s)	

	 **View looking east from Beach Road**  **View looking east toward Colborne Street underpass, Railway Bridge beyond**
Date of Photo(s)	November 6, 2017
Historic Photo(s)	

	 **Looking southeast**  **Looking east to TH&B Tracks Following Landslide**
Date of Historic Photo(s)	1909; 1986 (Maus n.d.)

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method		
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community	✓	Associated with Indigenous transportation route from Lake Erie through the area while following the former alignment of the road from the Mohawk Village as well as railway development through the County of Brant.
	Yields or has the potential to yield information that contributes to the understanding of a community or culture	✓	Has the potential to yield information about Indigenous trail routes that represent the physical documentation of how people traveled from one place to another historically.
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area		
	Is physically, functionally, visually or historically linked to its surroundings	✓	The trail route itself is historically linked to the First Nations communities in Southern Ontario, and is physically, functionally and visually linked to its surroundings as it follows the Indigenous route along the Grand River as well as the later established railway that followed the same route until the 1986 landslide. The trail is also physically, functionally and visually linked to the other portions of the TransCanada trail as well as the Mohawk Canal.
	Is a landmark	✓	The trail represents a local tourist attraction.

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: trail footprint along the bank of the Grand River, previously an Indigenous transportation route, Euro-Canadian footpath, then the right of way for a potion of the Canadian Pacific Railway; views to the Grand River; mature vegetation on the slope that descends from the road to the river.
Reference Materials	
Source(s)	Grand River Conservation Authority 2013 *Heritage River Inventory – Grand Rover Watershed, Cultural Features and Values that support the Grand (including Speed, Eramosa, Nith and Conestogo Rivers) as a Canadian Heritage River.* Accessed online at: www.grandriver.ca/en/our-watershed/resources/Documents/Heritage-Inventory_As-of-March-13_2013.pdf Maus, Orin P. n.d. *TH&B*. Unpublished compiled history of the Toronto, Hamilton and Buffalo Railway. Accessed at the Brant Museum and Archives, Brantford, Ontario. University of Toronto

	2009 *Southern Ontario Railway Map.* Accessed online at http://individual.utoronto.ca/sorailmap/.

CULTURAL HERITAGE LANDSCAPE NO. 5

Description of Property	
Street Address	Terminus of Mohawk Canal at the Grand River on Locks Road
Name	Mohawk Canal Locks
Recognition	None
Location	City of Brantford
Type of Landscape	Lock system
Description	• Mohawk Canal was a three lock, 4.8 kilometre (3 mile) canal bypassed a 19 kilometre (12 mile) shallow loop to make the Grand River entirely navigable from Brantford to Dunnville • The canal, built in 1848, attracted people to the city and various businesses opened. Steamers, schooners and barges exported and imported various marketable goods • The locks were built by the Grand River Navigation Company, completed in 1848 • All three locks were located from near the Locks Road Bridge and the junction of the canal and Grand River • Noted by ASI in the feasibility study to be: "Strong candidate for conservation and integration into any future CHL Study as a contributing feature."
Photo(s)	 **View looking southwest at location of locks**

	 **View looking northeast**
Date of Photo(s)	November 6, 2018

Evaluation of Property			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method		
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture	✓	The locks property has the potential to yield information about the early transportation history of the City of Brantford. While the locks themselves are indiscernible from current infrastructure on and around the site, they may be underwater and considered archaeological features.
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community	✓	Associated with the Grand River Navigation Company, who were significant to the community as they built the Mohawk Canal which allowed for increased commerce, transportation and eventually the construction of the Alfred Watts Hydro Generating Station, all of which were integral to Brantford's early

			economic growth.
Contextual Value	Is important in defining, maintaining or supporting the character of an area		
	Is physically, functionally, visually or historically linked to its surroundings	✓	The locks are physically, functionally and historically linked to their surroundings due to their association with the canal and the part it played in the historic development of the local economy.
	Is a landmark		

Results of Heritage Assessment	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: its original location and layout (i.e., at the junction between the Mohawk Canal and the Grand River);
Reference Materials	
Sources	Grand River Conservation Authority 2013 *Heritage River Inventory – Grand Rover Watershed, Cultural Features and Values that support the Grand (including Speed, Eramosa, Nith and Conestogo Rivers) as a Canadian Heritage River.* Accessed online at: www.grandriver.ca/en/our-watershed/resources/Documents/Heritage-Inventory_As-of-March-13_2013.pdf Archaeological Services Inc. (ASI) 2016 *Cultural Heritage Landscape Feasibility Study: Mohawk Canal and Alfred Watts Hydro Generating Station Ruins.* Accessed online at: www.brantford.ca/Population%20Projections%20%20Documents/FINAL_June%2028_15SP-082%20CHL%20Feasibility%20Study.pdf

Appendix B: Key Team Member Two Page Curriculum Vitae

Curriculum Vitae

Paul J. Racher, M.A., CAHP
Principal - Management and Senior Review (MSR) Team
ARCHAEOLOGICAL RESEARCH ASSOCIATES LTD.
219-900 Guelph Street, Kitchener, ON N2H 5Z6
Phone: (519) 804-2291 x100 Mobile: (519) 835-4427
Fax: (519) 286-0493
Email: pracher@arch-research.com
Web: www.arch-research.com

Biography

Paul Racher is a Principal of ARA. He has a BA in Prehistoric Archaeology from WLU and an MA in anthropology from McMaster University. He began his career as a heritage professional in 1986. Over the three decades since, he has overseen the completion of several hundred archaeological and cultural heritage contracts. Paul has years of experience related to linear transportation and rail projects, notably through the ongoing work to complete a Cultural Heritage Inventory for the Region of Waterloo's Stage 2 LRT from Kitchener to Cambridge, Ontario. He holds professional license #P007 with the MTCS. Paul is a former lecturer in Cultural Resource Management at WLU. He is a professional member of the Canadian Association of Heritage Professionals (CAHP) and the President of the Ontario Archaeological Association (OAS).

Education

1992-1997	PhD Programme, Department of Anthropology, University of Toronto. Supervisors: E.B. Banning and B. Schroeder. Withdrawn.
1989-1992	M.A., Department of Anthropology, McMaster University, Hamilton, Ontario. Thesis titled: "The Archaeologist's 'Indian': Narrativity and Representation in Archaeological Discourse."
1985-1989	Honours B.A., Wilfrid Laurier University, Waterloo, Ontario. Major: Prehistoric Archaeology.

Professional Memberships and Accreditations

Current	Ministry of Tourism Culture and Sport Professional Licence (#P007).
	Professional Member of the Canadian Association of Heritage Professionals (CAHP), Volunteer on the ethics committee.
	Member of the Ontario Archaeological Society (OAS), Volunteer on the Professional Committee.
	Associate of the Heritage Resources Centre, University of Waterloo.
	RAQS registered with MTO.

Work Experience

Current	**Vice-President, Operations, Archaeological Research Associates Ltd.** Responsible for winning contracts, client liaison, project excellence, and setting the policies and priorities for a multi-million dollar heritage consulting firm.
2000-2011	**Project Manager/Principal Investigator, Archaeological Research Associates Ltd.** Managed projects for a heritage consulting firm. In 10 field seasons, managed hundreds of projects of varying size.
2008-2011	**Part-Time Faculty, Wilfrid Laurier University.** Lecturer for Cultural Resource Management course (AR 336). In charge of all teaching, coursework, and student evaluations.
1995	**Field Archaeologist, University of Toronto.** Served as a supervisor on a multinational archaeological project in northern Jordan.
1992-1995	**Teaching Assistant, University of Toronto.** Responsible for teaching and organizing weekly tutorials for a number of courses.
1991-1994	**Part-Time Faculty, Wilfrid Laurier University.** Lectured for several courses in anthropology. Held complete responsibility for all teaching, coursework, and student evaluations.
1992-1996	**Partner in Consulting Company, Cultural Management Associates Incorporated.** Supervised several archaeological contracts in Southern Ontario. Participated in a major (now published) archaeological potential modeling project for MTO.
1989-1991	**Partner in Consulting Company, Cultural Resource Consultants.** Managed the financial affairs of a consulting firm whilst supervising the completion of several contracts performed for heritage parks in central Ontario.
1988-1991	**Principal Investigator/Project Director, Archaeological Research Associates Ltd.** Oversaw the completion of large contracts, wrote reports, and was responsible for ensuring that contracts were completed within budget.
1988	**Assistant Director of Excavations, St. Marie among the Hurons, Midland, Ontario.** Duties included crew supervision, mapping, report writing and photography.
1986-1987	**Archaeological Crew Person, Archaeological Research Associates Ltd., Waterloo, Ontario.** Participated in background research, survey, and excavation on a number of Archaeological sites across Ontario.

Kayla Jonas Galvin, M.A., CAHP
Heritage Operation Manager
ARCHAEOGICAL RESEARCH ASSOCIATES LTD.
1480 Sandhill Drive, Unit 3, Ancaster, ON L9G 4V5
Phone: (519) 804-2291 x120 Fax: (519) 286-0493
Email: kjgalvin@arch-research.com Web: www.arch-research.com

Biography
Kayla Jonas Galvin, Archaeological Research Associates Ltd.'s Heritage Operation Manager, has extensive experience evaluating cultural heritage resources and landscapes for private and public-sector clients to fulfil the requirements of provincial and municipal legislation such as the *Environmental Assessment Act*, the *Standards & Guidelines for the Conservation of Provincial Heritage Properties* and municipal Official Plans. She served as Team Lead on the Ministry of Tourism, Culture and Sport Historic Places Initiative, which drafted over 850 Statements of Significance and for *Heritage Districts Work!*, a study of 64 heritage conservation districts in Ontario. Kayla was an editor *of Arch, Truss and Beam: The Grand River Watershed Heritage Bridge Inventory* and has worked on Municipal Heritage Registers in several municipalities. Kayla has drafted over 150 designation reports and by-laws for the City of Kingston, the City of Burlington, the Town of Newmarket, Municipality of Chatham-Kent, City of Brampton and the Township of Whitchurch-Stouffville. Kayla is the Heritage Team Lead for ARA's roster assignments for Infrastructure Ontario and oversees evaluation of properties according to *Standards & Guidelines for the Conservation of Provincial Heritage Properties*. Kayla is a professional member of the Canadian Association of Heritage Professionals and sits on the board of the Ontario Association of Heritage Professionals.

Education

2016	MA in Planning, University of Waterloo. Thesis Topic: *Goderich – A Case Study of Conserving Cultural Heritage Resources in a Disaster*
2003-2008	Honours BES University of Waterloo, Waterloo, Ontario Joint Major: Environment and Resource Studies and Anthropology

Professional Memberships and Accreditations

Current	Professional Member, Canadian Association of Heritage Professionals (CAHP) Board Member, Ontario Association of Heritage Professionals. Candidate Member, Ontario Professional Planning Institute.

Work Experience

Current	**Heritage Operations Manager, Archaeological Research Associates Ltd.** Oversees business development for the Heritage Department, coordinates completion of designation by-laws, Heritage Impact Assessments, Built Heritage and Cultural Heritage Landscape Assessments, and Cultural Heritage Resource Evaluations.
2009-2013	**Heritage Planner, Heritage Resources Centre, University of Waterloo** Coordinated the completion of various contracts associated with built heritage including responding to grants, RFPs and initiating service proposals.

Work Experience (Continued)

2008-2009, 2012 **Project Coordinator–Heritage Conservation District Study, ACO**
Coordinated the field research and authored reports for the study of 32 Heritage Conservation Districts in Ontario. Managed the efforts of over 84 volunteers, four staff and municipal planners from 23 communities.

2007-2008 **Team Lead, Historic Place Initiative, Ministry of Culture**
Liaised with Ministry of Culture Staff, Centre's Director and municipal heritage staff to draft over 850 Statements of Significance for properties to be nominated to the Canadian Register of Historic Places. Managed a team of four people.

Selected Professional Development

2018 Indigenous Canada, University of Alberta
2017 Empowering Indigenous Voices in Impact Assessments, Webinar, International Association for Impact Assessments
2015 Introduction to Blacksmithing, One-Day
2015 Leadership Training for Managers Course, Dale Carnegie Training
2014 Heritage Preservation and Structural Recording in Historical and Industrial Archaeology, Wilfrid Laurier University, 12 weeks
2014 Conservation and Craftsmanship in Sustainable City Building Presented by the Hamilton Burlington Society of Architects
2012 Region of Waterloo Workshop on Heritage Impact Assessments, Half-Day
2012 Conducting Historic Building Assessments Workshop, One-Day
2012 Window Restoration Workshop, One-Day
2011 Lime Mortars for Traditionally Constructed Brickwork, Two-Day Workshop, ERA Architects and Historic Restoration Inc., Toronto
2011 Energy & Heritage Buildings Workshop Two-Day Workshop, Heritage Resources Centre
2010 Architectural Photography, Mohawk College
2010 Project Management Fundamentals, University of Waterloo Continuing Education
2009 Cultural Heritage Landscapes Two-Day Workshop, Heritage Resources Centre
2009 Urban Landscape and Documentary Photography, Mohawk College
2008 Introduction to Digital Photography, Mohawk College
2008 Heritage Planning Four-Day Workshop, Heritage Resources Centre

Selected Publications

2018 "Restoring Pioneer Cemeteries" *Ontario Association of Heritage Professionals Newsletter.* Spring 2018. *In print.*
2015 "Written in Stone: Cemeteries as Heritage Resources." *Municipal World*, September 2015.
2015 "Bringing History to Life." *Municipal World*, February 2015, pages 11-12.
2014 "Inventorying our History." *Ontario Planning Journal*, January/February 2015.
2014 "Mad about Modernism." *Municipal World*, September 2014.
2014 "Assessing the success of Heritage Conservation Districts: Insights from Ontario Canada." with R. Shipley and J. Kovacs. *Cities*.

Jacqueline McDermid, B.A.
Technical Writer
ARCHAEOGICAL RESEARCH ASSOCIATES LTD.
1480 Sandhill Drive, Unit 3, Ancaster, ON L9G 4V5
Phone: (905) 304-6893 x221 Fax: (519) 286-0493
Email : jmcdermid@arch-research.com Web: www.arch-research.com

Biography

Jacqueline recently finished a 6-month contract with MTO as the Heritage Specialist for Central Region, returning to her permanent position at ARA in the Fall 2018 where she had been the acting Heritage Team Lead for the year previous. As the lead, she directed the preparation and oversaw the submission of deliverables to clients. Currently, she is the Heritage Team Technical Writer and Researcher, where she continues to research and evaluate the significance of cultural heritage resources using *Ontario Regulation 9/06* and *10/06*, most recently completing designation reports for the City of Burlington, City of Kingston and Town of Newmarket and the Town of Whitchurch-Stouffville. Further, Jacqueline has overseen the completion of many Built Heritage and Cultural Heritage Landscape Studies as well as Heritage Impact Assessments including reports for a proposed aggregate pit, road widening, the LRT in the Region of Waterloo and a National Historic Site in St. Catharines. As well as being a proficient technical writer, Jacqueline is skilled at writing in approachable language demonstrated by my crafting of 30 properties stories and 35 thematic stories for Heritage Burlington's website. She holds an Honours Bachelor of Arts in Near Eastern Archaeology from Wilfrid Laurier University. In addition to heritage experience, Jacqueline also has archaeological experience working as field crew, as an Assistant Lab Technician and archaeological technical writer.

Education

2000-2007	Honours B.A., Wilfrid Laurier University, Waterloo, Ontario Major: Near Eastern Archaeology

Work Experience

2015-current	**Technical Writer and Researcher – Heritage, Archaeological Research Associates Ltd., Kitchener, ON** Research and draft designation by-laws, heritage inventories, Heritage Impact Assessments, Built Heritage and Cultural Heritage Landscape Assessments, and Cultural Heritage Resource Evaluations using Ontario Regulation 9/06, 10/06 and the Ontario Heritage Bridge Guidelines.
2018	**Environmental Planner – Heritage Ministry of Transportation, Central Region** – Six-month contract. Responsibilities included: project management and coordination of MTO heritage program, managed multiple consultants, conducted and coordinated field assessments and surveys, estimated budgets including $750,000 retainer contracts. Provided advice on heritage-related MTO policy to Environmental Policy Office (EPO) and the bridge office.
2017-2018	**Acting Heritage Team Lead – Heritage Archaeological Research Associates Ltd., Kitchener, ON**

Managed a team of Heritage Specialists, oversaw the procurement of projects, retainers; managed all Heritage projects, ensured quality of all outgoing products

2014-2015 **Technical Writer – Archaeology, Archaeological Research Associates Ltd., Kitchener, ON**
Report preparation; correspondence with the Ministry of Tourism, Culture, and Sport; report submission to the Ministry and clients; and administrative duties (PIF and Borden form completion).

2012-2013 **Lab Assistant, Archaeological Research Associates Ltd., Kitchener, ON**
Receive, process and register artifacts.

2011-2012 **Field Technician, Archaeological Research Associates Ltd., Kitchener, ON**
Participated in field excavation and artifact processing.

2005-2009 **Teaching Assistant, Wilfrid Laurier University, Waterloo, ON**
Responsible for teaching and evaluating first, second, third- and fourth-year student lab work, papers and exams.

2005-2007 **Lab Assistant, Wilfrid Laurier University – Near Eastern Lab, Waterloo, ON**
Clean, Process, Draw and Research artifacts from various sites in Jordan.

Selected Professional Development

2017 Empowering Indigenous Voices in Impact Assessments, Webinar, International Association for Impact Assessments

2015 Introduction to Blacksmithing, One-Day

2015 Leadership Training for Managers Course, Dale Carnegie Training

Selected Cultural Heritage Projects

2018 **Credit River Bridge Strategic Conservation Plan**
Worked with environmental planners, consultants and MTO management advising and providing technical review for the MTO's pilot SCP, submission to MTCS.

2017-2018 **500 Bloomington Road CHER, Aurora** Client: Infrastructure Ontario

2018 **Queen Victoria Park Heritage Impact Assessment, Niagara Falls**
Client: Canadian Niagara Hotels

2016 **700 University Avenue CHER, Toronto** Client: Infrastructure Ontario

2017 **Weston Heritage Conservation District Phase II Study**
Client: Weston Heritage Conservation District Board

2017 **Cultural Heritage Assessment of 176 Rennick Road, Burlington**
Client: City of Burlington

2017 **Westdale Theatre Cultural Heritage Assessment**
Client: City of Hamilton

2017 **Documentation & Salvage Report for 264 Governors Road, Hamilton**
Client: Intero Development Group Inc.

2016-2018 **Cultural Heritage Inventory for Region of Waterloo LRT** Client: WSP

2016 **Town of Newmarket Designation Reports** Client: Town of Newmarket

2016 **Jigs Hollow Pit Cultural Heritage Impact Study, Township of Woolwich**
Client: Preston Sand & Gravel Company Limited

2016 **Municipal Register of Cultural Heritage Resources** Client: City of Burlington

2016 **East Side Sanitary Pumping Station Built Heritage and Cultural Heritage Landscape Assessment, Port Colborne** Client: Niagara Region

Lindsay Benjamin, MAES, CAHP
Heritage Project Manager
ARCHAEOLOGICAL RESEARCH ASSOCIATES LTD.
219-900 Guelph Street, Kitchener, ON, N2H 5Z6
Phone: (519) 804-2291 x120 Fax: (519) 286-0493
Email: lindsay.benjamin@arch-research.com
Web: www.arch-research.com

Biography

Lindsay Benjamin is practiced at providing professional planning recommendations and expertise on complex studies, research projects, cultural heritage impact and archaeological assessments. Through her work as a Cultural Heritage Planner, Lindsay researched, drafted and implemented policies for the Regional Official Plan and other planning documents regarding the recognition, review and conservation of cultural heritage resources, including archaeological resources, heritage bridges, cultural heritage landscapes and scenic roads. She served as a Team Lead on the MTCS Historic Places Initiative that drafted over 850 Statements of Significance, was Series Editor for Phase 2 of *Heritage Districts Work!* a study of 32 heritage districts, and was the Primary Author of *Arch, Truss and Beam: The Grand River Watershed Heritage Bridge Inventory*. Lindsay has developed heritage property tax relief programs, worked on Municipal Heritage Registers and drafted designation by-laws in several municipalities. She holds a Master of Applied Environmental Studies degree from the University of Waterloo School of Planning and is a Professional Member of the Canadian Association of Heritage Professionals (CAHP).

Education

2013	MAES, University of Waterloo, Waterloo, ON Focus: Planning
2009	Post-Graduate Diploma, Centennial College, Toronto, ON Publishing & Professional Writing
2007	Honours BES, University of Waterloo, Waterloo, ON Major: Urban Planning, Co-op Distinction: Dean's Honours List

Professional Memberships and Accreditations

Current	Professional Member, Canadian Association of Heritage Professionals (CAHP) Candidate Member, Ontario Professional Planning Institute.

Professional Development

2012-Present	Canadian Association of Heritage Professionals (CAHP), Professional Membership
2013-2017	Ontario Heritage Planners Network Workshops
2017, 2016	National Trust for Canada Conference
2016	Heritage Inventories Workshop, City of Hamilton & ERA Architects
2011-2015	Ontario Heritage Conference
2012	Heritage Impact Assessments Workshop, Region of Waterloo
2012	National Trust for Historic Preservation Conference, Spokane, WA
2012	Conducting Historic Building Assessments Workshop, National Trust for Historic Preservation Conference, Spokane, WA
2012	Canadian Institute of Planners National Conference, Banff, ON

2012	Historic Window Restoration Workshop, Ontario Heritage Conference
2011	Energy and Heritage Buildings Two-Day Workshop, Heritage Resources Centre
2011	Heritage Conservation Districts Workshop, Heritage Resources Centre

Awards

2014	Heritage River Award, Watershed Awards & Canadian Heritage River Celebration, Grand River Conservation Authority
2009	A. K. (Alice King) Sculthorpe Award for Advocacy - Architectural Conservancy of Ontario

Work Experience

2017-Present **Heritage Project Manager, Archaeological Research Associates Ltd.**
Coordinate the completion of heritage projects, including the evaluation of the cultural heritage value or interest of a variety of cultural heritage resources.

2013-2017 **Cultural Heritage Planner, Region of Waterloo**
Planned and implemented Arts, Culture and Heritage initiatives that support creativity and quality of life in the Region of Waterloo. Researched, developed and implemented Regional cultural heritage policies and programs. Fulfilled Regional and Provincial cultural heritage and archaeological review responsibilities under the Planning Act and Ontario Heritage Act.

2009-2013 **Heritage Planner, Heritage Resources Centre, University of Waterloo**
Facilitate the completion of various cultural heritage contracts by undertaking archival research, site visits, report writing, liaising with municipal staff and stakeholders and coordinating project scheduling and budgetary responsibilities.

2006-2007 **Project Manager, Heritage Resources Centre, University of Waterloo**
Established the process of nominating heritage properties to the National Register of Historic Places. Primary liaison between all stakeholder groups, responsible for motivating each group to participate and provide funding. Drafted over 130 Statements of Significance for properties to be nominated to the National Register. Managed a team of five employees.

2005-2006 **Heritage Conservation Easement Planning Assistant, Ontario Heritage Trust**
Supported easement acquisitions through researching the historical and architectural value of potential acquisitions and extensive photo documentation. Screened and processed activity requests from property owners and stakeholders relating to the easement program. Conducted site visits to monitor conservation easement sites and prepared condition assessment reports.

Publications

2017	Historic Interpretive Plaque, Village of German Mills
2016	Historic Interpretive Plaque, Huron Road Bridge
2015	Region of Waterloo Public Building Inventory
2015	Cultivating Heritage Gardens & Landscapes Workshop
2014	Historic Interpretive Plaque, West Montrose Covered Bridge
2014	Series of 17 Practical Conservation Guides for Heritage Properties

Penny M. Young, M.A., CAHP (#P092)
Heritage Project Manager
ARCHAEOGICAL RESEARCH ASSOCIATES LTD.
1480 Sandhill Drive, Unit 3, Ancaster, ON L9G 4V5
Phone: (519) 804-2291 x121 Email: penny.young@arch-research.com
Web: www.arch-research.com

Biography

Penny Young has 27 years of cultural heritage management experience, 21 years working in government, as a Heritage Planner, Heritage Coordinator, Regional Archaeologist and Archaeological Database Coordinator where she managed and coordinated the impacts to cultural heritage resources including built heritage, archaeological sites and cultural heritage landscapes for compliance with municipal, provincial and federal legislation and policy. She has conducted results-driven and collaborative management of complex cultural heritage resource projects within the public sector involving developing project terms of reference, defining scope of work, preparation of budgets and conducting sites visits to monitor and provide heritage/archaeological and environmental advice and direction. At the Ministry of Transportation Penny revised, updated and developed policy, as part of a team, for the *Ontario Heritage Bridge Guidelines for Provincially Owned Bridge Guidelines for Provincially Owned Bridges*. She received the MTO Central Region Employee Recognition Award in 2001 and 2002. While at MTO she provided technical advice and input into the development of the *MTO Environmental Reference for Highway Design - Section 3.7 Built Heritage and Cultural Heritage Landscapes* and the *MTO Environmental Guide for Built Heritage and Cultural Heritage Landscapes.* She is a professional member of the Canadian Association of Heritage Planners (CAHP) and holds Professional License #P092 from MTCS. She also holds memberships in the Ontario Professional Planners Institute (OPPI) and the Ontario Archaeological Society (OAS).

Education

1990-1993	Master of Arts, Department of Anthropology McMaster University, Hamilton Ontario. Specializing in Mesoamerican and Ontario archaeology.
1983-1987	Honours Bachelor of Arts (English and Anthropology), McMaster University, Hamilton, Ontario.

Professional Memberships and Accreditations

Current	Professional Member of the Canadian Association of Heritage Professionals (CAHP) Member of Ontario Archaeological Society Pre-Candidate Member of the Ontario Professional Planners Institute Ministry of Tourism Culture and Sport Professional Licence (#P092)

Work Experience

Current	**Heritage Project Manager, Archaeological Research Associates Ltd.** Coordinates ARA project teams and conducts heritage assessment projects including Heritage Impact Assessments, Built Heritage and Cultural Heritage Landscape Assessments, and Cultural Heritage Resource Evaluations. Additional

responsibilities include the completion of designation by-laws and heritage inventories. Liaises with municipal staff, provincial ministries and Indigenous communities to solicit relevant project information and to build relationships.

2008-2016 **Heritage Planner, Culture Services Unit, Ministry of Tourism, Culture & Sport (MTCS)**
Responsible for advising and providing technical review for management of cultural heritage resources in environmental assessment undertakings and planning projects affecting provincial ministries, municipalities, private sector proponents and Indigenous communities. Advised on municipalities' Official Plan (OP) policies cultural heritage conservation policies. Provided guidance on compliance with the Public Work Class EA, other Class EA legislation and 2010 *Standards and Guidelines for Provincial Heritage Properties*.

2014 **Senior Heritage Planner, Planning and Building Department, City of Burlington** (temporary assignment)
Project manager of the study for a potential Heritage Conservation District. Provided guidance to a multiple company consultant team and reported to municipal staff and the public. Liaised with Municipal Heritage Committee and municipal heritage property owners approved heritage permits and provided direction on Indigenous engagement, archaeological site assessments and proposed development projects.

2011 **Heritage Coordinator, Building, Planning and Design Department, City of Brampton** (temporary assignment)
Project lead for new Heritage Conservation District Study. The assignment included directing consultants, managing budgets, organizing a Public Information Session, and reporting to Senior Management and Council. Reviewed development/planning documents for impacts to heritage including OP policies, OP Amendments, Plans of subdivision and Committee of Adjustment applications and Municipal Class EA undertakings.

2010-2011 **Senior Heritage Coordinator, Culture Division, City of Mississauga** (temporary assignment)
Provided advice to Senior Management and Municipal Council on heritage conservation of built heritage, archaeological sites and cultural heritage landscapes. Liaised with multiple municipal staff including the Clerks' office, Parks and development planners and the public. Supervised and directed project work for junior heritage planner.

1999-2008 **Regional Archaeologist, Planning and Environmental Section, Ministry of Transportation (MTO)**
Responsibilities included: project management and coordination of MTO archaeology and heritage program, managed multiple consultants, conducted and coordinated field assessments, surveys and excavations, liaised with First Nations' communities and Band Councils, estimated budgets including $200,000 retainer contracts.

Sarah Clarke, B.A.
Research Manager
ARCHAEOLOGICAL RESEARCH ASSOCIATES LTD.
219-900 Guelph Street, Kitchener, ON N2H 5Z6
Phone: (519) 755-9983 Email: sclarke@arch-research.com
Web: www.arch-research.com

Biography
Sarah Clarke is Archaeological Research Associates Ltd.'s Heritage Research Manager. Sarah has over 12 years of experience in Ontario archaeology and 10 years of experience with background research. Her experience includes conducting archival research (both local and remote), artifact cataloguing and processing, and fieldwork at various stages in both the consulting and research-based realms. As Team Lead of Research, Sarah is responsible for conducting archival research in advance of ARA's archaeological and heritage assessments. In this capacity, she performs Stage 1 archaeological assessment site visits, conducts preliminary built heritage and cultural heritage landscape investigations and liaises with heritage resource offices and local community resources in order to obtain and process data. Sarah has in-depth experience in conducting historic research following the *Ontario Heritage Toolkit* series, and the *Standards and Guidelines for Provincial Heritage Properties*. Sarah holds an Honours B.A. in North American Archaeology, with a Historical/Industrial Option from Wilfrid Laurier University and is currently enrolled in Western University's Intensive Applied Archaeology MA program. She is a member of the Ontario Archaeological Society (OAS), the Society for Industrial Archaeology, the Ontario Genealogical Society (OGS), the Canadian Archaeological Association, and is a Council-appointed citizen volunteer on the Brantford Municipal Heritage Committee. Sarah holds an R-level archaeological license with the MTCS (#R446).

Education

Current	MA Intensive Applied Archaeology, Western University, London, ON. Proposed thesis topic: Archaeological Management at the Mohawk Village.
1999–2010	Honours BA, Wilfrid Laurier University, Waterloo, Ontario Major: North American Archaeology, Historical/Industrial Option

Professional Memberships and Accreditations

Current	Member of the Ontario Archaeological Society
Current	Member of the Society for Industrial Archaeology
Current	Member of the Brant Historical Society
Current	Member of the Ontario Genealogical Society
Current	Member of the Canadian Archaeological Association
Current	Member of the Archives Association of Ontario

Work Experience

Current	**Team Lead – Research; Team Lead – Archaeology, Archaeological Research Associates Ltd.** Manage and plan the research needs for archaeological and heritage projects. Research at offsite locations including land registry offices, local libraries and

local and provincial archives. Historic analysis for archaeological and heritage projects. Field Director conducting Stage 1 assessments.

2013-2015 **Heritage Research Manager; Archaeological Monitoring Coordinator, Archaeological Research Associates Ltd.**
Stage 1 archaeological field assessments, research at local and distant archives at both the municipal and provincial levels, coordination of construction monitors for archaeological project locations.

2010-2013 **Historic Researcher, Timmins Martelle Heritage Consultants Inc.**
Report preparation, local and offsite research (libraries, archives); correspondence with the Ministry of Tourism, Culture, and Sport; report submission to the MTCS and clients; and administrative duties (PIF and Borden form completion and submission, data requests).

2008-2009 **Field Technician, Archaeological Assessments Ltd.**
Participated in field excavation and artifact processing.

2008-2009 **Teaching Assistant, Wilfrid Laurier University.**
Responsible for teaching and evaluating first year student lab work.

2007-2008 **Field and Lab Technician, Historic Horizons.**
Participated in excavations at Dundurn Castle and Auchmar in Hamilton, Ontario. Catalogued artifacts from excavations at Auchmar.

2006-2010 **Archaeological Field Technician/Supervisor, Wilfrid Laurier University.**
Field school student in 2006, returned as a field school teaching assistant in 2008 and 2010.

Professional Development

2018 Grand River Watershed 21st Annual Heritage Day Workshop and Celebration (One day)
2018 Mississaugas of the New Credit First Nation Historical Gathering and Education Conference (One day)
2017 Ontario Genealogical Society Conference. (Two days)
2016 Ontario Archaeological Society Symposium (One day)
2015 Introduction to Blacksmithing Workshop, Milton Historical Society (One day)
2015 Applied Research License Workshop, MTCS (One day)
2014 Applied Research License Workshop, MTCS (One day)
2014 Heritage Preservation and Structural Recording in Historical and Industrial Archaeology. Four-month course taken at Wilfrid Laurier University, Waterloo, ON. Professor: Meagan Brooks

Presentations

2018 **The Early Black History of Brantford.** Brant Historical Society, City of Brantford.
2017 **Mush Hole Archaeology.** Ontario Archaeological Society Symposium, City of Brantford.
2017 **Urban Historical Archaeology: Exploring the Black Community in St. Catharines, Ontario.** Canadian Archaeological Association Conference, Gatineau, QC.

Volunteer Experience

Current **Council-appointed citizen volunteer for the Brantford Municipal Heritage Committee.**

Appendix E

Agency and Public Correspondence

AGENCY CONTACT LIST FOR E.A.'s
(Updated as of September 10, 2020)

CONSULTANTS TO MAIL:

AGENCY CONTACT LIST FOR E.A.'s
(as of September 10, 2020)

	Agency Name	Contact Person
A.	**Provincial Agencies**	
1	Ministry of the Environment, Conservation and Parks Hamilton District Office Ellen Fairclough Bldg 119 King Street West, 9th Floor, Hamilton, ON L8P 4Y7 Tel: (905) 521-7642 Fax: (905) 521-7806	Mr. Paul Widmeyer District Manager Email: paul.widmeyer@ontario.ca
2	Ministry of the Environment, Conservation and Parks Environmental Assessment and Permissions Branch 135 St. Clair Avenue West Floor 1 Toronto, Ontario M4V 1P5 Tel: (416) 314-8001 Fax: (416) 314-8452	Director ***only Notice of Completion**
3	Ministry of the Environment, Conservation and Parks Ellen Fairclough Bldg 119 King Street West, 12th Floor, Hamilton, On L8P 4Y7 Tel: (905) 521-7864 Fax: (905) 521-7820	Ms. Barbara Slattery Environmental Assessment and Planning Coordinator Email: barbara.slattery@ontario.ca * **only Notice of Completion**
4	Ministry of Natural Resources and Forestry Guelph District Office 1 Stone Road West Guelph, Ontario N1G 4Y2 Tel: (519) 826-4931 Fax: (519) 826-4929	Ms. Tammy Verhaeghe District Manager Email: tammy.verhaeghe@ontario.ca Cc: District Planner
5	Ministry of Tourism, Culture and Sport 401 Bay St. Suite 1700 Toronto, Ontario M7A 0A7 James Tel: (416) 212-7505 Laura Tel: (416) 314-3108	James Hamilton Manager of Heritage Program Unit Email: james.hamilton@ontario.ca Heritage Planner, Cultural Services

	Agency Name	Contact Person
6	Ministry of Tourism, Culture & Sport 900 Highbury Avenue London, Ontario N5Y 1A4 Tel: (519) 675-6898 Fax: (519) 675-7777	Shari Prowse Archaeology Review Officer Email: shari.prowse@ontario.ca
7	Ministry of Transportation 659 Exeter Road London, Ontario N6E 1L3 Tel: (519) 873-4100	John Morrisey Planner Email: john.morrisey@ontario.ca Cc: Bonnie Baker Email:bonnie.l.baker@ontario.ca
8	Ministry of the Environment, Conservation and Parks Attention: Assessment & Approval West Central Region 1 Stone Road West Guelph, Ontario N1G 4Y2 Tel: (519) 826-4255 Fax: (519) 826-4286	Amy Shaw District Manager Tel: (519)826-4258
9	Ministry of Municipal Affairs and Housing Western Municipal Services Office 659 Exeter Rd 2nd Floor London Ontario N6E 1L3 Tel: (519) 873-4020 Fax: (416) 585-6470	Ian Kerr Regional Director Email: ian.kerr@ontario.ca
10	Ministry of Municipal Affairs and Housing 777 Bay Street, 14th Floor (Housing) 16th Floor (Municipal Services) Toronto, On M5G 2E5	Hon. Steve Clark Minister Municipal Services Division Tel: (416) 585-6427 Janet Hope Assistant Deputy Minister Housing Division (416) 585-6755

	Agency Name	Contact Person
11	Ministry of Aboriginal Affairs McMurtry-Scott Building 720 Bay Street, 11th Floor Toronto, ON M7A 2S9 Tel: (416) 326-2220 Fax: (416) 326-4007	Counsel
12	Ministry of Indigenous Affairs 400 Bloor St E Suite 160 Toronto, Ontario M7A 2E6 (416) 327-4464	Hon. Greg Rickford Minister
13	Ministry of the Attorney General – Aboriginal Legal Issues Office Crown Law Office-Civil, 720 Bay Street, 8th Floor Toronto, Ontario M5G 2K1 Tel: (416) 326-4008 Fax: (416) 326-4181	Director of Legal Services (416) 590 7149
B	**Federal Agencies**	
1	Innovation, Science and Economic Development Canada C.D. Howe Building 235 Queen Street Ottawa, Ontario K1A 0H5 Canada Telephone (Ottawa): 613-954-5031 Fax: 343-291-1913	Hon. Navdeep Bains Minister of Innovation, Science and Economic Development Email: ised.minister-ministre.isde@canada.ca
2	Transport Canada Environment and Engineering 4900 Yonge Street, Suite 400 North York, Ontario M2N 6A5 Tel: (416) 952-0485	Ms. Monique Mousseau, Regional Manager Email:monique.mousseau@tc.gc.ca

3	Indigenous and Northern Affairs Canada 10 Wellington, North Tower Gatineau, QC K1A 0H4 Tel: 1-800-567-9604 Fax: 1-866-817-3977	Hon. Carolyn Bennett Minister Email: minister@aadnc-aandc.gc.ca
4	Indigenous Services Canada 25 St. Clair Avenue East, Toronto, Ontario M4T 1M2	Hon. Marc Miller Minister of Indigenous Services
5	Fisheries and Oceans Canada Central and Arctic Region 520 Exmouth Street Sarnia, ON, N7T 8B1 Toll-free: 1-866-290-3731 Telephone: 519-383-1809 Fax: 519-464-5128 Email: info@dfo-mpo.gc.ca	Regional Manager
C. Municipalities		
1	City of Brantford 100 Wellington Square P.O. Box 818 Brantford, Ontario N3T 5R7 Tel: (519) 759-4150	Kevin Davis, Mayor Email: kevindavis@brantford.ca Cc: RMatthews-Osmond@brantford.ca
2	City of Brantford 100 Wellington Square P.O. Box 818 Brantford, Ontario N3T 5R7 Tel: (519) 759-4150 Fax: (519) 759-7840	City Councillors JVanderstelt @brantford.ca RickWeaver@brantford.ca JohnSless@brantford.ca JohnUtley@brantford.ca DanMcCreary@brantford.ca GregMartin@brantford.ca RichardCarpenter@brantford.ca CherylAntonski@brantford.ca BrianVanTilborg@brantford.ca joshuawall@brantford.ca

3	City of Brantford 100 Wellington Square P.O. Box 818 Brantford, Ontario N3T 5R7 Tel: (519) 759-4150	Brian Hutchings, Chief Administrative Officer Email: BHutchings@brantford.ca
4	City of Brantford 100 Wellington Square P.O. Box 818 Brantford, Ontario N3T 5R7 Tel: (519) 759-4150	Andy McMahon, Acting Director Building Services, Chief Building Officer Email: amcmahon@brantford.ca
5	City of Brantford City Clerk's Office 100 Wellington Square P.O. Box 818 Brantford, Ontario N3T 5R7 Tel: (519) 759-4150	Tanya Daniels, City Clerk & Director of Clerk Services Email: tdaniels@brantford.ca
6	City of Brantford 100 Wellington Square P.O. Box 818 Brantford, Ontario N3T 5R7 Tel: (519) 759-4150	Inderjit Hans General Manager Public Works Email: ihans@brantford.ca
7	City of Brantford 100 Wellington Square P.O. Box 818 Brantford, Ontario N3T 5R7 Tel: (519) 759-4150	Paul Moore General Manager Community Development Email: pmoore@brantford.ca
8	City of Brantford 100 Wellington Square P.O. Box 818 Brantford, Ontario N3T 5R7 Tel: (519) 759-4150	Lucy Hives Director of Planning Email: LHives@brantford.ca

9	City of Brantford 100 Wellington Square P.O. Box 818 Brantford, Ontario N3T 5R7 Tel: (519) 759-4150	Catherine Brubacher General Manger Corporate Services/City Treasurer Email: CBrubacher@brantford
10	City of Brantford 220 Colborne Street Brantford, Ontario N3T 2H1	Aaron Wallace Acting General Manager Health & Human Services Email: awallace@brantford.ca
11	City of Brantford 100 Wellington Square P.O. Box 818 Brantford, Ontario N3T 5R7 Tel: (519) 759-4150	Russ Loukes Director of Engineering Services Email: rloukes@brantford.ca
12	City of Brantford 100 Wellington Square P.O. Box 818 Brantford, Ontario N3T 5R7 Tel: (519) 759-4150	Wendy Teufel Manager Design and Construction Email: wteufel@brantford.ca
13	City of Brantford 100 Wellington Square P.O. Box 818 Brantford, Ontario N3T 5R7 Tel: (519) 759-4150	Daniel Kreze Manager of Survey Email: DKreze@brantford.ca
14	City of Brantford 180 Greenwich Street Brantford, Ontario N3T 5R7	Selvi Kongara Director Environmental Services Email: SKongara@brantford.ca
15	City of Brantford 10 Earl Avenue Brantford, Ontario N3T 5R7 Tel: (519) 759-4150	Mark Jacklyn Director of Operational Services Email: mjacklyn@brantford.ca

16	City of Brantford 100 Wellington Square P.O. Box 818 Brantford, Ontario N3T 5R7 Tel: (519) 759-4150	Lise Sordo Director of Facilities Management and Security Email: lsordo@brantford.ca
17	City of Brantford Parks and Recreation 1 Sherwood Drive Brantford, Ontario N3T 1N3	Brian Hughes Director of Parks Services Email: BHughes@brantford.ca Vicki Armitage, Manager Parks Design Email: varmitage@brantford.ca
18	City of Brantford 100 Wellington Square P.O. Box 818 Brantford, Ontario N3T 5R7 Tel: (519) 759-4150	Maria Visocchi Director of Communications & Community Engagement Email: MVisocchi@brantford.ca
19	City of Brantford 100 Wellington Square P.O. Box 818 Brantford, Ontario N3T 5R7 Tel: (519) 759-4150	Heidi DeVries Director Legal & Real Estate Services Email: HDeVries@brantford.ca
20	City of Brantford 100 Wellington Square P.O. Box 818 Brantford, Ontario N3T 5R7 Tel: (519) 759-4150	Mike Bradley Director of Fleet and Transit Services Email: mbradley@brantford.ca
21	Brantford Police Services 344 Elgin Street P.O. Box 1116 Brantford, Ontario N3T 5T3 Tel: (519) 756-7050 Or: (519) 756-0113 bps02@police.brantford.on.ca	Robert Davis, Chief of Police

22	Brantford Fire Department 60 Clarence Street, P.O. Box 61 Brantford, Ontario N3T 5M3	Todd Binkley, Fire Chief Email: tbinkley@brantford.ca
23	Brantford Heritage Committee City of Brantford 100 Wellington Square P.O. Box 818 Brantford, Ontario N3T 5R7 Tel: (519) 759-4150	Chris Gauthier, Manager of Legislative Services Email: cgauthier@brantford.ca
24	Environmental Policy Advisory Committee City of Brantford 100 Wellington Square P.O. Box 818 Brantford, Ontario N3T 5R7 Tel: (519) 759-4150	Melanie Figueiredo, Legislative Assistant Email: MFigueiredo@brantford.ca
25	Brant County Health Unit 194 Terrace Hill Street Brantford, Ontario N3R 1G7 Tel: (519) 753-4937 Fax: (519) 753-5942	Dr. Elizabeth Urbantke Medical Officer of Health
26	Ambulance Services 303 Henry Street Brantford, Ontario N3T 5S7 Tel: (519) 756-4570	Russ King, Director
27	County of Brant 26 Park Avenue PO Box 160 Burford, Ontario N0E 1A0 Phone: (519)449-2451	The Clerk

D. Other Agencies		
1	Grand River Conservation Authority 400 Clyde Road P.O. Box 729 Cambridge, Ontario N1R 5W6 Tel: (519) 621-2761 Fax: (519) 621-4844 Email: grca@grandriver.ca	Chief Administrative Officer CC: Ashley Graham Resource Planner
2	Grand Erie District School Board 349 Erie Avenue Brantford, Ontario N3T 5V3 Tel: (519) 756-6301 Fax: (519) 756-9181	Brenda Blancher Director of Education
3	Brant Haldimand Norfolk Catholic District School Board P.O. Box 217 322 Fairview Drive Brantford, Ontario N3T 5M8 Tel: (519) 756-6369 Fax: (519) 756-9913 Email: info@bhncdsb.ca	Mike McDonald Director of Education Office Phone: (519) 756-6505 Email: directorsoffice@bhncdsb.ca
4	Brantford Christian School 7 Calvin Street Brantford, Ontario N3S 3E4	Justin DeMoor, Principal
5	Six Nations of the Grand River 1695 Chiefswood Road P.O. Box 5000 Ohsweken, Ontario N0A 1M0 Tel: (519) 445-2201	Chief Mark Hill
6	Six Nations Lands and Resources 2498 Chiefswood Road P.O. Box 5000 Ohsweken, Ontario N0A 1M0 Tel: (519) 753-0665	Lonny Bomberry Director of Lands and Resources Department

7	Six Nations of the Grand River 1721 Chiefswood Road Iroquois Village Plaza Unit 109 P.O. Box 5000 Oshweken ON, NOA 1M0	Weylin Bomberry Six Nations Wildlife Management Office
8	Mississaugas of the Credit First Nation Department of Consultation & Accommodation 4065 Hwy 6 Hagersville, ON N0A 1H0 Tel: 905-768-4260 Fax: 905-768-9751	Attention: Executive Director
E.	**Utilities**	
1.	Bell Canada P.O. Box 938 86 Market Street Brantford, Ontario N3T 5S5	Christine Telfer
2.	Rogers Cable 85 Grand Crest Place P.0. Box 488 Kitchener, Ontario N2G 4A8 Tel: (519) 894-8138 Fax: (519) 893-6463	Richard Bolliger Municipal & Utility Relations
3.	Union Gas P.O. Box 340 603 Kumpf Drive Waterloo, Ontario N2J 4A4	John Stauffer
4.	Brantford Hydro Inc. 44 King Street, Suite 207 Brantford, ON N3T 3C7 Tel: (226) 493-1043	James Nagle, Chief Operating Officer
5.	Brantford Power Inc. 84 Market Street Brantford, Ontario N3T 5N8 Tel: (519) 751-3522	Paul Kwasnik, Chief Executive Officer

6	CN Rail 1 Administration Road Concord, Ontario L4K 1B9 Tel: (905) 760-5007 (number kept ringing and no answering machine) Fax: (905) 760-5010	Manager, Community Planning & Real Estate

Colborne Street (East) Slope Stabilization
Municipal Class Environmental Assessment

First Nations Consultation Plan

February 27, 2019


Corporation of the City of Brantford
100 Wellington Square
Brantford, ON, N3T 5R7

Prepared by: Ecosystem Recovery Inc.
80-2 Courtland Avenue East
Kitchener, ON, N2G 2T8

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1. Introduction

Ecosystem Recovery Inc. (ERI) is the primary consultant on the Colborne Street (East) – Slope Stabilization Municipal Class Environmental Assessment project, currently being undertaken by the City of Brantford to address slope stability concerns along Colborne Street (East), adjacent to the Grand River. ERI has prepared this First Nations Consultation Plan on behalf of the City of Brantford to outline and guide the proposed activities for the Municipal Class Environmental Assessment (EA), and to seek input from First Nations on the project during the EA process.

This document describes the project scope, location, EA requirements, and planned consultation activities related to the Colborne Street (East) Slope Stabilization EA.

1.1 Location and Description of the Proposed Study

1.1.1 Study Background and Location

In 1986, a major landslide event occurred on the slope along Colborne Street (East) in the City of Brantford, in the section adjacent to the Grand River in the area known as 'the Oxbow'. Since this event in 1986, several studies have been completed to determine cause and effects. Monitoring shows that slope movement continues to occur. Slope stability concerns revolve around soil type and moisture issues as well as toe erosion. This EA was initiated to develop feasible alternatives to address stability concerns and to create a management strategy for the area. The study is being completed under Schedule "C" of the Municipal Class Environmental Assessment process. The objective of the EA process is to minimize the risk to the public and private properties resulting from slope instability, while also minimizing the impacts on the natural environment, local businesses, public recreational activities, transportation, and other factors considered in the study.

The overall study area is shown in **Figure 1**; any potential rehabilitation work would likely be limited to the area shown as the 'Slope Monitoring Area', depending on the alternative solution selected through the EA process.

Figure 1. Project Location and Study Area

1.2 Parties Involved in the Study

The Colborne Street (East) Municipal Class Environmental Assessment involves work from the following parties:

- City of Brantford – Municipality undertaking the EA study
- Ecosystem Recovery Inc., (ERI), primary consultant undertaking the study on behalf of the City of Brantford
- Pinchin Environmental Ltd. – geotechnical consultant
- Archaeological Research Associates (ARA) – archaeology and cultural heritage consultant

In addition, the project is being undertaken in close consultation with the Grand River Conservation Authority (GRCA) and the County of Brant.

1.3 Schedule 'C' Municipal Class Environmental Assessment Requirements

As specified in the Municipal Class Environmental Assessment document (Municipal Engineers Association, 2011), First Nations are an important stakeholder group in the EA process for municipal consultation. As part of the consultation component of the MEA process, consultation with First Nations groups will be undertaken in coordination with the Ontario Ministry of the Environment, the Ontario Ministry of Aboriginal Affairs, and the Department of Indian and Northern Affairs.

1.4 Project Schedule

The project was initiated in 2018, with the first Public Information Centre (PIC) occurring on September 13th, 2018 and the second PIC scheduled for March 12, 2019. The anticipated project schedule for the remainder of the project, including two additional PICs, First Nations Consultation, and the selection of alternative solutions and alternative designs is provided in **Figure 2**.

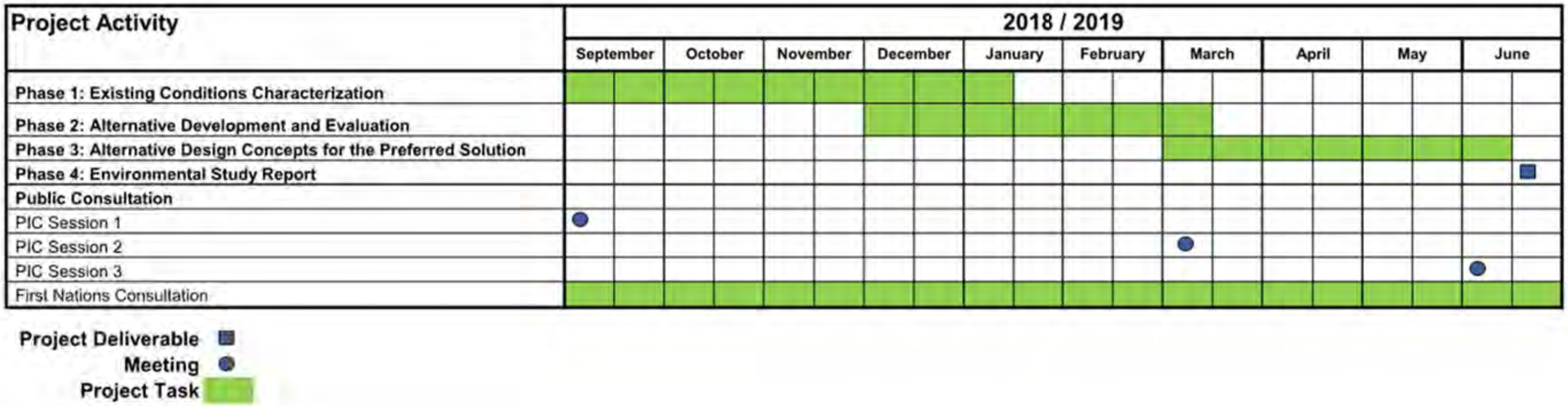


Figure 2. Anticipated Project Schedule

2. First Nations in the Project Area

The Six Nations of the Grand River (SNGR) and the Mississaugas of the New Credit First Nation (MNCFN) are both First Nations Communities located near the project study area, and will be involved in the EA process and communications related to the project, as described in **Section 3**.

The SNGR shall be contacted through their Consultation and Accommodation Process (CAP) Team, as discussed in the Six Nations of the Grand River Consultation and Accommodation Policy (Six Nations of the Grand River, 2013).

The Department of Consultation and Accommodation (DOCA) of the MNCFN was established to proactively address the 'duty to consult' (DOCA, n.d.), and will be the point of contact on this project for the MNCFN to provide feedback on potential development and construction activities on the traditional territory of the MNCFN.

The contact information for the SNGR CAP Team and the MNCFN DOCA are listed below.

Paul General, Wildlife Manager
Six Nations of the Grand River
1721 Chiefswood Road
Iroquois Village Plaza
Unit 109
P.O. Box 5000
Oshweken ON, NOA 1M0

Fawn Sault
Mississaugas of the New Credit
Department of Consultation & Accommodation
6 First Line Road, Unit 1
R.R. #6
Hagersville, Ontario, N0A 1H0

3. Consultation Activities and Work Plan

Throughout the project, ERI and the City of Brantford will share project information and seek the input from First Nations communities, including the SNGR and MNCFN, in order to develop a greater understanding of the interests and values of affected First Nations communities. This understanding will be reflected in the decision-making made in selecting preferred alternative solutions and designs as part of the EA process.

The following section describes the consultation activities planned for this project.

3.1 Consultation Methods

The City of Brantford has reached out to First Nations communities early in the EA process to establish points of contact for lines of communication on this project, and will provide regular updates and facilitate meetings with First Nations communities throughout the EA process. ERI and the City of Brantford will:

- Provide project updates to First Nations communities at key points of the project

- Provide announcements of all upcoming Public Information Centres,
- Facilitate regular meetings with First Nations Communities leaders to ensure the perspectives of First Nations Communities are heard and understood throughout the process,
- Include First Nations perspectives and concerns in all decision-making activities, including the selection and modification of preferred alternatives, and
- Maintain records of all concerns received from First Nations communities, including logging all consultation efforts and meetings with First Nations communities.

3.2 Consultation Reporting

Consultation reports will be submitted to the SNGR and the MNCFN, which will include details of any formal meetings as well as site visits. The consultation reports shall include:

1. Date(s) of Stakeholder Contact
2. Six Nations of the Grand River Primary Lead/contact
3. Individuals/Groups Contacted
4. Method of Contact and/or activity (Direct mail; Phone Call; Email; Meeting; Other)
5. Summary of Issues Discussed
6. Outcomes
7. Follow Up / Outstanding Issues (linked back to previous reports or discussions)
8. General comments/concerns

In addition, ERI will submit formal records of correspondence and meetings to the Ontario Ministry of Aboriginal Affairs (MAA).

3.3 Tracking Interests and Concerns

In addition to the monthly consultation reports discussed in **Section 3.2**, a summary of all concerns and comments received by SNGR will be summarized and included as part of the EA study. The summary of all concerns and comments received will be compiled in a format similar to the one shown in **Table 1**.

Table 1. Sample Format for Tracking Interests and Concerns with First Nations Communities

Potential Issue	Comments/ Concerns	ERI and City of Brantford Response	Status of Issue Resolution
Wildlife impacts			
Water Quality			
Disturbance to Archaeological Sites			

3.4 Archaeological and Cultural Heritage Resources

As part of the site characterization and understanding, ARA have conducted a Stage 1 Archaeological Assessment to review the archaeological potential on site and the potential for disturbance and significant artefacts. ARA has recommended a Stage 2 Archaeological Assessment for the majority of the study area, to be undertaken through test pits on the table lands and construction monitoring for the slope area.

In addition, ARA has completed a Built Heritage and Cultural Landscape Assessment, which identified buildings and sites of cultural significance within the study area. The selection of alternative designs will take the identified resources into consideration and provide measures to mitigate disruption to cultural assets. In addition, ARA has recommended a Heritage Impact Assessment be undertaken during the detailed design of the alternative solution, which will confirm the anticipated impacts of the design and outline mitigation measures during design and construction.

3.5 Public Consultation Activities

As part of the EA process, a total of three (3) Public Information Centres (PICs) has been planned for key stages in the process to interact with and gain feedback from members of the public. The first PIC introduced the project and the initial results of the background characterization of the site, and was held on September 13, 2018. The second PIC is planned for March 2019 and is intended to introduce the methodology for evaluation of alternatives. The comments and questions received from the second PIC will be considered in the evaluation of alternative solutions.

The third PIC will be held prior to the release of the Environmental Study Report (ESR), and will present the selected alternative solution to the public with sufficient time to provide feedback on details of the alternative design. The selected alternative design will be developed in consideration of the comments received at all three of the PICs held throughout the EA process.

4. Contact Information

The primary contacts for this project include the following representatives from Ecosystem Recovery Inc. (ERI) and the City of Brantford.

Jeff Prince, P. Eng
Senior Project Manager
Ecosystem Recovery Inc.
80 Courtland Ave East, Unit 2
Kitchener, Ontario N2G 2T8
Phone: 519-621-1500
Email: jeff.prince@ecosystemrecovery.ca

Matt Welsh C. Tech., PMP
Project Coordinator
Design and Construction
Public Works Commission
City of Brantford
100 Wellington Square, P.O. Box 818
Phone: 519-759-4150 ext 5446
Email: mwelsh@brantford.ca

5. References

Department of Consultation & Accommodation (DOCA). (n.d.). Retrieved January 11, 2019, from http://mncfn.ca/doca/

Municipal Engineers Association (2011). Municipal Class Environmental Assessment, as Amended in 2007 and 2011.

Six Nations of the Grand River (2013). Consultation and Accommodation Policy. Retrieved January 11, 2019, from www.sixnations.ca/LRConsultationPolicySept2413.pdf

ecosystem recovery inc.
PROFESSIONAL ENGINEERS

Meeting Minutes

80 Courtland Ave. East, Unit 2, Kitchener, ON N2G 2T8
Tel 519.621.1500 ■ Fax 226.240.1080

Project: Colborne Street Slope Stabilization EA

Meeting No.: 6

Meeting Date: March 13, 2019

Project No.: 1824

Meeting Time: 2:00 PM to 3:00 PM

Location: 1721 Chiefswood Road, Iroquois Village Plaza, Unit 109, Ohsweken

Present: Matt Welsh, Wendy Teufel, Vic Bohdanow,
Robert Chlumsky, Jeff Prince,
Paul General, Matt Jako, Phil Manturo, Robin Lynn, Joanne Thomas, Lonny Bomberry

Regrets:

Purpose: Presentation of PIC 2 Materials and Alternative Solutions

Item	Description	Action By
1	Phil asked whether any private properties still exist in the slope area. Jeff: Currently there are six properties still on the slope, including the school Phil: Do they have an option to sell out their properties to the City? Vic: Not at this time, other properties following the landslide and others since then have been acquired by the City as they were at immediate risk.	
2	Lonny: What was the cause of the slope failure in 1986? Did the railway have any impact? Vic: It is possible that the railway had some impact on the slope conditions. Jeff: There are lots of reasons for the failure, some of which are natural and some anthropogenic. The railway would have steepened the slope on both sides to make room for the railway path, which may have contributed to the failure. Matt: The City would certainly not develop these lands today with the current policies, these properties exist in the area due to past development policies allowing development there.	
3	Lonny: How big is the ossuary mentioned near the site? Jeff: Not sure exactly, would be discussed in the archaeological report.	
4	Paul: Recall an archaeological site called the Porteous site, is located near the site. Jeff: That may be, given that there are 43 registered sites within a 1km of the study area. (Follow up from meeting: ARA Stage 1 Report has site with ID No. AgHb-1 under the name Porteous, located >1km from the study area).	
5	Discussion on various mechaniucal stabilization approaches: - Lonny: What about a wall? Jeff: bedrock is too deep to anchor a wall, would have nothing to support it from slope failure - Phil: 403 and Hamilton Rd stabilization with piles? Vic and Jeff: similar issue with depth to bedrock, not practical to have piles that deep -	
6	Phil: Any impact due to development of the site to the slope conditions? Jeff: Likely some impact on soil moisture, anything which adds surface runoff or moisture to the soils on site would contribute to slope instability.	
7	Paul: Do the trees on site actually contribute to slope stability? Recalls on Tutela heights the trees actually contributed to the slope failure in some cases.	

	Vic: Yes, tree roots help to stabilize the soil. Jeff: Trees do not help with controlling the deep-seated failures, which is the main concern in slope stability.	
8	Phil: What is the depth of the Grand River in vicinity of the bend? Is it quite shallow? Jeff: It is not that shallow, in the 1-3m range in some locations. The GRCA recently completed a collection of bathymetry data which will give us a better idea in the future.	
9	Next meeting: PIC #3 will be in September 2019 to which Six Nations will receive an invite, and we can certainly setup another presentation around that time as well.	MW to send invite for PIC #3 once date is finalized and potentially setup a second presentation.

WELCOME

Colborne Street (East) Slope Stabilization
Municipal Class Environmental Assessment

Public Information Centre No. 1

Mohawk Park Pavilion
September 13, 2018
4:00 pm - 6:00 pm

PLEASE SIGN IN AND TAKE A COMMENT SHEET

The Purpose of this Information Centre

- ❑ Provide information on the Environmental Assessment (EA) study purpose and background
- ❑ Describe the process that will be followed for the EA study
- ❑ Indicate EA activities now in progress
- ❑ Provide a characterization of the study area and its elements
- ❑ Provide an opportunity for your input

Study Purpose

The EA study follows the **Municipal Class Environmental Assessment** under Schedule 'C' for the slope area situated between Colborne Street (East) and the north bank of the Grand River at a road section between Calvin Street to the west, and Johnson Road to the east in the City of Brantford.

Problem Statement:

Since the landslide event that occurred in 1986, several studies have been completed to determine cause and effects. Monitoring shows that slope movement continues to occur. Slope stability concerns revolve around soil type and moisture issues as well as toe erosion.

The EA is being initiated to develop feasible alternatives to address stability concerns and to create a management strategy for the area.

Background Information and Timeline

Beach Road after 1986 landslide

951 Colborne Street (East) after 1986 landslide

1986
Major slope failure on South side of Colborne Street, Initiates investigations into slope failure within study area. Slope monitoring begins with installation of monitoring equipment.

1987
First Environmental Study Report (ESR) completed by Golder for GRCA. Landslide was determined to be primarily caused by ongoing riverbank erosion and high groundwater levels. First slope stability analysis completed as part of report.

1988
Canadian Pacific Railway removed.

Railway along Beach Road after 1986 landslide

1995
Second ESR completed by Golder; presented the preferred alterative as toe erosion protection with minor regrading of the slope.

1996
Former railbed converted to Hamilton-Brantford Rail Trail.

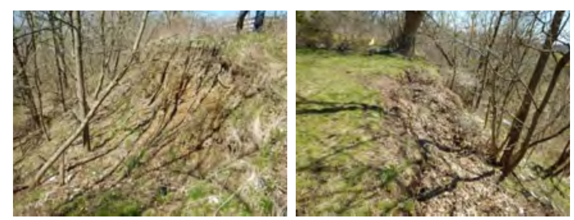
1999
Grand River bank failure along toe of slope.

Hamilton-Brantford Rail Trail within Study Area, April 2016

929 Colborne Street (East) after 1986 landslide

2012
Update to 1995 ESR including revisiting slope stability, no change to the preferred alternative. A detailed Environmental Assessment was noted as required to adopt a preferred solution.

2015/2016
Additional studies to review slope monitoring data and collect additional field observations undertaken by Ecosystem Recovery Inc.



Slope monitoring in 2016, unstable slope evidence (left) and slumping near property line (right)

2018 (Today)
First PIC for Municipal Class Schedule 'C' EA for Colborne Street (East) Slope Stabilization.

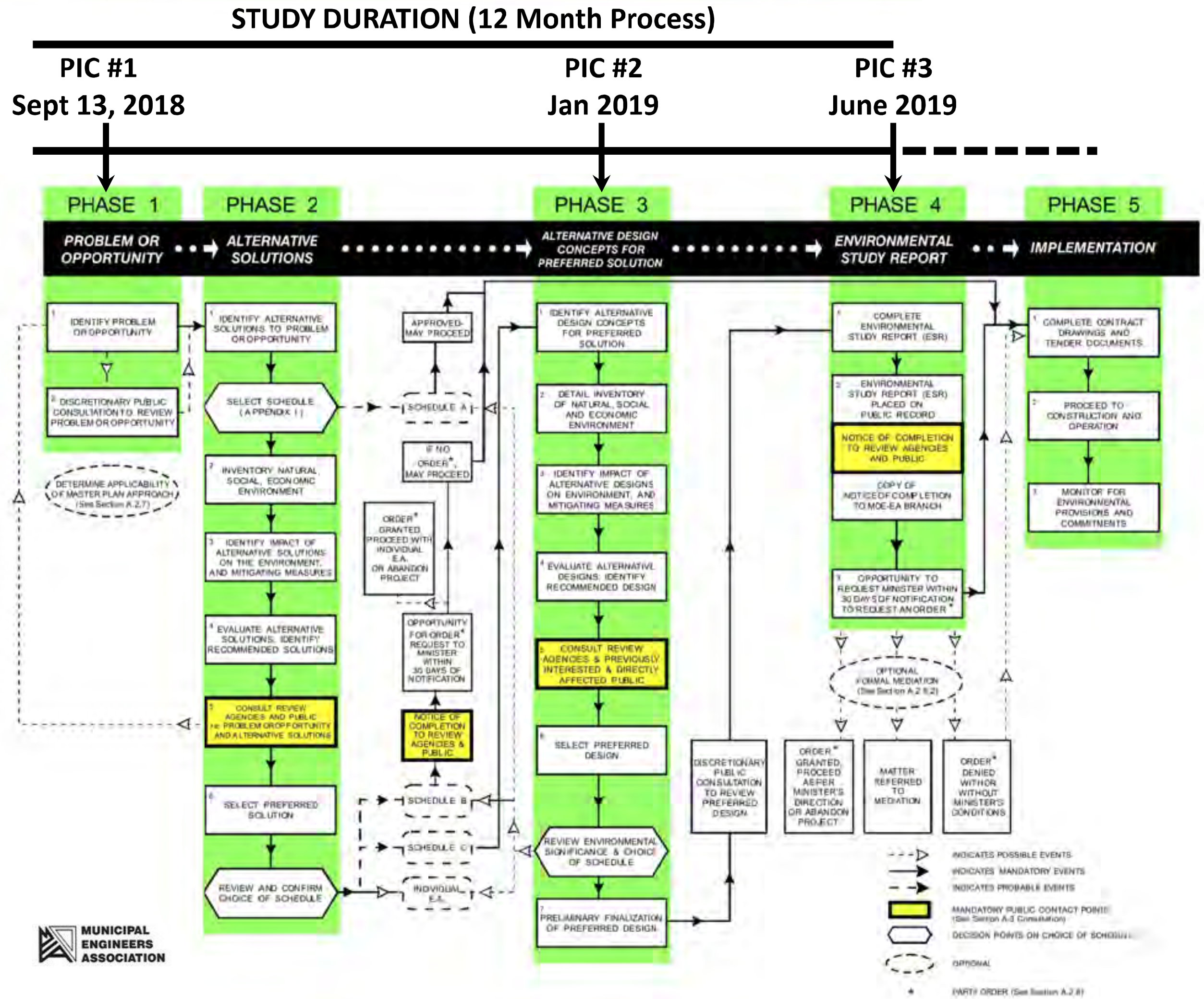
2019 (June)
Anticipated final draft of Environmental Study Report for Municipal Class EA delivered to City of Brantford.

Evidence of toe erosion, including bare banks and fallen trees, April 2016

City of Brantford
Public Information Centre

Municipal Class EA Process Overview

- ❑ The Municipal Class EA process provides opportunities for **public and stakeholder involvement** throughout the study
- ❑ Ensures that all **reasonable alternatives** are considered and that a selected alternative would have minimal impact on the surrounding environment
- ❑ The Colborne Street (East) Slope Stabilization EA study is being undertaken as a **Schedule 'C'** Class EA Project, which provides the most opportunity for public input



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Brantford

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Characterization of Existing Conditions

Site Geometry

Description: General description of the slope area

Quick Facts:
- Study area spans approximately 1.1km along the Grand River.
- Slope height is an average of 31m.
- Currently six (6) private properties are located adjacent to the slope.

Geotechnical

Description: Slope condition and hydrogeologic factors

Quick Facts:
- Slope is defined with an upper slope, table land and lower slope.
- Overburden is approximately 40m thick with two silty clay layers intersected by a sand layer.
- Groundwater measured within 1m of lower slope and rises to 3m below table land surface.
- Main influencing factors affecting slope stability are high groundwater levels and toe erosion.

Geomorphological

Description: Grand River impacts on slope

Quick Facts:
- Previous ESR suggests toe erosion from Grand River is a factor in slope instability.
- Slope toe movement tends to be greater in lower zones due to erosion impacts.
- Grand River width was reduced to half as a result of the 1986 slope failure. Since 2012 it has returned to its pre-failure width.

Surface Runoff

Description: Impact of overland flow and hydrologic conditions on slope

Quick Facts:
- Surface runoff from Colborne Street increases soil moisture at top of slope, increasing potential for slope failure.

Natural Heritage

Description: Potential impacts on natural environment

Quick Facts:
- Study area includes lowland deciduous forest and mineral cultural thicket.
- No species at risk have been identified; however significant plant, fish and mussel species are known to be in the area.
- Potentially suitable bat habitat exist.
- Vegetation includes native and non-native species.

Social

Description: Impacts on communities

Quick Facts:
- Relocation of eight (8) properties within the study area occurred between 1995 and 2012, currently six (6) private properties are located adjacent to the slope.
- Hamilton-Brantford Rail Trail, which begins along Beach Road within the study area, is a well-used recreational asset.

Economic

Description: Costs and life cycle impacts

Quick Facts:
- Colborne Street (East) is a major arterial road.

Archaeological

Description: Archaeological significance of Study Area

Quick Facts:
- Study area meets the Ministry of Tourism, Culture and Sport's (MTCS) criteria for requiring a Stage 1 Archaeological Assessment.
- Proximity to known archaeological sites, water sources, early historic settlements and transportation routes.
- The study area is within 1 km of 43 registered archaeological sites.
- Area is within the historic community of Cainsville.
- Colborne Street is a historic transportation route.

Built and Cultural Heritage

Description: Built heritage and cultural heritage landscapes

Quick Facts:
- The criteria from the Ministry of Tourism, Culture and Sport suggests that the proposed EA meets the criteria for evaluation.
- The study area is within a Canadian Heritage River watershed.
- The study area contains structures over 40 years old.
- The study area contains the Hamilton-Brantford Rail Trail which follows a section of the old Toronto, Hamilton and Buffalo Railway.

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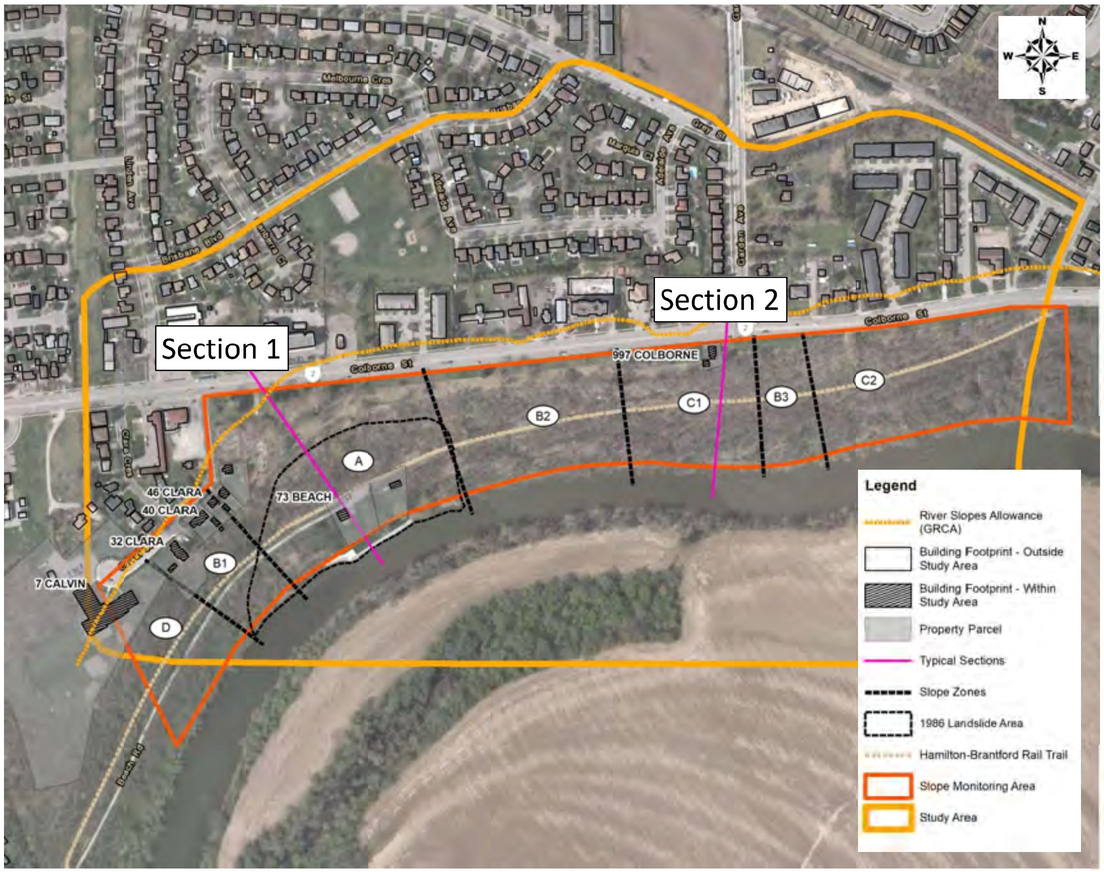
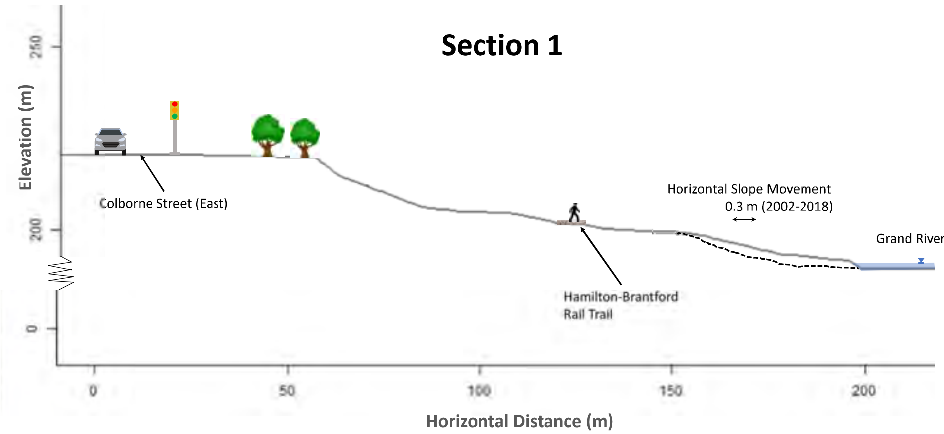
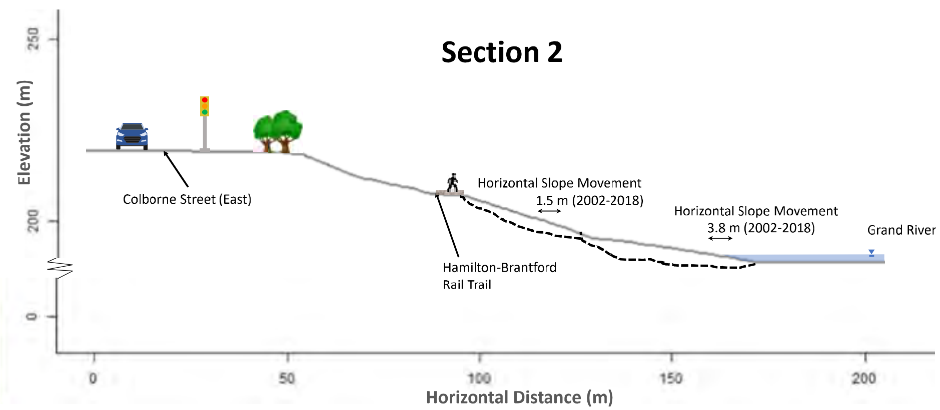
Colborne Street (East) Slope Study Area







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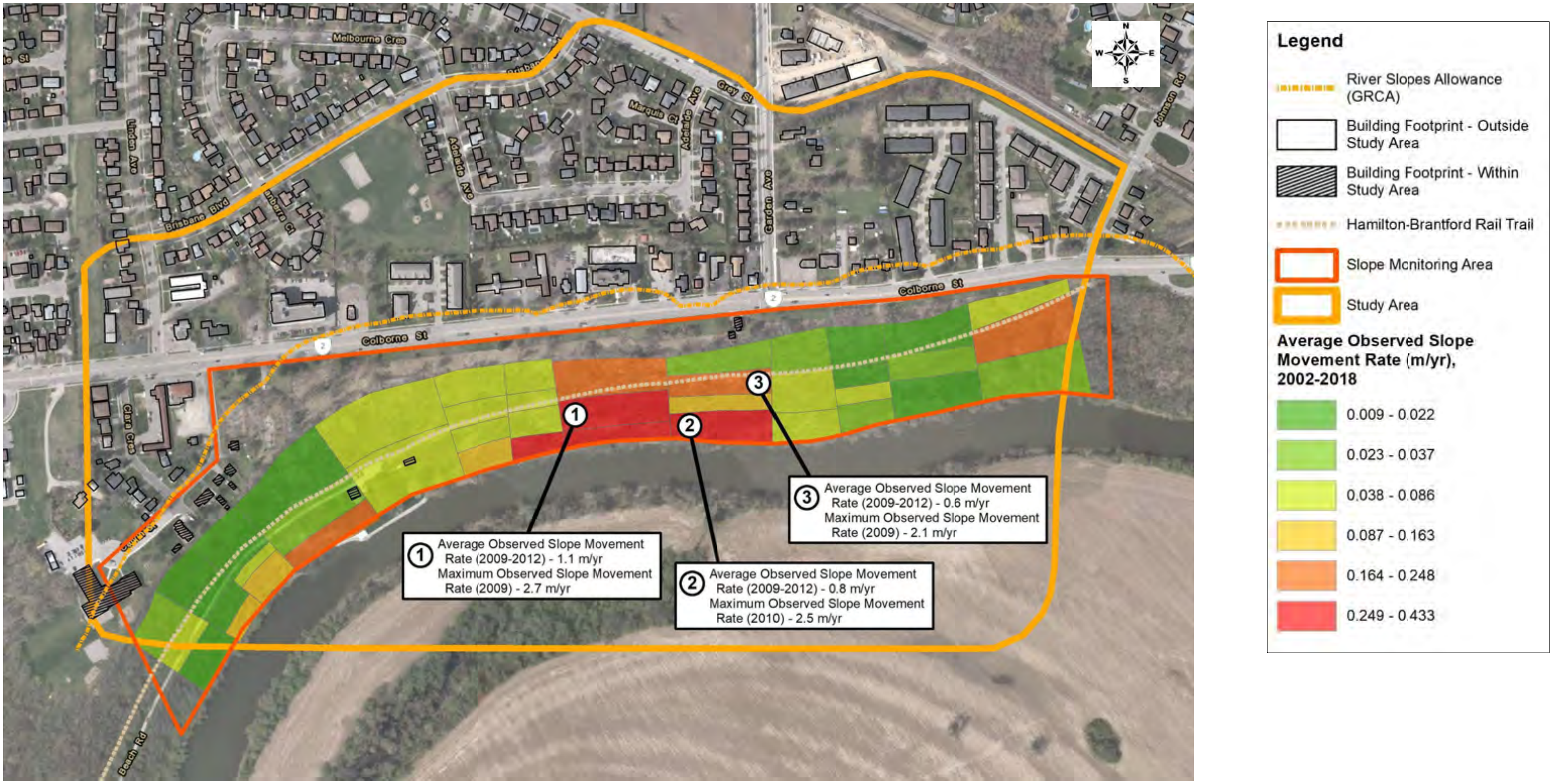
Colborne Street (East) Slope Movement Rates



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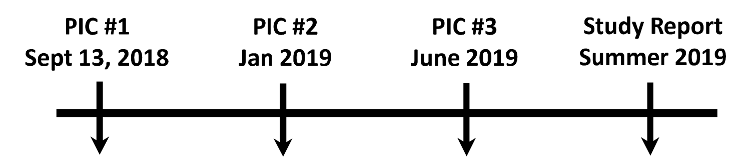
Next Steps before PIC #2

- ❑ Complete the characterization of existing conditions
- ❑ Develop alternative solutions
- ❑ Develop evaluation criteria
- ❑ Conduct evaluation of alternatives
- ❑ Public Information Centre #2 (January 2019)
  - Summarize characterization of existing conditions
  - Present alternative solutions and evaluation
  - Receive public input on alternative solutions



City of Brantford
Public Information Centre

Project Contacts

Please complete a Comment Sheet and leave it here today, or return it to Jeff Prince by Friday, September 28, 2018.

Should you have any questions or concerns at any time during the project, please contact either of the following people:

Jeff Prince, P. Eng
Senior Project Manager
Ecosystem Recovery Inc.
80 Courtland Ave East, Unit 2
Kitchener, Ontario N2G 2T8
Phone: 519-621-1500
Email: jeff.prince@ecosystemrecovery.ca

Matt Welsh C. Tech., PMP
Project Coordinator
Design and Construction
Public Works Commission
City of Brantford
100 Wellington Square, P.O. Box 818
Phone: 519-759-4150 ext 5446
Email: mwelsh@brantford.ca

City of Brantford
Public Information Centre

PUBLIC COMMENT INVITED

We are interested in hearing any comments or concerns that you may have about this study. Comments and information regarding the study are being collected to assist the City of Brantford in meeting the requirements of the Environmental Assessment Act. This material will be maintained on file for use during the project and may be included in project documentation. With the exception of personal information, all comments will become part of the public record.

Comments:

THE HEAVY TRUCK TRAFFIC ON COLBORNE IS A GREAT CONCERN FOR POSSIBLY ADDING TO THE INSTABILITY OF THE BANK IN QUESTION. PLEASE CONSIDER THIS ISSUE.

Thank you for your participation. Please submit your comments by September 28, 2018.

Please print your name and address below, and leave your completed Comment Form in the box provided. You may also mail, or email your comments to:

Jeff Prince, P. Eng
Senior Project Manager
Ecosystem Recovery Inc.
80 Courtland Ave East, Unit 2
Kitchener, Ontario N2G 2T8
Phone: 519-621-1500
Email: jeff.prince@ecosystemrecovery.ca

Matt Welsh C.Tech., PMP
Project Coordinator
Design and Construction
Public Works Commission
City of Brantford
100 Wellington Square, P.O. Box 818
Phone: 519-759-4150 ext 5446
Email: mwelsh@brantford.ca

Name: WILMA VAN KEULEN

Address & Postal Code: 948 COLBORNE ST. UNIT 3

E-mail Address: bikelamond @live. ca

DISCLAIMER: UNDER THE FREEDOM OF INFORMATION AND PROTECTION OF PRIVACY ACT AND THE ENVIRONMENTAL ASSESSMENT ACT, UNLESS OTHERWISE STATED IN THE SUBMISSION, ANY PERSONAL INFORMATION SUCH AS NAME, ADDRESS, TELEPHONE NUMBER AND PROPERTY LOCATION INCLUDED IN A SUBMISSION WILL BECOME PART OF THE PUBLIC RECORD FILES FOR THIS MATTER AND WILL BE RELEASED, IF REQUESTED, TO ANY PERSON.

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Comments:
- a number of heavy trucks using Colborne St E after 6pm until long after midnight.
- home owner at our complex is 45 feet from curb to her front door. Heavy trucks going over speed limit are causing items on her kitchen counter + island to vibrate.
- all traffic including heavy trucks travel well over the speed limit at all hours of day and night.

Thank you for your participation. Please submit your comments by September 28, 2018.

Please print your name and address below, and leave your completed Comment Form in the box provided. You may also mail, or email your comments to:

Jeff Prince, P. Eng
Senior Project Manager
Ecosystem Recovery Inc.
80 Courtland Ave East, Unit 2
Kitchener, Ontario N2G 2T8
Phone: 519-621-1500
Email: jeff.prince@ecosystemrecovery.ca

Matt Welsh C.Tech., PMP
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Design and Construction
Public Works Commission
City of Brantford
100 Wellington Square, P.O. Box 818
Phone: 519-759-4150 ext 5446
Email: mwelsh@brantford.ca

Name: Lynn Stepien

Address & Postal Code: 948 Colborne St E #12

E-mail Address: lynnstepien@yahoo.ca

* please email me a copy of presentation
thanks.

PUBLIC COMMENT INVITED

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Comments: Depending on the outcome(s) + change(s) possibly to this length of Colborne St, E, what will be the potential impact on residential (+ business) property values (query affect on ~~p~~property taxes of same) on the North side of Colb. St, ?

Thank you for your participation. Please submit your comments by September 28, 2018.

Please print your name and address below, and leave your completed Comment Form in the box provided. You may also mail, or email your comments to:

Jeff Prince, P. Eng
Senior Project Manager
Ecosystem Recovery Inc.
80 Courtland Ave East, Unit 2
Kitchener, Ontario N2G 2T8
Phone: 519-621-1500
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Public Works Commission
City of Brantford
100 Wellington Square, P.O. Box 818
Phone: 519-759-4150 ext 5446
Email: mwelsh@brantford.ca

Name: JANETTE COLLINS

Address & Postal Code: 6-948 COLBORNE ST, E.

E-mail Address:

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Comments:

We live in the area marked 'B1' and we've had significant change over the last two years. This does not seem to be reflected in the 'Slope Study area' picture board. Movement at the top of the slope has been happening for two years. This is concerning.

Thank you for your participation. Please submit your comments by September 28, 2018.

Please print your name and address below, and leave your completed Comment Form in the box provided. You may also mail, or email your comments to:

Jeff Prince, P. Eng
Senior Project Manager
Ecosystem Recovery Inc.
80 Courtland Ave East, Unit 2
Kitchener, Ontario N2G 2T8
Phone: 519-621-1500
Email: jeff.prince@ecosystemrecovery.ca

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100 Wellington Square, P.O. Box 818
Phone: 519-759-4150 ext 5446
Email: mwelsh@brantford.ca

Name: Bill Poisson & Audrey Bowen

Address & Postal Code: 46 Clara Cres N3S 7E1

E-mail Address: befish.6591@gmail.com

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Comments:

THE NORTH/EAST RAILWAY TRACK (SECTION 2) GIVES MUCH VIBRATION, THAT RAILWAY LINE WAS TO BE DISCONTINUED WHEN WE MOVED HERE 5½ YEARS AGO. IT'S MY UNDERSTANDING A NEW CONTRACT WAS ISSUED INSTEAD OF SHUTTING IT DOWN AND TURNING IT INTO A RAILTRAIL FOR PUBLIC USE. CERTAINLY THE TRAIN VIBRATION IS A CONTRIBUTING FACTOR.

Thank you for your participation. Please submit your comments by September 28, 2018.

Please print your name and address below, and leave your completed Comment Form in the box provided. You may also mail, or email your comments to:

Jeff Prince, P. Eng
Senior Project Manager
Ecosystem Recovery Inc.
80 Courtland Ave East, Unit 2
Kitchener, Ontario N2G 2T8
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100 Wellington Square, P.O. Box 818
Phone: 519-759-4150 ext 5446
Email: mwelsh@brantford.ca

Name: HENRY ORZEPOWSKI

Address & Postal Code: 21 – 1038 COLBORNE ST

E-mail Address: horzepowski@gmail.com

PUBLIC COMMENT INVITED

We are interested in hearing any comments or concerns that you may have about this study. Comments and information regarding the study are being collected to assist the City of Brantford in meeting the requirements of the Environmental Assessment Act. This material will be maintained on file for use during the project and may be included in project documentation. With the exception of personal information, all comments will become part of the public record.

Comments: - Take HEAVY Truck traffic off Colborne St
- Limit building Height & Density along Colborne St. in Designated area.

Thank you for your participation. Please submit your comments by September 28, 2018.

Please print your name and address below, and leave your completed Comment Form in the box provided. You may also mail, or email your comments to:

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Public Works Commission
City of Brantford
100 Wellington Square, P.O. Box 818
Phone: 519-759-4150 ext 5446
Email: mwelsh@brantford.ca

Name: Pat McQuinn Joanne Lloyd.

Address & Postal Code: 1-1030 Colborne St. E.

E-mail Address: joanne@lloydmcquinn.com

Colborne Street (East) Slope Stabilization Municipal Class Environmental Assessment

Public Information Centre No. 2

Tuesday, March 12, 2019
Woodman Park Community Centre

The Purpose of this Information Centre

- Provide information on the Environmental Assessment (EA) study purpose and background
- Provide an update of the EA activities now in progress
- Provide summaries of the existing conditions assessments
  - Historical Slope Movements and Geotechnical Condition
  - Water Resources and Geomorphic Conditions
  - Natural Heritage
  - Archaeological and Cultural Heritage
- Present alternative solutions and proposed evaluation criteria
- Present the recommended alternative solution
- Provide an opportunity for your input on the alternative solutions

Study Purpose

The EA study follows the **Municipal Class Environmental Assessment** under Schedule 'C' for the slope area situated between Colborne Street (East) and the north bank of the Grand River at a road section between Calvin Street to the west, and Johnson Road to the east in the City of Brantford.

Problem Statement:

Since the landslide event that occurred in 1986, several studies have been completed to determine cause and effects. Monitoring shows that slope movement continues to occur. Slope stability concerns revolve around soil type and moisture issues as well as toe erosion.

The EA is being completed to develop feasible alternatives to address stability concerns and to create a management strategy for the area.

Background Information and Timeline

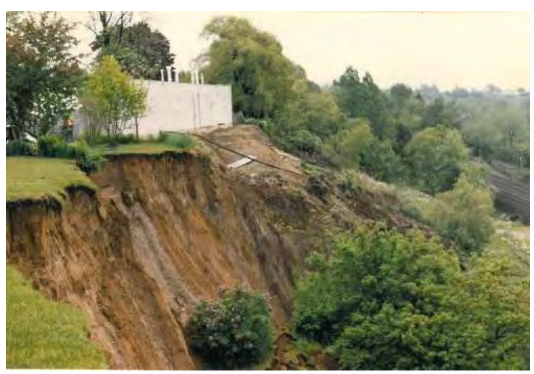
Beach Road after 1986 landslide

1986
Major slope failure on South side of Colborne Street.

1987
First Environmental Study Report (ESR) completed for the GRCA.

Railway along Beach Road after 1986 landslide

1988
Canadian Pacific Railway removed.



929 Colborne Street (East) after 1986 landslide

1995
First Environmental Assessment completed to evaluate slope stability alternatives.

1996
Former railbed converted to Hamilton-Brantford Rail Trail.

1999
Grand River bank failure along toe of slope.

951 Colborne Street (East) after 1986 landslide

Background Information and Timeline

Evidence of toe erosion, including bare banks and fallen trees, April 2016

Slumping of the slope adjacent to the Rail Trail, October 2018

Hamilton-Brantford Rail Trail within Study Area, April 2016

2012
Update made to the 1995 Environmental Assessment.

2015/2016
Additional studies to review slope monitoring data and collect additional field observations.

Sept 2018
First PIC for Colborne Street (East) EA.

March 2019 (today)
Second PIC for Colborne Street (East) EA.

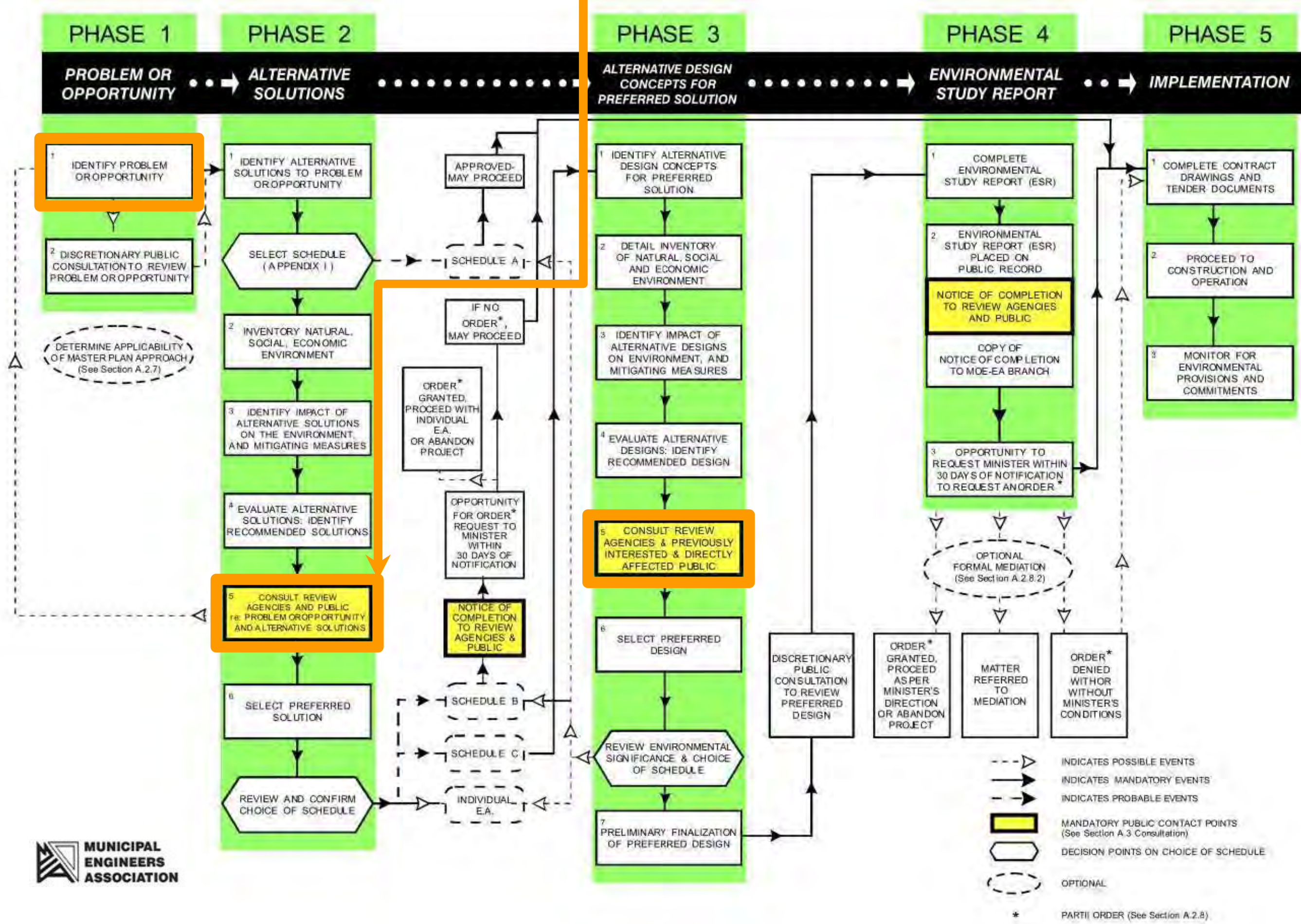
Summer/Fall 2019
Third PIC (Summer) and final draft of Environmental Study Report (Fall).

Slope monitoring in 2016, unstable slope evidence (left) and slumping near property line (right)

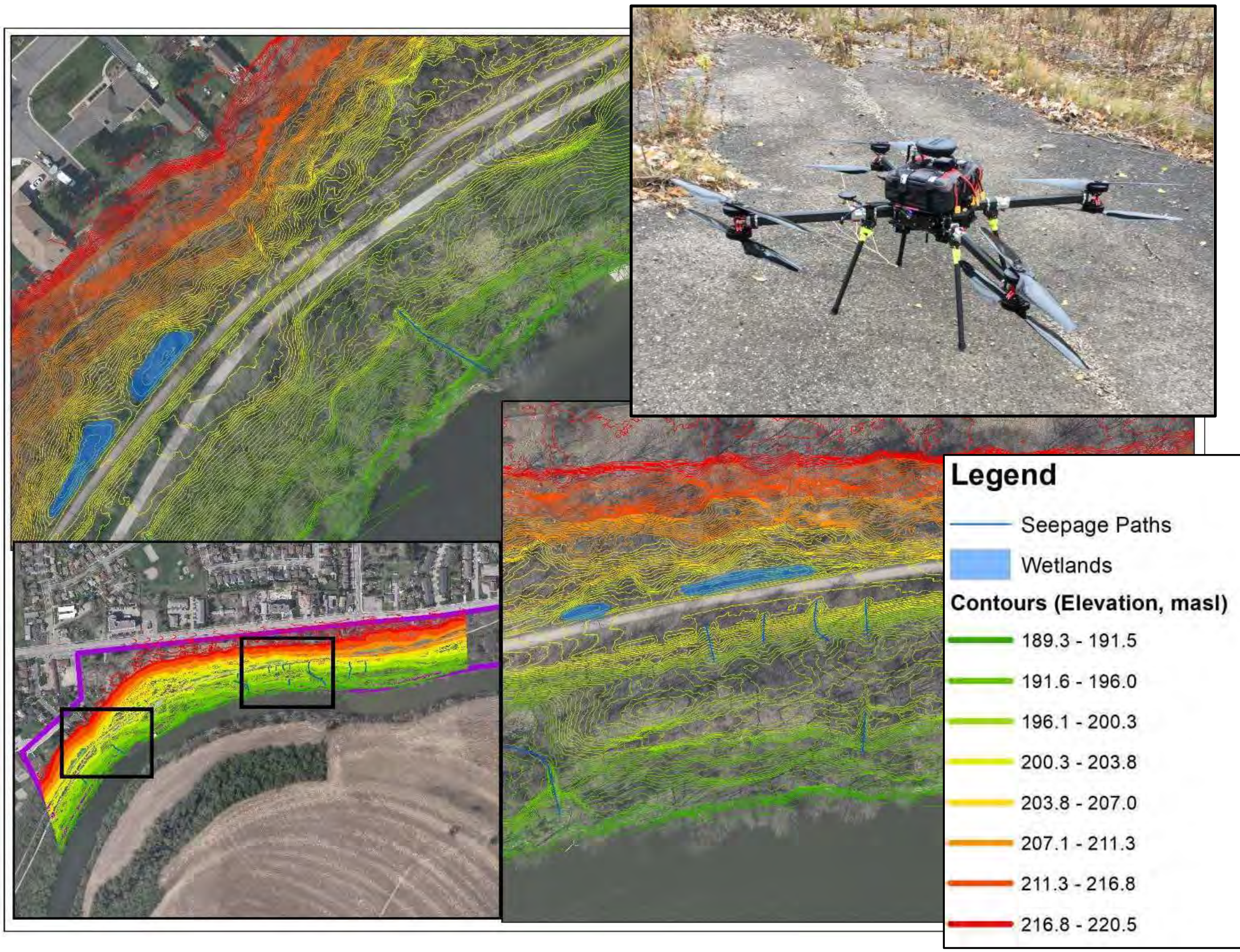
Municipal Class EA Process Overview

STUDY DURATION (12-14 Month Process)

PIC #1	PIC #2	PIC #3
September 13, 2018	March 12, 2019	Summer 2019



Drone Survey



- Light Detection and Ranging (LiDAR) survey completed using a drone in November 2018
- Drone collected 40-80 elevation points per square metre, which was used to build a bare earth digital terrain model (DTM) and elevation contours of the site

Characterization of Existing Conditions

Site Geometry

Description: General description of the slope area

Quick Facts:
- Study area spans approximately 1.1km along the Grand River.
- Slope height is an average of 31m.

Geomorphological

Description: Grand River impacts on slope

Quick Facts:
- Toe erosion from Grand River is a factor in slope instability.
- Slope toe movement tends to be greater in lower zones.
- Grand River width was reduced to half as a result of the 1986 slope failure. Since 2012 it has returned to its pre-failure width.

Natural Heritage

Description: Potential impacts on natural environment

Quick Facts:
- No species at risk have been identified; however significant plant, fish and mussel species are known to be in the area.
- Potentially suitable bat habitat exists.

Geotechnical

Description: Slope condition and hydrogeologic factors

Quick Facts:
- Slope is defined with a table land, upper slope and lower slope.
- Overburden is approximately 40m thick with two silty clay layers intersected by a sand layer.
- Groundwater measured within 1m of lower slope and rises to 3m below table land surface.
- Main influencing factors affecting slope stability are high groundwater levels, weak native soils and toe erosion.

Surface Runoff

Description: Impact of overland flow on slope

Quick Facts:
- Surface runoff from Colborne Street increases soil moisture at top of slope.
- Outfalls and seepage pathways identified in slope area from field investigations and LiDAR survey.
- Local drainage issues increase risk of slope failure, and should be a consideration in the alternative solution.

Characterization of Existing Conditions

Social

Description: Impacts on communities

Quick Facts:
- Relocation of eight (8) properties within the study area occurred between 1995 and 2012, currently six (6) private properties are located adjacent to the slope.
- Hamilton-Brantford Rail Trail, which begins along Beach Road within the study area, is a well-used recreational asset.

Archaeological

Description: Archaeological significance of Study Area

Quick Facts:
- The study area is within 1 km of 43 registered archaeological sites, including an ossuary.
- Area is within the historic community of Cainsville.
- A Stage 1 Archaeological Assessment has been completed, and recommends further Stage 2 assessment for the slope area.

Economic

Description: Costs and life cycle impacts

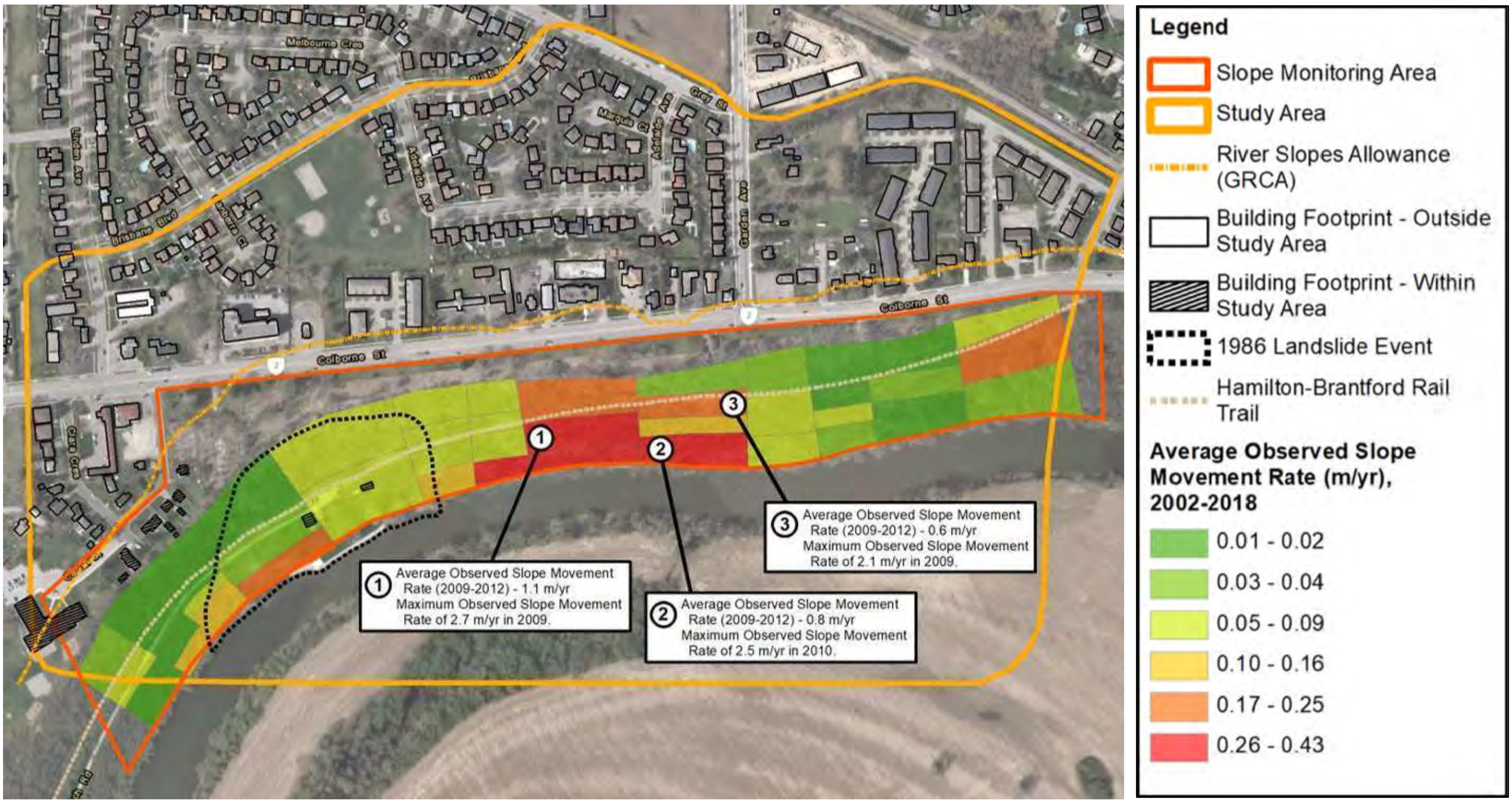
Quick Facts:
- Colborne Street (East) is a major arterial road.
- The study area contains a mix of land uses, including eight (8) commercial properties.

Built and Cultural Heritage

Description: Built heritage and cultural heritage landscapes

Quick Facts:
- The study area is within a Canadian Heritage River watershed, and is adjacent to the Grand River.
- The study area contains structures over 40 years old.
- Built and Cultural Heritage Assessment identified several important assets in the study area, including the rail trail, and several properties along Colborne Street (East), Clara Crescent and near Johnson Road.
- A Heritage Impact Assessment report is recommended to be undertaken once a preferred alternative is selected.

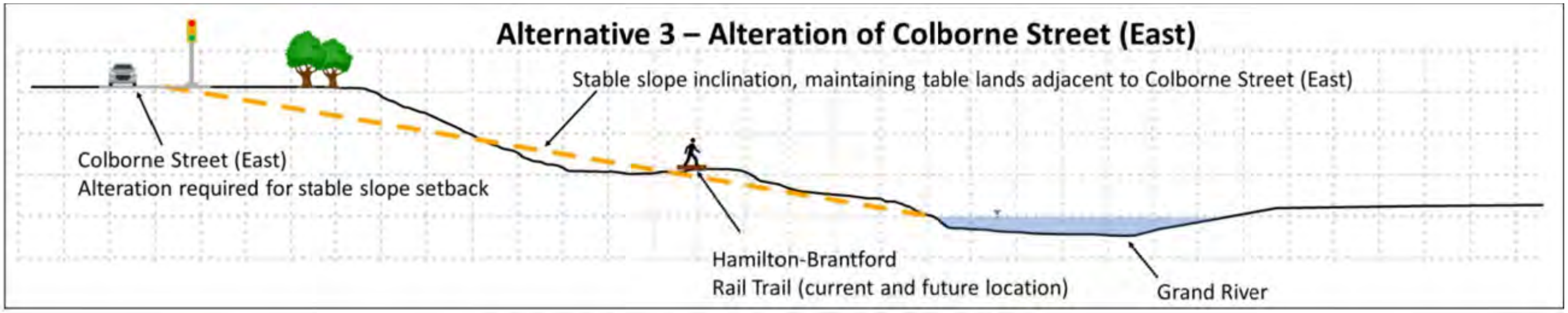
Existing Conditions – Slope Movement Rates

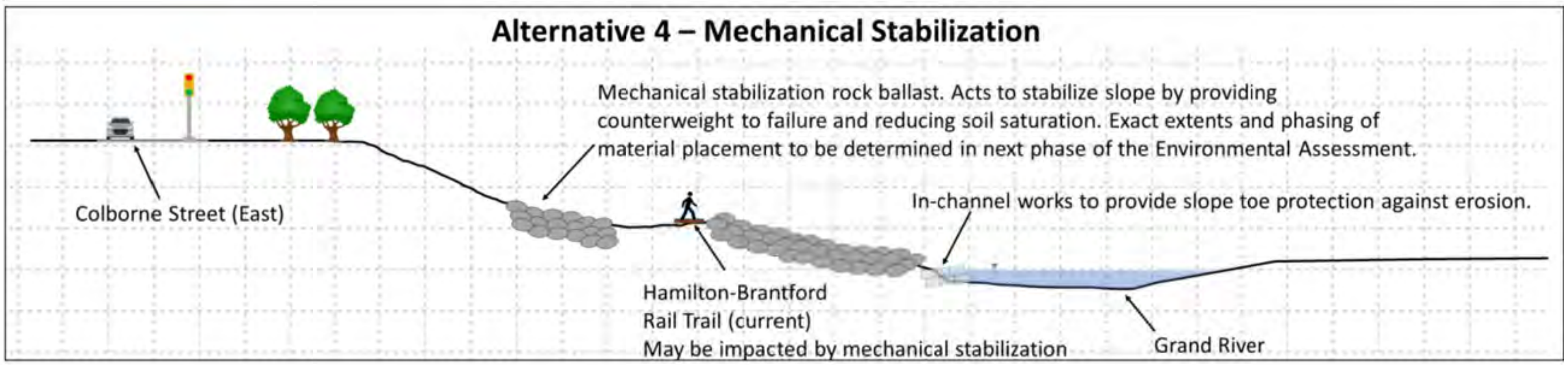


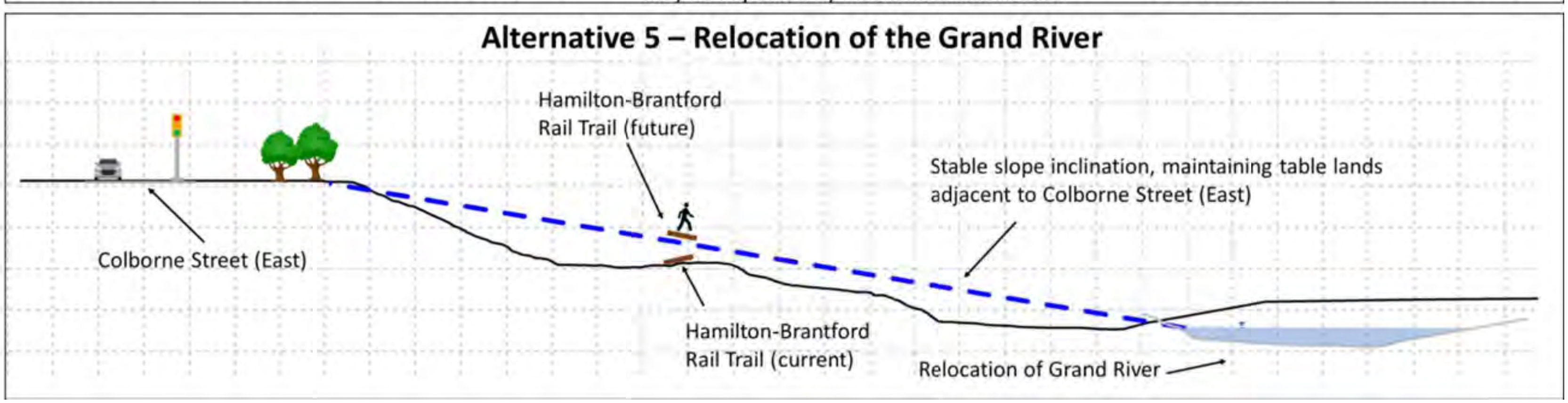
Alternative Solutions

Alternative No.	Alternatives	Details
1	Do Nothing	• Continue physical topographic survey and monitoring
2	Monitoring, Assessment and Phased Stabilization	• Bi-annual LiDAR survey and monitoring • Acquire private properties if required or if available to reduce risk to public • Implement real-time monitoring and mitigation plan • Implement phased slope stabilization and toe protection, based on monitoring and assessment
3	Alter the top of slope constraint (change the level of service of Colborne Street East)	• Alter level of service of Colborne Street (East) • Reduce the slope through a cut at the top of the slope that would extend into Colborne Street (East) • Acquire private properties or provide mechanical stabilization where required • Continue slope monitoring to ensure success
4	Mechanical Slope Stabilization (maintain both the top and toe of slope)	• Stabilize slope using mechanical/structural approach • Stabilize toe of slope at the bank of the Grand River • Could be implemented in stages, or phased • Continue slope monitoring to ensure success
5	Alter the toe of slope constraint (realign the Grand River)	• Realign the Grand River away from the slope (70m minimum) • Reduce the slope through filling from the toe • Acquire private properties or provide mechanical stabilization where required • Continue slope monitoring to ensure success

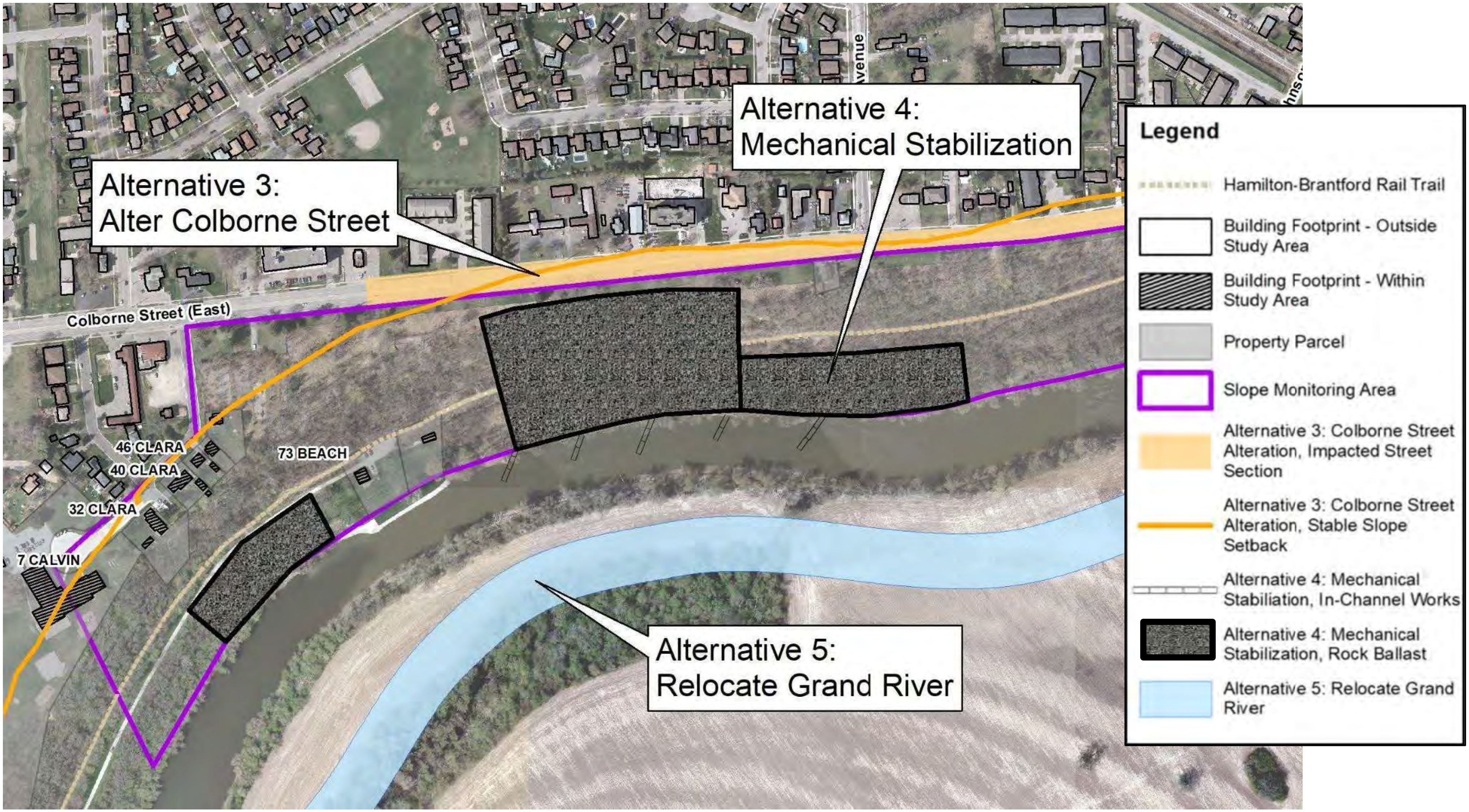
Alternative Solutions







Alternative Solutions



Evaluation of Alternative Solutions

Category	Criteria
Public Health and Safety	• Protection of residents and property/ buildings from eventual slope failure • Protection of travelling public along Colborne Street from eventual slope failure • Protection of residents from potential flood impacts • Reduction of risk impact to major future slope failures
Technical	• Protection from erosion • Impacts to river stability and flood risk • Protection of traffic use along Colborne Street (East) • Impacts on water quality in the Grand River
Environmental	• Impact on fish habitat and vegetation • Impact on terrestrial habitat
Archaeological and Heritage Resources	• Disturbance of potential archaeological resources • Disturbance of heritage resources
Socio-economic	• Impact on existing usage of the Hamilton-Brantford rail trail • Disruption of businesses • Impacts to private property
Construction Cost	• Property acquisition costs • Construction costs • Operation and Maintenance costs
Constructability	• Design implementation and access • Project constructability • Maintenance requirements • Impact to existing utilities

Evaluation of Alternative Solutions

Criteria	Alternative 1 (Do Nothing)	Alternative 2 (Monitoring, Assessment and Phased Stabilization)	Alternative 3 (Alter Colborne Street)	Alternative 4 (Mechanical Stabilization)	Alternative 5 (Relocate Grand River)
Public Health and Safety (25%)	○	◑	◕	◕	◕
Technical (10%)	◔	◑	◑	◕	◕
Environmental (15%)	●	●	●	◔	◔
Heritage and Archaeological Resources (10%)	●	●	◑	◔	◕
Socio-economic (15%)	◑	●	◔	◑	◑
Construction Cost (15%)	◕	◕	◔	◑	◔
Constructability (10%)	◕	◕	◔	◑	◔
Overall Score	○	●	◑	◕	◔

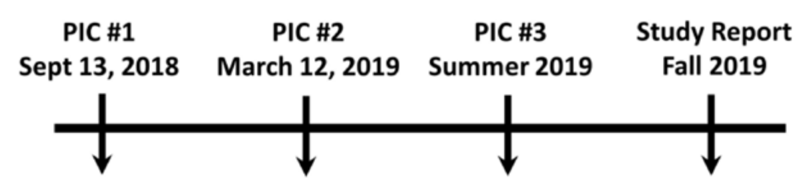
○ ◔ ◑ ◕ ●

Least desirable ← → Most desirable

Recommended alternative solution at this stage

Next Steps Before PIC #3

- ❑ Selection of the alternative solution
- ❑ Develop alternative designs to the selected alternative solution
- ❑ Develop evaluation criteria
- ❑ Conduct evaluation of alternative designs
- ❑ Public Information Centre #3 (Summer 2019)
  - Present the selected alternative solution
  - Present alternative design concepts to the alternative solution
  - Present evaluation criteria for the alternative design
  - Announce 30-day period following notice of completion for study
- ❑ Final report and City Council presentation (Fall 2019)



Project Contacts

Please complete a Comment Sheet and leave it here today, or return it to Jeff Prince by March 26, 2019.

Should you have any questions or concerns at any time during the project, please contact either of the following people:

Jeff Prince, P. Eng

Senior Project Manager

Ecosystem Recovery Inc.

80 Courtland Ave East, Unit 2

Kitchener, Ontario N2G 2T8

Phone: 519-621-1500

Email: jeff.prince@ecosystemrecovery.ca

Matt Welsh C. Tech., PMP

Project Coordinator

Design and Construction

Public Works Commission

City of Brantford

100 Wellington Square, P.O. Box 818

Phone: 519-759-4150 ext 5446

Email: mwelsh@brantford.ca

QUESTIONS

The following are the Alternative Solutions:

Alternative 1: Do Nothing

Alternative 2: Monitoring, Assessment and Phased Stabilization

Alternative 3: Alter Colborne Street

Alternative 4: Mechanical Slope/Bank Stabilization

Alternative 5: Relocate Grand River

The current preferred alternative solution is Alternative 2: Monitoring, Assessment and Phased Stabilization.
Do you have any comments or concerns specific to this alternative?

All alternatives should emphasize restoration of the vegetation in the area in order to aid bank stabilization & restoration of the in river features to help take pressure off the bank - with the UN naming the next decade for Ecological Restoration, presumably federal Funding will be available of such project

Additional Comments:

It concerns me that herptiles aren't listed in the existing conditions poster under natural heritage - at the very least turtles need to be accounted for in the river. Even the most common of these are Special Concern Species at Risk. NHIC has records of map turtle in the study area at the time of the last bank collapse & the Ontario Herp Atlas has records from the last 5 years for map, painted & snapping turtles. Basking & Nesting Surveys should be Complete

Adjacent wetlands may also have Chorus frogs.

Thank you for your participation. Please submit your comments by March 26, 2019.

Please print your name and address below and leave your completed Comment Form in the box provided. You may also mail, or email your comments to:

Jeff Prince, P. Eng
Senior Project Manager
Ecosystem Recovery Inc.
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Kitchener, Ontario N2G 2T8
Phone: 519-621-1500
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Project Coordinator
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Public Works Commission
City of Brantford
100 Wellington Square, P.O. Box 818
Phone: 519-759-4150 ext 5446
Email: mwelsh@brantford.ca

If your orgs. are interested in local volunteers for ecological monitoring assistance, please contact me.

Name: Gwyneth Govers

Address & Postal Code: 97D Sympatica Cres. N3P 1X8

E-mail Address: gwynethgovers@gmail.com

The following are the Alternative Solutions:

Alternative 1: Do Nothing

Alternative 2: Monitoring, Assessment and Phased Stabilization

Alternative 3: Alter Colborne Street

Alternative 4: Mechanical Slope/Bank Stabilization

Alternative 5: Relocate Grand River

The current preferred alternative solution is Alternative 2: Monitoring, Assessment and Phased Stabilization.
Do you have any comments or concerns specific to this alternative?

I believe that one fact is overlooked. We should try to drain waterout of the whole slope. As long as there is enough water in that slope it can be unstable and may slide down. In my opion you have to put in drain lines into the whole slope. I have not seen any study to show where the water in the slope comes from.

Additional Comments: It may be rainwater that got 1/2 km away in the ground and moved towards the slope.
You might have to put in draintiles that go 50-80 m or more horizontally into the slope. You will need a layer of draintiles every 2-5 m so that the whole slope is drained. You also have to move the river. Sooner or Later it will eat away the slope.

Thank you for your participation. Please submit your comments by March 26, 2019.

Please print your name and address below and leave your completed Comment Form in the box provided. You may also mail, or email your comments to:

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Email: mwelsh@brantford.ca

Name: J. Moons

Address & Postal Code: 34 Langford Church Rd Brantford

E-mail Address: campbell.moons@silomail.ca

The following are the Alternative Solutions:

Alternative 1: Do Nothing

Alternative 2: Monitoring, Assessment and Phased Stabilization

Alternative 3: Alter Colborne Street

Alternative 4: Mechanical Slope/Bank Stabilization

Alternative 5: Relocate Grand River

The current preferred alternative solution is Alternative 2: Monitoring, Assessment and Phased Stabilization.
Do you have any comments or concerns specific to this alternative?

~~4~~ 5. ALTERNATIVE. Very concerned about my home because I have lived here for fifty-five years and watched all my neighbors homes taken away for a lot less money than they were actually worth and didn't want to be relocated.

Additional Comments: I feel you should have done something a long time ago but don't want you to keep delaying the process and have a back up plan God forbid if anything should happen again.

Thank you for your participation. Please submit your comments by March 26, 2019.

Please print your name and address below and leave your completed Comment Form in the box provided. You may also mail, or email your comments to:

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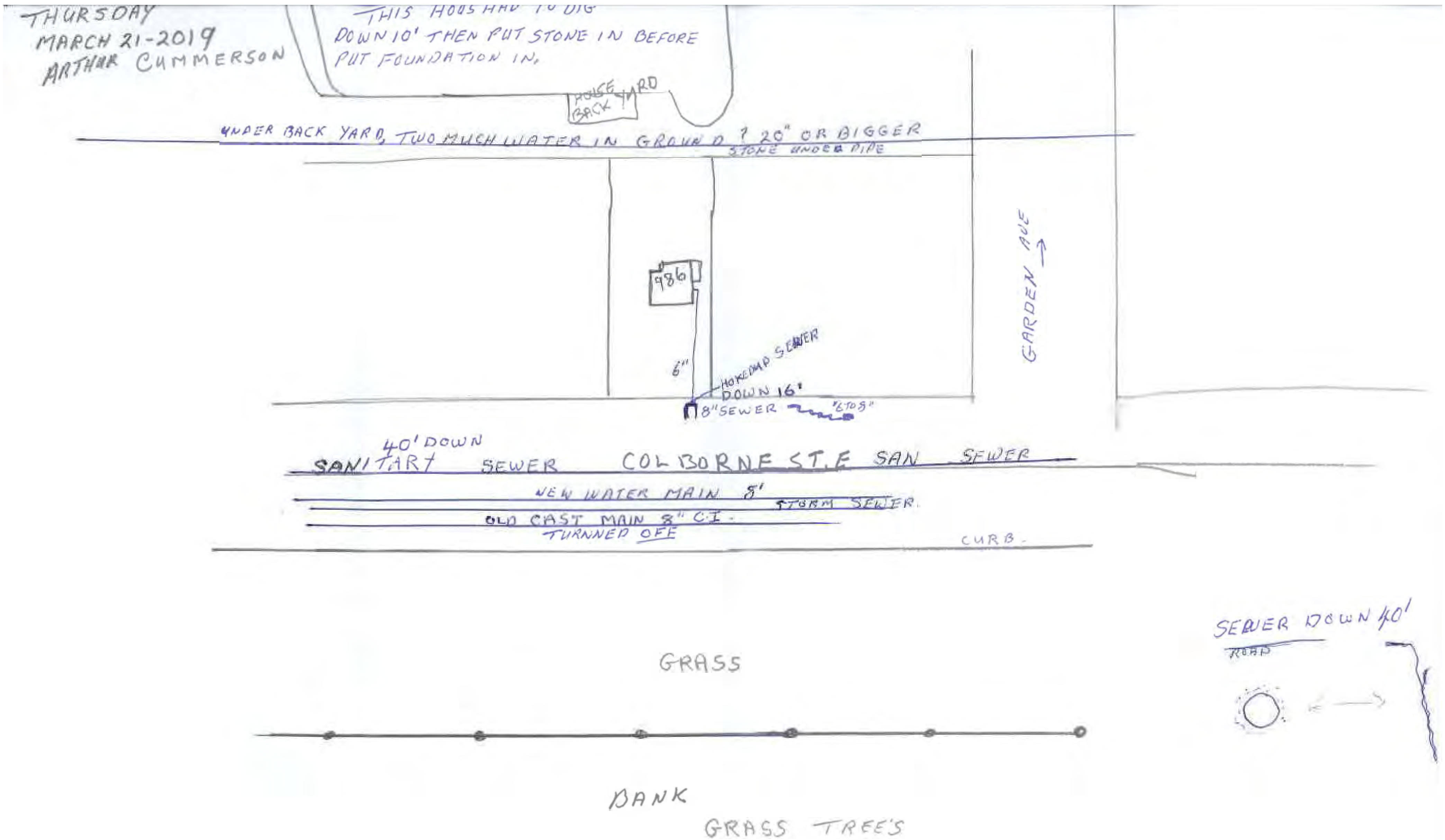
Email: mwelsh@brantford.ca

Name: ARTHUR CUMMERSON

Address & Postal Code: 986 COLBRONE, ST. EAST. N3S 3T4

E-mail Address: NO


THURSDAY
MARCH 21-2019
ARTHUR CUMMERSON
THIS HOUS HAD TO DIG DOWN 10' THEN PUT STONE IN BEFORE PUT FOUNDATION IN.
HOUSE BACK YARD
UNDER BACK YARD, TWO MUCH WATER IN GROUND ? 20" OR BIGGER
STONE UNDER PIPE
GARDEN AVE
986
6"
HOMEMADE SEWER
DOWN 16'
8" SEWER
"6TO8"
40' DOWN
SANITARY SEWER COLBORNE ST. E SAN SEWER
NEW WATER MAIN 8'
STORM SEWER.
OLD CAST MAIN 8" C.I.
TURNNED OFF
CURB.
GRASS
BANK
GRASS TREE'S
SEWER DOWN 40'
ROAD

Robert Chlumsky

From: Deborah Conte <ce-group@hotmail.com>
Sent: March 31, 2019 9:20 PM
To: Matthew Welsh
Subject: slope failure colborne st

I not received a reply on my last E-mail. Just wanted to forward some information that you might find helpful. The safe slope that ecosystem is using 5.4 to 1 is a slope that was mentioned in the conclusions of TROW engineering report done on the land slide for the railway company. Page 41 This angle has no scientific or engineering basis to it. After the province paid for the damages of the land slide they designated the area hazard land and restricted development up to the far side of colborne st. which distance equates to a slope of 5.4 to 1. This safe slope is just there to justify a political decision but has no scientific merit. The safe angle of that particular type of soil is only 2.5 to 1 even is there water coming out of the slope. And this is reflected in the Golder drawings in creating a safe slope for colborne st.
The river has zero impact on the stability of the top of slope, the river had no impact what so ever on that particular slope failure; you could lose twenty feet of river bank and have absolutely no impact on the top of slope. You can reference the Trow eng. Calculations on toe erosion and the Ministry of Natural Resources slope stability rating chart. No part of colborne st needs to be affected and no part of the Grand need to be moved. The bottom line ecosystem is taking full advantage of the city of Brantford and creating needless work. It seems nobody at the city has done their home work and is able to oversee the work done by ecosystem. These are big engineering firms that need to make substantial amount of money to keep in business; it not in their best incentive to offer simple solutions. I think they are crossing the line creating needless work to the point of being fraudulent. You should get a second opinion from and honest engineering firm. After interviewing several engineering firms I settled on Edward Wong due to his integrity first and fore-most and his credential are pretty good to having a Masters in soils eng. And structural eng.
There is a lot of information to cover it is better if we meet and discuss slopes in general and the two studies; I am not here to hurt the city of Brantford if that was the case I would have done it already; I have had all this information for the last five years.

Sent from Mail for Windows 10

WELCOME

Colborne Street (East) Slope Stabilization Municipal Class Environmental Assessment

Public Information Centre No. 3

St. Peter's School

Wednesday, November 13th, 2019

7:00 pm - 8:30 pm

Open House Format

PLEASE SIGN IN AND TAKE A COMMENT SHEET

PIC Purpose and Study Background

Purpose of the PIC today:

- ❑ Summarize and address comments from PIC #2
- ❑ Present the selected alternative solution
- ❑ Present the current preferred alternative design
- ❑ Provide an update on the Environmental Assessment timeline
- ❑ Consult with the public on the preferred alternative design

Environmental Assessment (EA):

The EA study follows the **Municipal Class Environmental Assessment** under Schedule 'C' for the slope area situated between Colborne Street (East) and the north bank of the Grand River at a road section between Calvin Street to the west, and Johnson Road to the east in the City of Brantford.

Problem Statement:

Since the landslide event that occurred in 1986, several studies have been completed to determine cause and effects. Monitoring shows that slope movement continues to occur. Slope stability concerns revolve around soil type and moisture issues as well as toe erosion.

The EA is being initiated to develop feasible alternatives to address stability concerns and to create a management strategy for the area.

Background Information and Timeline

Beach Road after 1986 landslide

951 Colborne Street (East) after 1986 landslide

1986
Major slope failure on South side of Colborne Street. Initiated investigations into slope failure within study area. Slope monitoring begins with installation of monitoring equipment.

1987
First Environmental Study Report (ESR) completed by Golder for GRCA. Landslide was determined to be primarily caused by ongoing riverbank erosion and high groundwater levels. First slope stability analysis completed as part of report.

1988
Canadian Pacific Railway removed.

Railway along Beach Road after 1986 landslide

1995
First EA completed by Golder; presented the preferred alterative as toe erosion protection with minor regrading of the slope.

1996
Former railbed converted to Hamilton-Brantford Rail Trail.

929 Colborne Street (East) after 1986 landslide

1999
Grand River bank failure along toe of slope.

Evidence of toe erosion, including bare banks and fallen trees, April 2016

Hamilton-Brantford Rail Trail within Study Area, April 2016

2012
Update to 1995 EA including revisiting slope stability, no change to the preferred alternative. A detailed Environmental Assessment was noted as required to adopt a preferred solution.

2015/2016
Additional studies to review slope monitoring data and collect additional field observations undertaken by Ecosystem Recovery Inc.

Slope monitoring in 2016, unstable slope evidence (left) and slumping near property line (right)

Sept 2018
First PIC for Colborne Street (East) EA.

Slumping of the slope adjacent to the Rail Trail, October 2018

March 2019
Second PIC for Colborne Street (East) EA.

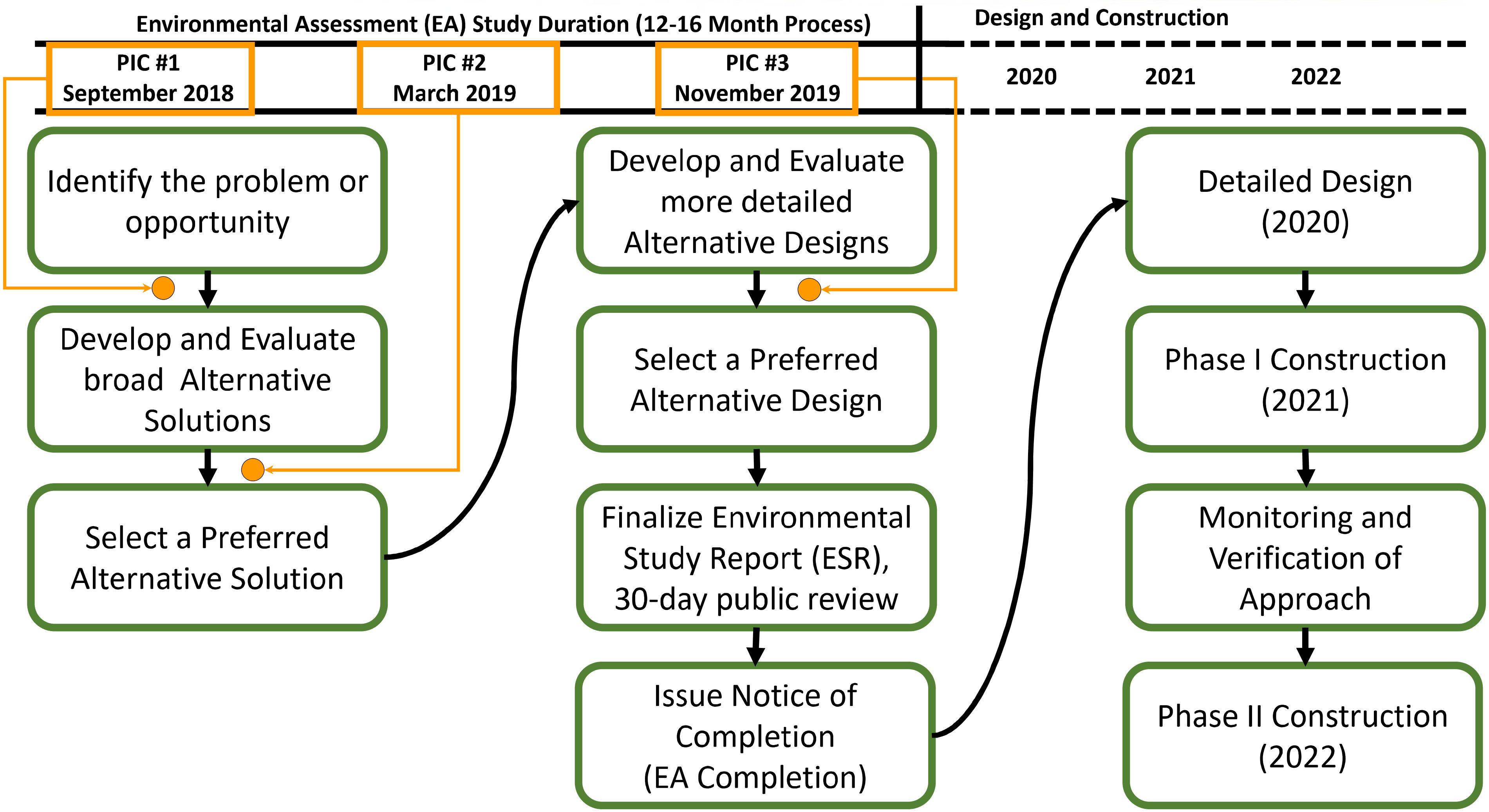
Nov 2019 (today)
Third and final PIC, Draft of the Environmental Study Report to be completed by the end of the year.

City of Brantford
Public Information Centre

THE CORPORATION OF THE CITY OF BRANTFORD

ecosystem recovery inc. PROFESSIONAL ENGINEERS

Municipal Class EA Process Overview (Schedule 'C')



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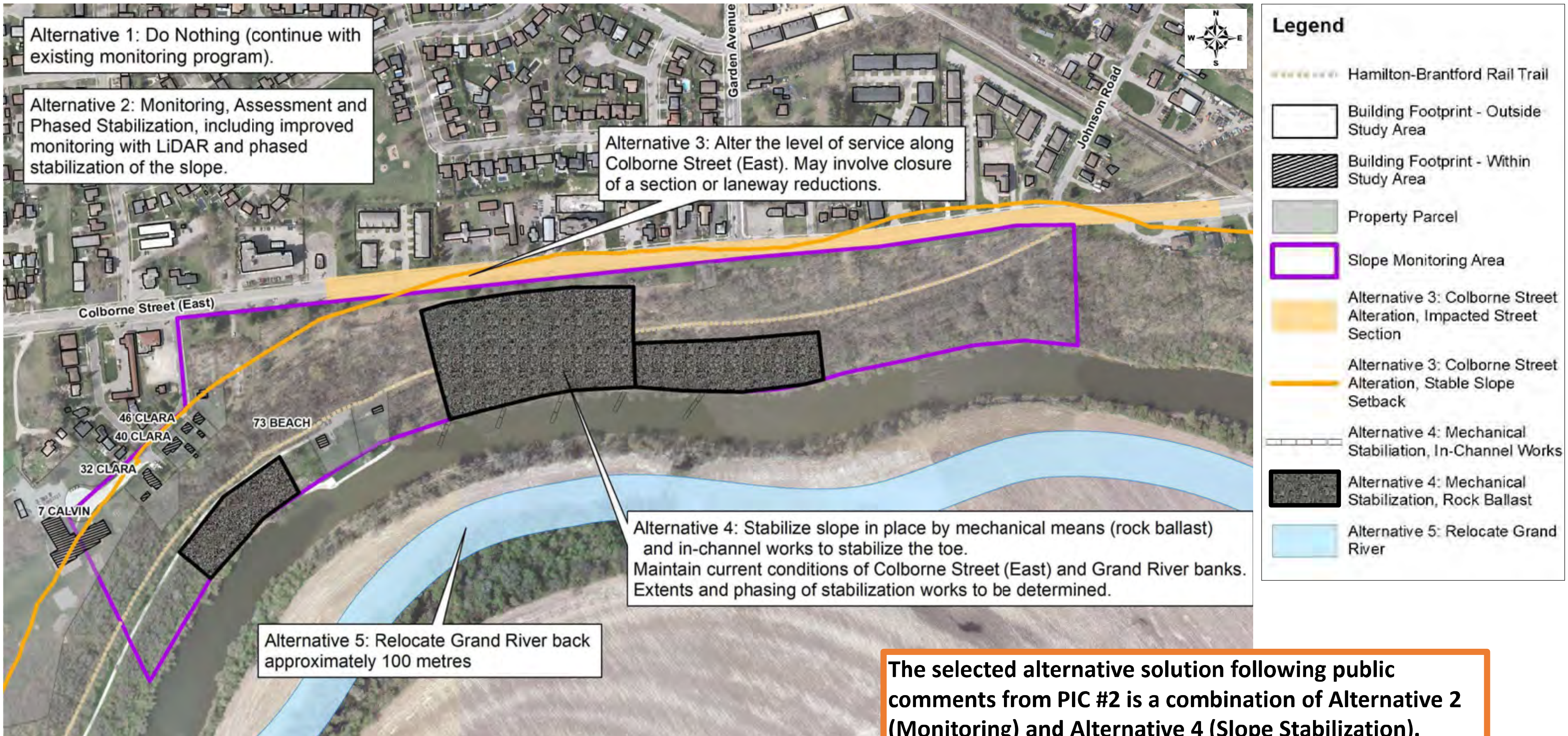
Public Information Centre

Summary of Alternative Solutions (from PIC #2)



The selected alternative solution following public comments from PIC #2 is a combination of Alternative 2 (Monitoring) and Alternative 4 (Slope Stabilization).

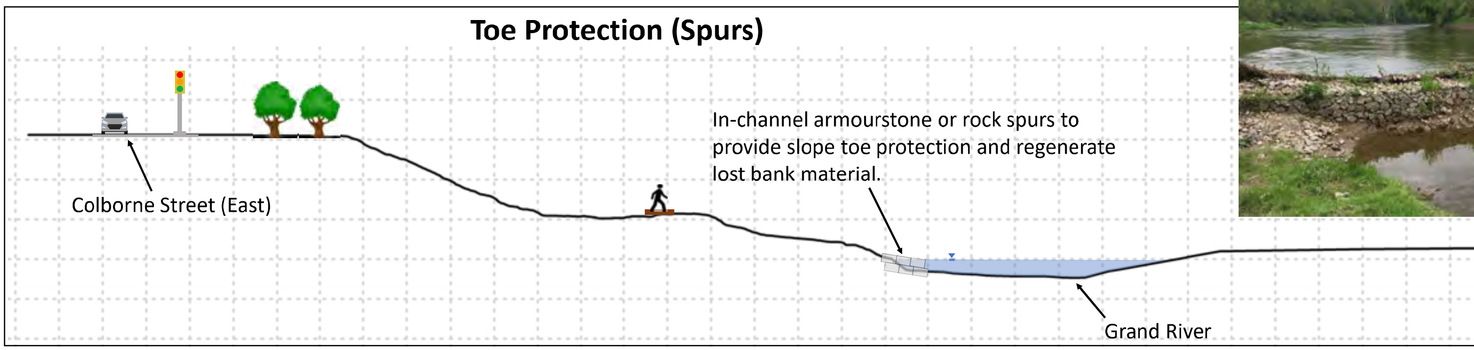
City of Brantford
Public Information Centre

Summary of PIC #2 Comments and Responses

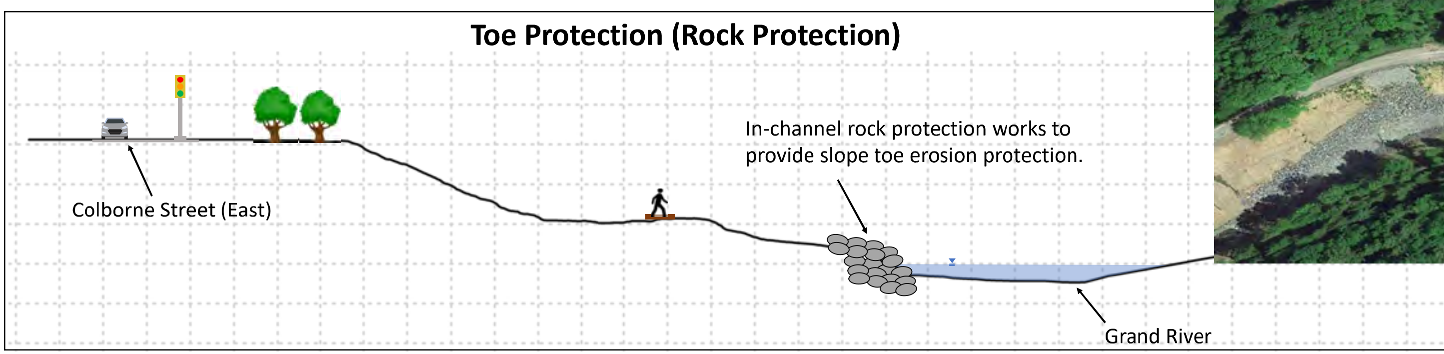
PIC #2 Received Comment	Response
Excessive rail vibration expressed as a concern for private property and potential for impacting slope stability.	The **key contributors** to the failing slope are the **presence of clay soils and high groundwater levels**, exacerbated by erosion of the toe of the slope at the Grand River and poor surface drainage.
Concern from the public received over the stability of the slope and potential for failure, with a strong call for action rather than further observation.	The preferred alternative was reviewed to ensure that steps to stabilize the slope will be taken in the first phase of the project construction.
Suggestion that moisture from the slope can be removed through a network of tile drains.	Given the clay soils present on the slope and the size of the site, a comprehensive network of subsurface tile drains is not technically or economically feasible. However, surface drains will be used to remove excess moisture from the slope, as shown in the preferred alternative design.
All of the considered alternatives should focus on the restoration of terrestrial vegetation on the site.	The preferred alternative design will minimize disruption to existing vegetation, as well as incorporate restorative vegetation where possible. Any rock placed will also incorporate vegetative plantings where possible.
Concern that important species are not included in the natural heritage assessment, including herptiles, turtles, and chorus frogs.	The natural heritage field assessment did not reveal and species at risk, however, these comments will be considered in the alternative design to minimize any potential disruptions to the habitat of important species in the study area.
The slope should be sufficiently stable at a 2.5H to 1V slope, and the recommended stable slope of 5.4H:1V is excessive.	The 5.4H:1V slope was calculated from a geotechnical investigation following the initial slope failure. The current slope inclination is approximately 4H:1V and the slope is currently experiencing signs of minor failures, indicating that a steeper slope would not be sufficiently stable.

Alternative Design - Toe Protection Concepts

Armourstone Spurs



Rock Protection



City of Brantford
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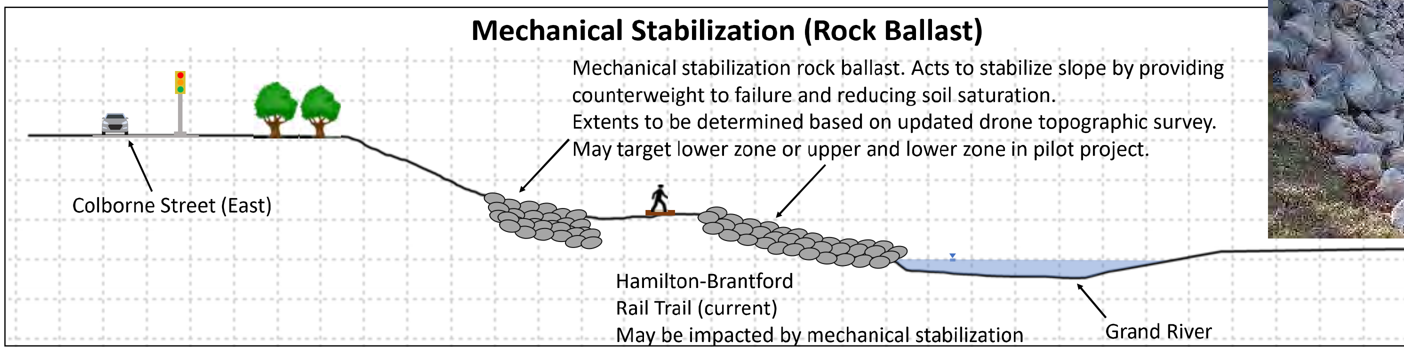
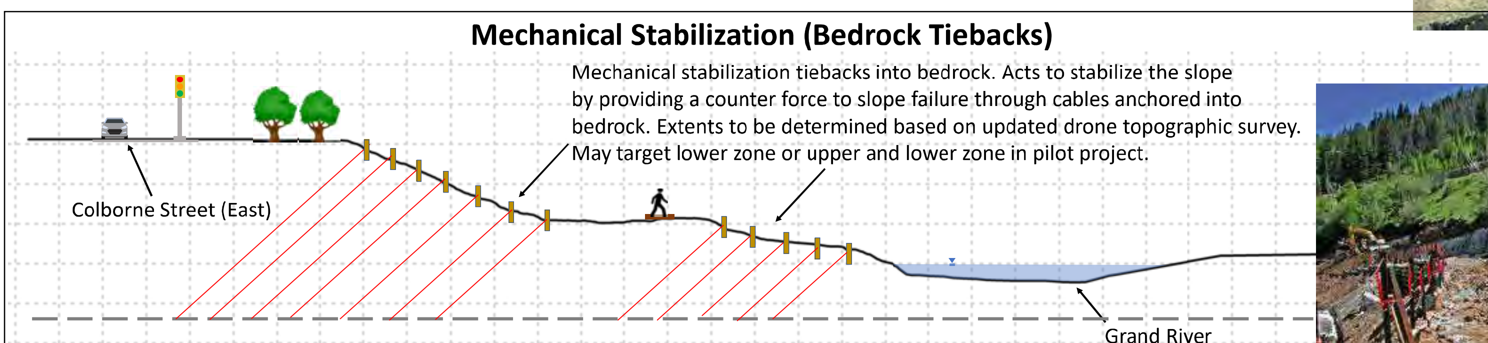
Alternative Design - Mechanical Stabilization Concepts

Rock Ballast



Tiebacks to Bedrock



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Public Information Centre

Alternative Design - Drainage Concepts

Berm

Berm to manage and redirect overland flows. Could be used at the top of slope to minimize runoff onto the slope.

Flexible Piping

Flexible HDPE pipes to convey water across the slope towards the Grand River without breaking during slope shifts and failures.

Rock Fingers

Series of rock drainage features on the lower slope to reduce soil moisture. Would be required to support mechanical stabilization.

Trail Culverts

Culverts installed at locations along the trail to drain pooled water along the trail. Would reduce soil moisture on the slope.

Interceptor Trench

Interceptor Trench to collect and drain near-surface water at the top of slope and at the trail.

Alternative Design Concepts and Evaluation

	Drainage					Mechanical Stabilization		Toe Protection		Slope Monitoring		
Criteria	Berms	Trail Culverts	Flexible Piping	Interceptor Trenches	Rock Fingers	Rock Ballast	Bedrock Tiebacks	Rock Protection	Spurs	Groundwater Monitoring	Annual LiDAR Survey	Real-time Slope Monitoring
Public Health and Safety (25%)	◑	◕	◕	◕	●	●	●	◕	◕	◔	◔	◑
Technical (10%)	◔	◑	◑	◑	◑	◕	◑	◕	◕			
Environmental (15%)	◑	◔	◔	◔	◔	◑	◑	◑	◑			
Heritage and Archaeological Resources (10%)	◔	◑	◑	◑	◑	◑	◑	◑	◑			
Socio-economic (15%)	◕	◑	◑	◕	◕	◔	◑	◑	◑			
Cost (15%)	○	◕	◕	◕	◑	◕	○	●	◔	◑	◑	◔
Constructability (10%)	◑	◑	◑	◑	◕	◕	○	●	◔	◑	◕	○
Include in Preferred Alternative Design?	○	●	●	●	●	●	○	●	○	●	●	○

○ ◔ ◑ ◕ ●

Least desirable ⟷ Most desirable

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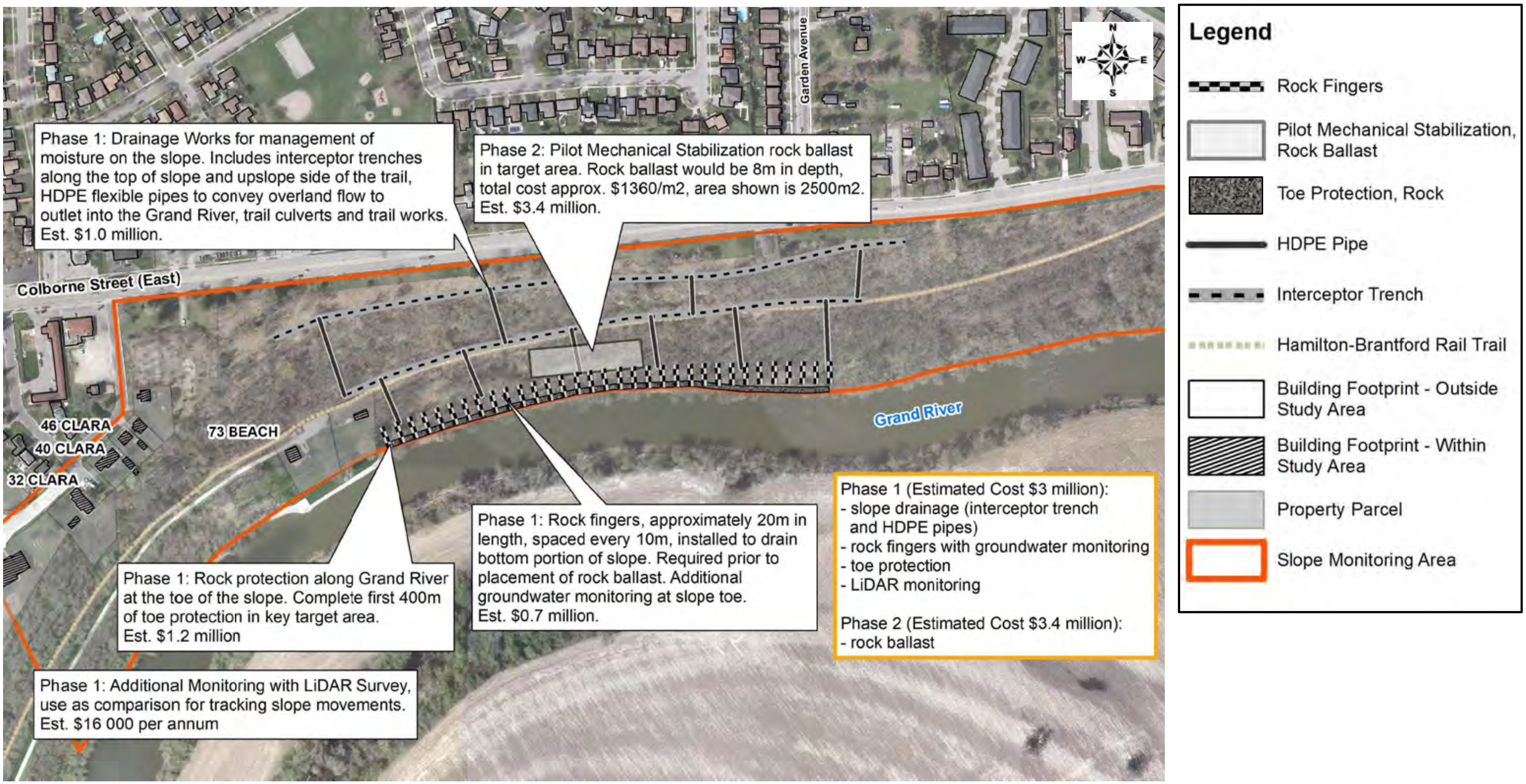
Preferred Alternative Design Concept



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Steps Following PIC #3

- ❑ Finalization of the alternative design, considering public feedback
- ❑ Completion of the Environmental Study Report (ESR)
- ❑ Announcement of the 30-day public review period
- ❑ Notice of Completion for this study
- ❑ Final report and City Council presentation (March 2020)
- ❑ Detailed Design Tender (2020)
- ❑ Phase I Construction (2021)

Project Contacts

Please complete a Comment Sheet and leave it here today, or return it to Jeff Prince by November 27, 2019.

Should you have any questions or concerns at any time during the project, please contact either of the following people:

Jeff Prince, P. Eng
Senior Project Manager
Ecosystem Recovery Inc.
80 Courtland Ave East, Unit 2
Kitchener, Ontario N2G 2T8
Phone: 519-621-1500
Email: jeff.prince@ecosystemrecovery.ca

Matt Welsh C. Tech., PMP
Project Coordinator
Design and Construction
Public Works Commission
City of Brantford
100 Wellington Square, P.O. Box 818
Phone: 519-759-4150 ext 5446
Email: mwelsh@brantford.ca

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Robert Chlumsky

From:	Jeff Prince
Sent:	October 29, 2019 3:02 PM
To:	Robert Chlumsky
Subject:	FW: Brantford Colborne Street (east) Slope Stabilization - CN Contact information
Follow Up Flag:	Follow up
Flag Status:	Flagged

Hi Rob, can you please add Michael to our contact list? Thanks.

Jeff Prince, P.Eng. | Consulting Engineer, Senior Project Manager | Cell: (226) 339-5605

From: Matthew Welsh <MWelsh@brantford.ca>
Sent: Tuesday, October 29, 2019 10:58 AM
To: Susanne Glenn-Rigny <Susanne.Glenn-Rigny@cn.ca>; Jeff Prince <jeff.prince@ecosystemrecovery.ca>
Cc: Michael Vallins <Michael.Vallins@cn.ca>
Subject: RE: Brantford Colborne Street (east) Slope Stabilization - CN Contact information

Thanks Susanne, we'll include Michael in our correspondences to stakeholders.

Best Regards,

Matt Welsh C.Tech., PMP
Project Coordinator
Design and Construction
Public Works Commission
100 Wellington Square
***NEW* Direct phone 519-759-4150 ext 5446**
Cell: 226-387-0859

From: Susanne Glenn-Rigny [mailto:Susanne.Glenn-Rigny@cn.ca]
Sent: Monday, October 28, 2019 4:56 PM
To: jeff.prince@ecosystemrecovery.ca; Matthew Welsh
Cc: Michael Vallins
Subject: Brantford Colborne Street (east) Slope Stabilization - CN Contact information

Good afternoon Jeff and Matt

Thank you for circulating CN Rail on the Municipal Class EA for the Colboune Street East Slope Stabilization study.

The eastern edge of the study area abuts the CN Hagersville subdivision at milepost32.2.

I would invite you to contact my colleague Michael Vallins about this project. He can be reached at michael.vallins@cn.ca.

Regards

Susanne

Susanne Glenn-Rigny

Senior Officer, Community Planning and Development | Corporate Services
T: **514-399-7844** | C: **514-919-7844**

Celebrating 100 years | Célébrons nos 100 ans

Robert Chlumsky

From: Jeff Prince
Sent: November 26, 2019 5:04 PM
To: Robert Chlumsky
Subject: FW: comments on public information evening Colborne Street slide
Attachments: Colborne landslide.docx

Follow Up Flag: Follow up
Flag Status: Flagged

For the file. Thanks.

Jeff Prince, P.Eng. | Consulting Engineer, Senior Project Manager | Cell: (226) 339-5605

From: Matthew Welsh <MWelsh@brantford.ca>
Sent: November 26, 2019 3:34 PM
To: Jeff Prince <jeff.prince@ecosystemrecovery.ca>
Subject: FW: comments on public information evening Colborne Street slide

FYI

From: Joan and John [mailto:campbell.moons@silomail.com]
Sent: Tuesday, November 26, 2019 1:11 PM
To: Matthew Welsh
Subject: comments on public information evening Colborne Street slide

Hello Matt,
Here by I send you a few comments on the Colborne Slide problems. I hope you find them useful.
Greetings, John Moons.

Hello Matt, County of Brant, November25. 2019.

My name is John Moons and I met you at St. Peter's School on November 13th where the City explained what should be done about the unstable slope along Colborne Street East.
I have been looking at it and the first question I have : why is this the City's responsibility? We live at Langford Church Road and when we do something about any little stream, even when it is dry 95 % of the time, the Grand River Conservation Authority is there to tell us that nothing can be done without their permission. In the whole process of the unstable slope, I have not noticed anything from that Authority.
When I look at the problem of the unstable slope I believe we have two very different problems, but the one problem causes the other problem.
The very first problem is the Grand River. We see here a process that is called "meandering". Rivers that have a fair amount of water flowing through the system and flow in an area that is quite flat, will start meandering. That means that the river washes away the soil on the outside of a bend and a lot of material will be deposited on the inside bend. The river will walk away from it's original location. You have to see this as a process that takes centuries. There is a very nice example of meandering just south of Tavistock. Driving North from Woodstock you turn left at the John Deere dealership and at the end of that short road you turn left. In that area on the right hand side, you see the Thames River in a meandering pattern. The Grand River at one point was flowing hundreds of meters south of Colborne. That is why the land there is so flat, because it was there deposited by the river. This process will continue unless something very drastic is done. We have to stop the river from eating away the outside bend and the measures that were proposed at the meeting are not going to stop it. In The Netherlands they had the same problems in the big rivers and they managed to keep the flow of the river in the middle of the river, so that the river cannot eat away the outside bends. They did it by building piers in the river at certain intervals. You can see it when you drive over one of the bridges. These piers are made of material that the river cannot wash away. You have to realize that the river flow will make very deep "eddies" or vortexes right behind the piers. I am sure that there are formula's that will determine how long the piers have to be and how far apart they should be placed. I don't see any of this proposed anywhere. Instead of piers you can also pour sheets of concrete along the outside bend like the City has done in the Grand River South of the Lorne Bridge and that seems to work.
I believe it would be a very good idea to bring the river a few hundred meters to the south. While you are digging you can put in things that prevent the river from eating away the outside bend. It is always easier to do it on dry land.
The second problem of course is the unstable slope itself.
Every year hundreds of people get killed in landslides. It is often on slopes where the vegetation is removed and houses or sheds are built on the slopes. When they get heavy rains a thick layer of soil with everything on it can slide down the hill. Here in Canada we see slides on the mountains in Alberta and B.C. I have seen the results of the Frank Slide in S.W. Alberta. There rocks came down over an area that is more than 1 km wide. Here in Brantford we do not have to be afraid of a rock slide. What has happened in the St Lawrence Valley in Quebec should be a warning sign for us here. At places there are deposits of a clay called Leda Clay and they can be 10 to 25 m thick. When this clay gets very wet it can slip away and disappear in the river. This process is called a retrogressive flowslide. Since 1840 more than 100 people have been killed by this type of slides. In 1971 in St. Jean-Vianney 40 houses were carried away and 31 people were killed by such a slide. I do not believe we have to be afraid of such a disaster to happen here in Brantford. The clay at Colborne is different, but clay nevertheless. The warning is that when clay gets very wet it can become very unstable and slide away. It would be interesting to see what the precipitation numbers were for 1985 and the first months of 1986 when the last big slide took place along Colborne.

I believe that water plays a very important role in the stability of the slope. I do not see that this problem is sufficiently addressed. The engineers who studied the problems for the City do not have an idea where the water comes from and in which soil layers the water moves. The water can come from different directions in different layers. I believe we have to prevent that water from coming near the slope. If the clay gets too wet it will become unstable and we will have the next slope. This time part of Colborne might disappear. The heavy trucks that go over Colborne do not help either. I talked to the people who live in condo's along that stretch of Colborne and they tell me that they can feel the vibrations of some of the trucks in their condo's.

It will not be easy or cheap to prevent rain water from reaching the soil in the slope. It would be nice to install a system with drain tiles or gravel north of Colborne, but this will be very difficult because it is built-up so much. A drain will have to be at least 300 cm deep. I would not dare to dig to such a deep trench South of the road. I believe that you will make the slope very unstable if you dig on that side.

An other option would be to use directional drilling and lay drain tiles at different levels parallel to the street . A very expensive way to solve the drain problem would be to put the drain system under the road. A drain system would not have to be too wide. A width of 30 or 40 cm would be enough.

It would also a good idea to prevent the water that falls on the street, to reach the soil on the South side of the road. This is simple a matter of some concrete along the pavement that brings the water in drains and from there through pipes to the river.

Building a big retaining wall along the slope would be an expensive option. I have seen some of these walls 15m high. When I see videos of how they are built they put a lot of emphasis on the draining of the whole slope. I am not sure if the local soil conditions can carry such a heavy structure.

I have read about a very simple way of stabilizing a slope by planting the whole slope with willow shrubs.Willows have a very fine root system that holds the soil together very well. You plant willows by sticking willow branches in the soil of the slope. I have propagated willows by sticking a 20 cm long willow branch in the ground. You leave only 2 cm above the soil. In September you can have a 2m high willow tree. You have to put these branches in the ground in the spring. If you do this in the summer the willows will not grow any roots. You put the branches in very dense patterns. Some people even braid these branches into 30 cm high fences parallel to the slope.

Through contacts in Landscape Ontario I have found the name of an engineering company that is specialized in this type of problems. It is: Terra-Probe; an engineering firm from Brampton. A number of years ago the CN Tower in Toronto was sold and this company was asked to investigate the soil conditions so that the new owners knew what they were buying. Landscape companies use this firm when they deal with problems like what we see here in Brantford.

The problem with something like an unstable slope is that you spend good money now or a lot more money in the future. The City cannot afford to lose Colborne Street.

Hopefully I have given you some useful information and I hope to hear back from you.

Greetings, John Moons.