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Prepared for:
The Corporation of the City of Mississauga

Attn: Anthony Di Giandomenico, P. Eng.
Storm Drainage Engineer, Environmental Services
City of Mississauga
T: 905-615-3200 x 3491
E: Anthony.digiandomenico@mississauga.ca

Schedule B Class Environmental Assessment – Project File

Credit River Erosion Control Program From Dundas St. to Hwy 403

A project file submitted by:
Aquafor Beech Limited

June 6, 2024
Contact:
Rob Amos, MASc, P. Eng.
Amos.R@aquaforbeech.com

Aquafor Beech Ltd.
2600 Skymark Avenue
Building 6, Unit 202
Mississauga, ON L4W 5B2

T. 905.629.0099 ext.284
F. 905.629.0089

Aquafor Beech Reference:
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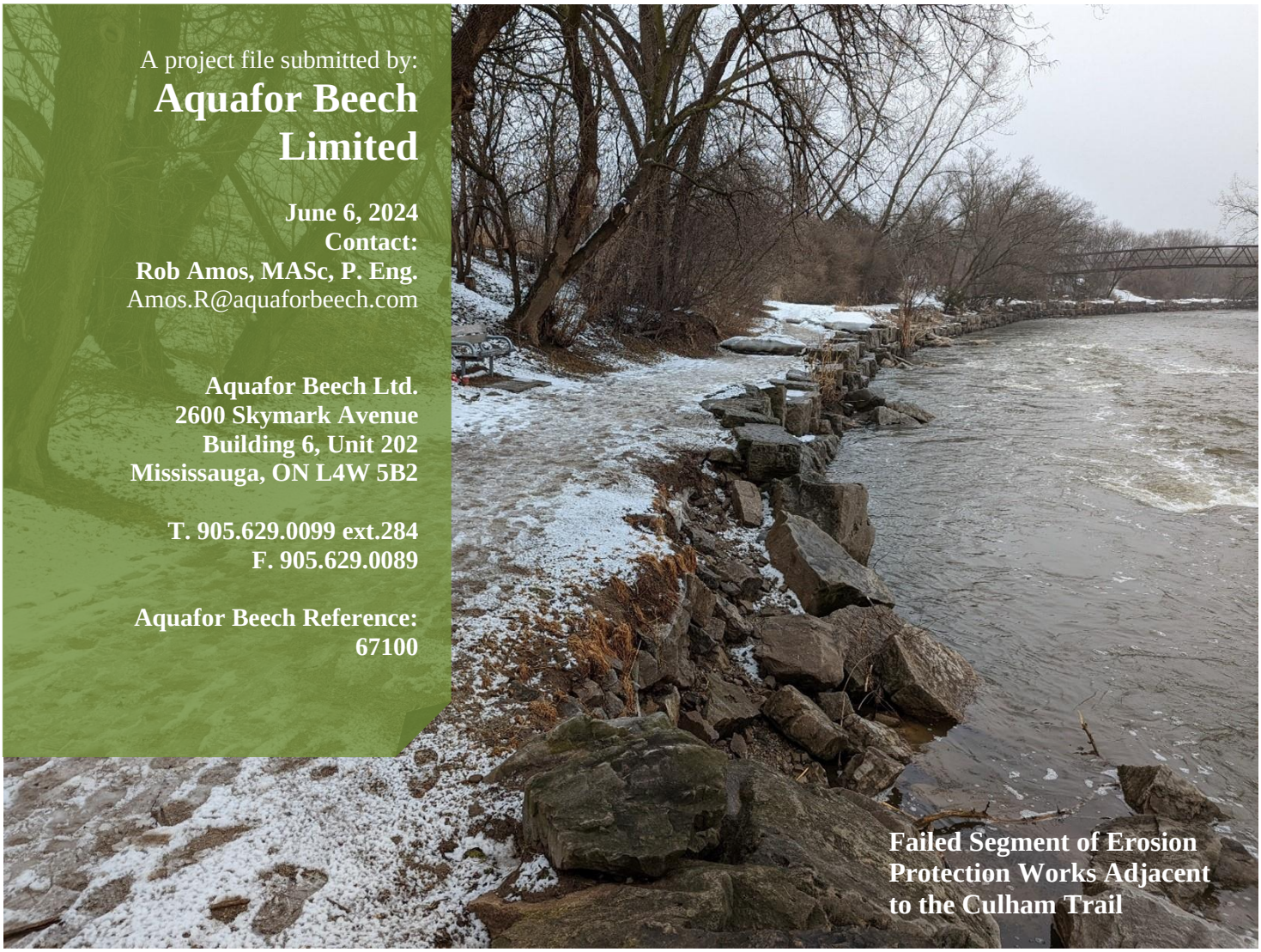


Failed Segment of Erosion Protection Works Adjacent to the Culham Trail

CITY OF MISSISSAUGA – NOTICE OF STUDY COMPLETION

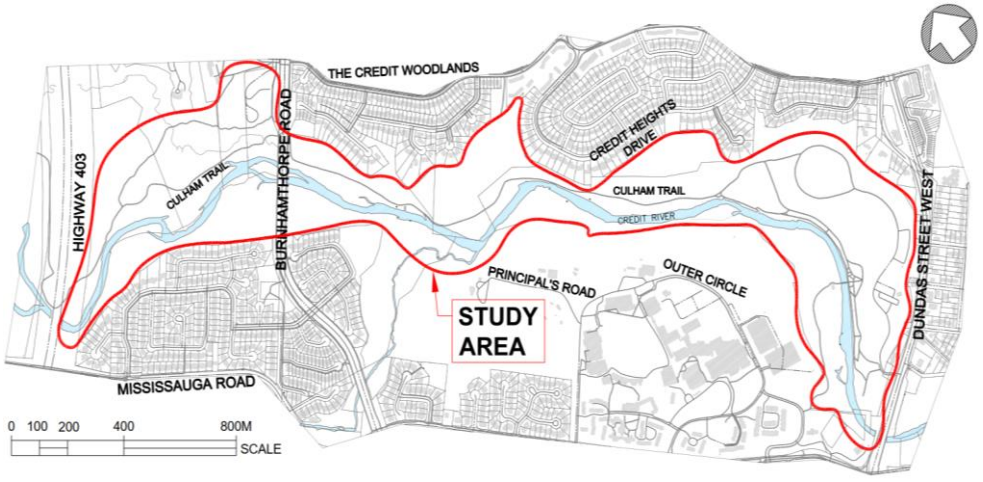
Municipal Class Environmental Assessment (EA) Study:
Credit River Erosion Control Project from Dundas St West to Highway 403

PROJECT BACKGROUND

The City of Mississauga has completed a Schedule B Class Environmental Assessment (Class EA) Study for erosion control and restoration of the Credit River between Dundas Street West and Highway 403.

The Study was undertaken to address existing erosion and safety issues along the river and adjacent Culham Trail.

This section of the Credit River and Culham Trail are in need of rehabilitation to remediate existing river erosion, risk to property and infrastructure, and improve safety. Some of the impacts include segments of failed river bank protection, washouts and damage to the trail, valley wall erosion and ice control.



STUDY COMPLETION

Based on the Study findings and feedback received, the following solutions were selected as the preferred approach to provide long-term erosion control while maintaining usability of public space and managing environmental impacts.

Site 1 – Ice Control Structure: Retain By-Pass Channel
Site 2 – Erindale Park Bank Restoration: Revetment and Buttress
Site 3 – Credit Height Bank Restoration: Vegetated Buttress
Site 4 – Ashington Court Retaining Wall: Replace Wall
Site 5 – Summit Court Slope: Gravity Wall
Site 6 – Downstream Trails – Realign Trail
Site 7 – Mid Trails: Boardwalk
Site 8 – Upstream Trails – Hybrid Trail Option

A Project File Report has been prepared to document the planning and decision-making process for this study. By this Notice**,** the Project File is being made available for review over an extended timeframe of 30 days, from June 10, 2024 to July 10, 2024 on the City's project website: www.mississauga.ca/creditrivererosionea

PROVIDING COMMENTS

If you have any questions, comments or concerns, please contact the project team by July 10, 2024:

Anthony Di Giandomenico, P.Eng.
Project Manager
City of Mississauga
300 City Centre Drive
Mississauga, Ontario L5B 3C9
(905) 615-3200, ext. 3491
Anthony.DiGiandomenico@mississauga.ca

Robert Amos, P.Eng.
Consultant Project Manager
Aquafor Beech Ltd.
2600 Skymark Avenue, Unit 6-201
Mississauga, Ontario, L4W 5B2
(905) 629-0099, ext. 294
Amos.R@aquaforbeech.com

In addition, a request may be made to the Ministry of the Environment, Conservation and Parks for an Order requiring a higher level of study on the grounds that the requested Order may prevent, mitigate, or remedy adverse impacts on constitutionally protected Aboriginal and treaty rights. This request should be sent in writing or email by July 10, 2024 to the addresses listed below:

Minister of Environment, Conservation and Parks
Ministry of Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto ON M7A 2J3
minister.mecp@ontario.ca

Director, Environmental Assessment Branch
Ministry of Environment, Conservation and Parks
135 St. Clair Ave. W, 1st Floor
Toronto ON, M4V 1P5
EABDirector@ontario.ca

A copy of the Order request should also be sent to the City of Mississauga project manager.

This Study was conducted in accordance with the planning process for Schedule "B" projects as outlined in the *Municipal Engineers Association Municipal Class Environmental Assessment* (October 2000, as amended in 2007, 2011, and 2015), which is approved under the *Ontario Environmental Assessment Act*. Personal information submitted is collected under the authority of the Environmental Assessment Act and will become part of the record that is available to the general public.

This Notice issued on **June 10, 2024**.

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1 INTRODUCTION

1.1 Overview of Study Area

Aquafor Beech Limited (Aquafor), was retained by the City of Mississauga to provide comprehensive engineering, geomorphic, ecological, and Environmental Assessment (EA) services to complete the Schedule B Municipal Class EA Credit River Erosion Control project.

This Project File is intended to document the process used to determine the preferred restoration strategy for the deteriorated areas along the Credit River corridor between Dundas St. W. and Highway 403. The study reach is approximately 4km long. The project will provide long-term protection against erosion and flooding, reducing the risk to public safety and municipal infrastructure, preventing future infrastructure damage, and improving the overall health of the watercourse. The general extent of the study area is illustrated in **Figure 1-1.**

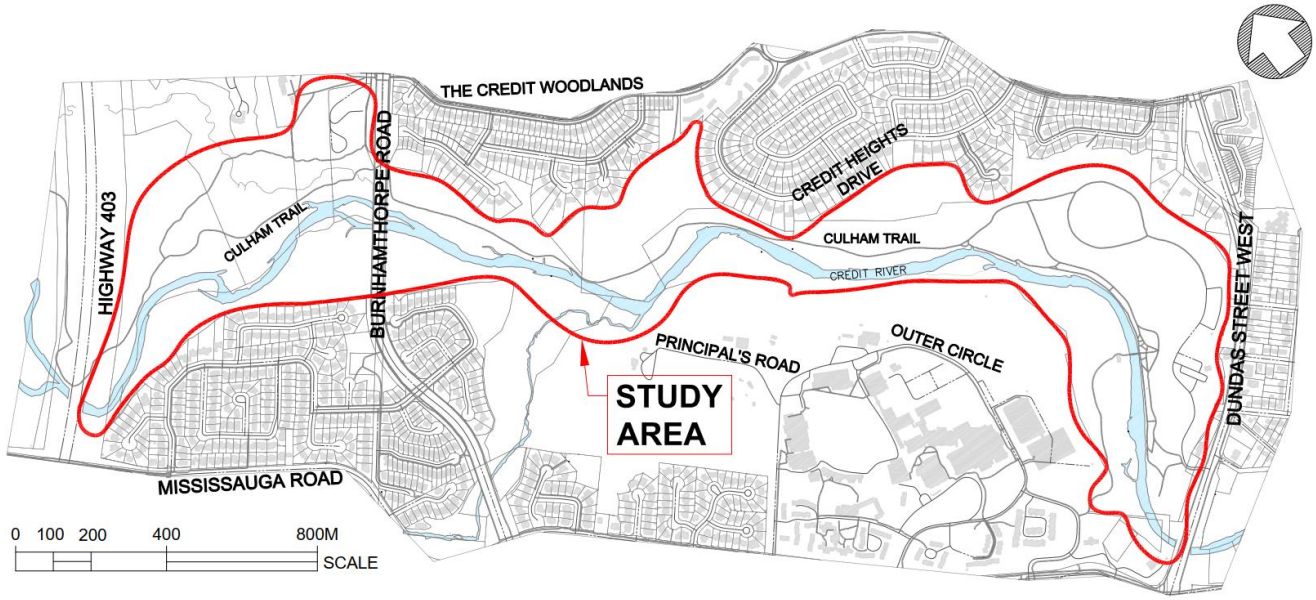

Figure 1-1: Study Area Extents from Highway 403 to Dundas Street West

This study examined a series of design alternatives through the Municipal Class EA process (Schedule B). A solution was proposed to mitigate erosion and flooding related risks to private properties, municipal, regional and CVC managed infrastructure, with an emphasis on protecting/rehabilitating the Culham Trail system. Consideration was given to naturalization and to relocation of the trail or watercourse. These solutions involved localized protection works at critical areas by retrofitting existing measures, as well as a combination of traditional engineered solutions with more natural approaches.

1.2 The Environmental Assessment Process

The Environmental Assessment Act was legislated by the Province of Ontario in 1975 to ensure that an Environmental Assessment (EA) is conducted prior to the onset of development and development-related (servicing) projects. The "environment" as defined by the EA Act is understood broadly to include the biophysical, socio-cultural, built and economic environments and the interrelationships between them. The EA Act applies primarily to public sector undertakings and extends to private sector projects where designated under the regulation. Depending on the individual project to be completed, there are different processes that municipalities must follow to meet Ontario's Environmental Assessment requirements.

The EA Act draws a distinction between "Individual" and "Class" environmental assessments. Individual EAs are prepared for large, complex projects in which significant environmental impacts are foreseeable. A "Terms of Reference" are devised which outline the EA process, and the final EA document is submitted to the Ministry of the Environment, Conservation and Parks (MECP) for approval. Alternatively, a Class EA is a streamlined approval process for a group of routine undertakings with predictable environmental impacts. Once a Class EA planning document is approved by the MECP, all projects of this type are pre-approved provided that they adhere to its design. In this fashion, the Class EA process expedites approval for smaller, recurring projects.

The Municipal Class EA, which is followed here, outlines how municipal infrastructure projects are planned in accordance with the EA Act. The Municipal Class EA is consistent with the EA Act's five key principles for successful planning:

- Consultation with affected parties early on and throughout the process, such that the planning process is a cooperative venture;
- Consideration of a reasonable range of alternatives, both the functionally different "alternatives to" and the "alternative methods" of implementing the solution;
- Identification and consideration of the effects of each alternative on all aspects of the environment;
- Systematic evaluation of alternatives in terms of their advantages and disadvantages, to determine their net environmental effects; and,
- Provision of clear and complete documentation of the planning process followed, to allow "traceability" of decision-making with respect to the project.

As the project being undertaken is defined as an Erosion project, the Schedule B process as defined in the Municipal EA (2015) document is applicable.

A summary of the Class EA process and phases is provided below, with the accompanying flow chart (**Figure 1-2**) illustrating the process followed in the planning and design of projects covered by this Class Environmental Assessment:

Phase 1: Identify the problem or deficiency.

Phase 2: Identify alternative solutions to the problem by taking into consideration the existing environment and establish the preferred solution, taking into account public and agency review and input. At this point, determine the appropriate Schedule for the undertaking and documenting decisions in a Project File for Schedule B projects, or proceed through the following phases for Schedule C projects.

Phase 3: Examine alternative methods of implementing the preferred solution, based upon the existing environment, public and government 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 throughout the above phases, and make such documentation available for scrutiny by review agencies and the public.

Phase 5: 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. Public and agency consultation is also an important and necessary component of the five phases.

The Municipal Engineers Association's Class EA document also classifies projects as Schedule A, A^{+}, B or C depending on their level of environmental impact and public concern.

- Schedule 'A' projects are limited in scale, have minimal adverse environmental effects and generally include routine maintenance and operational activities. These projects are pre-approved and may proceed to implementation without following the full Class EA planning process.

- Schedule 'A+' projects have minimal adverse environmental effects and are pre-approved, however the public is to be advised prior to project implementation."

- Schedule 'B' projects have the potential for some adverse environment effects. Projects generally include improvements and minor expansions to existing facilities. These projects require completion of Phases 1 and 2 of the Class EA process, before proceeding to Phase 5 Implementation.

- Schedule 'C' projects have the potential for significant environment effects. Projects generally include the construction of new facilities and major expansions to existing facilities. These projects require completion of Phases 1 through 4 of the Class EA process, before proceeding to Phase 5 Implementation."

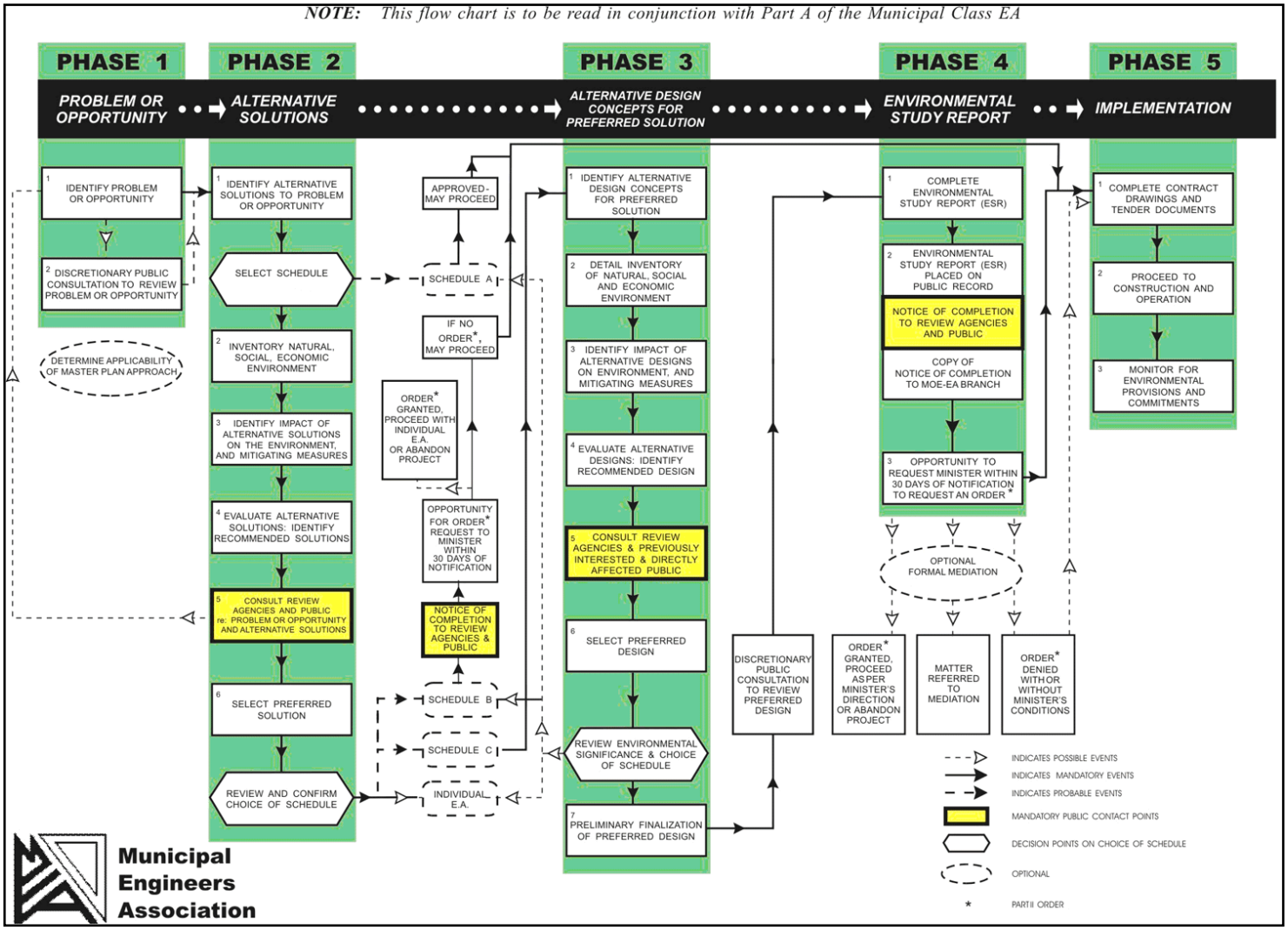

Figure 1-2: Municipal Class Environmental Assessment Planning and Design Process (MCEA, 2015).

2 PHASE 1 – PROBLEMS AND OPPORTUNITIES

Identification of problems and opportunities is the first phase of the Environmental Assessment process. The specific problems and opportunities with respect to erosion in the Credit River study area are described in further detail in the sections below.

2.1 Problem Identification

The study area is located within the Credit River Watershed, along the main branch of the Credit River, between Dundas Street West and Highway 403. Emerging from its headwaters above the Niagara Escarpment and discharging into Lake Ontario at Port Credit, the Credit River watershed drains an area of approximately 860 km^2. While the upper and middle segments of the watershed are primarily rural, the lower watershed passes through the Cities of Brampton and Mississauga and has been subjected to rapid urbanization over the last fifty (50) years. Ongoing urbanization has altered the natural rainfall-runoff response of the watershed creating a modified hydrologic regime characterized by more frequent, and more intense, peak flows. This transition has accelerated the erosion process, forcing the channel system to enlarge as it attempts to establish a new state of quasi-equilibrium. The results of this accelerated erosion process are readily apparent within the project study area, where ongoing channel erosion has created numerous erosion related risks to private property as well as infrastructure managed by the City of Mississauga (Culham Trail, Storm Sewer Outfalls, Pedestrian Bridges), the Region of Peel (Sanitary Sewers), and the Credit Valley Conservation Authority (Downstream Ice Control Structure near the historic Erindale Dam). A map illustrating the general extents of the study area, with the key erosion risks sites highlighted, is provided as **Figure 2-1** below.

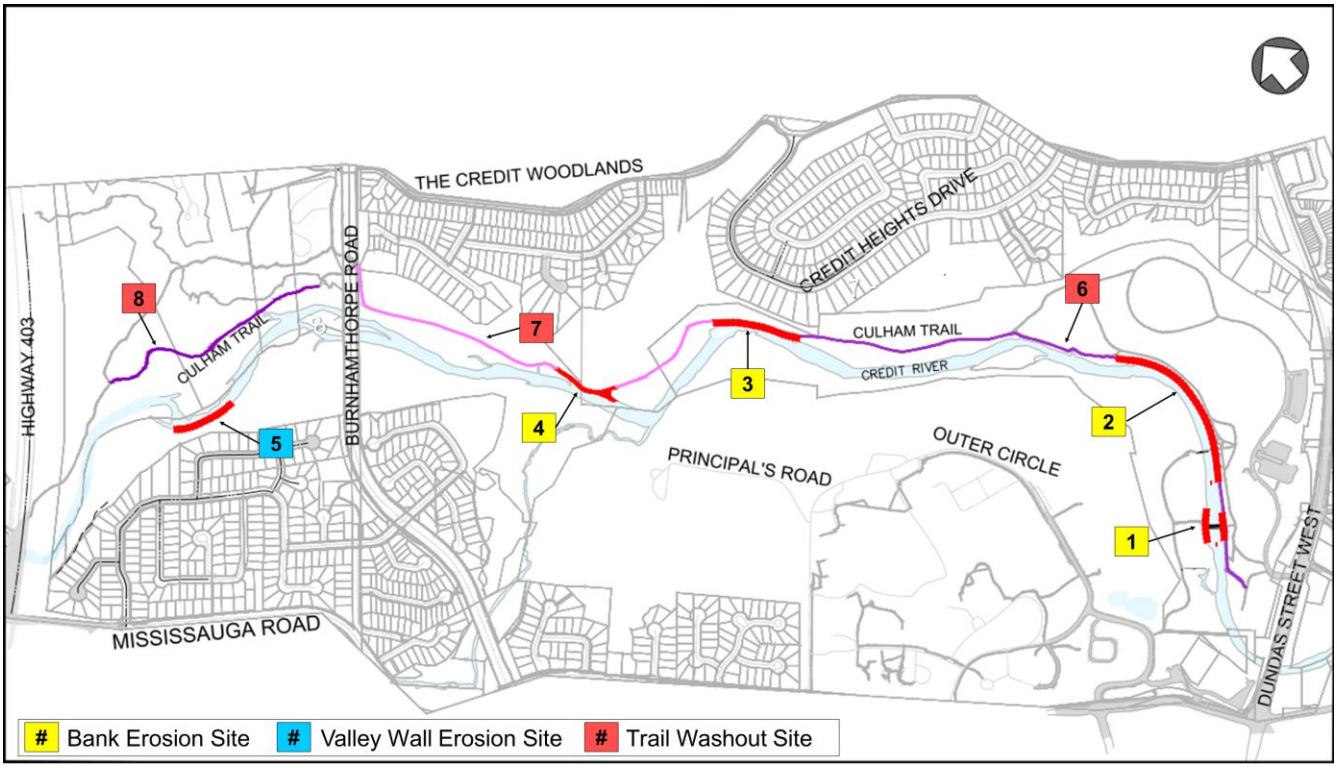

Figure 2-1: Study Area Extents from Highway 403 to Dundas Street West with the Locations of Key Features

Specific to the study area, the west bank (left bank if looking upstream towards Hwy 403) is defined by steep valley slopes that border private properties at the crest of the tablelands, while the eastern bank transitions into a low-lying floodplain. Erosion along the west bank illustrates the degree to which the Credit River has incised into horizontally bedded sedimentary layers of friable shale bedrock. Active erosion along the toe of the valley slope is creating risks of slope instability, to the detriment of private properties along Summit Court (**Figure 2-2**). Overlying the bedrock on the east bank is a low-lying floodplain composed of glacial overburden. The Culham

trail system runs through this floodplain on the east side of the river, and is viewed as a highly valuable recreational resource for the local community. The gravel trail system is severely degraded as a result of ongoing bank erosion and frequent inundation of the floodplain during rainfall events. Engineered bank treatments designed to protect the trail from erosion have failed at a number of locations due to a combination of localized scour (undermining, outflanking), hydrodynamic forces, and damage from severe ice accumulation (**Figure 2-4**, **Figure 2-5**, and **Figure 2-6**). Frequent flooding has washed out the gravel base along several portions of the trail, particularly upstream of Burnhamthorpe Road (**Figure 2-7**).

Regional sanitary sewer infrastructure is embedded into the eastern floodplain, with manhole elevations low enough to experience frequent inundation with river water during moderate to high intensity storm events. A number of damaged/degraded manholes were observed during Aquafor's site investigations, with at least one manhole partially exposed within the main channel of the Credit River (**Figure 2-8** and **Figure 2-9**).

Unique to the study area is the degree of ice buildup. Large chunks of ice have been observed to settle in the floodplain and along the Culham trail throughout the study area (**Figure 2-10**). A historic Ice Control Structure, managed by the Credit Valley Conservation Authority, is situated towards the downstream extents of the study area near the historic Erindale Dam. Channel widening has resulted in significant outflanking of the Ice Control Structure along the west bank, preventing the structure from functioning as intended (**Figure 2-11**).

Figure 2-2: Site #5 – Slope Instability Adjacent to Private Property on Summit Court

Figure 2-3: Slope Erosion behind Bridewell Court.

Figure 2-4: Site #2 – Failed Armourstone Retaining Wall Segment Adjoining the Culham Trail

Figure 2-5: Site #3 – Failed Bank Protection Works

Figure 2-6: Site #6 – Failed Armourstone Retaining Wall Segment Adjoining the Culham Trail

Figure 2-7: Trail Erosion Site #8 – Washout of Gravel Trail due to Frequent Flooding

Figure 2-8: Site #8 - Degraded Sanitary Sewer Manhole Structure Along the Culham Trail

Figure 2-9: Site #7 - Exposed Sanitary Sewer Manhole Along the East Bank of the Credit River

Figure 2-10: Large Chunks of Ice Debris Deposited Along the Culham Trail. Significant Tree Damage Observed.

Figure 2-11: Site #1 – Outflanked Ice Control Structure Resulting from Channel Erosion Along the West Bank

2.2 Opportunities

Undertaking the Environmental Assessment process for erosion mitigation studies highlights the importance of considering multiple alternatives and evaluating the positive and negative effects to the environment, including social and economic factors.

The opportunities identified for the Credit River Erosion Control EA study are summarized in the following list and are explored further in Phase 2 of the study (**Section 4**).

- Opportunity to address both erosion, flooding, and ice floe issues within the Credit River study area, including public safety issues related to trail deterioration.
- Opportunity to restore or enhance riparian and aquatic habitats.
- Opportunity to improve social and cultural opportunities within the parklands throughout the study area.
- Opportunity to reduce ongoing trail maintenance requirements.

2.3 Study Objective

The objective of this study is to assess the existing condition of the Credit River and explore and assess alternatives to address the erosion concerns within the selected reaches.

The main focus of this study is to find a preferred alternative that will maintain and protect the adjacent trail, properties, and infrastructure at a reasonable cost, while enhancing ecological and aquatic conditions of the corridor. This solution will include erosion mitigation and prevention measures for the Credit River and adjacent lands, and will ensure conveyance capacities and flooding are not negatively impacted.

3 EXISTING CONDITIONS

Site-specific studies were conducted to support the selection and design of the preferred alternative. A summary of the site-specific inventories that were conducted as part of the study process is provided below.

3.1 Surveys and Property Assessment

Initial geospatial and topographic assessments were completed using existing GIS databases and LIDAR, respectively. The available data was determined to be of sufficient detail to enable the completion of geomorphic analysis, hydraulic modelling, and conceptual design.

The topographic information was compiled into planform drawings to illustrate existing conditions within the study area, as shown in **Figure 3-1** to **Figure 3-8.**

Further in-field data collection will be completed where required to support detailed design. A combination of total station and RTK GPS technologies will be used to collect high accuracy, high detail topographic data of existing conditions.

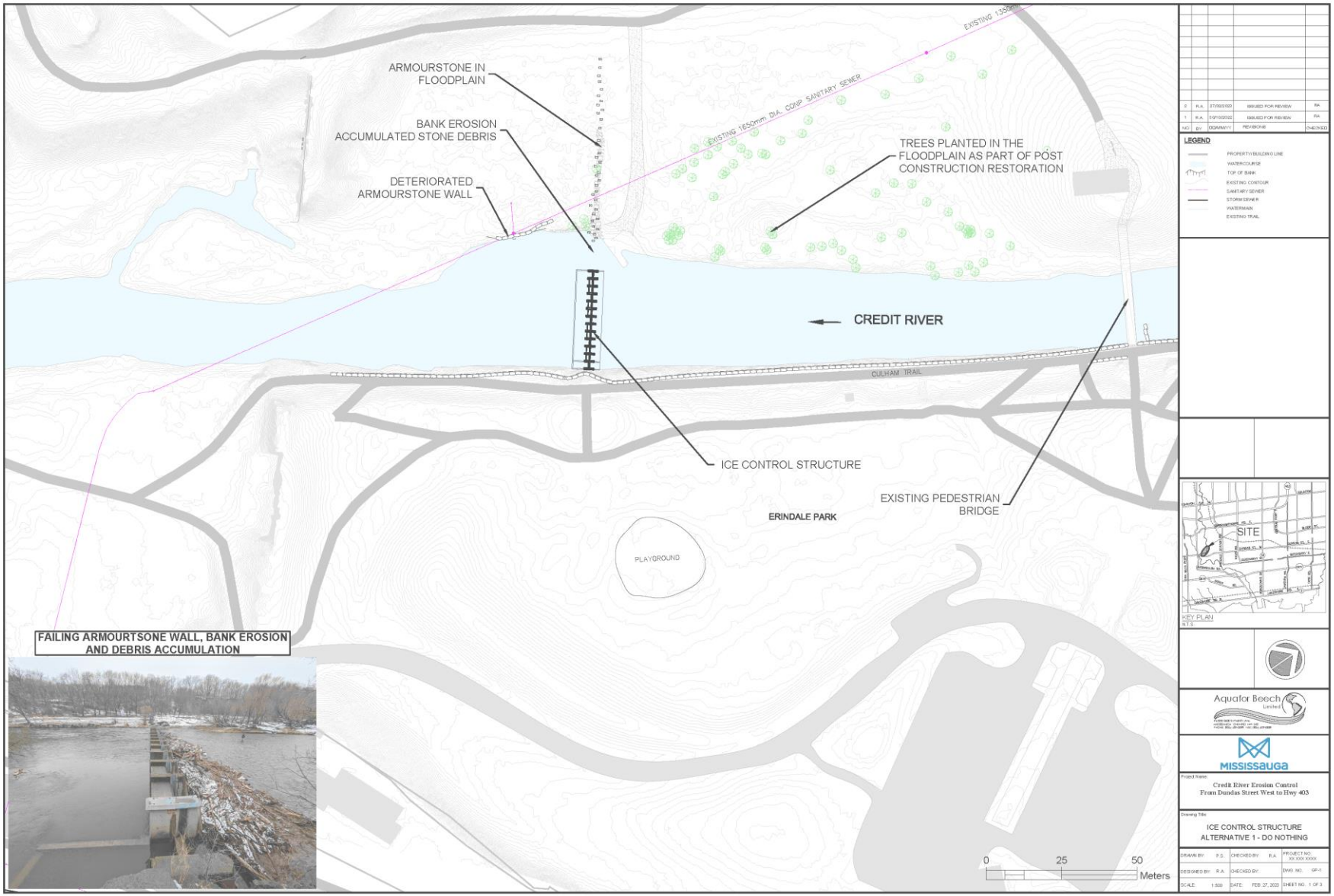

Figure 3-1: Site #1 Existing Conditions

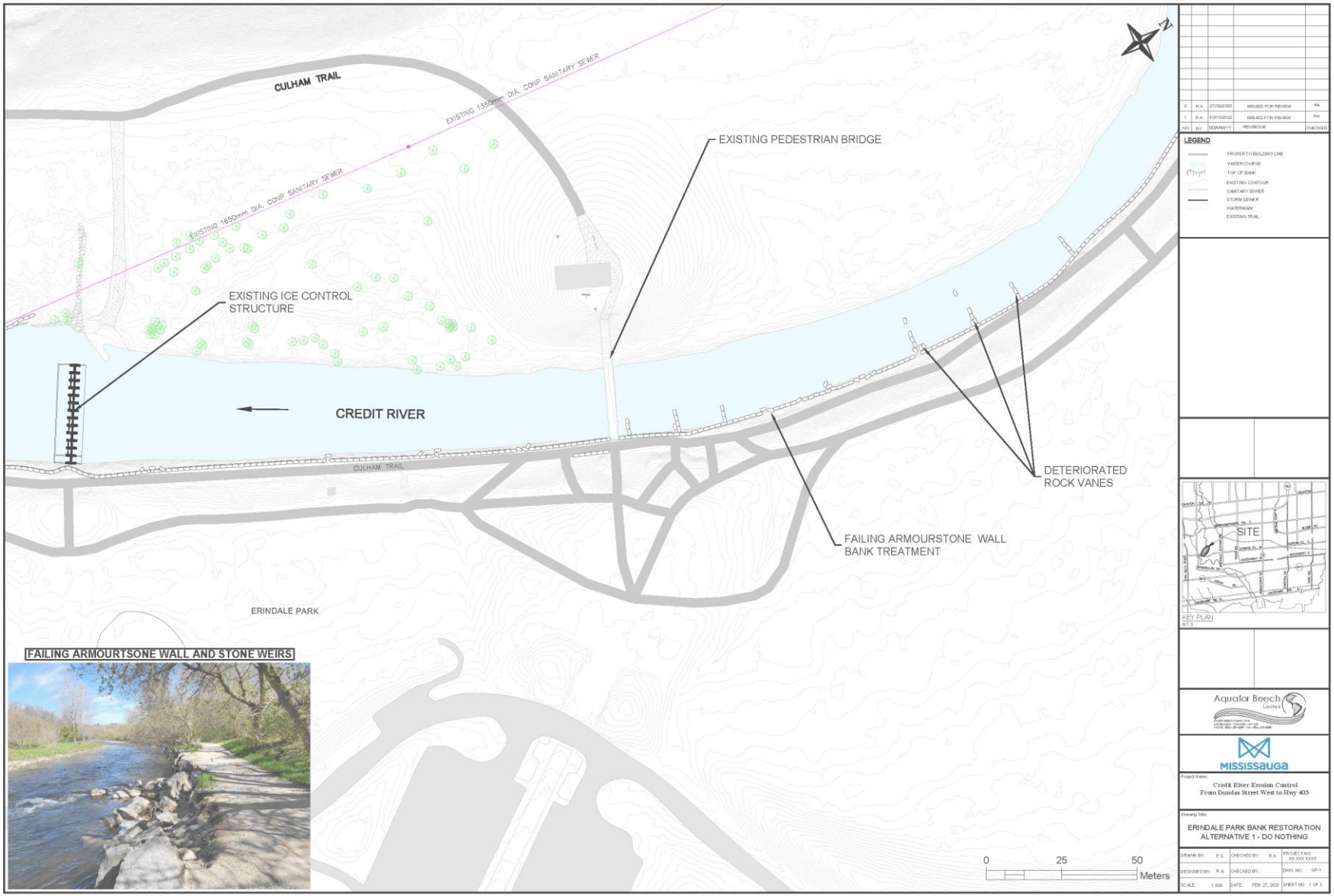

Figure 3-2: Site #2 Existing Conditions

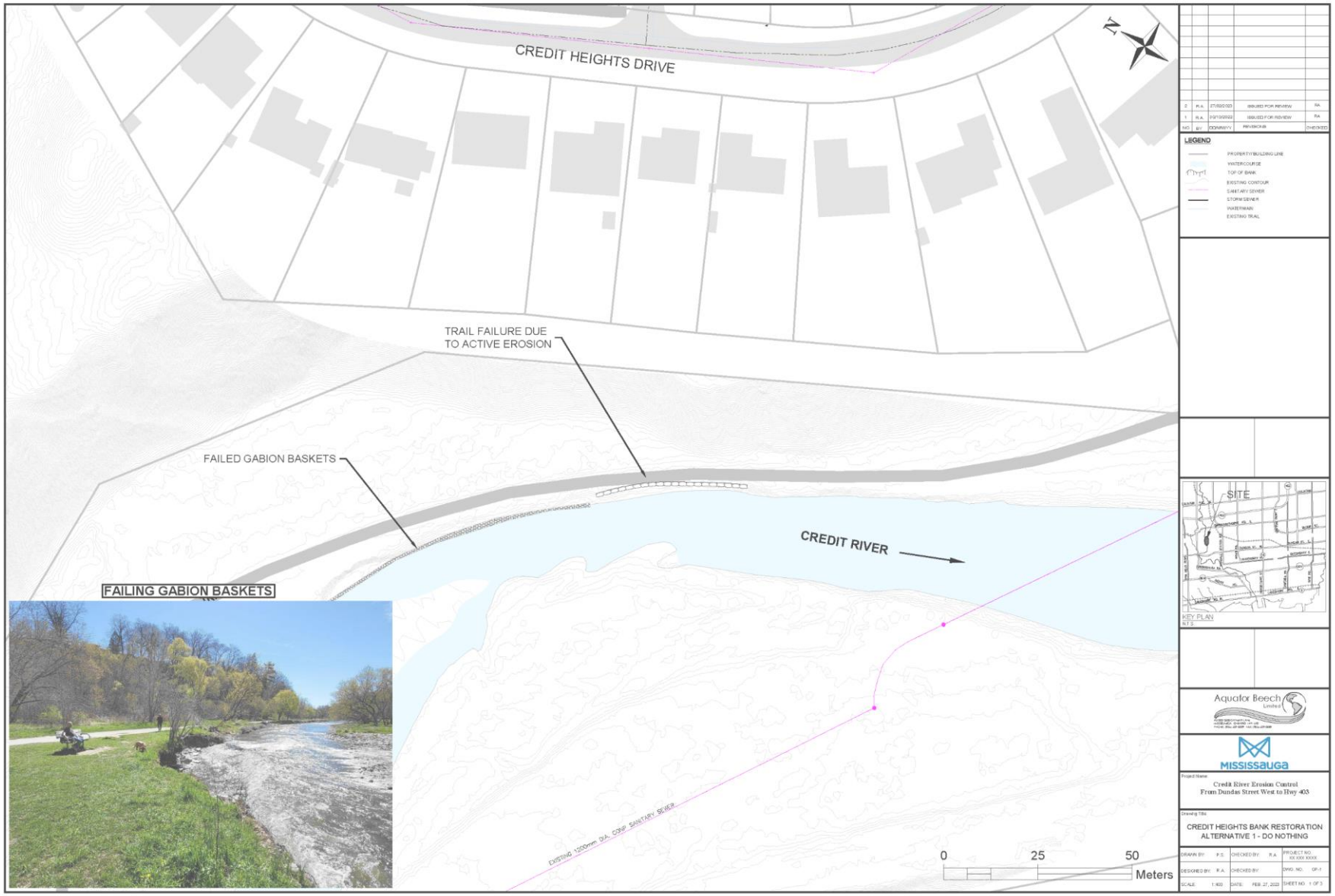

Figure 3-3: Site #3 Existing Conditions

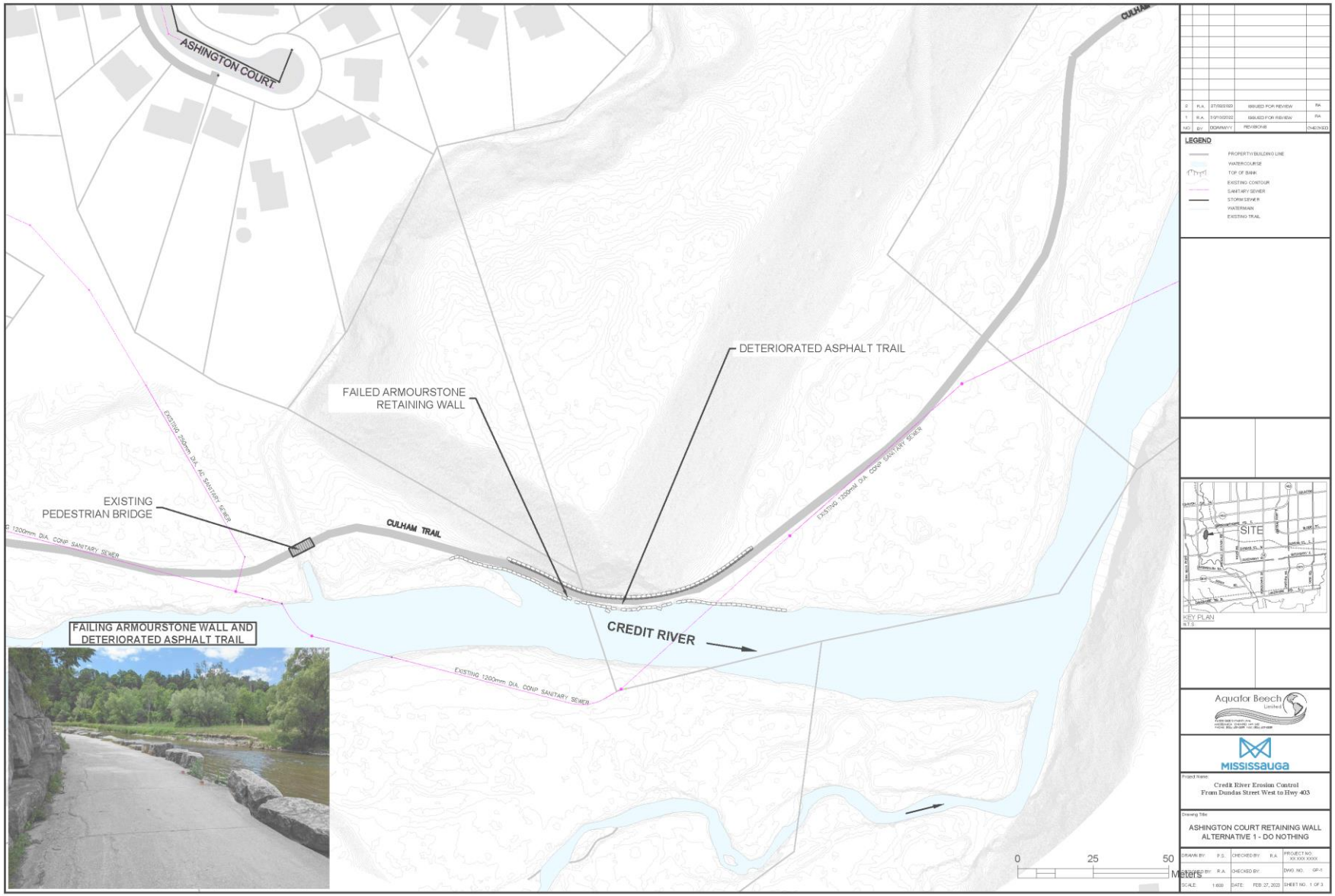

Figure 3-4: Site #4 Existing Conditions

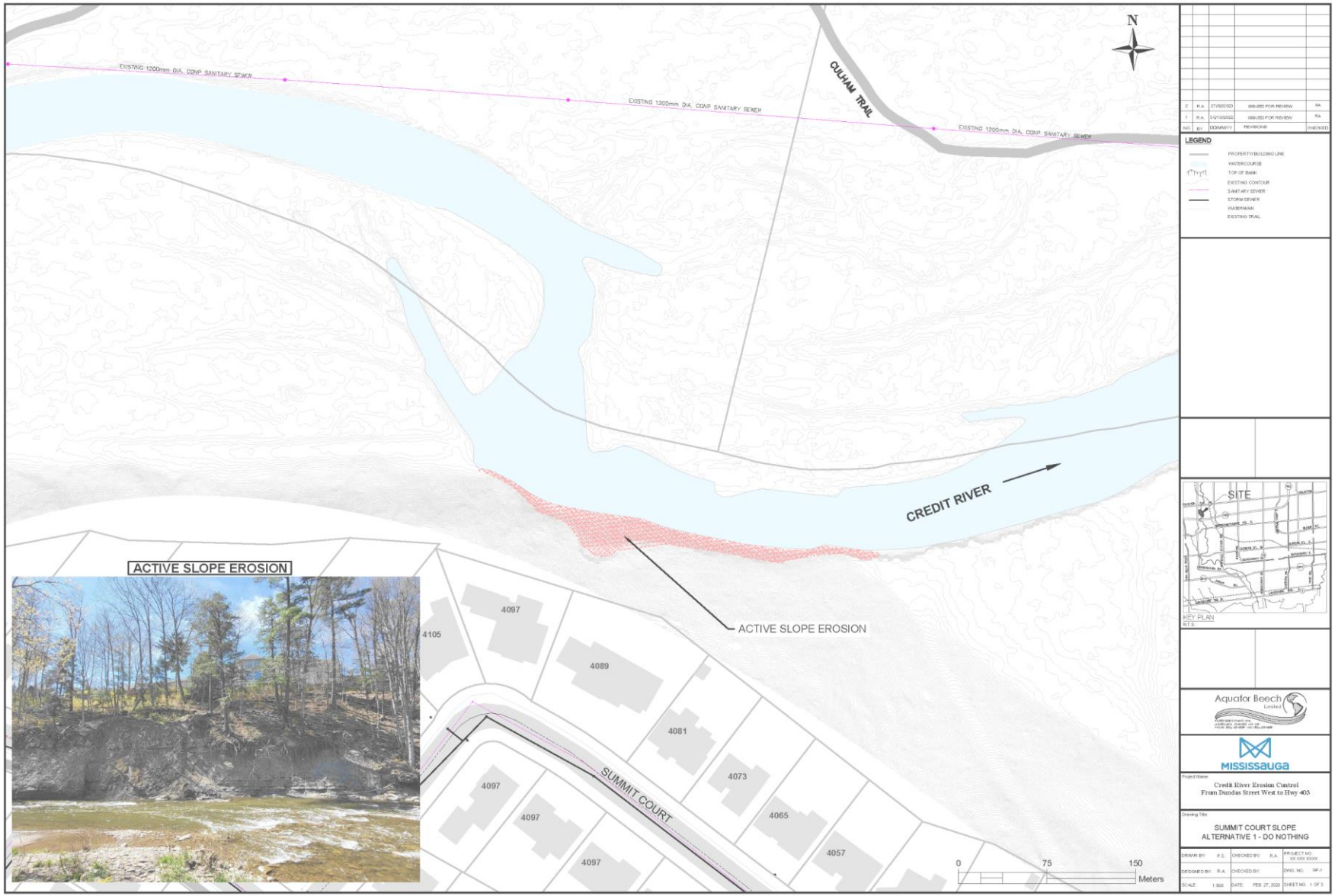

Figure 3-5: Site #5 Existing Conditions

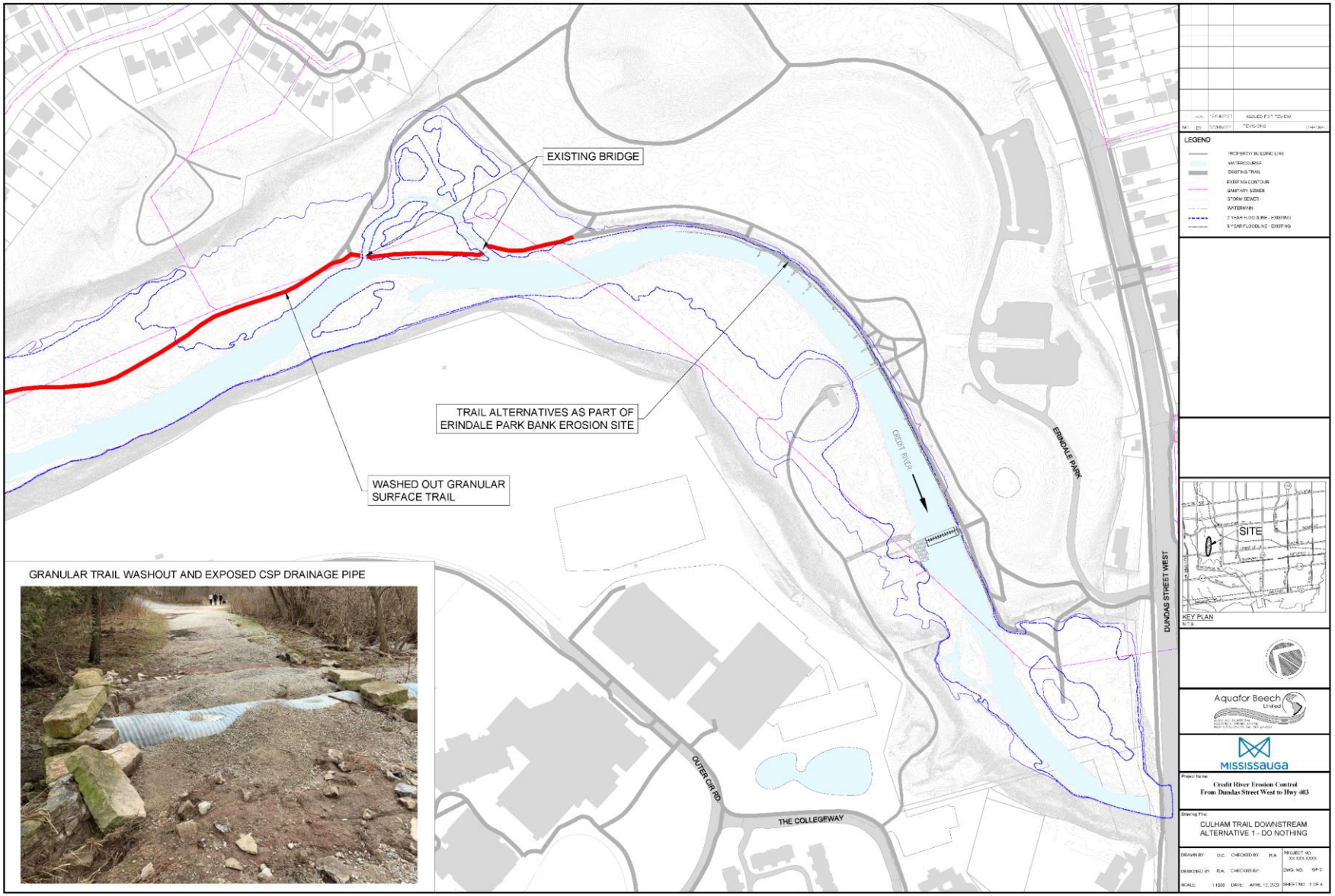

Figure 3-6: Site #6 Existing Conditions

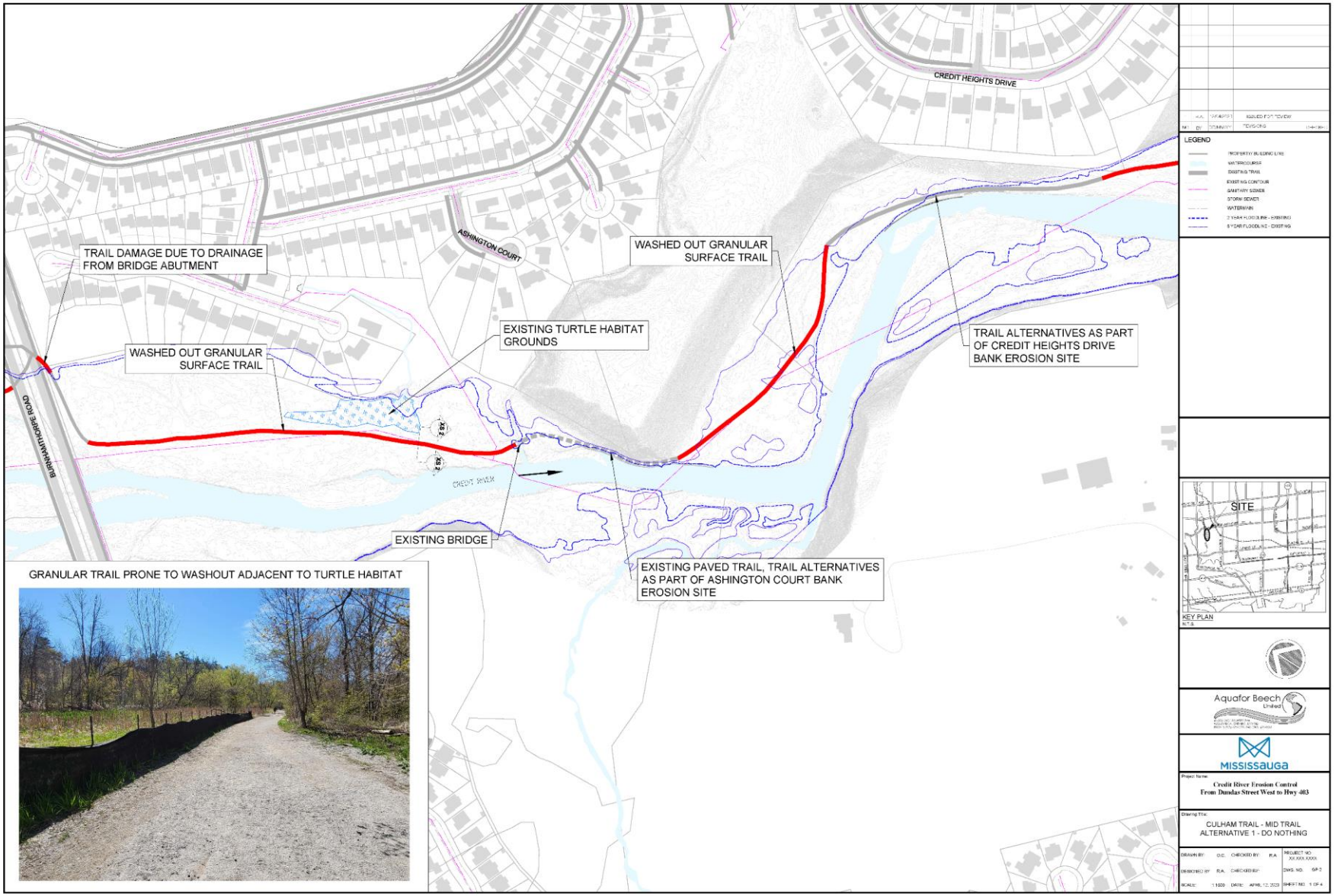

Figure 3-7: Site #7 Existing Conditions

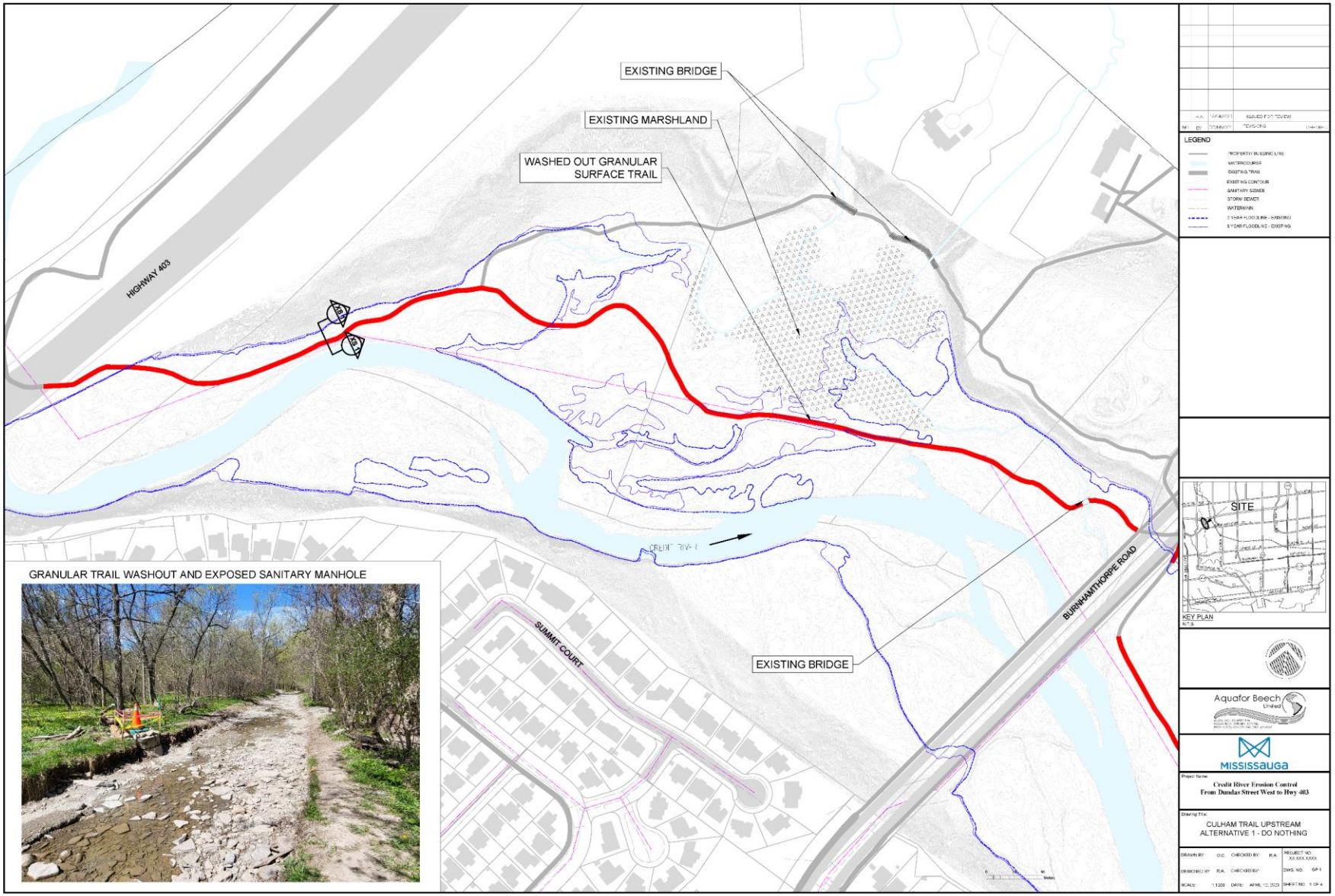

Figure 3-8: Site #8 Existing Conditions

3.2 Geographic and Geotechnical Investigations

The Credit River study area is situated on young tills within the Iroquois Plain physiographic region of southern Ontario (Sharpe, 1980). Draining into Lake Ontario, this area of the Credit River watershed is primarily characterized by the following stratigraphic units: Modern Alluvium, Deltaic and Lacustrine Deposits, Older Terrace Alluvium, and Bedrock (**Figure 3-9**).

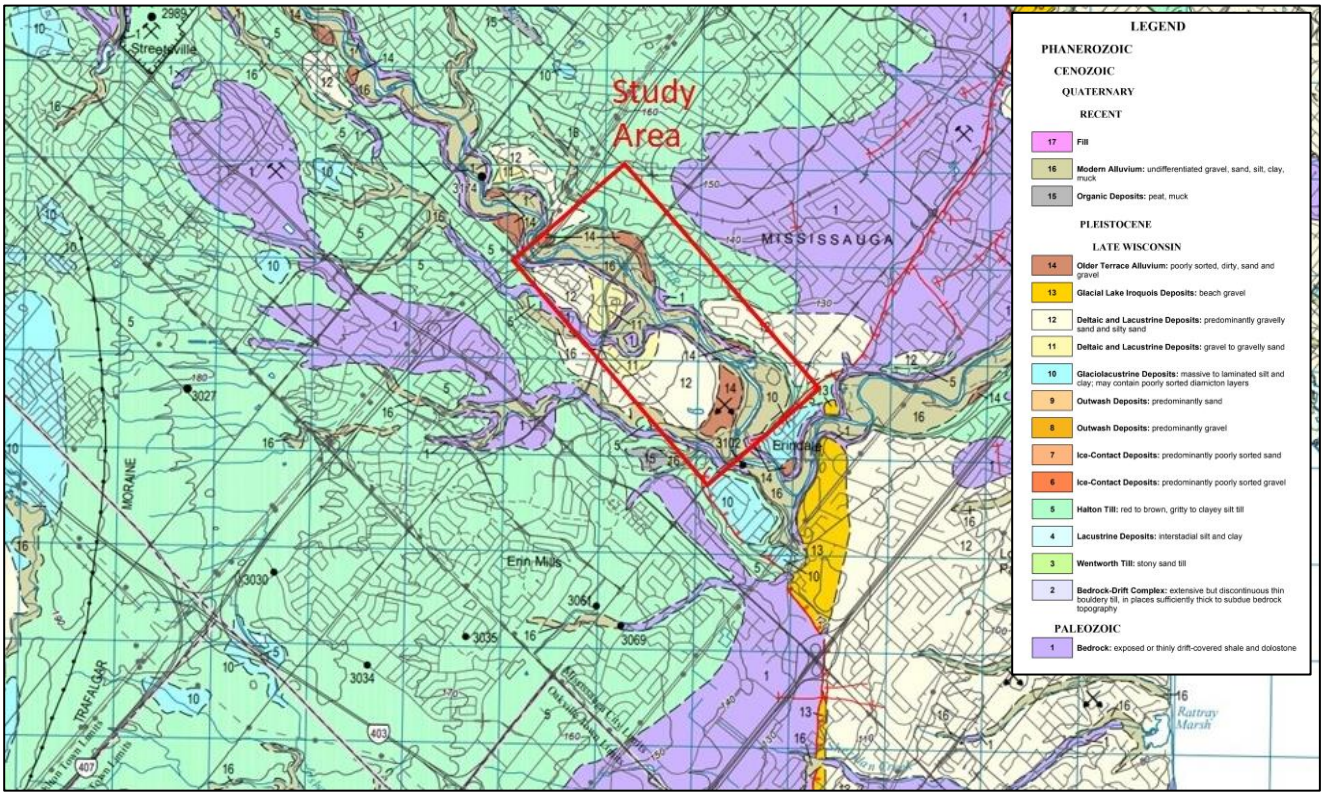

Figure 3-9: Modified Quaternary Geology Map 2223 - Brampton Area (Karrow & Easton, 2015)

Geotechnical and slope stability analyses and soil characterization will be undertaken at the detailed design stage to support the design process. Preliminary plans include the advancement of boreholes and the collection of soil samples throughout the study area.

3.3 Geomorphic and Erosion Assessment

3.3.1 Reach Delineation

Geomorphic stream reaches are relatively uniform lengths of channel in terms of surface geology, hydrology, channel slope, boundary materials, and vegetation that control dominant geomorphic processes and sediment transport dynamics. In other words, the physical channel processes and resulting river morphology are relatively consistent over the length of the reach as compared to the differences between adjacent reaches. While in practice this requires that reaches be discretely divided by "reach breaks", in reality, reach changes may be abrupt or may transition gradually depending on changes in the controlling variables. For example, contact with bedrock may abruptly confine the channel vertically or horizontally, modifying channel processes and thus can represent a distinct reach break. In contrast, a gradual change in the boundary materials (e.g., increasing or decreasing sand supply) would result in a gradual change in channel processes and the mapped reach break would only approximate the location of this transition.

The Credit River has been previously delineated into reach segments recognized by the CVC. Within the study area, three (3) reaches are recognized. These reach delineations are summarized in **Table 3-1**, with a description of their upstream and downstream extents along with the date of field assessment.

Table 3-1: Summary of Reach Limits Within the Study Area

Reach	Reach Limits	Date Assessed
CRED-0700	Southern meander at Principal's Rd to Dundas St. West	April 12, 2023
CRED-0800	Burnhamthorpe Rd West to Southern meander at Principals Rd	April 12, 2023
CRED-0900	Hwy 403 to Burnhamthorpe Rd West	April 12, 2023

Reach CRED-0700

The most downstream reach in the study area extends upstream 2,100 m from the Dundas St West crossing to a mid-channel bar at the northern extent of Principal's Road. The channel ranges from 20 to 45 m in width and has historically been prevented from widening or migrating with erosion control measures. The channel substrate is composed of cobbles with predominantly sandy bank material (**Figure 3-10**). The ice control structure at Erindale Park creates frequent debris obstructions and has been outflanked due to channel widening in the immediate area (**Figure 3-11**). Additionally, a lobate bar has formed upstream of the ice control structure in response to debris and ice obstruction.

Figure 3-10: Reach CRED-0700 Downstream of the Ice Control Structure

Figure 3-11: Ice Control Structure at Erindale Park

A multi-use trail spans the entire length of this reach in close proximity to the east bank. The trail is composed of asphalt and gravel segments. Several sections of the trail are lined with armourstone to protect the trail from being undermined by the channel and to protect the toe of slope (**Figure 3-12**). Previous erosion protection works have failed as a result of channel widening combined with overland drainage issues which washed away interstitial material behind the armourstone (**Figure 3-13**). Improper stone embedment depth and trail drainage issues may have also contributed to the retaining wall failure.

Figure 3-12: Armourstone Retaining Wall and Pedestrian Trail through Reach CRED-0700

Figure 3-13: Failed Retaining Wall Adjacent to the Trail

Reach CRED-0800

The middle reach within the study area extends from the bridge crossing at Burnhamthorpe Road West, 750 m downstream to the mid-channel bar at the northern extent of Principal's Road. The channel spans 20 to 55 m in width, with the narrower segments reinforced with armourstone and the widest segment close to the Burnhamthorpe Road bridge (**Figure 3-14).** The pedestrian trail network extends along the northeast bank where a 3 m wide compacted gravel trail runs parallel to the top of bank, at an offset of just 1 m or less. Sections of the trail show a high degree of erosion and are currently in poor condition. The cause of the trail failure is partly due to channel widening and undermining of the armourstone, and partly due to the overland drainage on the valley side of the trail. Similar to the retaining wall collapse in Reach CRED-0700, the channel has scoured beneath the armourstones and removed the material enough for the retaining wall to collapse. Additionally, the lack of trail culverts or culvert capacity causes the overland flow conveyed by the valley slope to overtop the trail berm, converge into drainage pathways, and erode the trail by gullying and channelization (**Figure 3-15**).

Figure 3-14: Armourstone Lined Bank through Reach CRED-0800

Figure 3-15: Trail Washout from Runoff and Gullying

The lack of offset between the trail and the top of bank prevents vegetation from establishing and reinforcing the bank. Ideally, an enhanced riparian buffer would help mitigate erosion between the top of bank and the trail, and deter foot traffic from further eroding the banks by limiting access to the channel. Alternatively, the trail degradation can be slowed, by surfacing the trail with a less erodible material such as asphalt or concrete, however

this would still be susceptible to undermining at the outside channel bends if suitable erosion control was not incorporated.

Reach CRED-0900

The most upstream reach in the study area extends 1,100m downstream of Hwy 403 to Burnhamthorpe Road West. The channel is 20 – 25 m in width for most of the reach, but widens to almost 80 m at Burnhamthorpe to accommodate an island. The banks are lower through this reach with the pedestrian trail aligned further away from the banks. The lack of retraining wall on the northeast bank allows the channel access to the floodplain more easily on that side (**Figure 3-16**). At higher flow stages the flow has exceeded its banks and created chute channels across the floodplain, evident from gravel deposits transported by the overtopping flows (**Figure 3-17**).

Figure 3-16: Low Banks in the Upper Reach Allow Access to the Floodplain

Figure 3-17: Overland Flows Transporting Gravel Material to the Floodplain

Figure 3-18: Washed Out Pedestrian Trail

Figure 3-19: Chute Confluence with Trail

The pedestrian trail that runs through the northeast floodplain is coincident with several relict chute channels. The trail is set lower in elevation than the adjacent floodplain or has become so. As a result, the upper layer and much of the trail bed has been eroded or washed away by these overbank flow events. Being a relatively straight, elongate, topographic low with a considerable gradient, this trail has acted like an engineered channel, but without appropriate stone sizing to prevent the transport of material. Manholes along the trail have been scoured down over 0.3 m, and demonstrate the erosion potential of an unvegetated drainage feature in this high energy environment.

Figure 3-20 shows the elevation of the channel, floodplain and valley relative to the road crossings at Hwy 403 and Burnhamthorpe Rd West, and the trail network through Erindale Park. The light blue segments show the main channel and floodplain chute channels that intersect with the pedestrian trail, causing the trail to act as a channel in its current condition. The confluence of this trail with existing chute channels has connected it to the complex drainage network throughout the floodplain. During higher flows, this trail now conveys the majority of the northeast overbank flow downstream and will continue to function as a chute channel resulting in significant risk to pedestrians and infrastructure along that segment of the trail

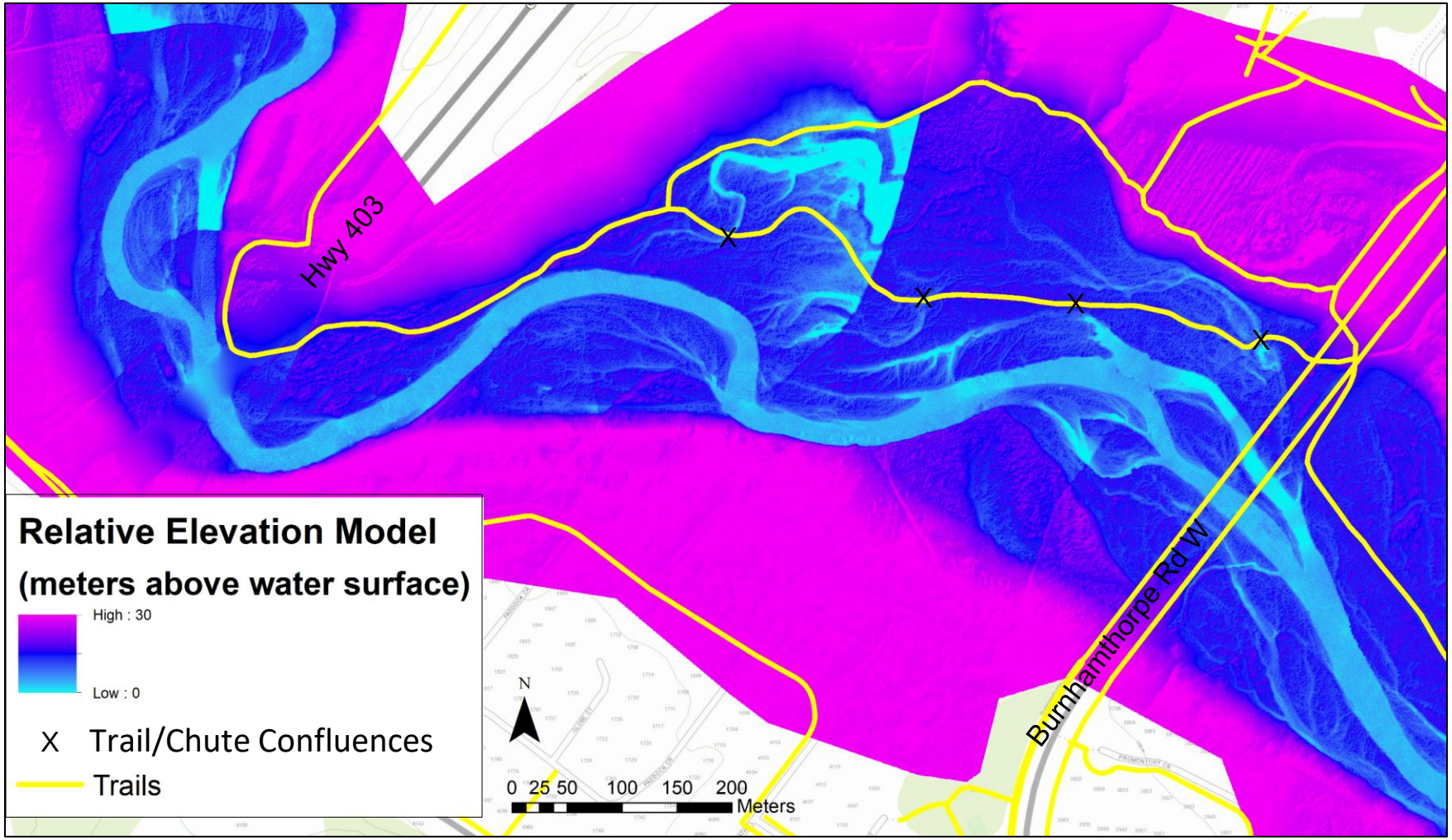

Figure 3-20: Relative Elevation of the Credit River Floodplain Above the Surface of the Channel at Low Flow

3.3.2 Geomorphic Stability

The Rapid Geomorphic Assessment (RGA) (MOE, 2003) tool was used during field walks to assess the fluvial conditions of the watercourses. The RGA protocol uses visual indicators to determine whether a given stream is stable or in adjustment. Stability of the channel is determined by adjustments in slope; the bed elevation may be increasing due to sediment deposition (aggradation) or decreasing due to bed erosion (degradation). Consideration of increases in bank-to-bank width (widening) and indicators suggesting a change in the planform regime (planimetric form adjustment) are also part of the assessment. Based on the results of the RGAs, reaches were classified as "stable", "transitional", or "in adjustment" depending on the stability index value as described in **Table 3-2**.

Table 3-2: Rapid Geomorphic Assessment (RGA) Descriptions Based on Index Value

Stability Index (SI) Value	Stability Class	Description
SI ≤ 0.2	In Regime	Channel morphology is within the expected range of variance for stable channels of similar type. Channels are in good condition with minor adjustments that do not impact the function of the watercourse.
0.21 ≤ SI ≤ 0.4	Transitional	Channel morphology is within the expected range of variance but with evidence of stress. Significant channel adjustments have occurred and additional adjustment may occur.
SI > 0.4	In Adjustment	Metrics are outside of the expected range of variance for channels of similar type. Significant channel adjustments have occurred and are expected to continue.

The existing geomorphic conditions of the Credit River were documented during the field assessments. RGA (Rapid Geomorphic Assessment) stability classifications for all reaches assessed are listed in **Table 3-3**.

As noted previously, the RGA score does not provide a measure of the risk to property, infrastructure, and public safety. Thus, alone, the RGA score is not a means of prioritizing channel restoration works. Rather, as a measure of channel stability. RGA scores can be used as both a predictor and a proxy for locations where erosion-related risks occur. In general, reaches with high geomorphic instability are more likely to exhibit erosion sites, and the results of the geomorphic assessment are valuable in providing an understanding of the channel adjustments at work in the reach. The information gathered during the geomorphic assessment can be used further in the development of restoration approaches for priority erosion sites.

Table 3-3: RGA Stability Classification for All Reaches in the Study Area

Reach #	RGA Score	Dominant Process	Stability Regime
CRED-0700	0.36	Widening	In Transition
CRED-0800	0.35	Widening	In Transition
CRED-0900	0.34	Aggradation, Planform Adjustment	In Transition

3.3.3 Ice Control Structure History

In 1982, the CVC preformed a study to address ice flow concerns in the southern reach of the Credit River. This report, titled *Lower Credit River Ice Control Study*, specifically targeted the Mississauga Golf and Country Club (MGCC), the Credit Valley Golf and Country Club (CVGCC) as well as Streetsville Memorial Park. The study attributed the repetitive ice damages at these locations to the presence of sharp bends, bridges constricting flow, and areas of transitional flow.

Using the results of this report, the CVC contracted IBI Group (formally Cumming-Cockburn & Associates Ltd.) in 1986 to preform a feasibility study and present recommendations for reducing ice damage. The chosen alternative, constructed in 1987, was an ice control structure consisting of a set of concrete piers across the river. In the event of an ice jam, the piers block ice flows, directing ice into the adjacent floodplain storage area to limit the amount of ice travelling downstream. The ice storage area uses a row of spaced armourstone blocks in the floodplain to accept water flows while retaining ice chunks.

As the ICS was being constructed, a stretch of the adjacent northwest bank was also reinforced with an armour stone retaining wall. 35 metres upstream and downstream of the structure was protected in an effort to mitigate the bank erosion and direct all ice into the structure. The wall failed in later years and erosion has since created a large bypass channel for ice to flow around the structure and continue downstream.

Since installation, there have been a number of events within the original study area where significant damages occurred due to compromised performance of the structure. Floods carrying ice through the valley have resulted in extensive repairs on the golf courses, and carried one bridge off of its abutments. These events brought the performance of the ICS to the attention of both the CVC and the municipality, leading to separate repair studies taking place in both 2015 and 2018.

Ecosystem Recovery Inc. was retained by the City of Mississauga in 2018 to design a long-term solution to the deterioration of the ICS. They found, through available aerial photography, that between 1987 when the structure was built, and 2014, the northwest bank line receded from the piers by 14.1m upstream of the ICS and 23.6m downstream of the ICS.

3.4 Hydrologic & Hydraulic Assessment

A review of the study area hydrology and hydraulic conditions was undertaken to determine the existing flood levels and extents of the Credit River within the study area, as well as to gain an understanding of the hydraulic parameters observed under the range of flood flow conditions which attribute to erosion and channel alteration.

3.4.1 Credit River Hydrology

At the onset of the study, a hydraulic (HEC-RAS) model was obtained from CVC which addresses a range of hydrologic conditions (i.e., flood flow scenarios), including the regional event and return period events for 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year storms, under existing land use conditions. Flows under the various storm scenarios are summarized in **Table 3-4** below.

Table 3-4: Summary of Credit River Flow Regime within the Study Area

Profile	Flow Rate (m^3/s)
2-Year	90
5-Year	202
10-Year	264
25-Year	353
50-Year	428.2
100-Year	510.8
Regional	732.6

3.4.2 Credit River Hydraulics

For the purposes of this EA, the Credit River HEC-RAS model obtained from CVC was used to define the existing hydraulic conditions within the study area. The schematics and cross-section arrangement of the existing HEC model within the study boundary are depicted in **Figure 3-21**, along with the regional flood line. The model was run under a mixed flow regime and a summary of the hydraulic modeling results for each of the various flood flow events is provided below in **Table 3-5**. The detailed model results are included in **Appendix A**.

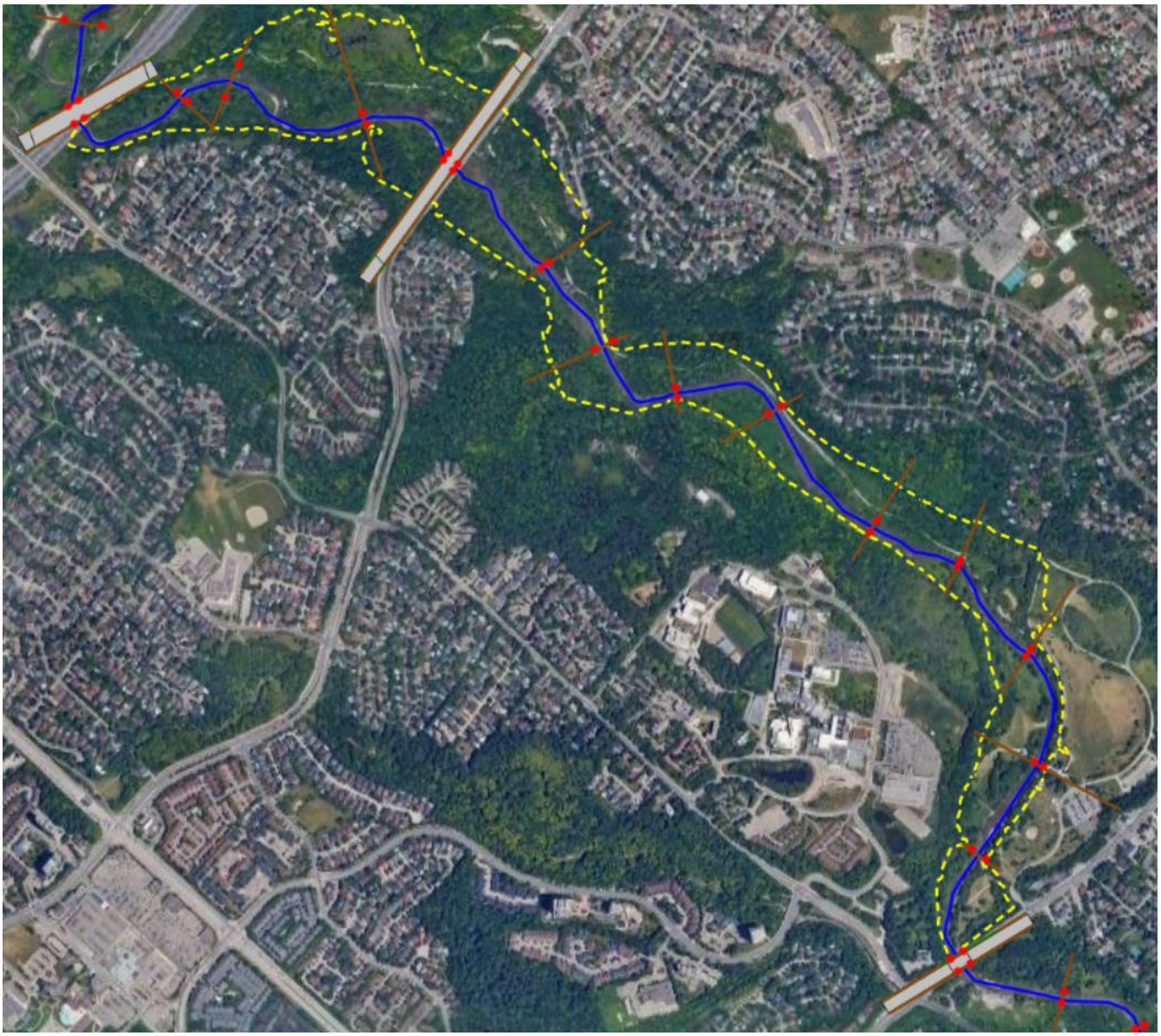

Figure 3-21: Existing HEC-RAS Schematic of Credit River showing Regional Floodline and Cross Sections

Table 3-5: Summary of Hydraulic Parameters for Flood Flow Events

Flood Event	Flow (m^3/s)	Hydr. Depth (m)	Velocity (m/s)		Channel Shear (N/m^2)		Channel Power (N/m*s)		Top Width (m)
		Avg.	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.
2-year	90	1.15	2.18	2.82	52.04	97.61	122.21	275.16	93.15
5-year	202	1.67	2.87	3.82	78.79	135.15	240.57	433.04	119.68
10-year	264	1.88	3.13	4.40	90.12	165.93	301.73	595.85	125.67
25-year	353	2.15	3.42	4.99	103.44	203.16	382.67	827.33	130.45
50-year	428.2	2.35	3.64	5.28	114.07	230.36	453.44	1015.87	133.86
100-year	510.8	2.57	3.81	5.55	121.48	260.16	504.53	1237.46	140.41
Regional	732.6	3.04	4.24	6.11	142.28	313.55	662.01	1694.12	146.20

The results of the hydraulic assessment demonstrate that the Credit River experiences high velocities, shearing forces, and channel power under the range of flood flow conditions, which can contribute to continuous erosion and increased levels of channel activity under extreme wet-weather flow events. These conditions have been considered in the process of defining the types of restoration options, the sizing and resistance thresholds for materials, and appropriate channel planform configurations.

In order to provide further insight into the impact of the hydraulics parameters, Aquafor reviewed the published data on the critical erosional thresholds for river bed and bank materials as presented in **Table 3-6**. A comparison between **Table 3-5** and **Table 3-6** suggests shearing and velocity conditions will surpass the permissible thresholds for natural materials, and in turn, careful attention to stone sizing and placement of material will be required to mitigate failure of the reconstructed channel banks.

Table 3-6: Erosion Thresholds for Stream Bed and Bank Materials (Fischenich, 2001)

Boundary Material	Permissible Shear Stress		Permissible Velocity	
	N/m^2	N/m^2	m/s	m/s
Fine Gravels	3.6		0.76	
Stiff Clay	12.4		0.91	1.37
Alluvial Silt	12.4		1.14	
Graded Silt to Cobble	18.2		1.14	
Shales and Hardpan	32.1		1.83	
Non-Uniform Gravel / Cobble				
2-inch	32.1		0.91	1.83
6-inch	95.8		1.22	2.29
12-inch	191.5		1.68	3.66
Long native grasses	57.5	81.4	1.22	1.83
Short native and bunch grass	33.5	45.5	0.91	1.22
Reed plantings	4.8	28.7		
Hardwood tree plantings	19.2	119.7		
Wattles	9.6	47.9	0.91	
Reed fascine	28.7	59.8	1.52	
Coir roll	143.6	239.4	2.44	
Vegetated coir mat	191.5	383.0	2.90	
Live brush mattress (initial)	19.2	196.3	1.22	
Live brush mattress (grown)	186.7	392.6	3.66	
Brush layering (initial/grown)	19.2	299.2	3.66	
Live fascine	59.8	148.4	1.83	2.44
Live willow stakes	100.5	148.4	0.91	3.05
Gabions	478.8		4.27	5.79
Concrete / Armourstone	598.5		5.49	

3.5 Fish Habitat Assessment

Synoptic level fish community and aquatic habitat was initially reported on in the Credit River Erosion and Slope Stabilization Municipal Class EA (Aquafor Beech Limited, 2012) and further developed during additional works downstream of the study area discussed in this report. Additional information was provided in the Credit River Fisheries Management Plan (MNRF and CVC, 2002). Site conditions were confirmed as a part of this study by Aquafor Beech aquatic biology staff. The aquatic components of the sites are described in the following subsections.

3.5.1 Aquatic Habitat

The study site is located within the Lower Credit subwatershed, or "Subwatershed 9: Norval to Port Credit" as defined by the CVC, within the main branch of the Credit River adjacent to Culham Trail and Erindale Park in the City of Mississauga. Subwatershed 9 is currently being studied by the CVC within the general location of the study area in relation to the CVC subwatershed mapping area shown in **Figure 3-22**. Subwatershed 9 is bordered by very little natural heritage cover, with the majority of the land use south of Highway 401 consisting of urban areas. The majority of the upstream reaches are surrounded by residential, industrial and commercial land use. The valley

corridor is variably wide (~ 130 to 600 m) with parkland, recreational trails, and the Credit Valley Golf and Country Club from the 401 to the mouth of Lake Ontario. A busy marina and tourist destination (Port Credit) is located at the mouth of the river.

The Credit River Fisheries Management Plan notes the following for the Lower Credit River Subwatershed, "This area is highly urbanized and urban growth is anticipated to continue relatively rapidly. The area includes the western edge of Brampton, and most of Mississauga. Many of the tributaries in the lower watershed have been channelized or placed in sewers. Below Highway 401, water quality in the main stem of the Credit and its tributaries is generally poor." As noted above, the study area is adjacent to the Culham Trail and Erindale Park, with the main branch bordered entirely by the public access trails and parkland on the right bank, with residential and institutional property beyond the top of bank on the left bank. The upstream and downstream limits are delimited by Highway 403 and Dundas Street, respectively, with Burnhamthorpe Road bisecting the study area. The river valley in the study area was observed from the downstream to the upstream extents. At the time of the field investigations conducted by Aquafor biology staff in 2022, flow was representative of normal summer conditions, allowing for high visibility.

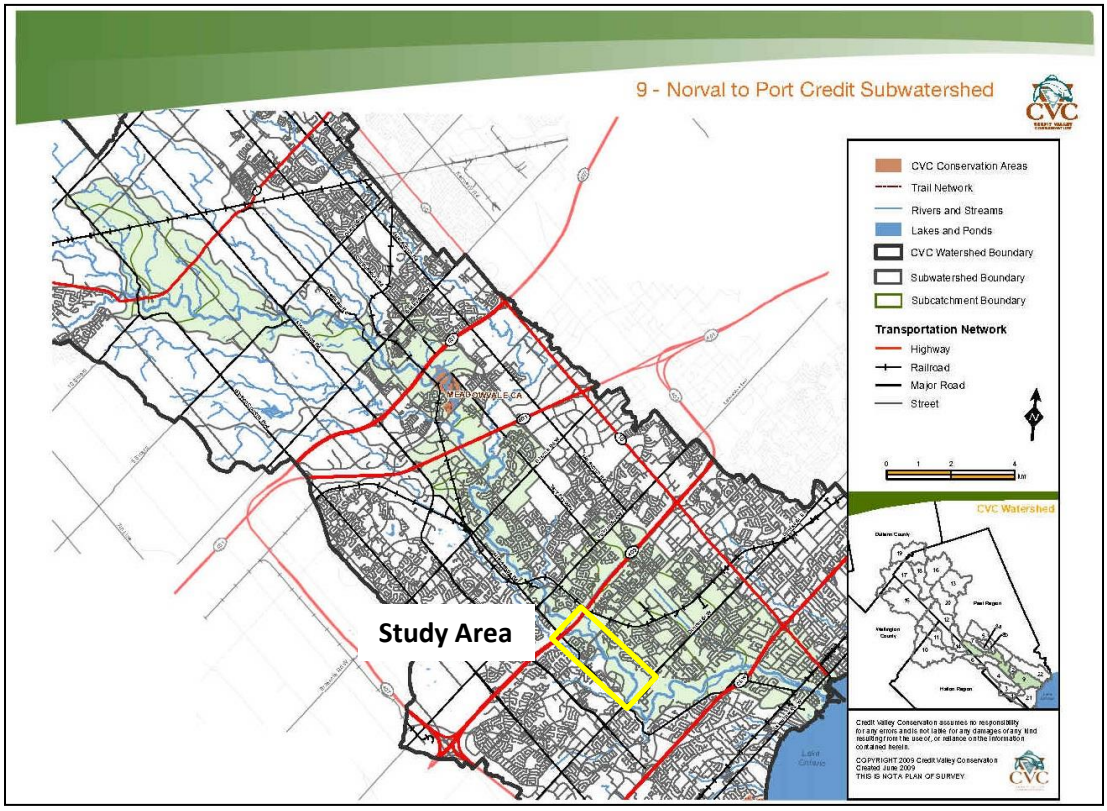

Figure 3-22: CVC Subwatershed 9 Mapping

The study area is large in size and extent, representing a 5th order tributary and the largest watercourse in the watershed, covering a variety of aquatic habitat and fisheries habitat. This reach displayed evenly distributed habitat between shallow pools, riffles and glides, with some deeper runs observed downstream of fast chutes. Few deep pool habitats were observed adjacent to large erosion scars and downstream of select crossovers. Ample instream cover was provided throughout the entire reach by larger cobbles and boulders, as well as failed and failing armourstone and gabion, with areas of aggradation observed below diagonal bars. Consolidated clay stream bed habitat was observed adjacent to largescale erosion scars and where water velocity was high enough to transfer substrate. Past engineering was present throughout, particularly where the trail abutted directly with the watercourse. Very little canopy cover was provided by riparian forests with maintained parkland on the right bank and a wide riverine system. No barriers to fish migration were observed throughout the reach, with the habitat

contributing to occupied fish habitat for a diverse fish community as outlined by the Fisheries Management Plan (MNRF and CVC, 2002) as well as in-situ observations and interview information.

3.5.2 Fish Communities

The Credit River Fisheries Management Plan details that the study area represents fish habitat for a diverse community, supporting predominantly (over 55%) coolwater species with intermediate tolerance to disturbance (MNRF and CVC, 2002). The remaining population is relatively evenly split between cold and warmwater species (20% and 23%, respectively) and species with low and high tolerance to disturbance (27% and 18%, respectively). A full species list is detailed below in **Table 3-7**. While Subwatershed 9 has not been studied in detail yet, in-situ observations, online background information and interviews with anglers support this data. The study area is also a popular angling spot between September and March when migratory salmonids, such as Pacific Salmon, as well as Rainbow and Brown Trout, are in the system to spawn and rear. The Fisheries Management Plan notes ongoing stocking efforts to encourage sport fishing within the system, including that of Atlantic salmon (*Salmo salar*) (MNRF and CVC, 2002). In short, the fish species present within the study site are quite diverse, are predominantly coolwater species, and represent a community with low to intermediate tolerance to disturbance.

Table 3-7: Fish Community Results

COMMON NAME	SCIENTIFIC NAME	Ranking				Tolerance	Thermal Regime	1954A	1999B
		G Rank	S Rank	ESA	SARO				
Lamprey Family	*PETROMYZONTIDAE*								
American brook lamprey	*Lampetra lamottei*	*G4*	*S3*		*SC*	*Intolerant*	*Coldwater*		X
Sea lamprey	*Petromyzon marinus*	*G5*	*SNA*			*Intermediate*	*Coolwater*		X
Herring Family	*CLUPEIDAE*								
Alewife*	*Alosa pseudoharengus*	*G5*	*SNA*			*Intermediate*	*Coldwater*	X	
Salmon and Trout Subfamily	*SALMONIDAE*								
Pink salmon*	*Oncorhunchus gorbuscha*	*G5*	*SNA*			*Intolerant*	*Coldwater*		X
Coho salmon*	*Oncorhynchus kisutch*	*G5*	*SNA*			*Intolerant*	*Coldwater*		X
Chinook salmon*	*Oncorhynchus tshawytscha*	*G5*	*SNA*			*Intolerant*	*Coldwater*		X
Rainbow trout*	*Oncorhynchus mykiss*	*G5*	*SNA*			*Intolerant*	*Coldwater*	X	X
Atlantic salmon	*Salmo salar*	*G5*	*SNA*			*Intolerant*	*Coldwater*		X
Brown trout*	*Salmo trutta*	*G5*	*SNA*			*Intolerant*	*Coldwater*	X	X
Brook trout	*Salvelinus fontinalis*	*G5*	*S5*			*Intolerant*	*Coldwater*	X	X
Lake trout	*Salvelinus namaycush*	*G5*	*S5*			*Intolerant*	*Coldwater*		X
Pike Family	*ESOCIDAE*								
Northern pike	*Esox lucius*	*G5*	*S5*			*Intermediate*	*Coolwater*	X	X
Mudminnow Family	*UMBRIDAE*								
Central mudminnow	*Umbra limi*	*G5*	*S5*			*Tolerant*	*Coolwater*	X	X
Sucker Family	*CATOSTOMIDAE*								
White sucker	*Catostomus commersoni*	*G5*	*S5*			*Tolerant*	*Coolwater*	X	X
Northern hog sucker	*Hypentelium nigricans*	*G5*	*S4*			*Intermediate*	*Warmwater*	X	X
Redhorse	*Moxostoma sp.*							X	
Silver redhorse	*Moxostoma anisurum*	*G5*	*S4*			*Intermediate*	*Coolwater*		X
Minnow Family	*CYPRINIDAE*								
Goldfish*	*Carassius auratus*	*G5*	*SNA*			*Tolerant*	*Warmwater*		X
Northern redbelly dace	*Chrosomus eos*	*G5*	*S5*			*Intermediate*	*Coolwater*	X	X
Finescale dace	*Chrosomus neogaeus*	*G5*	*S5*			*Intermediate*	*Coolwater*	X	X
Redside dace	*Clinostomus elongatus*	*G3G4*	*S1*	*END*	*END*	*Intolerant*	*Coolwater*	X	X
Common carp*	*Cyprinus carpio*	*G5*	*SNA*			*Tolerant*	*Warmwater*		X
Brassy minnow	*Hybognathus hankinsoni*	*G5*	*S5*			*Intermediate*	*Coolwater*		X
Hornyhead chub	*Nocomis biguttatus*	*G5*	*S4*			*Intermediate*	*Coolwater*	X	
River chub	*Nocomis micropogon*	*G5*	*S4*			*Intermediate*	*Coolwater*		X
Golden shiner	*Notemigonus crysoleucas*	*G5*	*S5*			*Intermediate*	*Coolwater*		X
Emerald shiner	*Notropis atherinoides*	*G5*	*S5*		*THR*	*Intermediate*	*Coolwater*		X
Common shiner	*Luxilus cornutus*	*G5*	*S5*			*Intermediate*	*Coolwater*	X	X
Blacknose shiner	*Notropis heterolepis*	*G5*	*S5*			*Intolerant*	*Coolwater*	X	
Spottail shiner	*Notropis hudsonius*	*G5*	*S5*			*Intermediate*	*Coolwater*		X
Rosyface shiner	*Notropis rubellus*	*G5*	*S4*			*Intermediate*	*Warmwater*	X	X

COMMON NAME	SCIENTIFIC NAME	Ranking				Tolerance	Thermal Regime	1954A	1999B
		G Rank	S Rank	ESA	SARO				
Spotfin shiner	*Cyprinella spilopterus*	*G5*	*S4*			*Intermediate*	*Warmwater*		X
Mimic shiner	*Notropis volucellus*	*G5*	*S5*			*Intermediate*	*Warmwater*	X	
Bluntnose minnow	*Pimephales notatus*	*G5*	*S5*			*Intermediate*	*Warmwater*	X	X
Fathead minnow	*Pimephales promelas*	*G5*	*S5*			*Tolerant*	*Warmwater*	X	X
Eastern Blacknose dace	*Rhinichthys atratulus*	*G5*	*S5*			*Intermediate*	*Coolwater*	X	X
Longnose dace	*Rhinichthys cataractae*	*G5*	*S5*			*Intermediate*	*Coolwater*	X	X
Creek chub	*Semotilus atromaculatus*	*G5*	*S5*			*Intermediate*	*Coolwater*	X	X
Pearl dace	*Semotilus margarita*	*G5*	*S5*			*Intermediate*	*Coolwater*		X
Catfish Family	*ICTALURIDAE*								
Brown bullhead	*Ameiurus nebulosus*	*G5*	*S5*			*Intermediate*	*Warmwater*	X	X
Stonecat	*Noturus flavus*	*G5*	*S4*			*Tolerant*	*Warmwater*		X
Killifish Family	*CYPRINODONTIDAE*								
Banded killifish	*Fundulus diaphanus*	*G5*	*S4*			*Tolerant*	*Coolwater*	X	
Stickleback Family	*GASTEROSTEIDAE*								
Brook stickleback	*Culaea inconstans*	*G5*	*S5*			*Intermediate*	*Coolwater*	X	X
Sunfish Family	*CENTRARCHIDAE*								
Rock bass	*Ambloplites rupestris*	*G5*	*S5*			*Intermediate*	*Coolwater*	X	X
Pumpkinseed	*Lepomis gibbosus*	*G5*	*S5*			*Intermediate*	*Warmwater*	X	X
Smallmouth bass	*Micropterus dolomieui*	*G5*	*S5*			*Intermediate*	*Coolwater*	X	X
Largemouth bass	*Micropterus salmoides*	*G5*	*S5*			*Tolerant*	*Warmwater*	X	X
Black crappie*	*Pomoxis nigromaculatus*	*G5*	*S4*			*Tolerant*	*Coolwater*		X
Perch Family	*PERCIDAE*								
Yellow perch	*Perca flavescens*	*G5*	*S5*			*Intermediate*	*Coolwater*		X
Rainbow darter	*Etheostoma caeruleum*	*G5*	*S4*			*Intolerant*	*Coolwater*	X	X
Iowa darter	*Etheostoma exile*	*G5*	*S5*			*Intermediate*	*Coolwater*	X	X
Fantail darter	*Etheostoma flabellare*	*G5*	*S4*			*Intolerant*	*Coolwater*	X	X
Johnny darter	*Etheostoma nigrum*	*G5*	*S5*			*Tolerant*	*Coolwater*	X	X
Logperch	*Percina caprodes*	*G5*	*S5*			*Intolerant*	*Warmwater*	X	
Walleye	*Sander vitreus*	*G5*	*S5*			*Intermediate*	*Coolwater*		X
Sculpin Family	*COTTIDAE*								
Mottled sculpin	*Cottus bairdi*	*G5*	*S5*			*Intermediate*	*Coolwater*	X	X
Slimy sculpin	*Cottus cognatus*	*G5*	*S5*			*Intolerant*	*Coldwater*	X	

*Indicates species not native to the Credit River watershed.

(A Department of Planning and Development 1956, B MNRF unpublished data, CVC unpublished data)

The Credit River Fisheries Management Plan (MNRF and CVC, 2002) notes that fish habitat is impacted throughout the watershed, and particularly within the lower watershed where the study area is located, due to a number of factors. It states that impacts from ongoing development, such as an increase in sedimentation leading to degraded spawning habitat and direct impacts to fish health, channelization of headwater features and contributing tributaries, increasing stormwater runoff, multiple sewage plants and gravel pits, and online ponds and fish barriers all contribute to a negatively impacted fish community (MNRF and CVC, 2002).

3.5.3 In-Water Work Timing Window Guideline

Based on the observations discussed above and on recommendations made by the MNRF In-water Work Timing Window Guidelines (MNRF, 2013) for Ontario's Southern Region, no in-water works should take place between March 15th and July 15th, as well as October 1st and May 31st of any given year. This restriction is aimed to protect the species observed in Table 3-7 during their vulnerable life stages of spawning and rearing and should be implemented to avoid contravention to the Federal *Fisheries Act*, among other mitigation measures.

3.5.4 Department of Fisheries and Oceans (DFO) Self-Assessment

The federal Fisheries Act requires that projects avoid causing the death of fish and the harmful alteration, disruption, or destruction of fish habitat unless authorized by the Minister of Fisheries and Oceans Canada (DFO). This applies to work being conducted in or near waterbodies that support fish at any time during any given year or are connected to waterbodies that support fish at any time during any given year. As noted above, the main

branch of the Credit River does contain fish at any time during any given year. Therefore, the Fisheries Act applies to works conducted in or near water at the study areas.

Upon completion of the detailed design for the channel works at the study site, the works should be cross-referenced with the DFO "Projects Near Water" online service to determine if a request for regulatory review under the federal Fisheries Act is required (Fisheries and Oceans Canada, 2022). Based on field investigations conducted by Aquafor staff and background information provided by the CVC, the study area does contain fish at any time during any given year. It is therefore the opinion of Aquafor that a request for regulatory review by Fisheries and Oceans Canada will be required. It is recommended that the proponent exercise the measures listed by Fisheries and Oceans Canada to avoid contravention with the Federal Fisheries Act and exercise due diligence by further mitigating accidental death of fish and the harmful alteration, disruption, or destruction of fish habitat.

3.5.5 Ontario Public Lands Act

As the Credit River is considered a navigable waterway, and works are likely to be undertaken along the shore of this waterway (i.e., "shore lands"), the work is subject to a work permit under the Ontario *Public Lands Act*. The Act notes that the following works are subject to work permits under the Act, which fit the description of the anticipated works on the Credit River: construct a trail, water crossing or road on public land; dredge shore lands; fill shore lands; remove invasive aquatic vegetation or native aquatic vegetation by mechanical means or by hand from shore lands; construct or place a structure or combination of structures that is in physical contact with more than 15 square metres of shore lands. As such, upon completion of the detailed design for the works, all proposed works regulated by the Act should be submitted to the MNRF for review and permitting.

3.6 Terrestrial Resources Assessment

3.6.1 Overview

The Credit River corridor through the study area includes portions of sites CRR6 and CRR10 in the Mississauga Natural Areas Survey (NAS; 2018, 2021 Natural Areas Update). The NAS further notes that this section of the Credit River valley is "highly significant" due to various factors including the presence of the regionally-significant Credit River at Erindale Life Science Area of Natural and Scientific Interest (ANSI), the presence of flora and fauna species considered at-risk or significant, a high diversity and quality of plant species and vegetation communities, and its large size and proximity to other natural areas. The City's Official Plan (Schedule 3: Natural System) shows the study area under the "Significant Natural Areas and Natural Green Spaces" designation.

3.6.2 Vegetation Communities and Flora

The 2021 Natural Areas Update of the Mississauga NAS indicates that the Credit River corridor through the study area includes a combination of open and manicured areas (parkland) and forest habitats dominated by Sugar Maple (*Acer saccharum*) with variously dominant associates oak (*Quercus* sp.), ash (*Fraxinus* sp.), and Eastern Hemlock (*Tsuga canadensis*) in the uplands and willows (*Salix* sp.) and/or ash in the lowlands. Aquafor's preliminary observations in the study area in September 2022 confirmed these community types, noting a variety of upland and lowland communities of various ages and canopy closures Consistent with the Mississauga NAS, Sugar Maple/Oak forests were often observed on upland slopes, while lowland woodlands, thickets and open areas were more common along the banks of the watercourse, often containing Poplars (*Populus* sp.), Willows, and disturbance tolerant meadow species. At least one large marsh feature was observed along the associated trail system containing Cattail (*Typha* spp.) and various wetland graminoids.

3.6.3 Terrestrial Wildlife

Aquafor's preliminary observations from the study area in September 2022 included 22 bird species, predominantly those common and widespread in southern Ontario urban parklands and watercourse corridors, such as Blue Jay (*Cyanocitta cristata*), Black-capped Chickadee (*Poecile atricapillus*), Downy Woodpecker (*Dryobates pubescens*), American Robin (*Turdus migratorius*), Mallard (*Anas platyrhynchos*), American Goldfinch (*Spinus tristis*), and House Sparrow (*Passer domesticus*). One species of interest was noted: a single Rusty Blackbird (*Euphagus carolinus*), designated Special Concern, was observed in proximity to the riparian

wetland in the northern part of the study area. Considering that the observation was made during the migratory period, and that this species generally does not nest in southern Ontario, this location is considered to provide potential migratory stopover habitat only.

Additional background information resources for the area include numerous observation checklists and data associated with five birding "hotspots" on the eBird.org community science website and database. These locations collectively list nearly 200 bird species from thousands of user-submitted checklists covering various reaches of the watercourse corridor in the study area, including not only breeding species but migrants and winter residents. The iNaturalist.org community science website and database also contains numerous "research grade" confirmed occurrence records of a wide variety of insects, birds, mammals, reptiles, and amphibians. Overall, the Credit River corridor through the study area has been noted as a significant habitat area providing important ecological features and functions for wildlife, and the available information supports the conclusion that a wide variety of wildlife taxa utilize the area for critical life processes.

3.7 Species at Risk Screening

For the purposes of this study, Species at Risk (SAR) are defined as species listed as Endangered (END), Threatened (THR), or Special Concern (SC) under the Ontario *Endangered Species Act* (ESA) and/or the federal *Species at Risk Act* (SARA). A list of potential SAR associations with the study area was compiled from background information including: species information provided by the CVC; the Ontario Natural Heritage Information Center (NHIC) online species occurrence database; community science websites iNaturalist and eBird; provincial species atlases; and DFO's online SAR mapping. A request for information was submitted to the Ontario Ministry of the Environment, Conservation, and Parks (MECP) to confirm and supplement those sources. The resulting list of species was screened by comparing the habitat requirements of each species to the habitat that is present in the study area, and any species with no habitat potential in the area were screened out of further discussion. Species which were determined to be present or potentially present in the study area, and therefore require some additional review or assessment as the project progresses, are listed below.

- Butternut (*Juglans cinerea*) – END: this tree is most commonly found in open valley lands and riparian corridors, and could feasibly be present in the study area. A detailed tree inventory is expected to be required during detailed design to confirm the presence/absence of this species and determine any impacts.

- Eastern Wood-Pewee (*Contopus virens*) and Wood Thrush (*Hylocichla mustelina*) – SC: These two birds nest in mature deciduous and mixed woodland habitat and could potentially find suitable habitat features in the study area. Protections for these and other migratory birds must be provided during the nesting season (e.g., timing restrictions on vegetation removals) and breeding bird surveys are recommended during the nesting season to confirm the species assemblage associated with the project area(s).

- Eastern Small-footed Myotis (*Myotis leibii*), Little Brown Myotis (*M. lucifugus*), Northern Myotis (*M. septentrionalis*), and Tri-colored Bat (*Perimyotis subflavus*) – END: Ontario's four SAR bats are frequently associated with forested areas and riparian corridors. If features providing potential roost habitat (e.g., standing dead trees with cavities or sloughing bark; large mature trees, particularly maples or oaks, and particularly where there are dead or dying clusters of leaves or branches; rock piles or rock fissures) will be removed or impacted as part of the proposed works, then additional review will be required, potentially including snag tree density surveys and/or acoustic monitoring.

- Turtles: Records of multiple species of SAR turtles exist for the study area, and the Credit River (and associated riparian wetlands, where present) are expected to provide suitable habitat. Turtle nesting habitat and migration has been specifically noted as a potential issue in association with sections of the study area where trail washouts occur. Protection measures for turtles should be provided in the vicinity of potential habitat areas during the active season (i.e., nesting and migratory areas) and overwintering period (i.e., pools) as appropriate.

- Rapids Clubtail (*Phanogomphus quadricolor*) - END: The Credit River is one of only four rivers in Ontario known to support this dragonfly species, and suitable habitat conditions could be present in the study area. Aquatic larvae occupy quiet, muddy pools in medium to large rivers, while adults perch and hunt in the adjacent forest and along the shoreline. The flight period of this species is generally restricted to the month of June. The project area(s) are recommended to undergo additional review for suitable habitat for this species (particularly any potential larval habitats that will be directly impacted by the proposed works).

The species noted above are those considered to have the highest possibility of impacts based on the preliminary understanding of the site conditions and proposed works. Other species were screened out at this preliminary level based on a lack of suitable habitat features in the area(s) that could be impacted by the proposed works. The SAR screening and assessment process should, however, continue through the detailed design and implementation phases of the project to confirm presence/absence of species or habitats and impacts thereto, as appropriate, based on the preferred solution.

3.8 Archaeological Assessment

A Stage 1 archaeological assessment was carried out by Archaeological Services Inc. (ASI) in 2022 and 2023. The assessment included review of background documentation and field investigations to determine if the project exhibits archaeological potential and therefore, whether a Stage 2 assessment will be required.

The Stage 1 background study determined 18 previously registered archaeological sites are located within one kilometre of the Study Area, three of which are within 50 metres of the broader study area. However, the identified previously registered archaeological sites will not be impacted by the proposed project works as they are not within 50 metres of the proposed area of disturbance associated with the conceptual designs.

The property inspection determined that parts of the Study Area exhibit archaeological potential and will require Stage 2 archaeological assessment by test pit survey at five-meter intervals, prior to any proposed impacts to the property, to be undertaken at the detailed design stage. Depending on the findings of the Stage 2 assessment, a Stage 3 and possibly Stage 4 assessments may be triggered for further investigations.

A summary of the baseline assessment results is shown in **Figure 3-23** to **Figure 3-26**. The full report is included in **Appendix B**.

Figure 3-23: Results of Stage 1 Archaeological Assessment (1/4) (ASI, 2023)

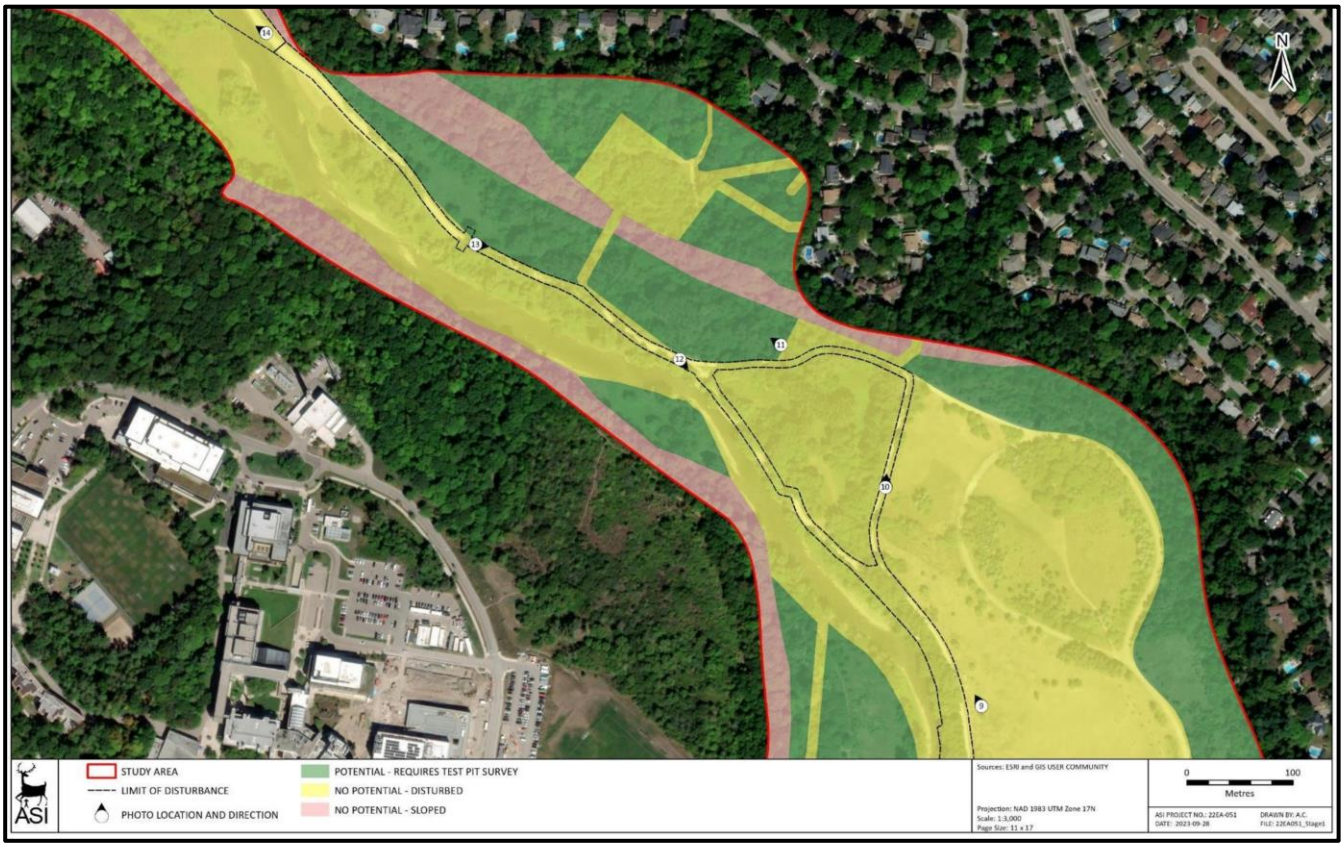

Figure 3-24: Results of Stage 1 Archaeological Assessment (2/4) (ASI, 2023)

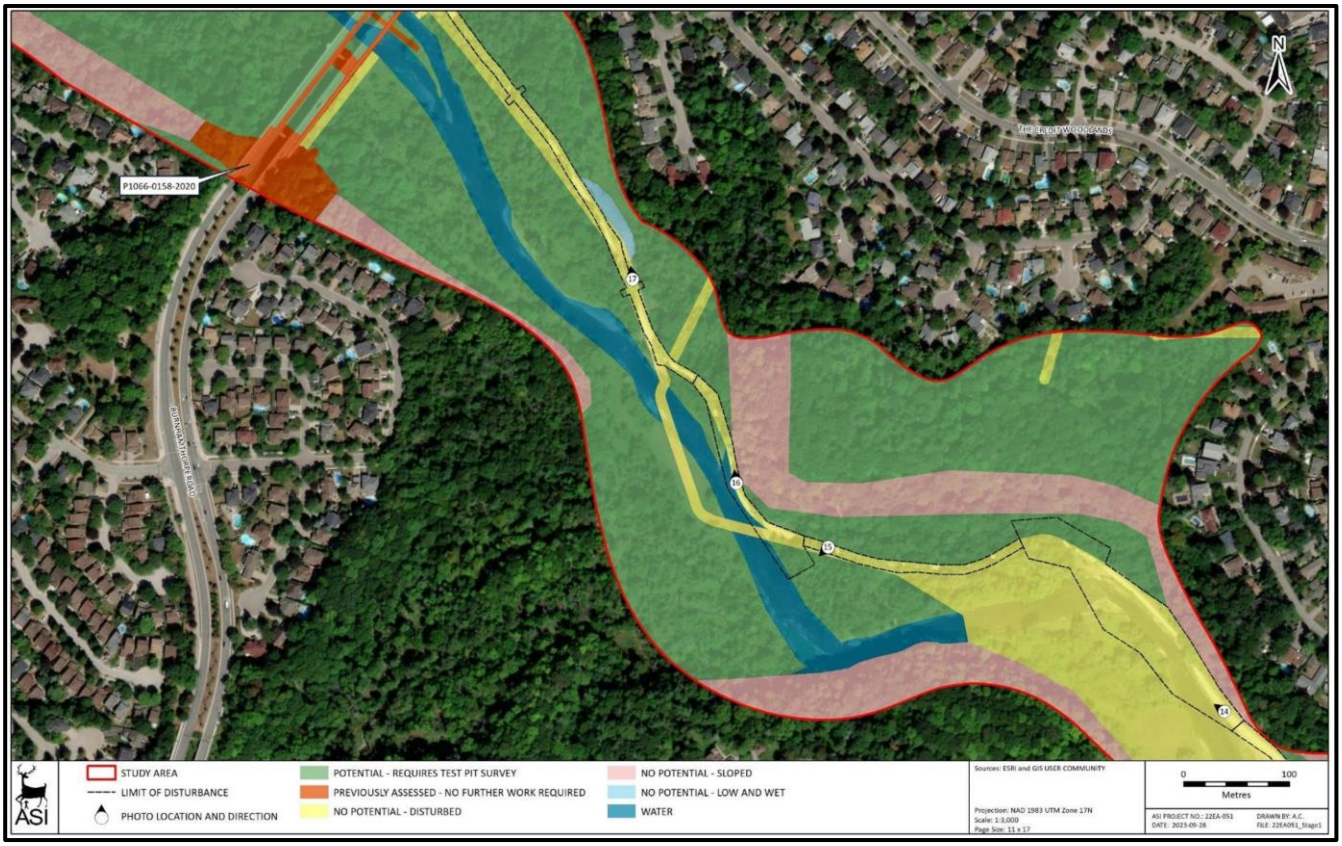

Figure 3-25: Results of Stage 1 Archaeological Assessment (3/4) (ASI, 2023)

Figure 3-26: Results of Stage 1 Archaeological Assessment (4/4) (ASI, 2023)

3.9 Land Ownership

The Credit River within the study area primarily flows through public parklands, including Erindale Park. The Riverwood Conservancy operates within the upstream part of the study area, between Burnhamthorpe road and Highway 403. The Riverwood property is co-owned by the City of Mississauga and the CVC. The Ontario Ministry of Transportation (MTO) owns a small parcel just below Highway 403, behind Bridewell Court. The study area is also located immediately adjacent to the University of Toronto Mississauga Campus.

For the Ice Control Structure, the CVC is responsible for maintenance, repair and improvements.

3.10 Built Heritage and Cultural Heritage Landscape Assessment

A Cultural Heritage Report was carried out by ASI in 2023. The purpose of the report is to describe the existing conditions of the study area and present an inventory of known and potential built heritage resources (B.H.R.s) and cultural heritage landscapes (C.H.L.s). The draft submission includes the Existing Conditions component of the assessment and is currently being updated to include a preliminary impact assessment based on the preliminary conceptual designs.

The results of background historical research and a review of secondary source material, including historical mapping, indicate a study area with a rural land use history dating back to the early nineteenth century. A review of federal, provincial, and municipal registers, inventories, and databases revealed that there are 65 known B.H.R.s, one potential B.H.R. and four known C.H.L.s in the Credit River Erosion Control study area.

Based on the results of the assessment, the following recommendations have been developed:

1. Construction activities and staging should be suitably planned and undertaken to avoid unintended negative impacts to identified B.H.R.s and C.H.L.s. Avoidance measures may include, but are not limited

to: erecting temporary fencing, establishing buffer zones, issuing instructions to construction crews to avoid identified features, etc.

2. Based on the preliminary preferred alternative concepts, this report is being updated with a confirmation of impacts of the undertaking on the B.H.R.s and C.H.L.s identified within the study area and will recommend appropriate mitigation measures. Mitigation measures may include, but are not limited to, completing a property-specific heritage impact assessment or documentation report, or employing suitable measures such as landscaping, buffering or other forms of mitigation, where appropriate. In this regard, provincial guidelines should be consulted for advice and further heritage assessment work should be undertaken as necessary.
3. Should future work require an expansion of the study area then a qualified heritage consultant should be contacted in order to confirm the impacts of the proposed work on potential B.H.R.s and C.H.L.s.

Once the report is updated with the preliminary impact assessment of the preferred alternative, the report will be submitted to the Ministry of Citizenship and Multiculturalism for review and comment, and to any other local heritage stakeholders that may have an interest in this project.

A copy of the Cultural Heritage Report is included as **Appendix C**.

3.11 Trail Usage Data

The City of Mississauga maintains a series of pedestrian counters along the Culham Trail in Erindale and Riverwood parks. Trail counter locations are illustrated in **Figure 3-27**, below. Data from trail counters 13, 126, and 127 (red) and 125, 128, and 132 (yellow) was provided by the City's Capital Asset Inventory group to inform the development and evaluation of alternatives for any trail-related project sites.

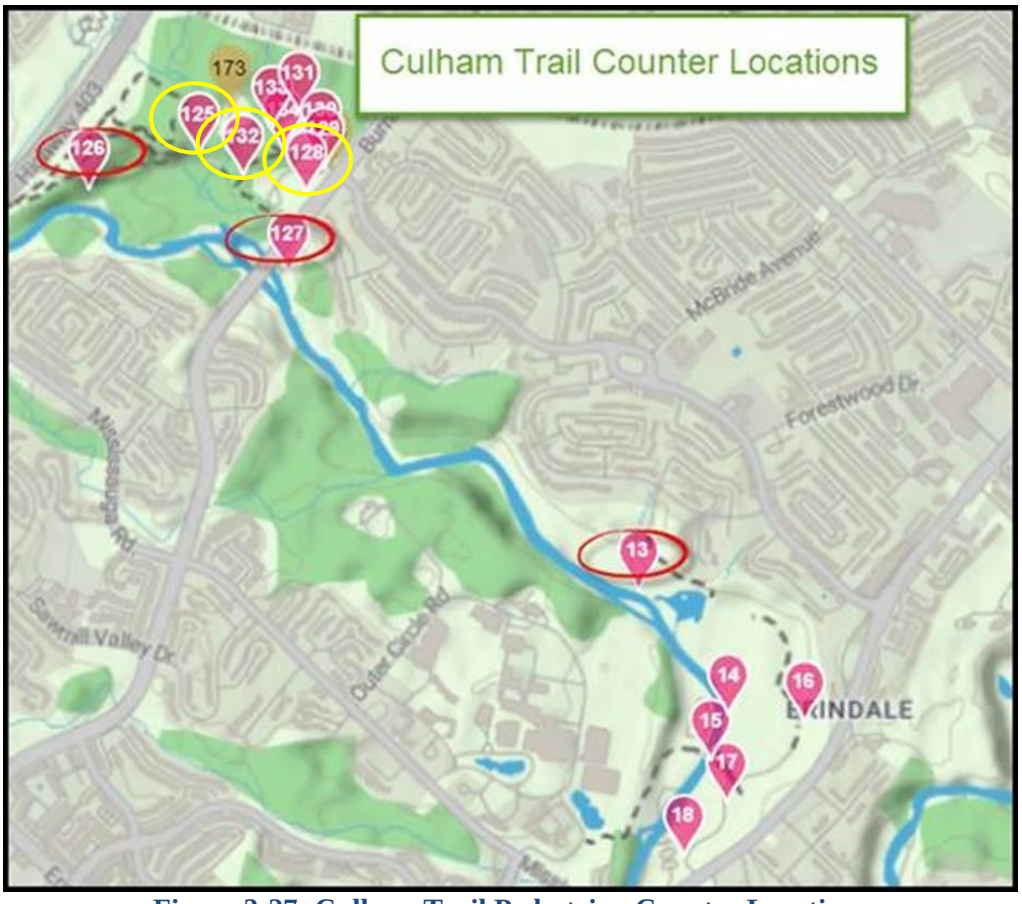

Figure 3-27: Culham Trail Pedestrian Counter Locations

The following statistics were made available for trail counters 13, 126, and 127:

- Annual visits observed 2021: 780,000 (3 sites)
- Annual visits observed 2022: 740,000 (3 sites)
- Average annual visits observed: 716,000 (3 sites)
- Busiest site: Riverwood South (Counter 127) with an average of 350,000 visits observed
- Busiest day in 2021: May 24th (Victoria Day) with 8,800 visits observed (3 sites)
- Busiest day in 2022: October 10th (Thanksgiving Day) with 6,200 visits observed (3 sites)
- Busiest time of year: May with peaks in March, June, July and August

Average annual trail count data was made available for trail counters 125, 128, and 132:

- 125 Riverwood Boardwalk – Average annual visits observed: 212,000
- 128 Riverwood Fisherman – Average annual visits observed: 437,000
- 132 Riverwood Pine Trail – Average annual visits observed: 317,000

The trail count data provides a quantitative understanding of the popularity of the trail system within these parks and the high volume of daily and annual users. Trail usage will be considered in the development and evaluation of alternatives both in terms of safety risks to users imparted by trail washouts, flooding, and ice floes, as well as social and cultural benefits of the valuable source of connection to the river and natural environment.

4 PHASE 2: DEVELOPMENT OF ALTERNATIVE SOLUTIONS

Three to five alternatives were developed for each of the eight study sites. Of the alternatives at each site, the first is the "do nothing" approach, and the remaining alternatives include a variety of restoration strategies. Conceptual design drawings for all alternatives can be found in **Appendix D**.

4.1 Site 1 – Ice Control Structure

4.1.1 Alternative 1 – Do Nothing

Taking no action at this site would allow for continued erosion of the channel on the left side (looking upstream) of the ice control structure. Ice flows could continue to bypass the structure and damage the properties downstream, including the Credit Vally and Mississauga Golf and Country Clubs. As the channel bypassing the structure continues to erode and widen, more ice will circumvent the structure.

Trees in the overbank ice storage area would continue to grow, further reducing the ability of ice to effectively enter the storage area, and lessening the overall storage capacity.

4.1.2 Alternative 2 – Restore to As-Built Condition

Restoration to the as-built conditions would include the following works:

- Restore or reset armourstone in the floodplain to original grade and alignment.
- Installation of armourstone wall at original bank location.
- Regrading of area behind wall with riprap.
- Raising/rehabilitating sanitary manhole near the structure.
- Removal of trees planted in the floodplain ice storage area.

4.1.3 Alternative 3 – Retain By-Pass Channel

Alternative 3 retains part of the bypass channel that has outflanked the ice control structure to maintain some of the increased channel conveyance capacity. This is intended to allow some flow bypass when the structure is jammed with ice or debris, while still reducing ice flow around the structure. Retaining the by-pass channel would include the following works:

- Restore or reset armourstone in the floodplain to original grade and alignment.
- Installation of armourstone wall at new bank location with armourstone vanes into the floodplain.
- Addition of riprap revetment in floodplain behind armourstone wall.
- Raising/rehabilitating sanitary manhole near the structure.
- Removal of trees planted in the floodplain ice storage area.

4.2 Site 2 – Erindale Park Bank Restoration

4.2.1 Alternative 1 - Do Nothing

Currently, armourstone bank protection and rock vanes have failed and erosion impacts to the trail are evident. Without taking action, the condition of these structures will continue to deteriorate, accelerating bank and trail erosion and increasing pedestrian and cyclist safety risks.

4.2.2 Alternative 2 – Replace Deteriorated Armourstone Wall

Alternative 2 includes the following works:

- Remove and replace deteriorated armourstone wall.
- Install new trail raised to 5-year flood elevation with pedestrian safety barrier installed, per CVC guidelines.

- Replace failing rock vanes with bendway armourstone weirs.

4.2.3 Alternative 3 – Replace with Revetment and Buttress

Replacement of the current vertical armourstone bank protection with a sloped revetment includes:

- Remove deteriorated armourstone wall.
- Salvage armourstone for construction of stone revetment along river bank extending beyond the 5-year flood elevation to reduce the frequency of overbank flooding.
- Decommission existing natural surface trail at top of bank and regrade area to include naturalized buffer.
- Redirect pedestrian traffic to adjacent trail at top of slope to reduce safety risks due to flooding and ice floes.
- Incorporate lookouts and fishing / resting areas to maintain views and recreational uses of river.
- Bendway armourstone weirs redirect flows to reduce bank erosion and enhance aquatic habitat.

4.3 Site 3 – Credit Heights Bank Protection

4.3.1 Alternative 1 – Do Nothing

At Site 3, the trail is aligned parallel to an eroding outer riverbend. Gabion basket treatments lining the outer bank are deteriorating and have fallen into the river in some locations. Bank erosion behind the failed baskets threatens the trail. Should the site be left as-is, the bank will continue to erode towards and into the trail, increasing public safety risks.

4.3.2 Alternative 2 – Replace Gabion Baskets with Armourstone Retaining Wall

Alternative 2 proposes:

- Realign trail beyond 5-year floodplain. 3m wide natural surface trail with pedestrian safety barrier to be installed.
- Replace failed gabion baskets with armourstone retaining wall, tied into existing armourstone downstream.

4.3.3 Alternative 3 – Replace Gabion Baskets with Vegetated Butress

Replacement of the gabion baskets with a vegetated buttress entails:

- Remove failed gabion baskets.
- Construct vegetated buttress along outer bank of river to mitigate erosion and protect trail.
- Realign trail beyond 5-year floodplain to reduce frequency of flooding and wash-out.
- Potential regrading of inner bank to maintain channel width and conveyance capacity.
- Vegetated buttress provides habitat enhancement opportunities with native plantings along the bank.

4.4 Site 4 – Ashington Court Retaining Wall

4.4.1 Alternative 1 – Do Nothing

Site 4 is located at a trail pinchpoint where the trail is bordered by an armourstone retaining wall controlling the valley slope on one side, and an armourstone retaining wall along the bank of the Credit River on the other side. The wall along the bank is in a deteriorating condition, with some blocks having fallen into the river. This presents a safety risk to trail users and makes the wall more vulnerable to widespread failure. If the site is not addressed, the wall will continue to deteriorate, which could eventually necessitate closure of the trail in this location.

4.4.2 Alternative 2 – Replace Armourstone Wall

Replacing the wall will include:

- Retain existing armourstone wall protecting slope behind trail

- Replace armourstone wall providing bank protection between the river and trail
- Wall replacement will include redesign to improve long-term stability and increase elevation to reduce frequency of flooding
- Install a safety barrier along the top of the armourstone bank protection to improve public safety

4.4.3 Alternative 3 – Cantilevered Trail

Alternative 3 removes contact between the trail and the ground surface by raising the trail via cantilevered platform. This work includes:

- Remove asphalt trail and replace with 75m long, 3.6m wide cantilevered pedestrian bridge.
- Replace failed armourstone bank protection with vegetated buttress.

4.5 Site 5 – Summit Court Slope

4.5.1 Alternative 1 – Do Nothing

The valley wall behind Summit Court is actively eroding at a river contact point. Residential properties are located along the top of the slope, with the back extents of some properties extending onto the slope. If the site is not addressed, risks to the adjacent private properties will continue, including risks to fencelines and trees.

4.5.2 Alternative 2 – Vegetated Butress and Channel Realignment

Alternative 2 involves the following works:

- Recess north bank and protect with vegetated buttress.
- Protect toe of slope with vegetated buttress up to the regional flood elevation.

4.5.3 Alternative 3 – Armourstone Retaining/Gravity Wall

Alternative 3 involves the following works:

- Construct armourstone retaining wall along the toe of the slope up to the 100-year flood elevation.
- Construct vegetated buttress above armourstone wall up to at least the Regional flood elevation.
- Gravity wall has smaller area of disturbance than vegetated buttress, but still incorporates native plantings along the top of the structure.
- Armourstone retaining wall provides long term stability protecting against toe erosion.
- The design has been used successfully on neighbouring reaches of the Credit River.

4.6 Sites 6, 7 and 8 – Trails

The trail restoration works have been divided into three sections in order to address unique constraints and opportunities located throughout the study area. The same set of alternatives has been applied to each trail site, as described below.

4.6.1 Alternative 1 – Do Nothing

The trails in their current state present usability and accessibility issues due to heavy washout, gullies, exposed stone, and frequent flooding. The regular loss of gravel into the surrounding natural area is damaging to the ecosystem and requires regular and costly maintenance.

4.6.2 Alternative 2 – Raised Gravel Trail

Raised gravel trails involve:

- Installing 3m granular trail above the 5-year flood elevation along existing alignments.
- Stone lined swale on both sides of trail with 200mm drainage pipes under the trails.
- Regrading side of raised trails, stabilization with coir matting, and Terraseeding/plantings.

4.6.3 Alternative 3 – Boardwalk

A raised boardwalk trail would include:

- Installation of helical piles to support structure.
- Construction of 3-4m wide steel deck boardwalk above the 5-year flood elevation.
- Safety railing required where drop is greater than 0.5m.
- Optional secondary 3m wide natural surface trail at grade.

4.6.4 Alternative 4 – Trail Realignment

The trail realignment alternative proposed decommissioning of the trail along the water's edge and regrading the ground to its natural elevation in sections where there are parallel trail routes. The remaining trail section, located further from the river, will be restored with gravel where required. Where moving the trail is not feasible, sections of raised gravel trail can be installed.

4.6.5 Alternative 5 – Hybrid Trail Option (Site 8 Only)

A fifth alternative was developed for Site 8 to address feedback received during the public consultation process, and includes a hybrid of design elements from Alternatives 2 and 4. The Hybrid Trail Option involves:

- Regrade the secondary lower trail above the 5-year flood elevation along the existing alignment
- Stone lined swale on both sides of lower trail with concrete box cross culverts under the trail.
- Improvements to the primary upper trail through Riverwood including formalization of the natural surface trail with limestone screenings and safety barriers where warranted, as well as short sections of boardwalk to connect existing trail structures.
- Construct vegetated buttresses along the outer bend to mitigate erosion and bank overtopping during low magnitude flood events.

4.7 Preliminary Cost Estimates

Preliminary cost estimates for each alternative described above are provided in **Table 4-1**. Estimates include 30% contingency, and exclude HST. The provided estimates are based upon 2023 rates.

Table 4-1: Preliminary Costing of Alternatives

Erosion Site	Alternative Description	Estimated Capital Costs
Site 1 – Ice Control Structure	1 - Do Nothing	$0
	2 - Restore to As-Built	$2,100,000
	3 - Retain Bypass Channel	$2,200,000
Site 2 – Erindale Park Bank Restoration	1 - Do Nothing	$0
	2 - Replace Armourstone Wall	$3,300,000
	3 - Revetment and Buttress	$3,400,000
Site 3 – Credit Heights Bank Restoration	1 - Do Nothing	$0
	2 - Armourstone Wall	$2,100,000
	3 - Vegetated Buttress	$2,200,000
Site 4 – Ashington Court Retaining Wall	1 - Do Nothing	$0
	2 - Replace Armourstone Wall	$1,200,000
	3 - Cantilevered Trail	$2,800,000
Site 5 – Summit Court Slope	1 - Do Nothing	$0
	2 - Vegetated Butress and Channel Realignment	$1,200,000
	3 - Gravity Wall	$1,500,000
Site 6 – Downstream Trails	1 - Do Nothing	$0
	2 - Raised Gravel Trail	$610,000
	3 - Boardwalk	$9,500,000

Erosion Site	Alternative Description	Estimated Capital Costs
	4 - Realign Trail	$530,000
Site 7 – Mid Trails	1 - Do Nothing	$0
	2 - Raised Gravel Trail	$600,000
	3 - Boardwalk	$5,800,000
	4 - Realign Trail	$460,000
Site 8 – Upstream Trails	1 - Do Nothing	$0
	2 - Raised Gravel Trail	$820,000
	3 - Boardwalk	$13,000,000
	4 - Realign Trail	$1,400,000
	5 – Hybrid Trail Option	$2,500,000

5 EVALUATION OF ALTERNATIVES

5.1 Alternative Evaluation Criteria

As part of the Municipal Class Environmental Assessment process, each alternative must be evaluated based on a set of environmental and engineering criteria, including physical, ecological, social, economic, and technical factors. A set of criteria was developed by Aquafor Beech Limited based upon characteristics specific to the Credit River study area. The evaluation criteria for the Credit River study area are described in **Table 5-1** with further details provided in **Appendix E**.

Table 5-1: Alternative Evaluation Criteria

Evaluation Criteria	Description
Physical and Natural Criteria	
Erosion	Rate of erosion, slope failures, and loss of tablelands. Greater effectiveness to address erosion risks to public and/or private lands for longer time scores higher
Water Quality	Impact on water quality. Greater potential to improve water quality scores higher.
Aquatic Habitat	Impact on contributing aquatic habitat and linkage. Greater potential to enhance or maintain existing aquatic habitat scores higher
Terrestrial Habitat	Impact on connectivity, diversity, and quantity / quality of habitat. Greater potential to enhance or maintain existing terrestrial habitat scores higher
Terrestrial Vegetation	Impact on existing riparian vegetation and mature trees. Greater potential to avoid environmental disruption and habitat disturbance scores higher.
Social and Cultural Criteria	
Public Safety	Impact on public safety. Greater protection of public health and safety for a longer time scores higher
Landowner Impacts	Impact on adjacent private properties and public parkland. Larger spatial or temporal disruptions to landuse score lower.
Benefit to Community	Access to trails, enjoyment of surrounding lands. Reduction in usability of park amenities scores lower.
Aesthetic Value	Impact on existing and proposed aesthetic value. Greater potential to improve aesthetic value scores higher.
Archaeology and Cultural Heritage	Impact on lands that have archaeological or heritage resources. Greater potential to avoid impacting lands with resources scores higher.
Economic Criteria	
Capital Construction Costs	One time cost to City. Lower construction cost relative to other alternatives scores higher
Operation and Maintenance Costs	Requirement for regular, irregular or no maintenance activities to ensure effectiveness of implemented measures. Lower operations and maintenance costs relative to other alternatives scores higher.
Technical and Engineering Criteria	
Impact on Existing Infrastructure	Protection or potential failure of infrastructure (e.g., bridges, trails, storm outfalls). Greater effectiveness of protecting infrastructure scores higher.
Constructability	Easiness to access, move equipment, and construct. Greater constructability scores higher.

Evaluation Criteria	Description
Lifespan of Works	Expected lifespan / years of works before intervention needs to be repeated. Longer lifespan scores higher.

5.2 Evaluation of Alternatives

Using the criteria described in the previous section, each of the erosion mitigation alternatives was evaluated using a scoring system from 0 to 4, where:

- 0 = Unfavourable, no improvement or negative impact;
- 2 = Acceptable; and,
- 4 = Favourable, most improvement or most positive impact.

The evaluation was completed with input from Aquafor technical staff, as well as representatives of the City of Mississauga by assigning a preliminary ranking score to each alternative. The ranking scores were then normalized to provide equal weighting for each category of evaluation criteria, with a maximum score of 2.5 per category, and a maximum score of 10.

A total score was determined for each alternative at each site and the alternative with the highest total score was deemed to be the preferred alternative for that site. This ranking has been presented to the public, landowners and relevant stakeholders, and was then updated based on comments received as well as based on supplementary technical investigations.

The total scores for each of the sites and alternatives are summarized in **Table 5-2**, with the detailed scoring matrices provided in **Appendix E**. Based on the evaluation analysis presented, the preferred alternative for all sites includes some level of restoration works, with the Do Nothing alternative earning the lowest score for all sites. To further summarize the evaluation results in **Appendix E**, a rationale for the preferred alternatives compared to the other alternatives at each site is provided in **Section 6.1.1**.

Table 5-2: Total Score Summary for Evaluation of the Erosion Mitigation Alternatives by Site

Erosion Site	Alternative 1 – Do Nothing	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Site 1 – Ice Control Structure	4.54	5.88	6.92	-	-
Site 2 – Erindale Park Bank Restoration	4.63	6.42	6.88	-	-
Site 3 – Credit Heights Bank Restoration	4.83	6.23	6.63	-	-
Site 4 – Ashington Court Retaining Wall	4.29	6.04	5.10	-	-
Site 5 – Summit Court Slope	4.17	6.02	6.75	-	-
Site 6 – Downstream Trails	3.83	5.77	5.42	8.04	-
Site 7 – Mid Trails	3.79	5.21	6.17	5.73	-
Site 8 – Upstream Trails	3.71	5.46	5.33	6.71	7.00

6 SELECTION AND DESCRIPTION OF PREFERRED ALTERNATIVE

6.1.1 Selection of Preferred Alternative

Based on the alternative concepts presented in **Section 4** and the evaluation scoring presented in **Section 5.2** (**Table 5-2**, **Appendix E**), the following **Table 6-1** summarizes the recommended preferred alternatives at each Credit River erosion site. **Table 6-2** provides a comparison between the preferred alternative and the other alternatives for each site, highlighting the key results of the evaluation process.

Table 6-1: Summary of the Preferred Alternative for Each Erosion Site

Preferred Alternatives	Summary of Recommendations
Site 1 – Ice Control Structure: Retain By-Pass Channel	Alternative 3 retains part of the bypass channel that has outflanked the ice control structure to maintain some of the increased conveyance capacity. This allows an erosion resistant flow relief passage when the structure is jammed with ice or debris, while still reducing ice flow around the structure. Select removal or thinning of trees in the floodplain will increase ice storage area and restore a key original design element.
Site 2 – Erindale Park Bank Restoration: Revetment and Buttress	Replacement of the current vertical armourstone bank protection with a sloped revetment will allow for a more natural bank progression and slope while providing improved and more stable erosion protection. Rerouting pedestrian traffic to the upper trail will alleviate safety risks during flooding or ice floes. Lookouts and fishing nodes will provide continued access to the riverside. Bendway armourstone weirs will redirect flows to reduce bank erosion and enhance aquatic habitat.
Site 3 – Credit Heights Bank Restoration: Vegetated Buttress	Replacement of the deteriorated gabion baskets with a vegetated buttress provides a naturalized riverbank and enhanced habitat. Routing the trail above the 5- year floodline will reduce the frequency of trail flooding and washout. If required, regrading of the opposite channel bank will ensure maintenance of flow conveyance capacity.
Site 4 – Ashington Court Retaining Wall: Replace Wall	Replacing the existing bank retaining wall with a redesigned wall will provide enhanced bank protection along the trail. The redesign will improve long-term stability and increase trail elevation to reduce frequency of flooding. A safety barrier along the top of the armourstone bank protection will improve public safety on the raised trail.
Site 5 – Summit Court Slope: Gravity Wall	Construction of an armourstone gravity wall along the toe of the slope up to the 100-year flood elevation and construction of vegetated buttress above armourstone wall to at least the Regional flood elevation will provide long term stability protecting against toe erosion. This method has a smaller area of disturbance than a vegetated buttress, but still incorporates native plantings along the top of the structure. This toe protection treatment has been used successfully on neighboring reaches of the Credit River.
Site 6 – Downstream Trails: Realign Trail	The trail realignment alternative proposes decommissioning of the trail along the water's edge and rerouting pedestrian traffic to the parallel upper trail to reduce existing safety risks related to flooding and ice floes. The decommissioned lower trail area will be re-

Preferred Alternatives	Summary of Recommendations
	naturalized, improving habitat connectivity. Trail maintenance and repair costs associated with washouts will be reduced, and the frequency of weather-based trail closures is expected to be reduced.
Site 7 – Mid Trails: Boardwalk	A 430 m length of raised boardwalk trail will be installed using helical piles to support a 3-4m wide steel deck boardwalk above the 5-year flood elevation. This will eliminate the washout of trail material and associated costs and environmental impacts, including impacts to adjacent turtle habitat. The trail could safely remain open in lesser storm events without impacting flooding and drainage. Drainage improvements under the Burnhamthorpe bridge will be incorporated into the design.
Site 8 – Upstream Trails: Hybrid Trail Option	The hybrid trail option proposes restoration of the secondary lower trail in its existing location, including regrading above the 5-year flood elevation and drainage improvements with stone lined drainage swales and concrete box cross culverts. The primary upper trail through Riverwood will be improved through formalization of the natural surface trail with limestone screenings and safety barriers where warranted, as well as short sections of boardwalk to connect existing trail structures. Vegetated buttresses have been proposed at two outer bend locations to shore up banks that are vulnerable to erosion, and to help mitigate bank overtopping during low magnitude flows.

Table 6-2: Preferred Alternative Rationale at Each Site by Comparison with Other Alternatives

Erosion Site 1 – Ice Control Structure	
Other Alternatives	**Preferred Alternative: Alternative 3 – Retain By-Pass Channel**
1. Do Nothing	Alternative 3 restores the intended functionality of the structure, improving safety. Functionality will continue to deteriorate under Alternative 1.
2. Restore to As-Built	Alternative 3 provides better design longevity than Alternative 2 by adjusting the original design to address the failure mechanisms instead of re-building it.

Erosion Site 2 – Erindale Park Bank Restoration	
Other Alternatives	**Preferred Alternative: Alternative 3 – Revetment and Buttress**
1. Do Nothing	Alternative 3 is better to reduce risks, improve habitat, and address safety concerns, as Armourstone bank protection and rock vanes will continue to deteriorate under Alternative 1.
2. Replace Wall	Alternative 3 is better to reduce risks, improve habitat, and address safety concerns than Alternative 2 as it redirects traffic into areas with lower frequency of flooding and ice floes, and provides greater naturalization opportunities.

Erosion Site 3 – Credit Heights Bank Restoration	
Other Alternatives	**Preferred Alternative: Alternative 3 – Vegetated Buttress**
1. Do Nothing	Alternative 3 is better to reduce risks, improve habitat, and address safety concerns as the bank will continue to erode towards the trail under Alternative 1.
2. Armourstone Wall	Alternative 3 is better to reduce risks, improve habitat, and address safety concerns than Alternative 2, as it addresses a longer section of bank erosion and provides greater habitat enhancement opportunities.

Erosion Site 4 – Ashington Court Retaining Wall	
Other Alternatives	**Preferred Alternative: Alternative 2 – Replace Wall**
1. Do Nothing	Alternative 2 is better to reduce risks, and address safety concerns, as the retaining wall will continue to deteriorate and cause safety risks to the trail under Alternative 1.

3. Cantilevered Trail	Alternative 2 involves less disturbance to environmental and social factors, and has a much lower cost and complexity than Alternative 3.

Erosion Site 5 – Summit Court Slope	
Other Alternatives	**Preferred Alternative: Alternative 3 – Gravity Wall**
1. Do Nothing	Alternative 3 is better to reduce risks, improve habitat, and address safety concerns, as the valley wall will continue to erode posing risks to adjacent private properties under Alternative 1.
2. Vegetated Buttress	Alternative 3 is better to reduce risks and address safety concerns, and has a smaller area of disturbance than Alternative 2.

Erosion Site 6 – Downstream Trails	
Other Alternatives	**Preferred Alternative: Alternative 4 – Realign Trail**
1. Do Nothing	Alternative 4 is much better to reduce risks, improve habitat, address safety concerns and reduce ongoing maintenance efforts than Alternative 1 under which trail usability and accessibility caused by flooding and washouts issues persist.
2. Raised Gravel Trail	Alternative 4 is better to reduce risks, improve habitat, address safety concerns, and reduce ongoing maintenance efforts than Alternative 2 by redirecting trail traffic to an area with lower flood frequency, and has a lower capital cost.
3. Boardwalk	Alternative 4 has a much lower cost than Alternative 3, is better to improve habitat, and has lower risk of ice damage to infrastructure.

Erosion Site 7 – Mid Trails	
Other Alternatives	**Preferred Alternative: Alternative 3 – Boardwalk**
1. Do Nothing	Alternative 3 is much better to reduce risks, improve habitat, address safety concerns and reduce ongoing maintenance efforts than Alternative 1, under which trail flooding and washouts will persist.
2. Raised Gravel Trail	Alternative 3 is much better to reduce risks, improve habitat, address safety concerns and reduce ongoing maintenance efforts than Alternative 2 by eliminating gravel washouts through replacement with a boardwalk structure.
4. Realign Trail	Alternative 3 is better to reduce risks, reduce maintenance requirements, improve habitat, and has better social and cultural value than Alternative 4, by eliminating gravel washout inputs to turtle habitat and maintaining access to the river.

Erosion Site 8 – Upstream Trails	
Other Alternatives	**Preferred Alternative: Alternative 5 – Hybrid Trail Option**
1. Do Nothing	Alternative 5 is much better to reduce risks, improve habitat, address safety concerns and reduce ongoing maintenance efforts than Alternative 1, under which trail flooding and washouts will persist.
2. Raised Gravel Trail	Alternative 5 is better to reduce risks, improve habitat, and provide social benefits that Alternative 2 due to the addition of vegetated buttresses and improvements to the upper trail.
3. Boardwalk	Alternative 5 has a much lower cost than Alternative 3, and has lower risk of ice damage to infrastructure.
4. Realign Trail	Alternative 5 provides much greater benefit to the community than Alternative 4 by retaining the trail loop system and improving the upper trail.

6.1.2 Preliminary Conceptual Designs

Preliminary conceptual design drawings have been prepared for each of the eight (8) sites. Conceptual designs for the preferred alternatives are illustrated in **Figure 6-1** to **Figure 6-8** below. The drawings show the proposed planforms and a representative cross section for each site.

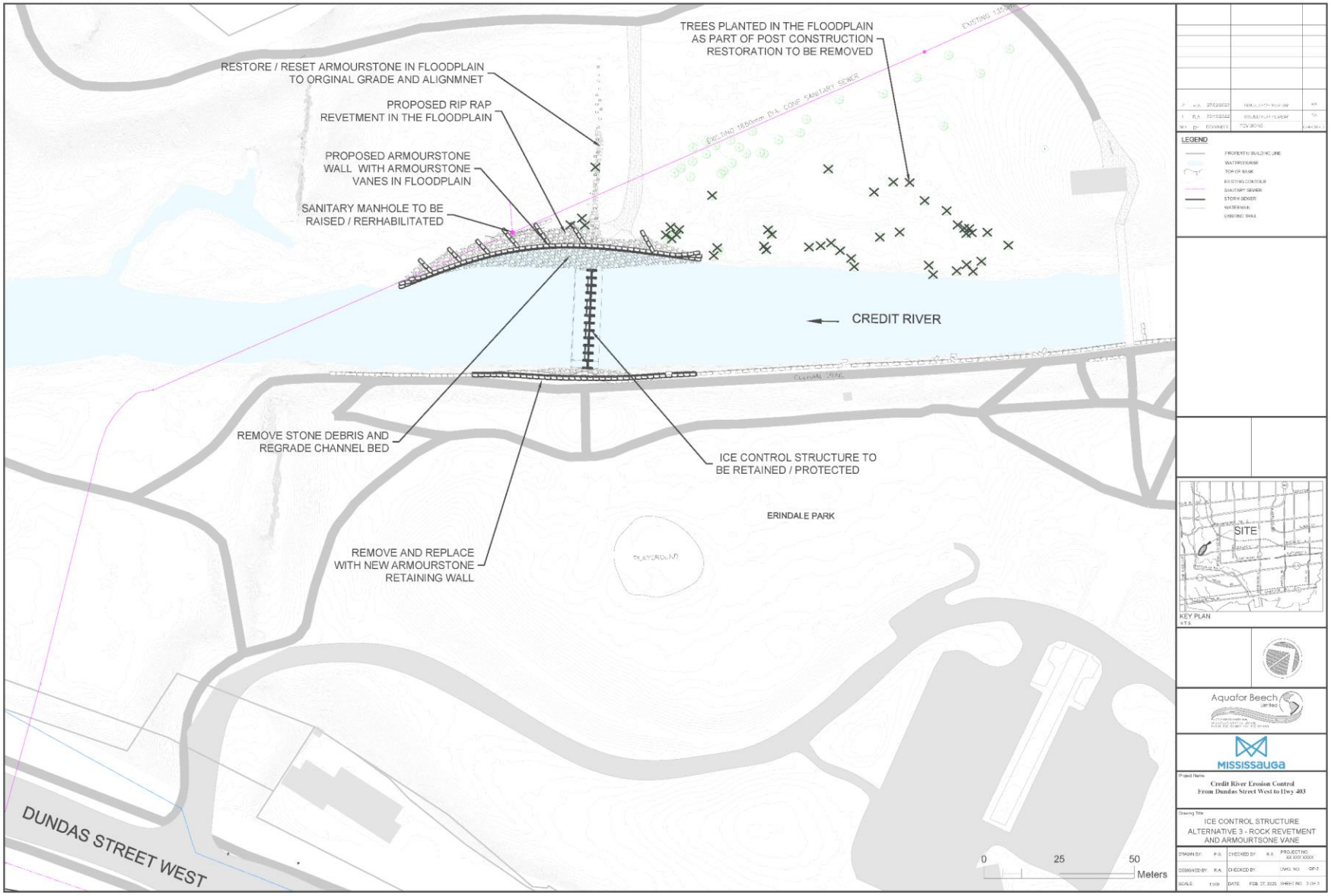

Figure 6-1: Preliminary Design for the Preferred Alternative – Site #1

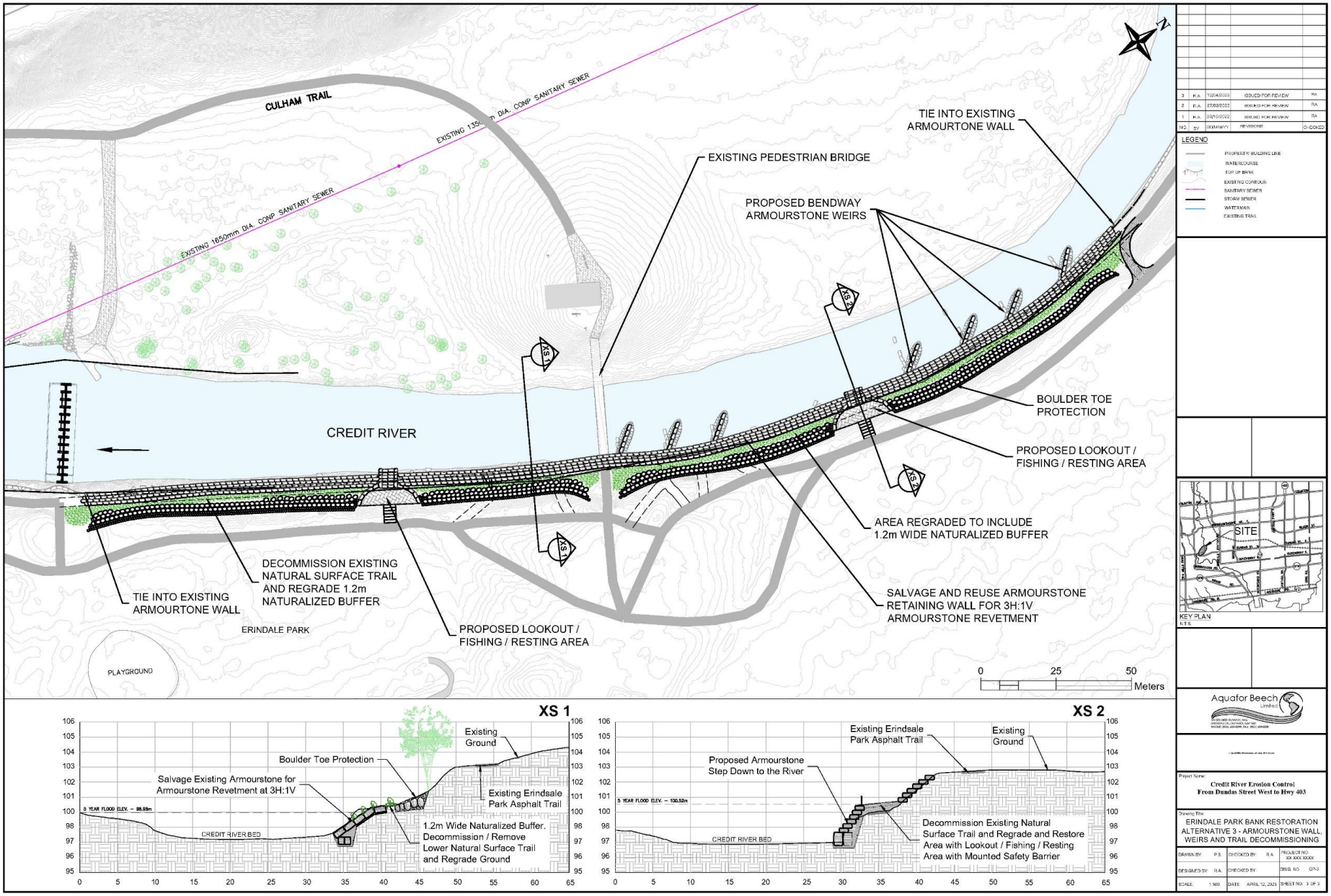

Figure 6-2: Preliminary Design for the Preferred Alternative – Site #2

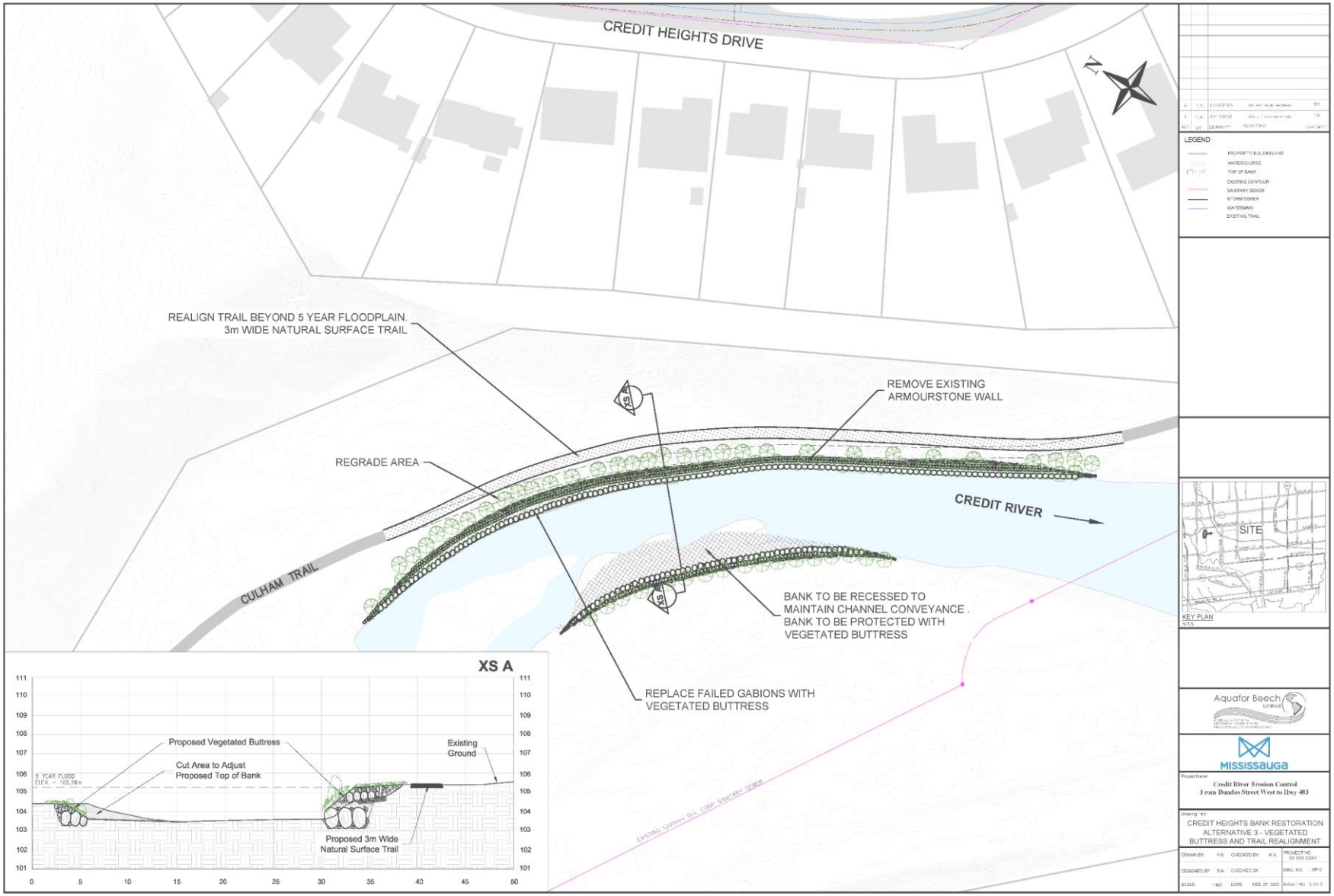

Figure 6-3: Preliminary Design for the Preferred Alternative – Site #3

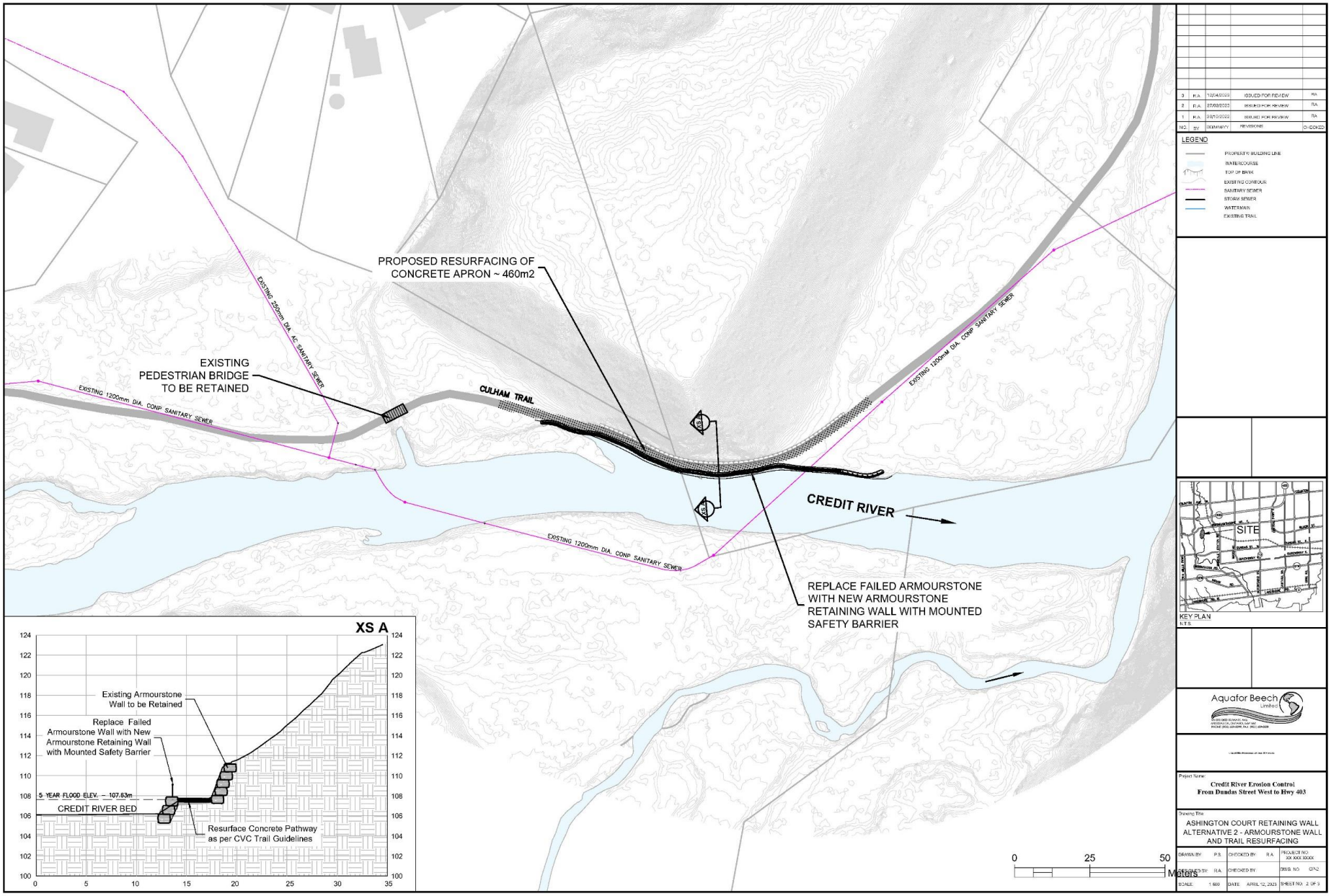

Figure 6-4: Preliminary Design for the Preferred Alternative – Site #4

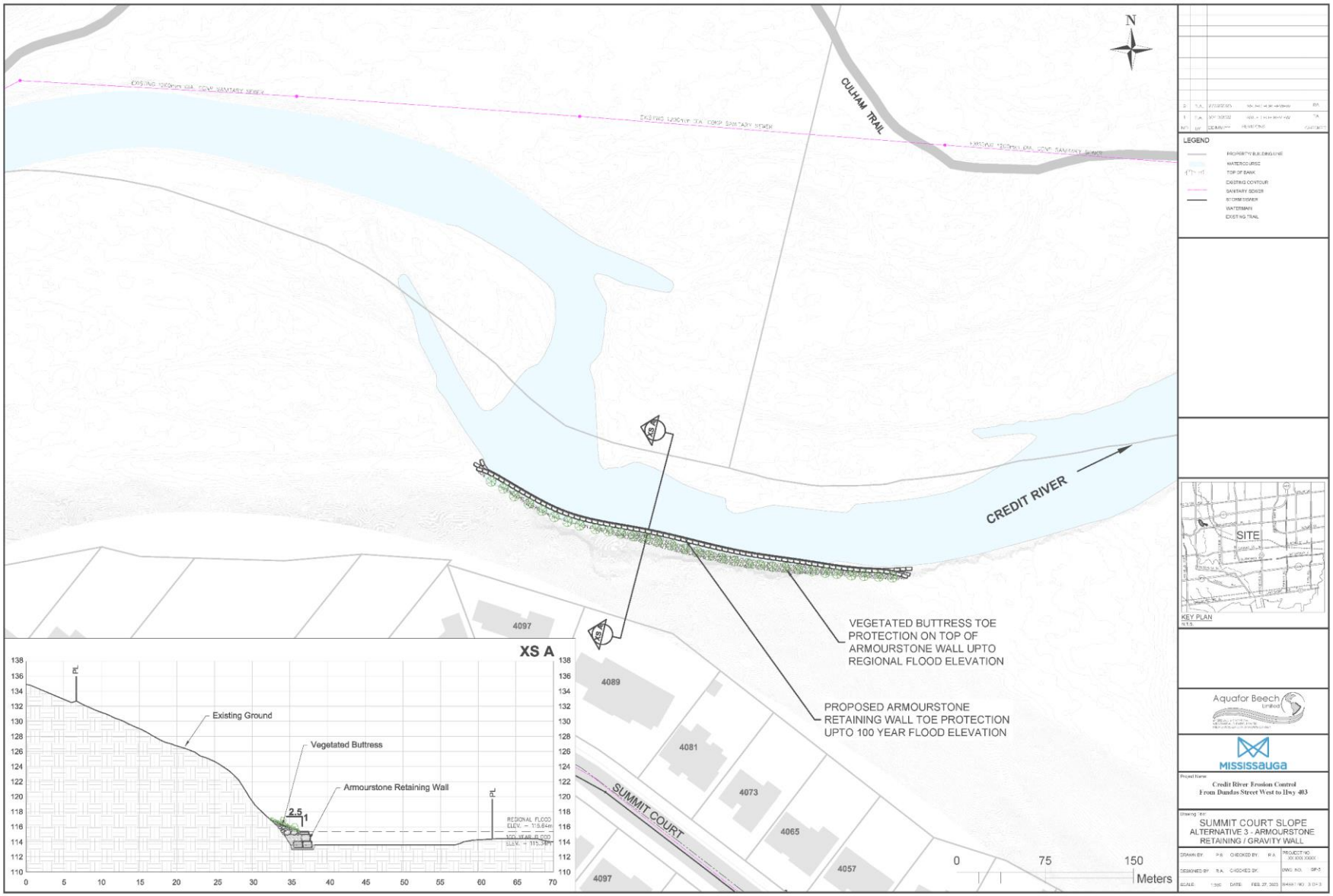

Figure 6-5: Preliminary Design for the Preferred Alternative – Site #5

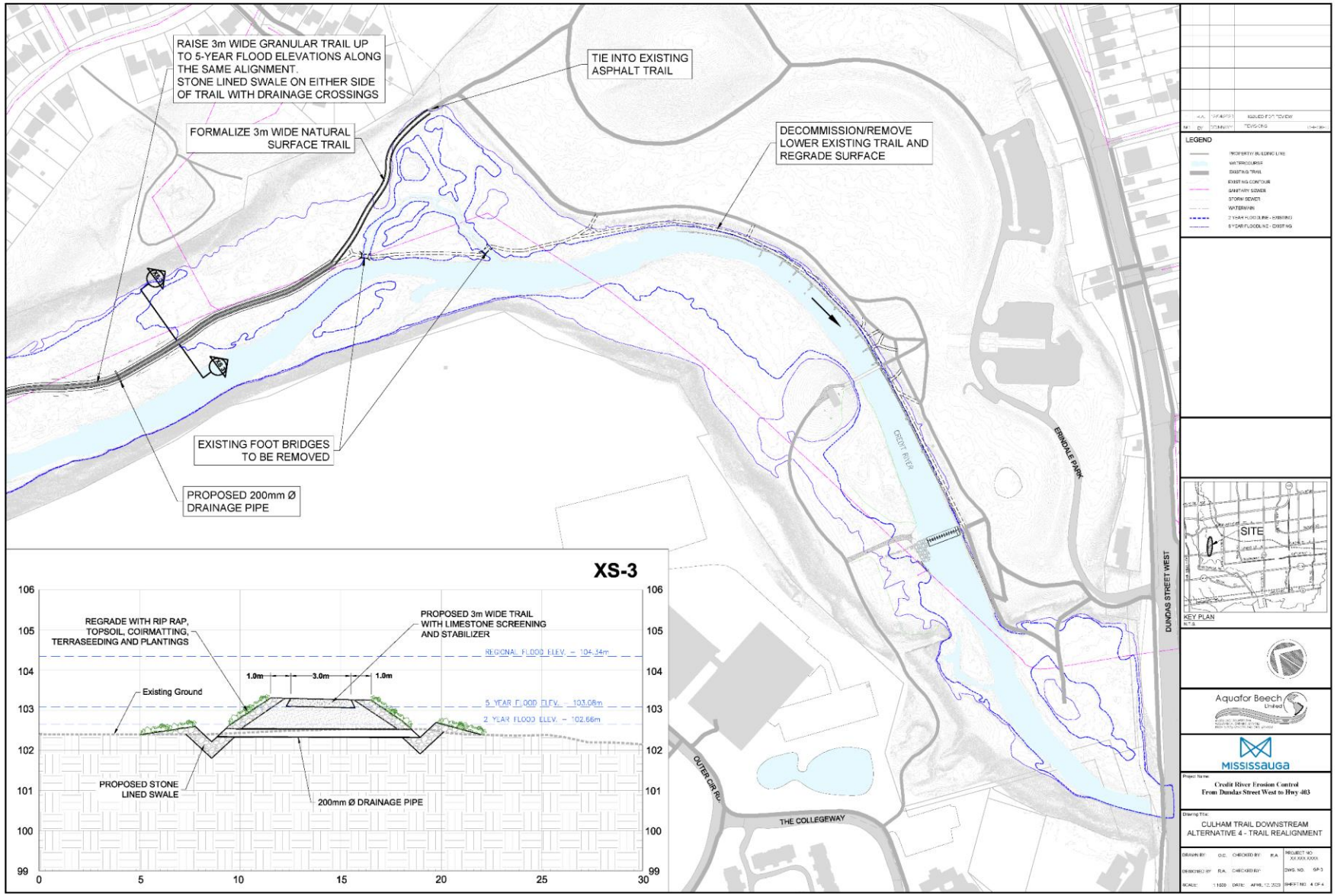

Figure 6-6: Preliminary Design for the Preferred Alternative – Site #6

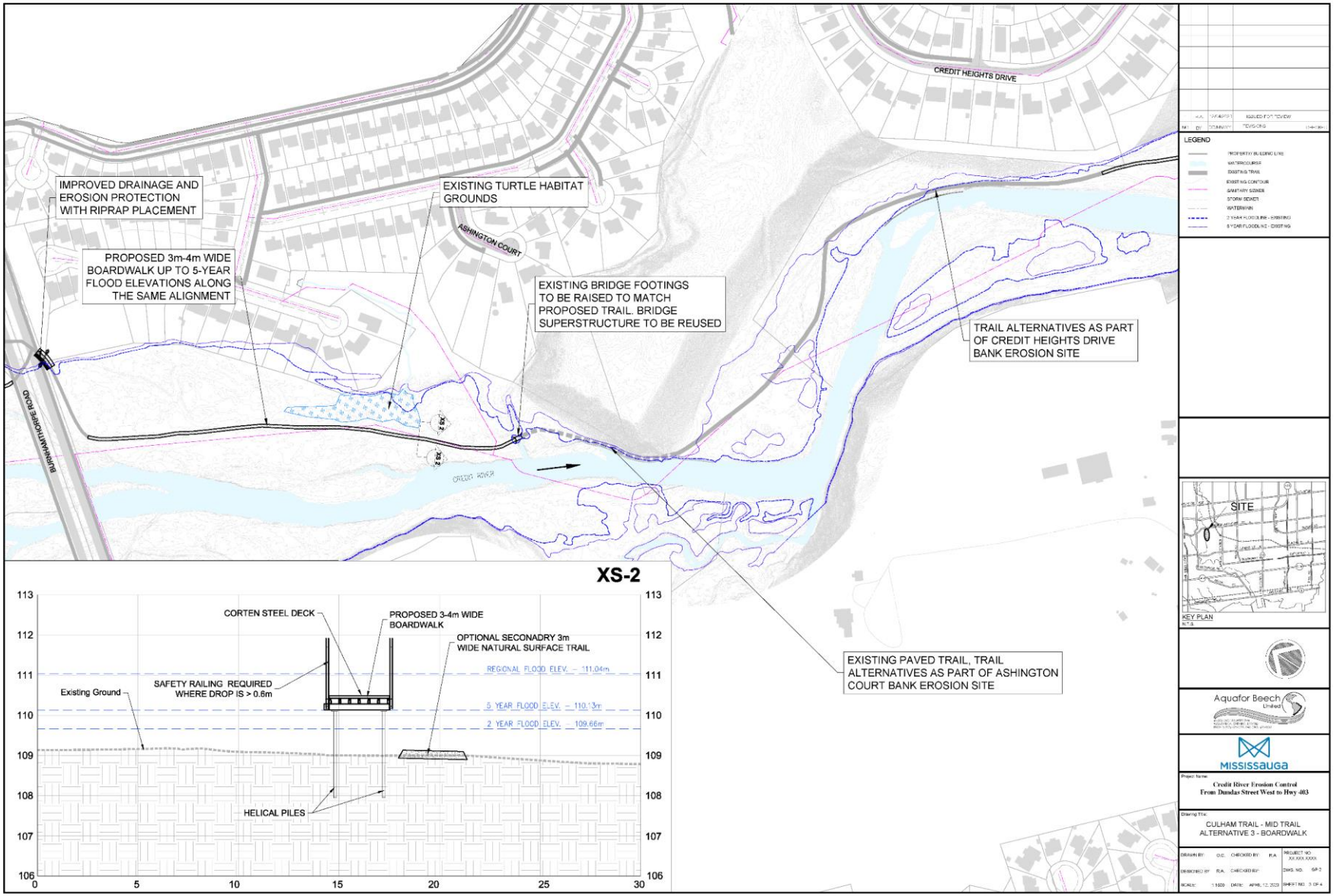

Figure 6-7: Preliminary Design for the Preferred Alternative – Site #7

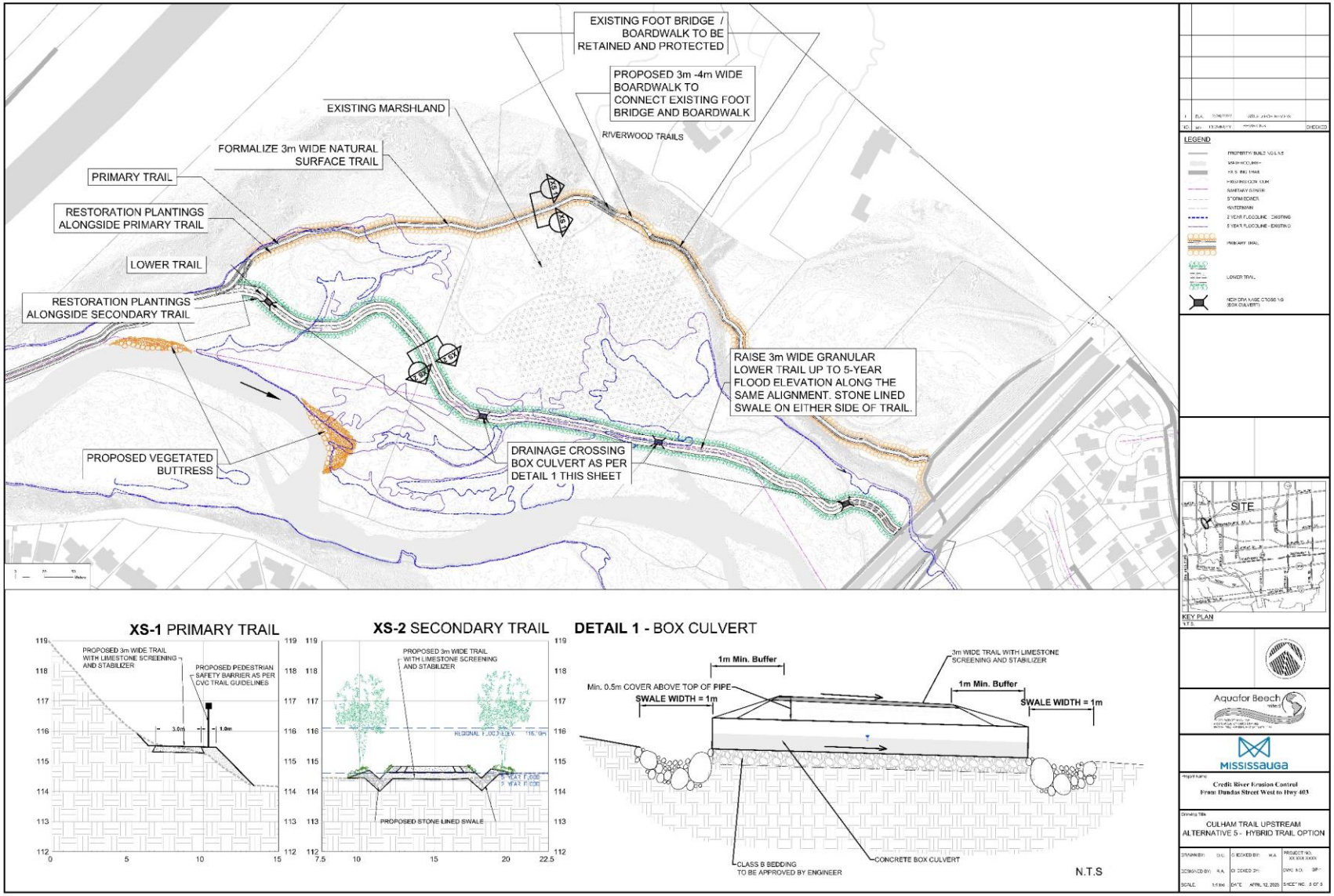

Figure 6-8: Preliminary Design for the Preferred Alternative – Site #8

6.1.3 Preliminary Cost Estimate

As presented in **Table 6-3**, a preliminary cost estimate was prepared for the preferred alternatives outlined in **Section 6.1.1**. The estimated total construction costs include 30% contingency, and exclude HST. The provided estimates are based upon 2023 rates. Costs will be further refined throughout the detailed design phase of this project.

Table 6-3: Cost Estimate for the Preferred Alternatives

Site	Description	Estimated Costs
Erosion Site 1	Retain Bypass Channel	$2,200,000
Erosion Site 2	Revetment and Buttress	$3,400,000
Erosion Site 3	Vegetated Buttress	$2,200,000
Erosion Site 4	Replace Wall	$1,200,000
Erosion Site 5	Gravity Wall	$1,500,000
Erosion Site 6	Realign Trail	$530,000
Erosion Site 7	Boardwalk	$5,800,000
Erosion Site 8	Hybrid Trail Option	$2,500,000
	Total Construction Cost Estimate:	**$19,330,000**

7 POTENTIAL ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES

7.1 Surface and Groundwater

The stretch of the Credit River between Dundas Street and Highway 403 falls within the Credit Valley Source Protection Area (CVSPA). Information on this source protection area was found using the MECP Source Protection Information Atlas tool.

According to O. Reg. 287/07, there are six (6) different designations of protected areas under the Clean Water Act. As the consultants undertaking this Municipal Class EA, Aquafor is responsible for considering these areas, and the impacts that its recommendations may have on these sensitive zones. There are four (4) different classifications of Source Protection areas that fall within the catchment of the study area.

This specific region of the Credit River is classified as a Type 3 Intake Protection Zone (IPZ-3), and is only at risk of contaminants during storm events. Consequently, this area is also encased by an event-based modelling area (EBA). The majority of land though the region of Erindale and Sherwood Forrest is delineated as Highly Vulnerable Aquifer (HVA). Throughout the entirety of the CVSPA, approximately 65% of the land is considered HVA. Finally, there are a number of zones within the study area that are designated as Significant Groundwater Recharge Areas (SGRA's). These areas experience large volumes of groundwater recharge that contribute to drinking water systems. In general, these zones are in close proximity to large crossings at main roads (either side of the 403, Burnhamthorpe and Dundas Street).

Water quality is not expected to be adversely impacted by any alternative discussed within this EA. As part of future detailed design and tender packages Aquafor will create a detailed erosion and sediment control plan for the Contractor which will protect surface water from sediment runoff during construction. No groundwater impacts are anticipated.

7.2 Air Quality, Dust and Noise

Limited local impacts to air quality from the proposed alternatives are expected only during construction activities. Construction impacts are short duration and low intensity, with minimal impact. Considering the geographical location of this specific stretch of the Credit River, there are no expected sensitive receptors within close proximity to the areas of impact. Therefore, active suppression is not necessary for construction activities. All sections of trail along the study area will be closed during construction, maintaining a buffer between park users and noise/dust hazards.

7.3 Contaminated Soils & Excess Materials Management

According to O. Reg. 406/19, consideration must be given to the management of excess construction soil, as well as identifying whether there is any risk of contaminants being in the soil existing in-situ. Erindale Park contains a former landfill site which was active in the early 1960s (**Figure 7-1**; City of Mississauga, 2013). The landfill continues to be monitored for leachate migration by the Region of Peel. As the soil depth over the landfill varies between 0.3m-2.4m tree planting or the installation of structures proposed in this area will require testing to determine the presence and depth of the clay cap. Works proposed within the extents of the former landfill will be reviewed by a geotechnical engineer during detailed design to ensure the integrity of the clay cap is retained. Consultation with Region of Peel will also be requested as part of the detailed design process to review implications of the monitoring data.

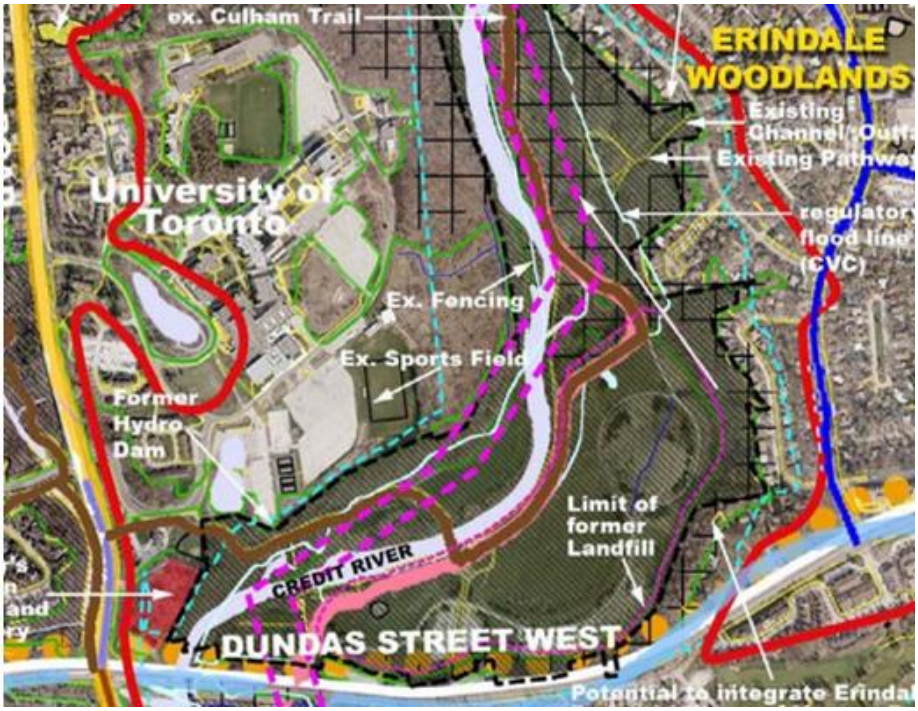

Figure 7-1: Limit of Former Landfill Contained within Erindale Park (Modified from Credit River Parks Strategy Figure 2.22N, City of Mississauga, 2013).

Review of historical aerial imagery available from the City of Mississauga does not show any additional previous development on this stretch of the Credit River. However, soil chemical analysis for any areas of excavation will be completed at both the detailed design and construction stages to characterize the soil quality prior to excavation and inform excess soil management as required.

7.4 Climate Change

There are two parts to assessing climate change as part of the EA process. First, consideration of the project's effect on climate change via emissions or other environmental impacts. Second, an assessment of the effects of climate change on the project over its lifespan and how those impacts may pose a risk to the environment.

7.4.1 Project's Impact on Climate Change

All alternatives in this EA will impact the environment in the form of construction emissions. Construction emissions are limited where possible with strategies such as cut/fill balances, which reduce the need for hauling material on and off site.

In the future development of the staging and access plans as part of the detailed design process, existing cleared areas will be utilized where feasible to limit the impacts of clearing vegetation in natural areas. This reduces emissions from clearing equipment, and provides positive benefit from the maintained vegetation's carbon capture and storage abilities. Furthermore, vegetation restoration plans will be completed for each project location. These plans ensure that any affected vegetation is properly replaced, ensuring biodiversity and promotion of a native ecosystem.

Due to the nature of the alternatives, no emissions or associated monitoring programs are anticipated post construction.

7.4.2 Impacts of Climate Change on the Project

Climate change is expected to increase the intensity and frequency of extreme rainfall events. Particularly in urban areas, this has limited opportunities for infiltration and rainfall is instead directed through storm sewers to local

waterways. This results in a rapid and unnatural increase in water levels, flows and hydraulic forces. The potential for more intense and frequent flood events presents risk to the durability and life expectancy of erosion control measures.

To ensure the stability and longevity of the proposed designs, all existing and proposed conditions will be hydraulically modelled during detailed design to quantify the forces endured under different storm events. Designs will be sized and otherwise adjusted to withstand these forces, or will be constructed in such a way that the expected movement of placed bed and bank materials does not impact their effectiveness.

8 CONSULTATION

Throughout the study process, an extensive consultation program involving the public, stakeholders and representatives of the various agencies was implemented. The process included an online Public Information Centre (PIC), onsite meetings with CVC staff and Riverwood Conservancy representatives, and virtual meetings with City Councillors and stakeholders.

These points of contact satisfied the general criteria defined within the Municipal Class EA process for Schedule B projects, where a mandatory two (2) points of public contact are required. Moreover, the following public and agency interactions were completed:

- Notice of Study Commencement;
- Notice of online PIC;
- EA Study Information Slides and narrated video (presented at the online PIC);
- Project File Report posted for public comment for 30 days; and
- Notice of Completion.

An overview of the PIC and a summary of the consultation program are presented below.

8.1 Consultation Approach

8.1.1 Project Webpage

A project webpage was hosted on the City of Mississauga's website. Information related to the Class EA study was posted on this webpage, including a study overview, study notices, Public Information Centre materials and comment forms, study reports, contact information for questions and comments, and links to other related projects. The link to the project webpage was included in the Notice of Commencement, Notice of Public Information Centre, and Notice of Completion. The link to the project webpage is provided below:

www.mississauga.ca/creditrivererosionea

8.1.2 Stakeholder List

A Stakeholder List was developed at the commencement of the Class EA study, and updated throughout the study process based on requests received. The list included Indigenous Communities identified by the Ministry of the Environment, Conservation and Parks (MECP), provincial government ministries, Region of Peel, City of Mississauga, City Councillors, Credit Valley Conservation (CVC), landowners adjacent to the study area, interest groups, and residents. A summary of the Stakeholder List is provided in **Table 8-1**. Residents added to the list included those living adjacent to the study area (188) and additional residents who requested to be included on the list. Resident contact information has not been included in this Project File report for privacy reasons.

Table 8-1: Stakeholder List Summary

Stakeholder Group	Name
Indigenous Communities	Mississaugas of the Credit First Nation; Six Nations of the Grand River Haudenosaunee Development Institute (HDI) Huron-Wendat
Provincial Government Ministries	Ministry of Tourism, Culture and Sport Ministry of Natural Resources and Forestry (MNRF) Ministry of the Environment, Conservation and Parks (MECP) Infrastructure Ontario (IO)
Region of Peel	Engineering Services Infrastructure Programming and Studies
City of Mississauga	Various Staff
Councillors	Ward 6 Councillor Ron Starr (previous), Joe Horneck (current)

Stakeholder Group	Name
	Ward 8 Councillor Matt Mahoney
Conservation Authority	Credit Valley Conservation (CVC)
Adjacent Land Owners / Operators	Credit Valley Golf and Country Club Mississauga Golf and Country Club University of Toronto Mississauga The Riverwood Conservancy St. Peter's Anglican Erindale Erindale Orthopaedic Sports Injuries & Rehabilitation Centre Erindale Family Clinic B.F. O'Neill's Vacuum Centre MacKinnon Calderwood Advertising Aliquot Law UltimateStager™ Academy
Interest Groups	Credit River Anglers Association South Peel Naturalists' Club Mississauga Mountain Bike Association
Residents	Residents adjacent to study area Residents who submitted a request to be added to the contact list

The final study Stakeholder List is provided in **Appendix F**.

8.2 Notice of Commencement

The Notice of Commencement for the study was distributed to the study contact list including delivery to the properties adjacent to the study area on September 7th, 2022 and posted on the City of Mississauga's Project Webpage.

The purpose of the notice was to inform the public that a Class EA study had been initiated, to provide background on the problem definition, and to distribute contact information for representatives of the City and Aquafor who interested parties could engage with throughout the study process.

8.3 Public Information Centre

An online Public Information Centre was arranged to allow local residents and interested members of the public an opportunity to review and comment on the project findings to date, the alternative solutions being considered, the evaluation process, and the preliminary preferred alternatives. The online PIC included a narrated video presentation and online survey platform to gather input and feedback. The PIC materials were made available to the public on the City's Project Webpage on June 14th, 2023, as well as a comment submission window that closed July 14th, 2023.

The presentation narrated a set of slides outlining the study purpose, background, findings, as well as next steps. A copy of the PIC presentation slides as presented is provided in **Appendix F**. The presentation slides outline the following items:

- The study area;
- The objectives of the study and the purpose of the public information package;
- The Municipal Class EA – Schedule B process;
- Natural Heritage Assessment and Species at Risk (SAR);
- Vegetation Community Classification;
- Fisheries and Aquatic Habitat;
- The hydrology and existing conditions of the Credit River within the study area;
- Cultural Heritage;

- Archaeology;
- Erosion Inventory;
- The evaluation criteria for proposed alternatives;
- The evaluation approach;
- The problems and opportunities;
- The site-specific findings and proposed preferred alternatives; and
- The next steps in the process.

A great number of comments were received from the public regarding the study and the materials presented at the online PIC, mostly from residents adjacent to the study area. A significant number of residents expressed concern about the adjacent Culham trail and the impacts of the project on its use. A further breakdown of the comments received through the comment form as well as via email can be found in **Section 8.8** below.

The Notice of Public Engagement, public information package (presentation boards), and consolidated comments from the public are provided in **Appendix F**.

8.4 Indigenous Consultation

Indigenous consultation is an important component of the Class EA process. Pre-consultation with MECP identified the following Indigenous communities as potentially affected by the proposed project:

- Mississaugas of the Credit First Nation;
- Six Nations of the Grand River (Both the Six Nations Elected Council and the Haudenosaunee Confederacy Chiefs Council (HCCC)/Haudenosaunee Development Institute (HDI)); and
- Huron-Wendat (only if there is to be any digging/excavation that may result in a disturbance to any archaeological resources)

Mississaugas of the Credit First Nation, the Haudenosaunee Development Institute (HDI), Huron-Wendat First Nation, and the Six Nations of the Grand River were notified about the project at the time of initiation of the study and prior to the date of the PIC, together with all stakeholders. In addition, separate letters were directly sent to the points of contact of the Indigenous Communities to notify them of the study. An Application for Consideration and Engagement for Development was submitted to HDI by the City project manager on December 13, 2022.

An email from the Mississauga's of the Credit First Nation was received on December 8, 2022, in response to notification of the project commencement. The Mississauga's of the Credit First Nation indicated they had no comments or concerns with the class EA report for the project and that they were interested in receiving and reviewing the Stage 1 Archeological Assessment. No other correspondence was received.

The Draft Stage 1 Archaeology Report and Cultural Heritage Report were provided to the aforementioned Indigenous Communities on March 25, 2024 for review and comment. No comments have been received to date. Upon filing the project, the Notice of Completion along with this Project File Report will be provided directly to the Indigenous Communities for review and comment.

As noted in **Section 3.8**, a Stage 2 Archaeologic investigation is required for select locations within the study area, during which all identified Indigenous communities will be invited to participate. Depending on findings of the Stage 2 assessment, a Stage 3 and possibly Stage 4 assessments may be triggered for further investigations, where applicable. First Nations will also be actively engaged throughout the process.

8.5 City Councillors

8.5.1 Virtual Meetings with Councillor Horneck

A virtual meeting was hosted by Councillor Joe Horneck on July 19, 2023 to discuss the study, with a focus on Site 8 – Upstream trails. The meeting was attended by Mississauga Parks staff (Raymond Lau, Geoff Bayne),

Aquafor project staff (Rob Amos, Emma Schiller), and one resident affiliated with University of Toronto Mississauga Campus, and the Riverwood Conservancy. Discussion topics included the development of additional design alternatives, concerns with trail traffic volume, existing safety and maintenance concerns, the alternative evaluation methodology, and development of a project implementation plan.

A second virtual meeting was hosted by Councillor Joe Horneck on April 16, 2024 to discuss the study with a focus on existing site conditions and preferred alternatives. The meeting was attended by Mississauga Environmental Services staff (Anthony Di Giandomenico), Aquafor project staff (Rob Amos, Emma Schiller), and three residents (including one associated with Credit River Anglers Association). Discussion topics included an EA status update, site history, and current park usage.

8.6 Credit Valley Conservation (CVC)

Credit Valley Conservation (CVC) has been included throughout the process of this study, including attendance at site meetings, virtual meetings, and providing comments and feedback at interim stages. CVC has included engineering, hydraulic, planning and land use, geomorphology, and ecology representation and feedback during all points of contact. CVC will continue to contribute as a primary stakeholder and permitting authority through the detailed design phase.

8.7 The Riverwood Conservancy

8.7.1 Riverwood Site Walk

A site walk was held on July 6, 2023 within The Riverwood Conservancy (TRC) section of the Culham Trail to review the existing conditions and discuss proposed design alternatives for Site 8 – Upper Trails. Attendees included representatives from City Parks, City Forestry, City Stormwater Projects, Aquafor, and The Riverwood Conservancy. Discussions topics included TRC programming and trail usage/traffic volume, concerns with existing trail conditions, conflicts between cyclists and pedestrians, invasive species, opportunities for trail improvements, and desire for a looped trail system in support of Riverwood programming.

8.7.2 Comment Submission

Following the site walk, TRC formally submitted their comments on July 13th, 2023 regarding the proposed alternatives for Site 8 – Upper Trails. With a section of the proposed works stretching through Riverwood Park, TRC is concerned with the increased traffic that could result from the realignment of the Culham Trail (Alternative Four). The realignment of the Culham Trail to the Red Trail could increase user conflicts in an area of high foot and bicycle traffic. TRC suggested reviewing any available trail usage data to inform the next iteration of design. Furthermore, it was suggested that should the trail continue be rerouted, any alteration to the Red Trail to accommodate should be done prior to the decommissioning of the Culham. Posting signage along the decommissioned trail section was recommended to prevent unauthorized usage.

TRC is an organization that runs numerous programs of public outreach, in an effort to educate the community in sustainable practices, and wildlife protection. With the additional traffic on the Red Trail, they are concerned that these program groups will no longer have the clearance to stop along the trail. They also run programs for individuals with mobility issues and seniors, which will have to be altered to account for the increase in bike traffic. TRC also raised concerns with wildlife behavior associated with a large influx of traffic. Wildlife may begin to withdraw from the area as noise and activity increases, and the trailside flora is affected by people moving off-trail to clear way for traffic. Considering traffic overflow, TRC suggested the addition of “nodes” across the planned route. This effectively gives users a place to stop and enjoy the scenery safely away from the flow of traffic, as well as a place for programs to stop for their classes.

There were concerns raised with the route of the preferred alternative as well, as with the realigned trail there will no longer be opportunity for a single loop to be completed through the park. Because of this, there will be two-way traffic on the trails as users return to their trip access point. There are also several terraces and significant drops immediately adjacent to the trail. At present, Emergency Medical Services can only access the lower trail

on foot. Should the alignment proceed as designed there will be no access road for EMS to reach the lower sections. TRC is suggesting consideration of a looped trail to reduce there-and-back traffic, or a twin boardwalk design to increase clearance. A twin boardwalk design could also accommodate access for EMS, addressing a number of concerns.

TRC also raised concerns with the evaluation of the preferred alternative for Site 8 and weighting of various evaluation criteria.

A fifth hybrid alternative was developed for the upstream trails site, as introduced in **Section 4.6.5**, in response to the comments received from TRC, the public, and additional stakeholders.

8.8 Credit River Anglers Association

Credit River Anglers Association is included as an EA stakeholder as a fishing and conservation group working on the Credit River watershed and species within. Comments were received from a representative of the CRAA on February 22, 2024 via email. Feedback and technical insight was provided on the preferred alternatives and design concepts for Sites 1 to 4. Suggestions provided on design elements related to tree removals, rock veins, and vegetation restoration will be further considered during detailed design.

8.9 Summary of Public and Stakeholder Comments

Feedback received regarding the alternatives and design concepts presented through the public engagement presentation are summarized below:

- Eleven (11) PIC Comment Forms (from residents and University of Toronto, Mississauga Campus)
- Five (5) additional resident emails
- Comments (via email) from:
    - Region of Peel, Public Health – Built Environment
    - Credit Valley Conservation Authority (CVC)
    - Ministry of Natural Resources and Forestry (MNRF)
    - Riverwood Conservancy
    - Credit River Anglers Association
    - City Staff

8.9.1 Existing Conditions

The majority of the public comments received were in agreement with the existing conditions findings. There was also public concern regarding erosion risk to infrastructure, particularly nearby sanitary sewers and the University of Toronto property.

8.9.2 Evaluation Criteria

A significant number of comments addressed the weighting of social and cultural criteria in the alternative assessment process. These comments were largely in regards to evaluating the trail alternatives and reflect the strong connection that the Culham trail provides for residents to the river and surrounding natural areas.

The weighting system was designed to give balanced consideration to all criteria, recognizing that different criteria hold higher significance to various stakeholder groups. As such, the weighting system was not adjusted in response to the comments, but the importance of social and cultural values was instead reflected through updates to the proposed alternatives relating to trail access and recreation opportunities.

8.9.3 Preliminary Scoring and Preferred Alternatives

The public agreed that maintaining a usable trail should be top priority, with some suggesting the trails closest to the river be left in place, despite cost or other factors. Concerns largely involve access to the riverfront, and an increase in user conflicts if some trail routes are decommissioned or constraining structures such as boardwalks are implemented. Usability/accessibility issues related to the proposed rerouting of trail traffic were mentioned for

Site #8 in particular. The cost of select alternatives, particularly the boardwalk, were questioned in comparison to their overall benefit.

Several comments indicated the importance of striking a balance between maintaining the natural aesthetic of the river and ensuring it can safely convey peak flows. Comments generally indicated agreement with the scoring of sites 1 through 5.

As noted in **Section 8.9.2**, updates were made to the alternative concepts in response to the feedback received from the public and various stakeholder groups. Updates include enhanced opportunities for access to naturalized areas, enhanced opportunities for river lookouts, and the development of a fifth hybrid alternative for Site #8 – Upstream Trails.

8.9.4 Additional Comments

Several members of the public used this section to reiterate their enjoyment of the trail system and highlight the desire that it remain as operational as possible at all times. The opinions on how this should be done were divided into suggestions that no work should be done or ensuring that work done prioritizes the trail and its usability as much as possible.

8.9.5 Email Comments

The email comments were consistent with the comments received through the comment form, with strong support of maintaining the trail and similar comments about the prioritization of the trail and the cost of the preferred alternatives.

9 IMPLEMENTATION PLAN

9.1 Notice of Completion

The Notice of Completion will be provided to all stakeholders, agencies and residents on the study distribution list, and copies of the Project File report will be available for review by the public. The Notice of Completion will also be delivered to properties adjacent to the study area. A copy of the notice of completion can be found at the start of this document.

9.2 Detailed Design and Investigations

The following plans and investigations will be completed at the design stage for each of the projects.

9.2.1 Construction Staging, Erosion and Sediment Control Measures

Appropriate plans are to be included within the detailed design package, based on consultations with the City and CVC. These plans will include information such as access route and staging areas, with comprehensive erosion and sediment control requirements to be implemented throughout construction. This will include both flow management plans to enable working in dry conditions, as well as detailed fencing and delineation of the extents of disturbance. In this regard, all areas of disturbance will be fully restored and stabilized to prevent loss and contribution of sediments downstream.

9.2.2 Tree Protection and Restoration Plan

Tree protection fences following the specifications in CVC's Landscaping and Tree Protection Guidelines should be erected along all construction access routes and work areas. If possible, it is also recommended that planting areas be fenced off for two years to protect newly planted vegetation and to allow time for growth and to anchor soils. Some mature trees will need to be removed to accommodate construction. To compensate, native trees and shrubs that fit the existing vegetation communities will be included within the restoration plan of the detailed design drawings. CVC's Plant Selection Guideline and Healthy Soils Guideline for the Natural Heritage System will be reviewed when developing the plan.

9.2.3 Utility Locations

All utility organizations should be contacted for as-constructed drawings and to complete field-marking of all underground services within the proposed restoration area. The utilities may include, but are not limited to, electricity, natural gas, cable television, telephone, water, sanitary sewer and storm sewer. At storm outfalls, the structure stability and flow hydraulics of the outfall channel must be considered in the detailed design.

9.2.4 Hydraulic Assessment

A detailed hydraulic assessment of the proposed conditions will be conducted and the results will be included in the detailed design brief. Computation of peak velocities for bank full and peak floods will be included and incorporated into evaluation of the proposed remedial measures. The assessment will be used to confirm that no negative flooding impacts will result from the proposed works, a condition of the CVC permit.

9.2.5 Tendering Support for Construction

All tender documentation will be completed applicable to the City of Mississauga standards, with Special Provisions and Schedule of Quantities with refined engineering cost estimates provided. The package will include Project Descriptions, Special Provisions, Specifications, Form of Tender and a Schedule of Prices. The final detailed design drawings will be issued as a set of contract drawings with the completed tender package. The contract drawings will be stamped by a professional engineer, signed, and labeled "Issued for Tender" complete with all necessary material and performance specifications. Aquafor will typically assist the City during the tendering and procurement period as required, providing responses and clarification to bidders during the procurement process.

9.2.6 Excess Soil Management during Construction

The Contractor will be required to handle all excess soil at the site in accordance to the Ministry's Excess Soil Regulation O. Reg. 406/19. Specifications include but not limited to removal, disposal, testing, onsite storing, and reuse of the excavated materials will be provided in the tender document in accordance with Ontario Provincial Standard Specification (OPSS) 180 and OPSS 206(1,2), O. Reg. 153/04 and O. Reg. 406/19.

9.2.7 Stage 2 Archaeological Assessment

Stage 2 Archaeological Assessment will be undertaken by ASI at the detailed design stage, including test pit surveys at selective locations as illustrated in **Section 3.8**. An indigenous engagement plan will be developed, ensuring all three First Nations are engaged directly and invited to arrange for monitors to join ASI during the Stage 2 property survey. The draft Stage 2 archaeology report and the indigenous engagement report will be submitted to First Nations for review and comment, prior to filing with the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI).

9.3 Permits

Prior to construction it will be necessary to coordinate environmental approvals and permits necessary to complete the intended works. At this time, it is Aquafor's understanding that approvals from CVC, MNRF, and DFO may be required. A brief summary of permits and approvals is included below:

CVC – O. Reg. 166/06 Permit
This typically involves two submissions (70% & 95% design), and will include supporting design brief information.

DFO – Assessment under the Federal Fisheries Act
Upon completion of the detailed design for the channel works at the study site, the works should be cross-referenced with the DFO "Projects Near Water" online service to determine if a request for regulatory review under the federal Fisheries Act is required. It is the opinion of Aquafor that a request for regulatory review by Fisheries and Oceans Canada will be required.

MNRF - Ontario Public Lands Act
As the Credit River is considered a navigable waterway, and works are likely to be undertaken along the shore of this waterway (i.e., "shore lands"), the work is subject to a work permit under the Ontario Public Lands Act. Upon completion of the detailed design for the works, all proposed works regulated by the Act should be submitted to the MNRF for review and permitting.

MECP - Endangered Species Act (ESA) Review Process
Depending on the results of SAR screening and habitat assessment associated with the specific construction locations, and the scope/extent of the proposed works, it may be necessary to initiate discussion with the MECP via the submission of an Information Gathering Form (IGF). The IGF notifies MECP that a project is anticipated to impact Endangered or Threatened species and/or their habitat and provides sufficient information that the MEC may provide further direction (e.g., the provision of mitigation measures and a letter of assurance, if the proposed works will not contravene the ESA, or initiation of an Overall Benefit Permit application). Projects specifically addressing erosion protection without the construction of any new infrastructure may also qualify for a regulatory exemption under O.Reg. 242/08, section 23.18 (non-imminent health and safety projects), if SAR impacts will occur. However, as part of that process, the project must be registered, habitat impacts must still be assessed and quantified, and effects to species must be minimized wherever possible.

Approvals may be required from the Region of Peel and other utilities for working adjacent to their infrastructure. Approvals/permits from the City may also be required for items such as tree removals, park access, and cultural heritage.

9.4 Construction Services

Inspection and resident services should be provided during construction under the guidance of a professional engineer who is well versed in similar construction projects. Tasks undertaken as part of the supervision role will include:

- Attend regular progress meetings, including pre-construction meeting, prepare and distribute meeting minutes within 3 days of the meeting;
- Respond to inquiries and request for information from external agencies, public stakeholders;
- Preparation of progress payment certificates and recording material quantities as they arrive to site;
- Overseeing the day-to-day construction and providing interpretation of the drawings;
- Ensuring that contractor's methodology complies with requirements of design;
- Monitor the traffic control measures to ensure they are consistent with traffic control plans;
- Inspect all layout and construction work to ensure compliance with the contract specifications and drawings;
- Provide advice to the contractor regarding the interpretation of the contract drawings and specifications and the preparation of supplemental details, instruction and clarifications as required;
- Notify the contractor of any deficiencies in the construction of the work, instructing the contractor to take appropriate corrective measures, confirm and report results of the corrective measures during construction. The deficiency list will be maintained and coordination of rectification throughout the 2-year maintenance period;
- Review, monitor and ensure compliance with contractor environmental conditions (i.e., ESC Plan).
- Preparation and issuance of substantial Performance certificate and recommendations; and
- Undertake a complete and thorough inspection of the contractor's work and prepare a report which lists all outstanding deficiencies at the end of the warranty period and coordinate and ensure that contractor corrects all warranty deficiencies expeditiously and to the satisfaction of the City.

9.5 Monitoring Program

A 3-year annual monitoring plan is recommended following completion of construction, which will include Warranty Period engineering review, as well as assessment of the efficacy of restoration plantings. The program should include time for inspection of both the channel works and vegetation plantings by the project geomorphologist/engineer, as well as the ecologist. Both the monitoring and warranty will be defined to suit the detailed design, and satisfy City, CVC and other agency requirements.

9.6 As-Constructed Drawings and Analysis

This task will set baseline conditions following construction, which will enable future monitoring and comparative analysis. Specifically, Aquafor will undertake an as-built survey of completed channel works (plan, profile, and cross sections) to verify implementation of design within reasonable tolerances. As-constructed drawings, together with a report summarizing pre- and post-construction conditions would be provided. The report would comment on significant deficiencies found with recommendations for correction or adaptive management as required.

Should CVC or the City wish the HEC model be updated to match as-built conditions (should the comparative analysis to the design highlight differential condition), the HEC-RAS model may be updated accordingly to confirm no negative impacts to flooding.

10 REFERENCES

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Appendix A – Detailed HEC-RAS Results

Appendix B – Stage 1 Archaeological Study Report

Appendix C – Preliminary Cultural Heritage Report

Appendix D – Conceptual Design Drawings for Alternative Solutions

Appendix E – Evaluation of Alternatives

Appendix F – Public Consultation

Appendix F1 – Public Notices

Appendix F2 – Stakeholder List

Appendix F3 – Public Information Centre Materials

Appendix F4 – Consolidated Comments from Stakeholders and Public