

WELCOME

Appleby Creek Erosion Control Environmental Assessment

PUBLIC INFORMATION CENTRE

February 19, 2019

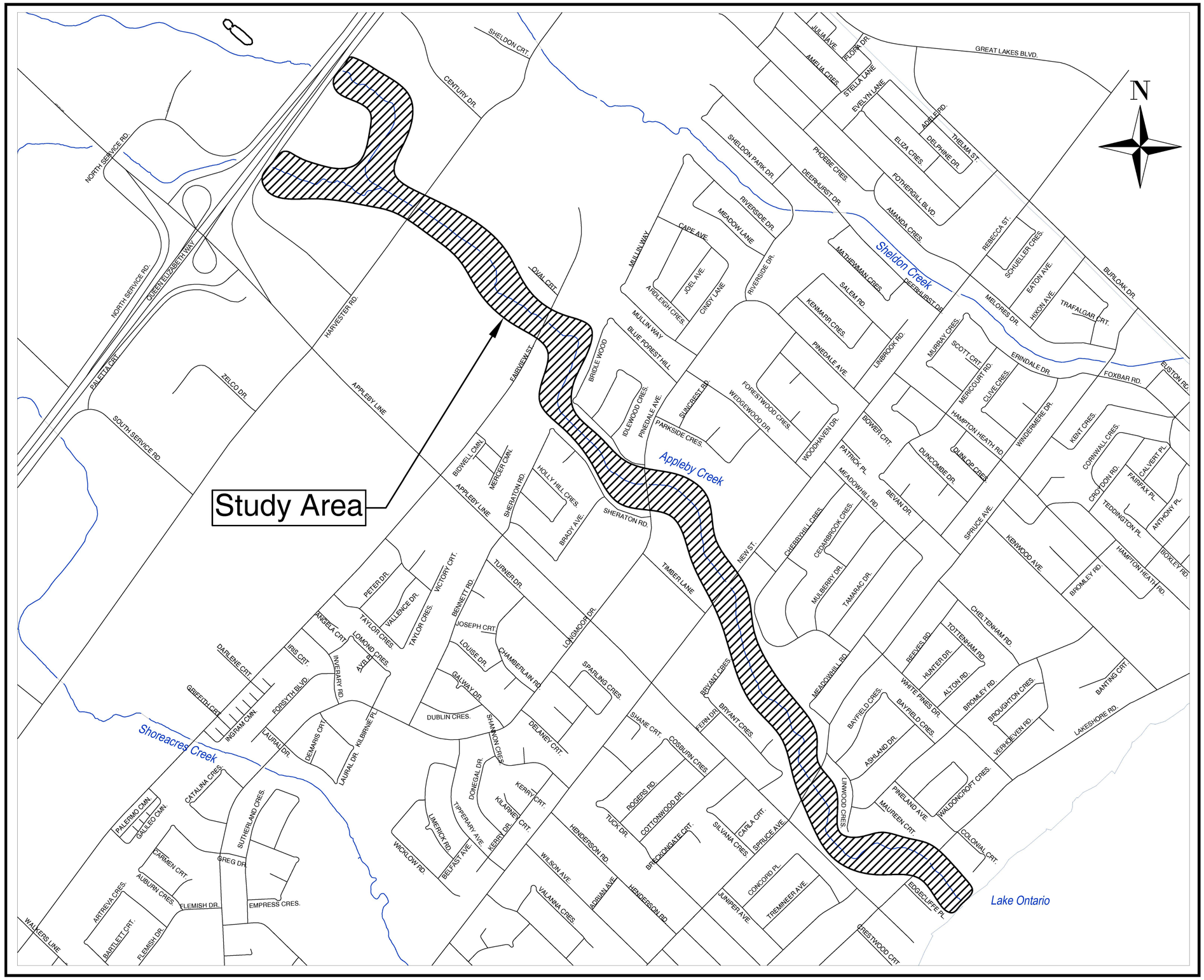
Your comments are encouraged and appreciated, as this will provide us an opportunity to address project issues and concerns.

Aquafor Beech Limited

CITY OF Burlington

STUDY AREA

The study area along Appleby Creek between South Service Road and Lake Ontario



STUDY PURPOSE / PROBLEM DEFINITION

The study is being carried out to study the risk of erosion related to Appleby Creek within the study area, and provide recommendations to reduce erosion and protect the natural heritage in the area.

PUBLIC INFORMATION CENTRE PURPOSE

This Public Information Centre (PIC) is Designed to:

- Present information on existing conditions
- Present alternative approaches to erosion protection
- Present study process and timelines

To gain community input on:

- Existing conditions information
- Identification of opportunities and mitigation preferences
- Alternative evaluation criteria and scoring

MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT PROCESS

CLASS EA PROCESS - SCHEDULE B

Many projects related to municipal systems are similar in nature, are carried out routinely, and have predictable and mitigatable environmental effects which are investigated according to the Municipal Engineers Association "Municipal Class Environmental Assessment" (October 2000, as amended in 2007 & 2011).

This study is being undertaken as a Schedule B project under the Municipal Class Environmental Assessment process. The flow chart illustrates the key steps to be undertaken as part of the EA process.

Phase 1 – Identify Problems

- Identify Problem or Opportunity
- Public Consultation

We Are Here →

Phase 2 – Alternate Solutions

- Identify Alternative Solutions
- Inventory Natural, Social, Economic Environment
- Environmental Impacts and Mitigation
- Alternatives Evaluation
- **Review Agency and Public Consultation**
- Select Preferred Solution
- Review and Confirm Choice of Schedule
- Notice of Completion to Review Agency & Public
- Implementation

NATURAL HERITAGE ASSESSMENT

To assess the existing natural environment within the study, the following studies were undertaken:

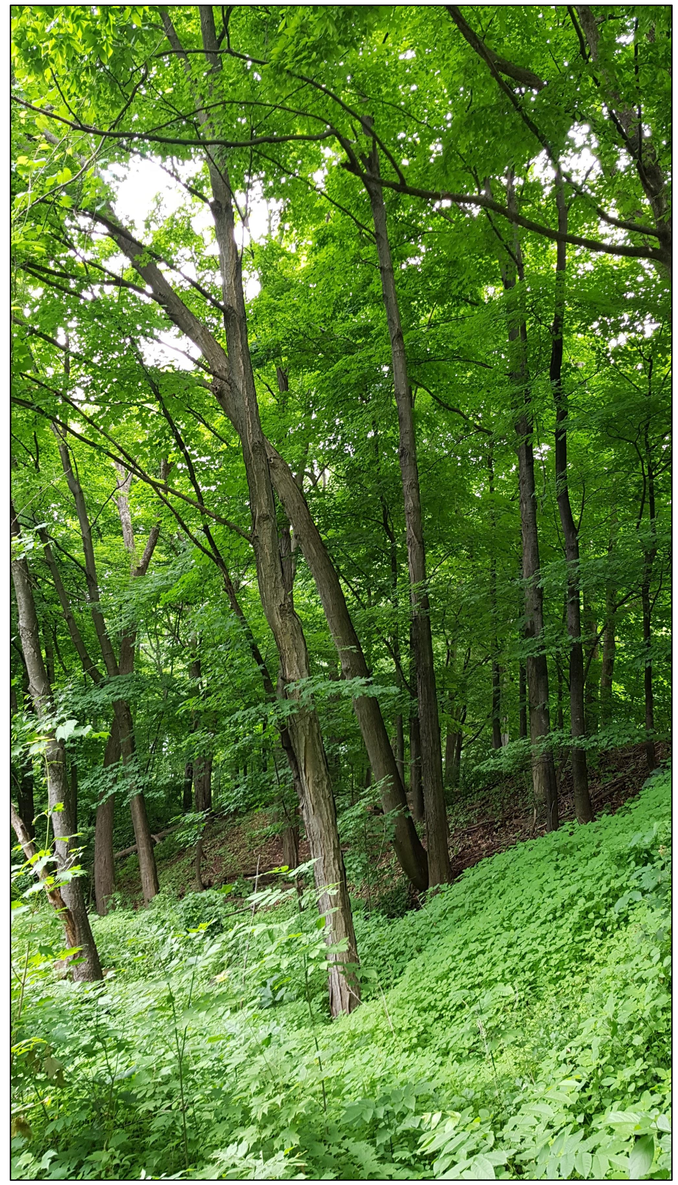
1. Tree inventory and assessment;
2. Vegetation community classification (Ecological Land Classification (ELC) protocol);
3. Vascular plant survey (includes vascular plant Species at Risk (SAR) survey);
4. Breeding Bird Surveys (BBS);
5. Candidate bat maternity roost surveys;
6. Snake surveys (no snakes recorded during surveys);
7. Frog and toad call surveys (no frogs or toads recorded during surveys);
8. Fish community and aquatic habitat assessment;
9. SAR screening and habitat assessment; and,
10. Significant Wildlife Habitat (SWH) screening and assessment.



Shagbark Hickory (*Carya ovata*) near Bromley Park, Burlington

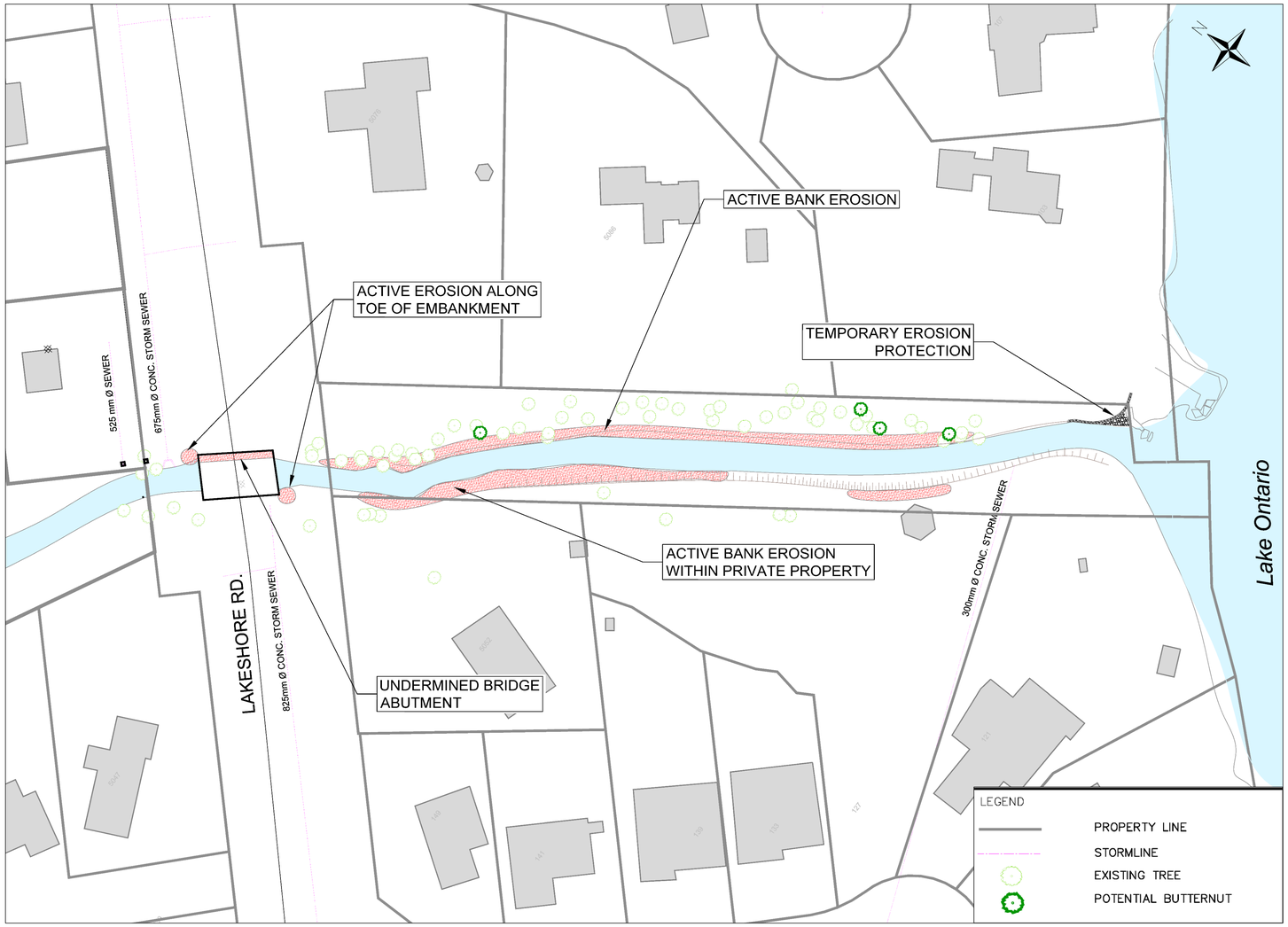


Black-crowned Night-heron (*Nycticorax nycticorax*) foraging in Appleby Creek



Oak, Maple and Hickory Forest on the slope of Appleby Creek

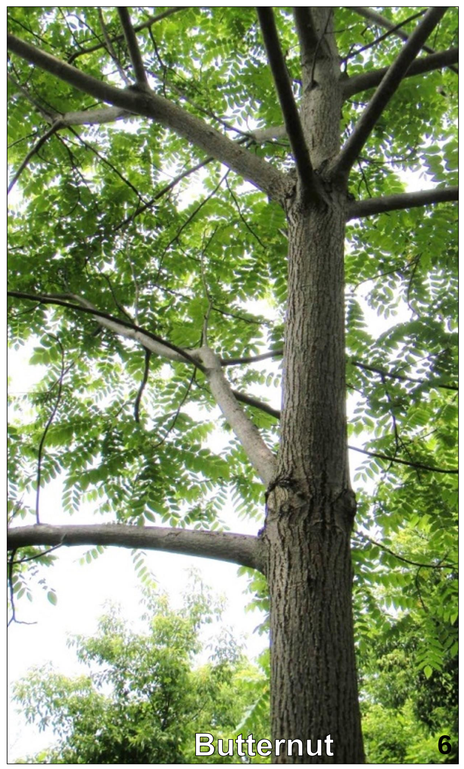
TREE INVENTORY



- Trees greater than 10cm diameter were inventoried in proximity to erosion sites within the study area, and a total of 39 species were identified.
- Within Reach 1, four **Butternuts**, which is an endangered species protected under Ontario's Endangered Species Act, were identified.
- Removal of trees may be required to accommodate channel and culvert works. However, the removed trees will be compensated with as per City of Burlington and Conversation Halton standards during restoration stage.

Common Name	Botannical Name	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7
Amur Maple	*Acer ginnala*					2		
Austrian Pine	*Pinus nigra*			3	2		5	
Basswood	*Tilia americana*		3	4				1
Bitternut Hickory	*Carya cordiformis*		1					
Black Locust	*Robinia pseudoacacia*			3				
Black Walnut	*Juglans nigra*	1	8	3	4	7	2	23
Bur Oak	*Quercus macrocarpa*			3			1	
Butternut	***Juglans cinerea***	4						
Colorado Blue Spruce	*Picea pungens*					1		
Common Apple	*Malus spp.*	1					1	1
Common Buckthorn	*Rhamnus cathartica*						1	
Crack Willow	*Salix x rubens*					4	1	
Douglas Fir	*Pseudotsuga menziesii*				4			
English Hawthorn	*Crataegus laevigata*					1	1	
European Mountain-Ash	*Sorbus aucuparia*			1				
Hackberry	*Celtis occidentalis*					4		
Honeylocust	*Gleditsia triacanthos var. inermis*					5	2	
Hop Hornbeam	*Ostrya virginiana*			2				
Horsechestnut	*Aesculus hippocastenum*	2						
Hybrid Crack Willow	*Salix x rubens*	7	2			1	11	4

Common Name	Botannical Name	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7
Little-leaf Linden	*Tilia cordata*					2	1	
Manitoba Maple	*Acer negundo*	1	2		1	14	10	1
Norway Maple	*Acer platanoides*	33	14	11	7	16	2	1
Red Oak	*Quercus rubra*		1	5		1		1
Russian Olive	*Elaeagnus angustifolia*						1	1
Shagbark Hickory	*Carya ovata*			1				
Siberian Elm	*Ulmus pumila*			6	1	1		1
Silver Maple	*Acer saccharinum*	1			4	4		
Slippery Elm	*Ulmus rubra*							1
Small-leaved Linden	*Tilia cordata*					1		
Smooth Serviceberry	*Amelanchier laevis*					1		
Sugar Maple	*Acer saccharum*		3	16				
Sweet Cherry	*Prunus avium*			1			1	
Weeping Willow	*Salix x sepulcralis* 'Chrysocoma'		2			1		
White Ash	*Fraxinus americana*	12	15	8		6	36	9
White Elm	*Ulmus americana*	2	5			1		
White Mulberry	*Morus alba*		3		1	1	2	
White Pine	*Pinus strobus*			1				
White Spruce	*Picea glauca*					5		



VEGETATION COMMUNITY CLASSIFICATION

Vegetation communities within the study area were identified during field surveys completed in accordance with the *Ecological Land Classification (ELC) System for Southern Ontario: First Approximation and its Application* (Lee et al., 1998) protocol in 2018. Additional surveys are scheduled for spring 2019.

Determining the vegetation communities within the study area aids in identifying the presence of significant vegetation communities, Significant Wildlife Habitat (SWH), and the habitats of potential Species at Risk.

In total, nine vegetation communities are within the study area (see Board 10). Some of these communities are either complex communities (i.e. a pattern of two or more vegetation ecosites or types forming a mosaic (Lee et al., 1998)) or have inclusions (i.e. vegetation types less than 0.5 ha within a larger vegetation type). None are provincially or globally significant.



Mineral Cultural Savannah



Mineral Deciduous Forest adjacent to Appleby Creek

VEGETATION COMMUNITY CLASSIFICATION

Aquafor Beech Limited

CITY OF Burlington

Appleby Creek Erosion Control Environmental Assessment





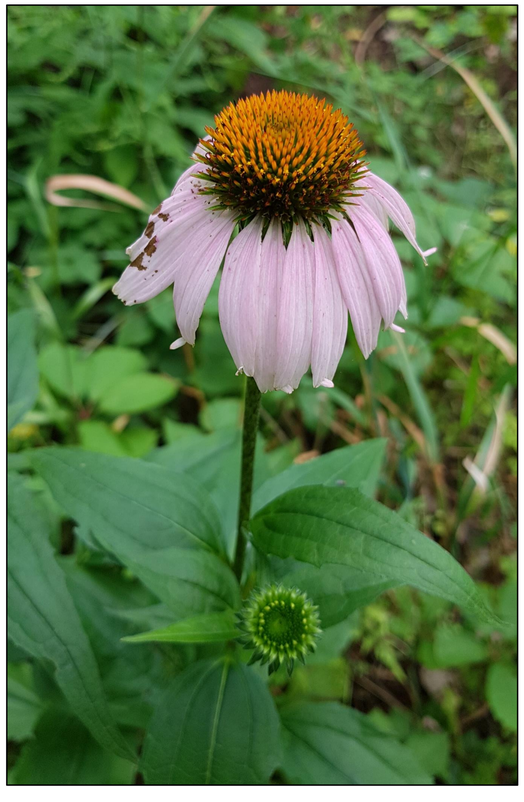
ID	Code	Community Type Description	ID	Code	Community Type Description
1	FOC2	Dry – Fresh Oak – Maple – Hickory Deciduous Forest	6	CUS1	Mineral Cultural Savannah
2	FOD7 (CUW1)	Fresh – Moist Lowland Deciduous Forest – Mineral Cultural Woodland Complex	6 INC1	MAM2-10	Forb Mineral Meadow Marsh
2 INC1	CUP3	Coniferous Plantation (White Spruce)	7	CUM1 (CUT1-1)	Mineral Cultural Meadow - Sumac Cultural Thicket Complex
3	CUW1 (FOD7)	Mineral Cultural Woodland – Fresh - Moist Lowland Deciduous Forest Complex	7 INC1	MAM2-10	Forb Mineral Meadow Marsh
4	FOD9-1 (FOD7 -4)	Fresh – Moist Oak – Sugar Maple Deciduous Forest - Fresh – Moist Black Walnut Lowland Deciduous Forest Complex	8	CUW1	Mineral Cultural Woodland
5	CUW1	Mineral Cultural Woodland	8 INC1	CUT1	Hawthorn / Buckthorn Mineral Cultural Thicket
5 INC1	CUT1	Hawthorn Mineral Cultural Thicket	8 INC2	MAS2-1	Cattail Mineral Shallow Marsh
5 INC2	CUS1	Dry – Moist Old Field Meadow	9	CUW1	Mineral Cultural Woodland

VASCULAR PLANTS

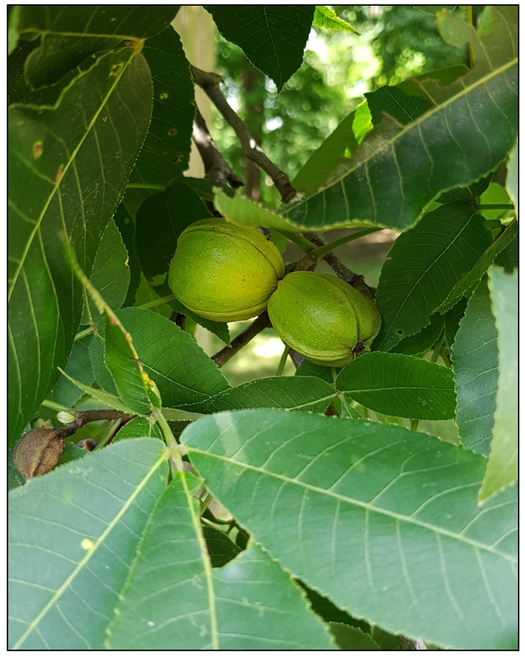
Vascular plants were identified in concert with vegetation community surveys in 2018. Additional surveys are planned for spring 2019. To date, 151 species have been identified, plus an additional 11 to genus.

Attributes of the vascular plant species recorded within the study area are as follows:

- Introduced Species: 76
- Native Species: 75
- Provincially Rare Species (S1-S3): 1 (Butternut, Juglans cinerea)
- Species at Risk: 1 (Butternut)



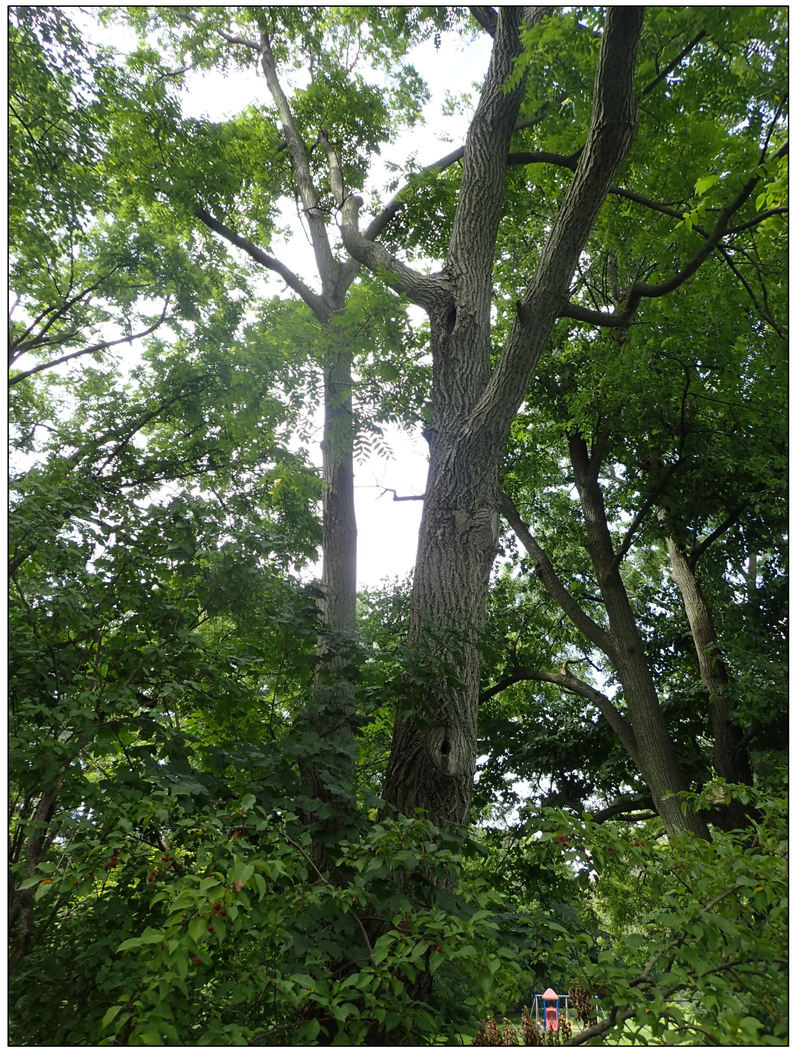
Purple Coneflower
(*Echinacea purpurea*)



Shagbark Hickory
(*Carya ovata*)



Water Plantain
(*Alisma subcordatum*)



Butternut (*Juglans cinerea*)

BREEDING BIRDS

Two Breeding Bird Surveys (BBS) were conducted in 2018 by a qualified avian biologist. A total of 35 species were recorded during surveys. BBS results are as follows:

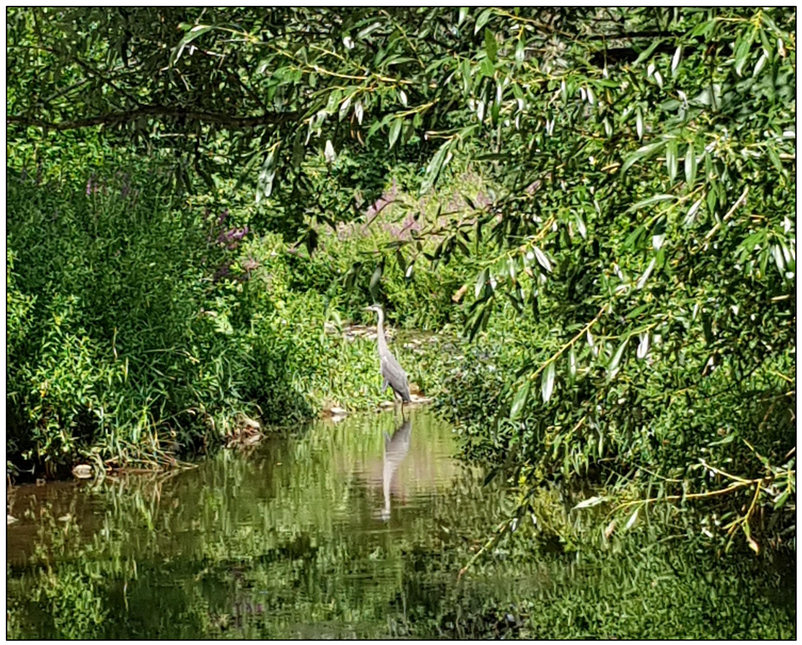
- Confirmed breeding: 1
- Probable breeding: 13
- Possible breeding: 16
- No breeding evidence: 5

Provincially rare species: 1 (Black-crowned Night-heron (*Nycticorax nycticorax*))

Due to a lack of breeding evidence (i.e. no nests were observed in trees), it is believed the Black-crowned Night-heron is using the Appleby Creek corridor north and south of the Appleby GO station to forage for fish.



Black-crowned Night-heron
(Nycticorax nycticorax)



Great Blue Heron (*Ardea herodias*)



Juvenile Red-tailed Hawk
(*Buteo jamaicensis*)

SPECIES AT RISK

For the purpose of this Study, Species At Risk (SAR) are defined as species listed as Endangered (END), Threatened (THR), or Special Concern (SC) under the provincial Endangered Species Act (ESA) and/or the federal Species at Risk Act (SARA). Other Species of Conservation Concern (SOCC) are those with Global ranks of G1-G3 and/or Subnational/Provincial ranks of S1-S3.

Species included in the screening assessment include those provided by secondary sources and those documented via direct observations by Aquafor Beech Limited. **A total of 18 SAR and SOCC are included in the screening assessment**. Of these, 10 are either confirmed present or have the potential to occur within the study area. These are as follows:

Species Name		Ranking					Assessment of Species Occurrence at or Near the Study Area
Scientific Name	Common Name	SARA*	ESA*	G-Rank	S-Rank	Halton Region	
Myotis leibii	Eastern Small-footed Myotis	END	END	G4	S2S3	-	Potentially Present
Myotis lucifugus	Little Brown Myotis	END	END	G3	S4	Common	Potentially Present
Myotis septentrionalis	Northern Myotis	END	END	G1G2	S3	Common	Potentially Present
Perimyotis subflavus	Tri-coloured Bat	END	END	G2G3	S3?	-	Potentially Present
Nycticorax nycticorax	Black-crowned Night-heron	-	-	G5	S3B, SZN	Uncommon	Confirmed Present
Cardellina canadensis	Canada Warbler	THR	SC	G5	S4B	Rare	Present (Likely Migrant)
Contopus virens	Eastern Wood-Pewee	SC	SC	G5	S4B	Common	Confirmed Present
Juglans cinerea	Butternut	END	END	G4	S2?	Common	Confirmed Present
Chelydra serpentina	Snapping Turtle	SC	SC	G5	S3	Common	Potentially Present
Danaus plexippus	Monarch	SC	SC	G4	S2N,S4B	Common	Confirmed Present

*Species ranking for SARA and ESA are as follows: EXT – Extinct, EXP – Extirpated, END – Endangered, THR – Threatened, SC – Special Concern, NAR – Not-at-Risk, and DD – Data Deficient

SIGNIFICANT WILDLIFE HABITAT

The province has provided guidance for the identification and assessment of Significant Wildlife Habitat (SWH). In Burlington, the primary document to use to identify SWH is the Technical Guide for Ecoregion 7E (Government of Ontario, 2015).

Candidate or Confirmed SWH types within the study area are as follows:

- **Bat Maternity Colonies – Candidate**
- **Migratory Butterfly Stopover Areas – Candidate**
- **Landbird Migratory Stopover Areas – Candidate**
- **Special Concern and Rare Wildlife Species – Candidate/Confirmed**
  - ❖ Snapping Turtle (SC, S3), Candidate
  - ❖ Black-crowned Night-heron (S3), Confirmed



Monarch (*Danaus plexippus*)

SWH is a *Key Feature* of Halton Region's Natural Heritage System (RNHS) and is protected under the Region's Official Plan.

FISHERIES & AQUATIC HABITAT

To assess the existing fisheries and aquatic habitat within the study the following studies were undertaken:

- Aquatic habitat assessments at Fairview Street, New Street & Pinedale Avenue;
- Aquatic community assessments of historic data;
- SAR screening and potential habitat identification; and,
- Significant Wildlife Habitat screening.

Summary of Fish Community Sampling:

Common Name	Scientific Name	Count
Blacknose Dace	*Rhinichthys atratulus*	1
Brassy Minnow	*Hybognathus hankinsoni*	2
Brook Stickleback	*Culaea inconstans*	24
Carps and Minnows	*Cyprinidae*	3
Creek Chub	*Semotilus atromaculatus*	286
Fathead Minnow	*Pimephales promelas*	10
Goldfish	*Carassius auratus*	1
Green Sunfish	*Lepomis cyanellus*	47
Largemouth Bass	*Micropterus salmoides*	1
Lepomis sp.	*Lepomis sp.*	8
Longnose Dace	*Rhinichthys cataractae*	22
Pumpkinseed	*Lepomis gibbosus*	4
Threespine Stickleback	*Gasterosteus aculeatus*	2
White Sucker	*Catostomus commersoni*	34

Data from Conservation Halton

Key Findings:

- No aquatic SAR were identified within the study area;
- The thermal classification of Appleby Creek within the study area is that of a Cool-Warm thermal regime and is dominated by warmwater and coolwater species;
- The Index of Biotic Integrity (IBI) for Appleby Creek ranges from Poor-Fair (indicating that there is limited high quality aquatic habitat);
- A number of **fish barrier(s)** were observed upstream of the crossing at Fairview Street (deteriorating gabion weir and debris jam) and upstream of the Go Line crossing; and,
- There are opportunities to improve fish habitat.



Fathead Minnow, *Pimephales promelas*
Photo Credit: Konrad P. Schmidt & Donals Biemborn

Next Steps:

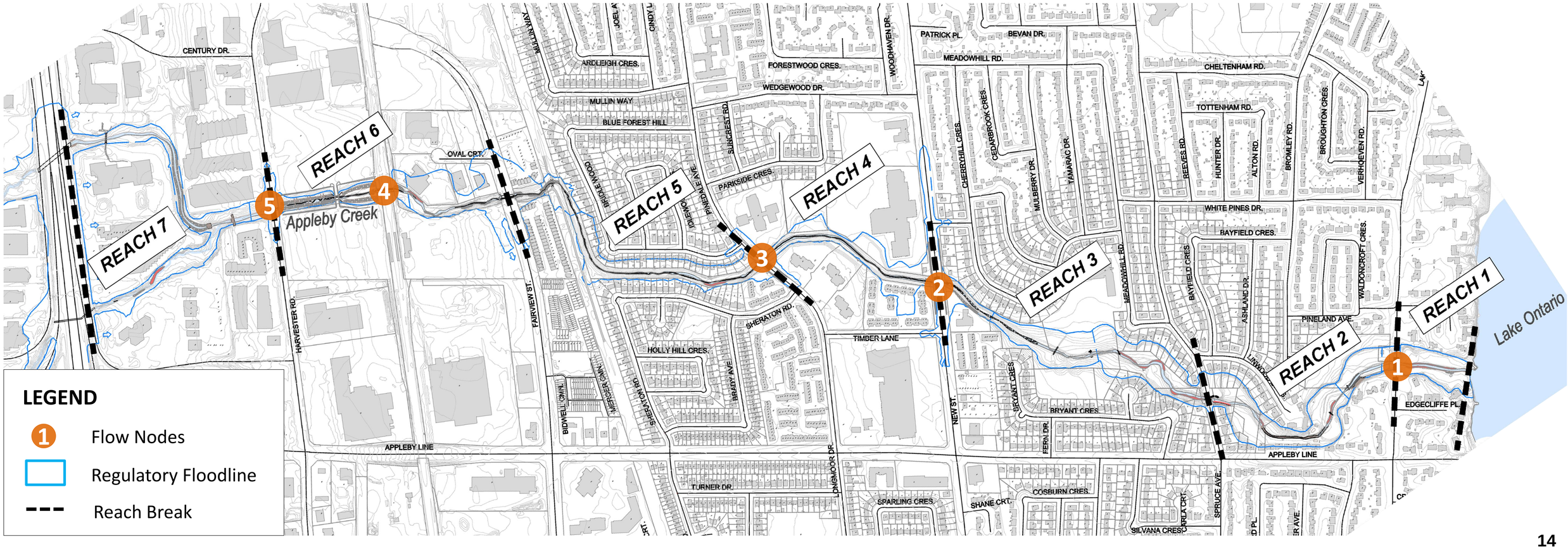
- More detailed aquatic habitat assessments following the Ontario Stream Assessment Protocol (OSAP) will be conducted in the spring of 2019, with efforts focused on areas of with significant erosion. Results will be compared to reference sites within the study area to better represent a healthy aquatic habitat in the design phase.

HYDROLOGY & EXISTING FLOODING PROFILE

Flows at different locations under various rainfall events are presented in the table, and the flooding profile under regional storm is shown in the figure.

Aquafor has recently completed the *Appleby Creek Flood Mitigation EA study between Fairview Street to New Street*, and identified flood mitigation measures within the study area. Hence, this study will incorporate the flood mitigation opportunities where possible to provide integrated solutions to mitigate both erosion and flooding.

Event	Flow (m^3/s)				
	Node 1	Node 2	Node 3	Node 4	Node 5
Regional	109	106	101	93	85
100 Year	61	59	57	54	50
50 Year	55	53	51	48	45
25 Year	48	47	45	42	39
10 Year	38	38	35	34	32
5 Year	31	31	30	28	26
2 Year	21	21	20	19	18



EROSION INVENORY

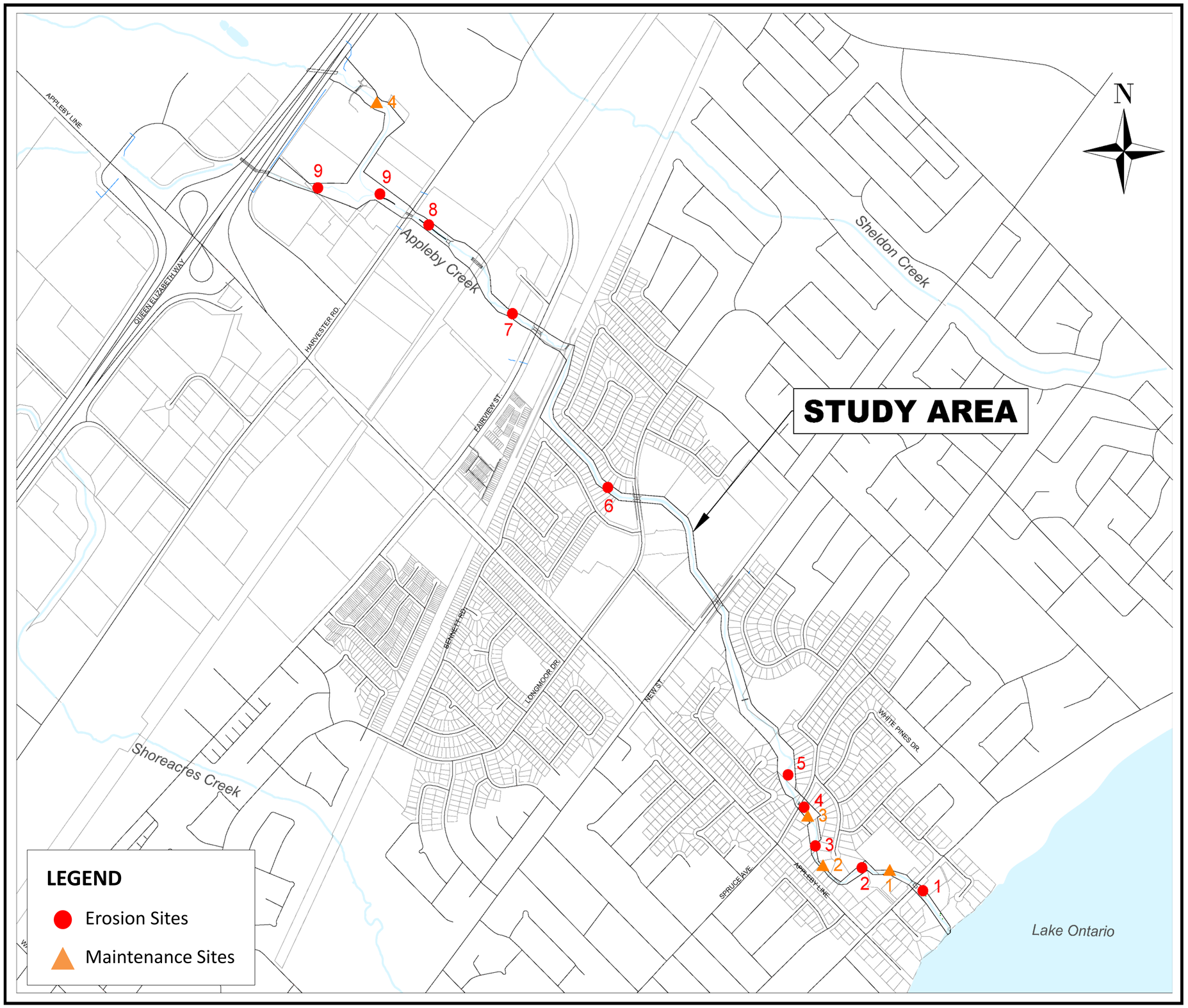
Nine erosion sites and four maintenance sites were identified within the study area.

Risks observed at the erosion sites include:

- Risks to private properties;
- Risks to municipal infrastructure;
- Negative impacts on water quality;
- Fish barrier.

Issues observed at maintenance sites consists of:

- Woody debris and fallen trees within the creek – negative impact on flow conveyance;
- Deteriorating engineered structures require maintenance.



EVALUATION CRITERIA

The following criteria are used to evaluate each alternative. It will help determine which alternative should be selected as the preliminary preferred alternative.

Comment sheets are provided to collect public feedback on the evaluation criteria and preliminary evaluation.

Physical / Natural Environment

Potential to Reduce Stream Bank and Stream Bed Erosion	Greater reduction of erosion risks to public
Potential to Reduce Flooding Risks	Greater reduction of flooding risks to public and/or private lands for longer time scores higher
Potential to Improve Aquatic Habitat	Greater improvements to fish and aquatic habitat scores higher, including substrate, overhanging vegetation, turbidity, and passage/connectivity
Potential to Improve Terrestrial Habitat	Greater improvements to terrestrial habitat scores higher, including loss and replacement of vegetation and natural corridor connectivity

Social / Cultural Environment

Aesthetics / Recreation	Greater improvements to the aesthetics of the creek corridor and how the alternative impacts recreational use of the corridor score higher
Compatibility with Adjacent Land Use	Greater compatibility with the land use of adjacent properties scores higher
Community Disruption	Less disruption the surrounding community and residents scores higher
Public Health and Safety	Greater protection of public health and safety for a longer time scores higher

Technical and Engineering Considerations

Ease of Implementation	Ease of Implementation Greater ease of implementing scores higher
Agency Acceptance	Agency Acceptance Greater likelihood that regulatory authorities will support the alternative scores higher
City Acceptance	Town Acceptance Greater compliance with existing City plans, policies, and bylaw requirements scores higher
Technical Feasibility	Greater technical feasibility relative to other alternatives scores higher

Economic Environment

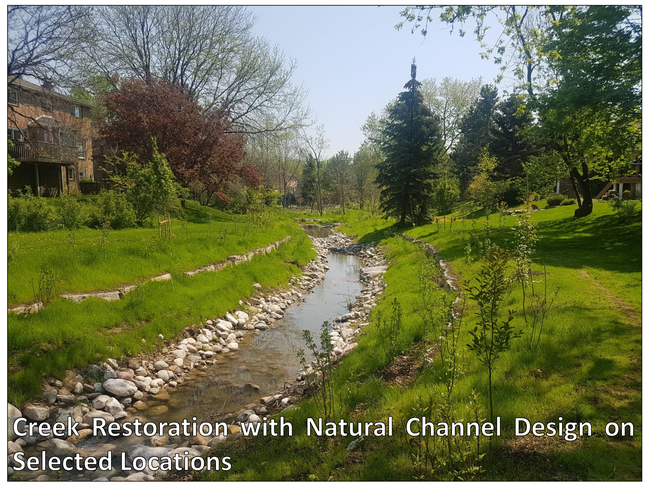
Construction Costs	Lower construction cost relative to other alternatives scores higher
Operation and Maintenance Costs	Lower operations and maintenance costs relative to other alternatives scores higher
Life Cycle Costs	Lower life cycle costs relative to the other alternatives scores higher
Infrastructure Protection	Greater protection of existing infrastructure for a longer time scores higher

PRELIMINARY ALTERNATIVE SOLUTIONS

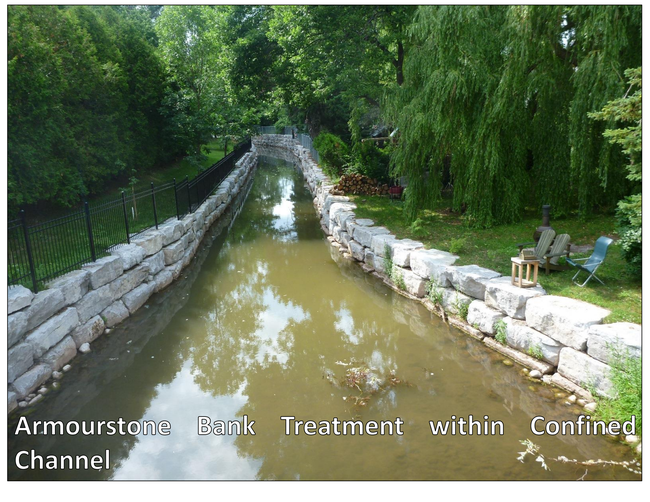
1. **Do nothing**
   - Leave the site as it is and allow erosional processes to continue within the watercourse corridor;
   - Maintenance or possibly emergency works may be required in the future.


Exposed Fence Pole Foundation and Tree Roots Due to Erosion, Risk to Private Property

2. **Selective Works**
   - Localized channel bank and/or bed work to address erosion issues at the site;
   - May require ongoing maintenance, occasional repairs, or eventual replacement;
   - Often preferred to limit the economic cost and the environmental damage of large-scale channel engineering and stream restoration works.


Creek Restoration with Natural Channel Design on Selected Locations

3. **Reach-based works**
   - A reach-based approach to address erosion issues at the site;
   - Typically applied in highly constrained urban watercourses;
   - Primarily utilizes “hard” channel engineering approaches, but may incorporate some natural channel designs;
   - Higher capital cost, but require minimal maintenance.

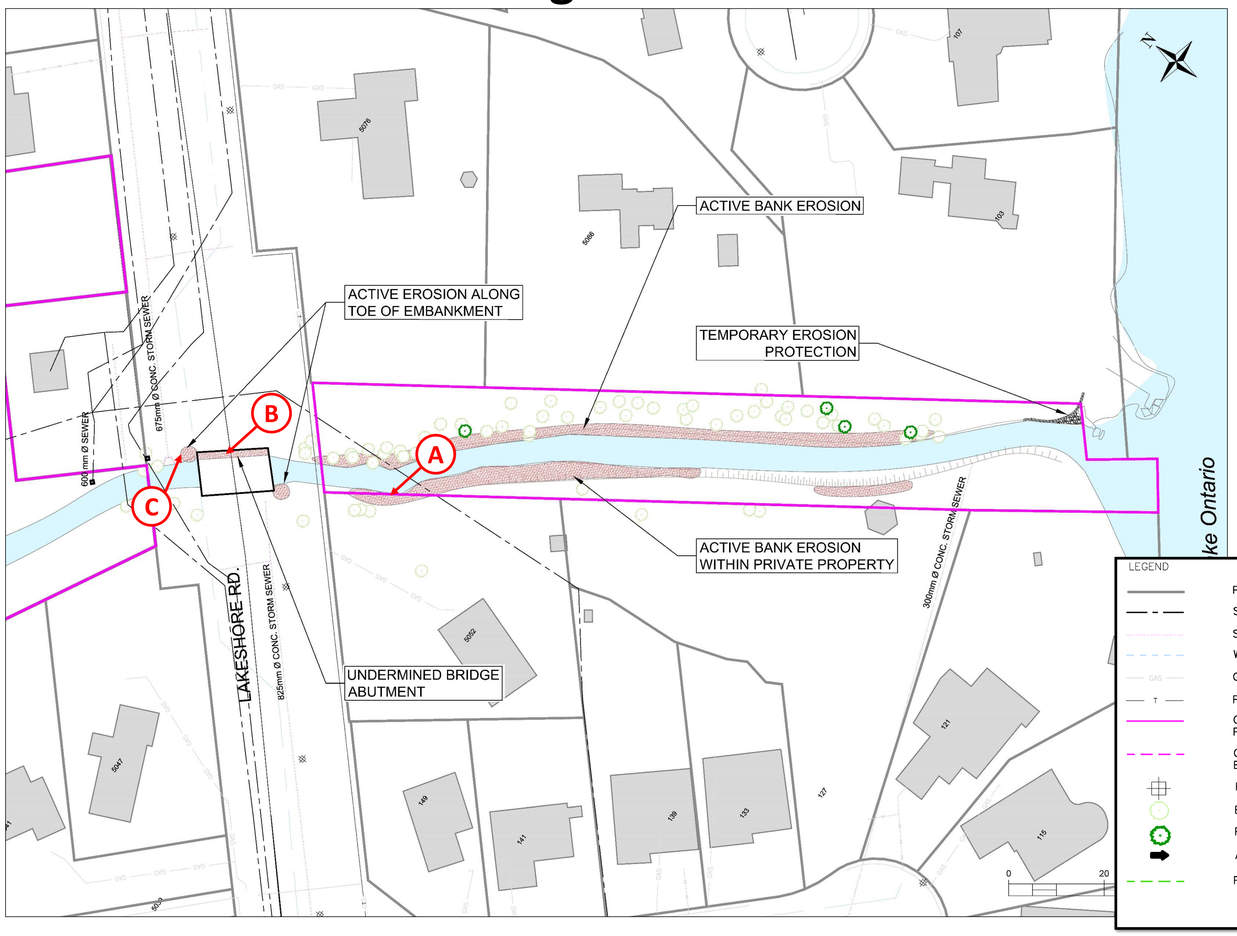

Armourstone Bank Treatment within Confined Channel

EROSION SITE 1

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Appleby Creek Erosion Control Environmental Assessment

Existing Conditions



Conceptual Design

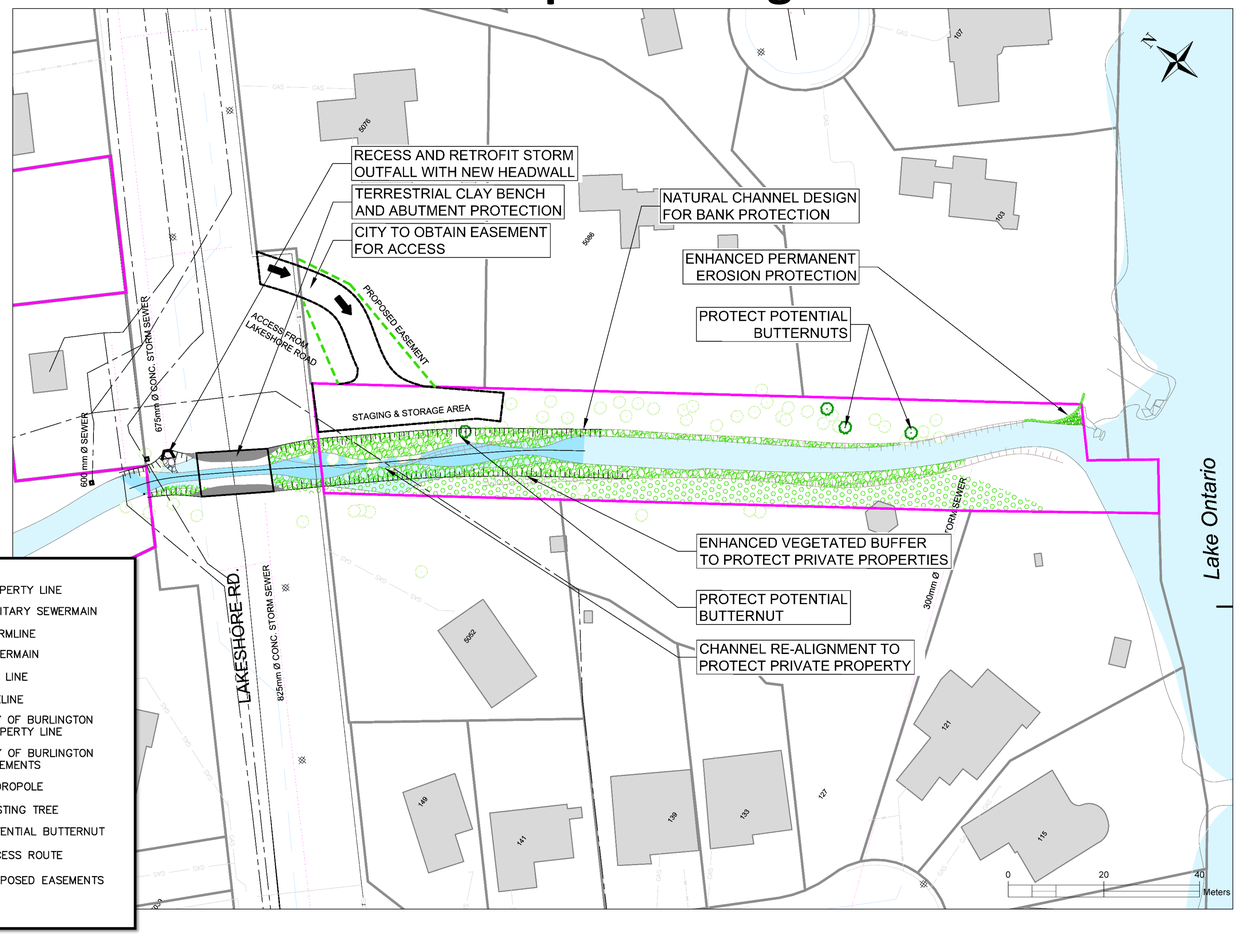
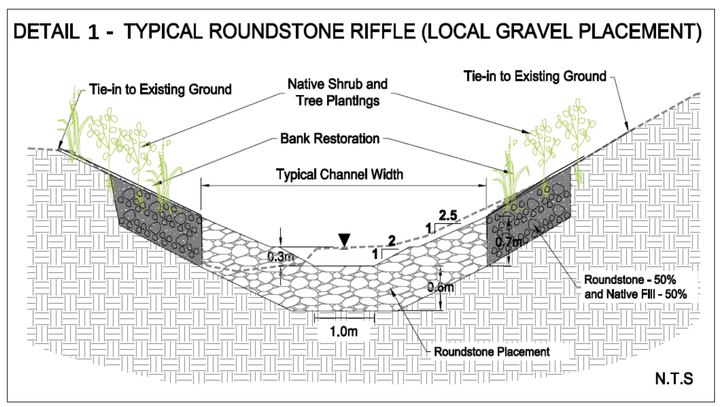



Photo A – Active Bank Erosion onto Private Property


Photo B – Failed Bridge Abutment Protection


Photo C – Undermined Outfall Headwall Due to Bedrock Loweing




An Example of Natural Channel Design Enhanced with Vegetation Buffer

Risks to private property, municipal infrastructure and aquatic habitat due to:

- Active bank erosion
- Shale bedrock lowering
- Failed bridge abutment protection and deteriorating storm outfall headwall

Level of Risk: High

Conceptual design notes:

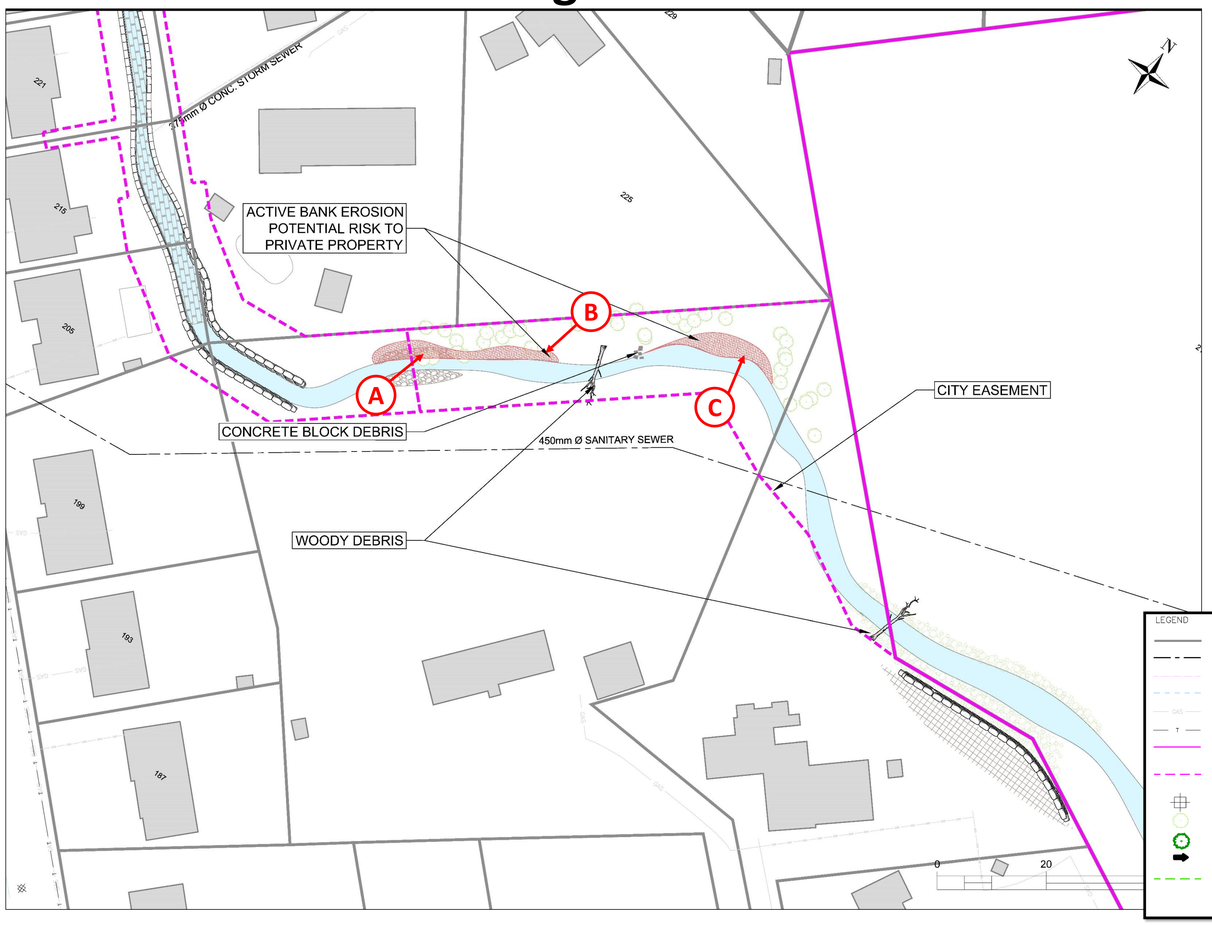
- Selective works
- Minor channel realignment to protect private property
- Natural channel design to enhance creek riparian while providing protection
- Terrestrial clay bench design for bridge to enhance terrestrial ecology while protecting bridge abutment

EROSION SITE 2 & MAINTENANCE SITE 1

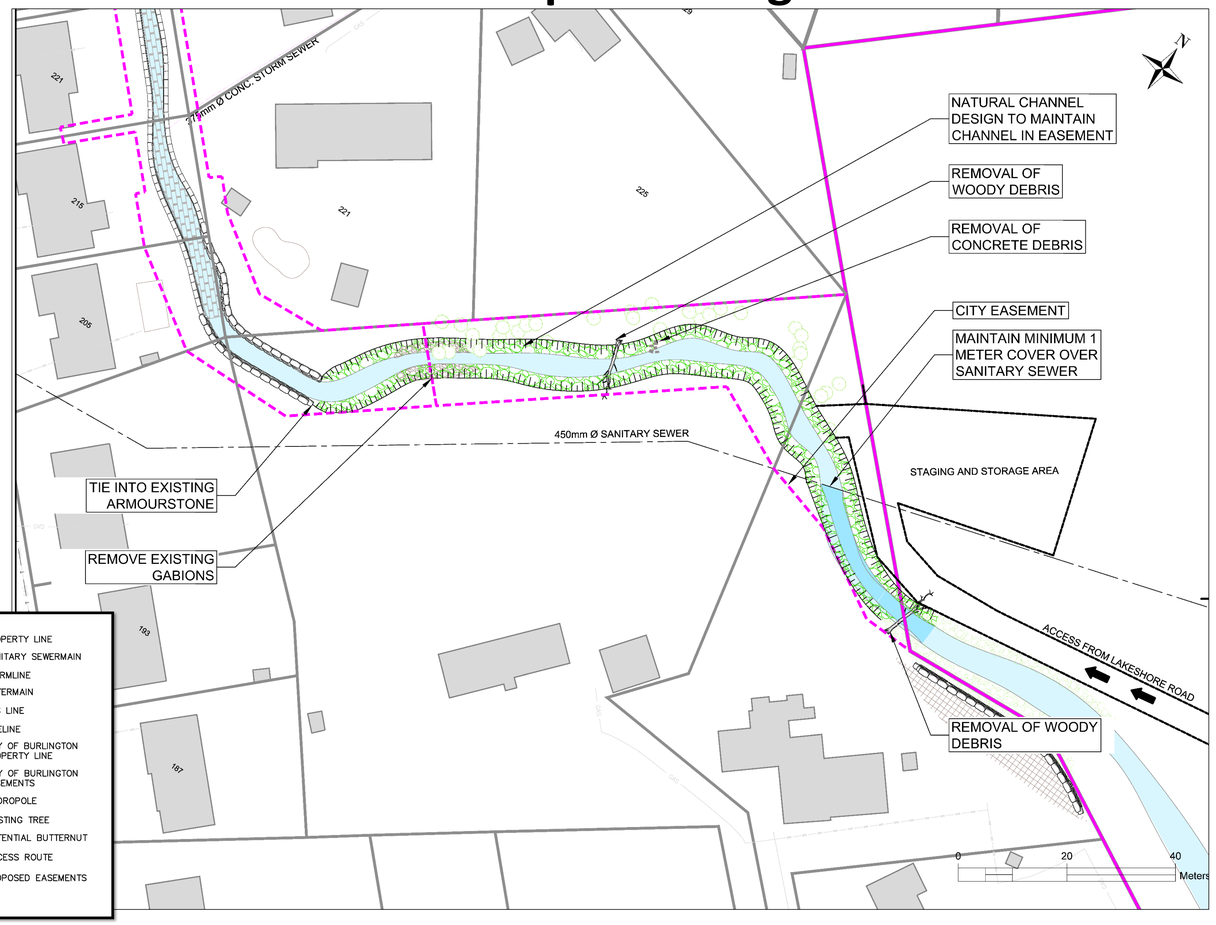
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Appleby Creek Erosion Control Environmental Assessment

Existing Conditions



Conceptual Design



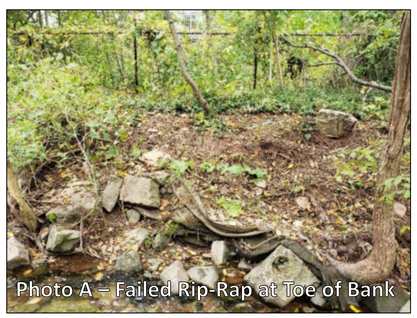
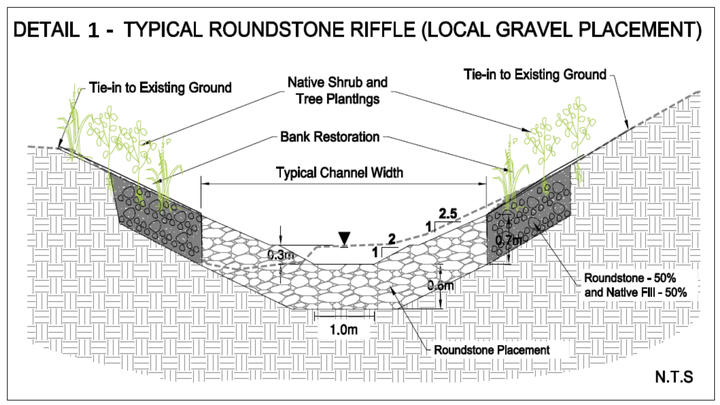
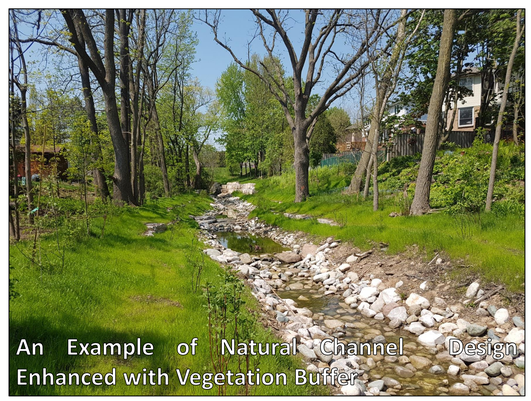

Photo A – Failed Rip-Rap at Toe of Bank


Photo B – Undermined Trees Leaning into the Creek


Photo C – Eroded Outer Bank with Near Vertical Slope, Exposed Shale Bedrock




An Example of Natural Channel Design Enhanced with Vegetation Buffer

Risks to private property and aquatic habitat due to:

- Active bank erosion, undermined trees
- Exposed Shale bedrock
- Failed bank protection measures

Level of Risk: low

Conceptual design notes:

- Selective works
- Natural channel design to enhance creek riparian, provide protection against bank erosion, and limit potential risks within City easements

Recommended maintenance work:

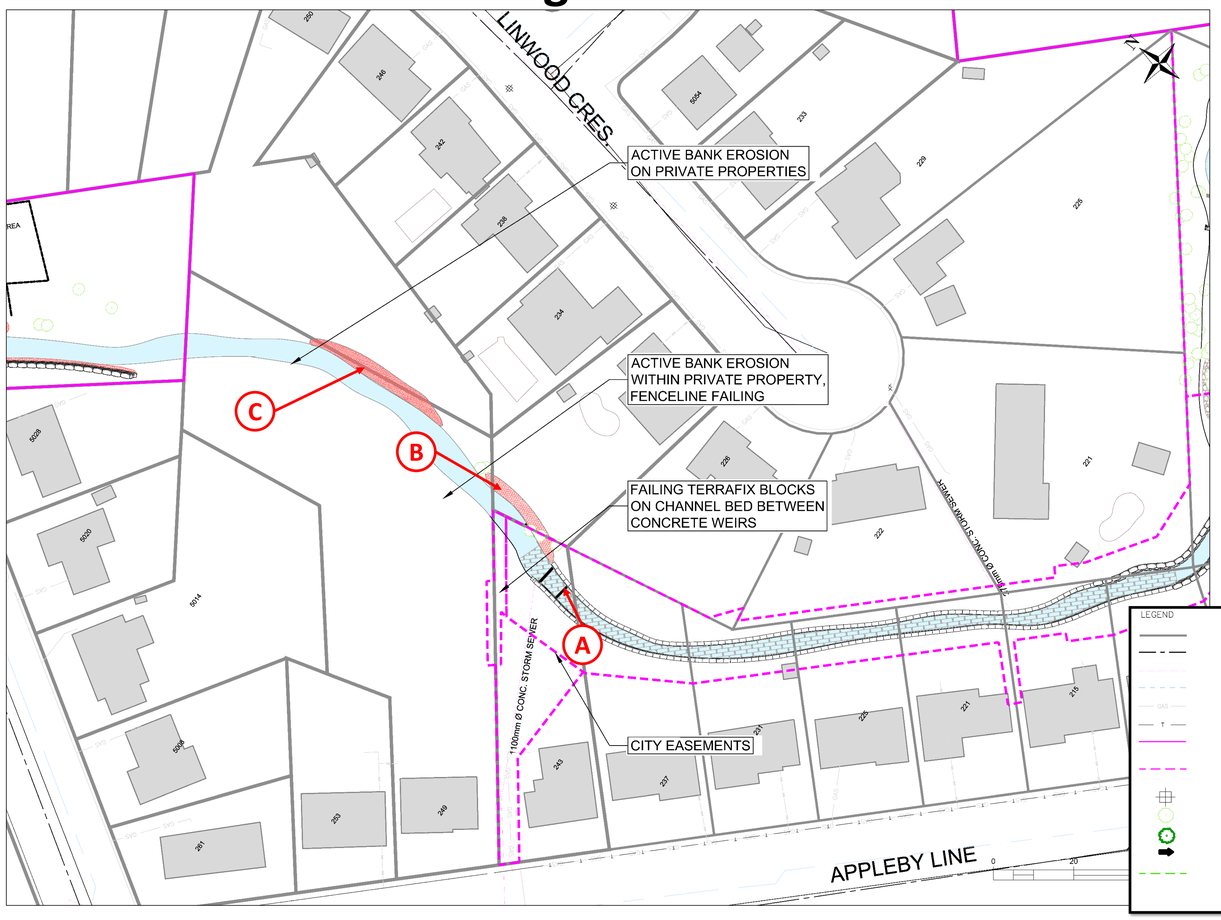
- Removal of fallen trees and woody debris

EROSION SITE 3 & MAINTENANCE SITE 2

Aquafor Beech Limited | CITY OF Burlington

Appleby Creek Erosion Control Environmental Assessment

Existing Conditions



Conceptual Design

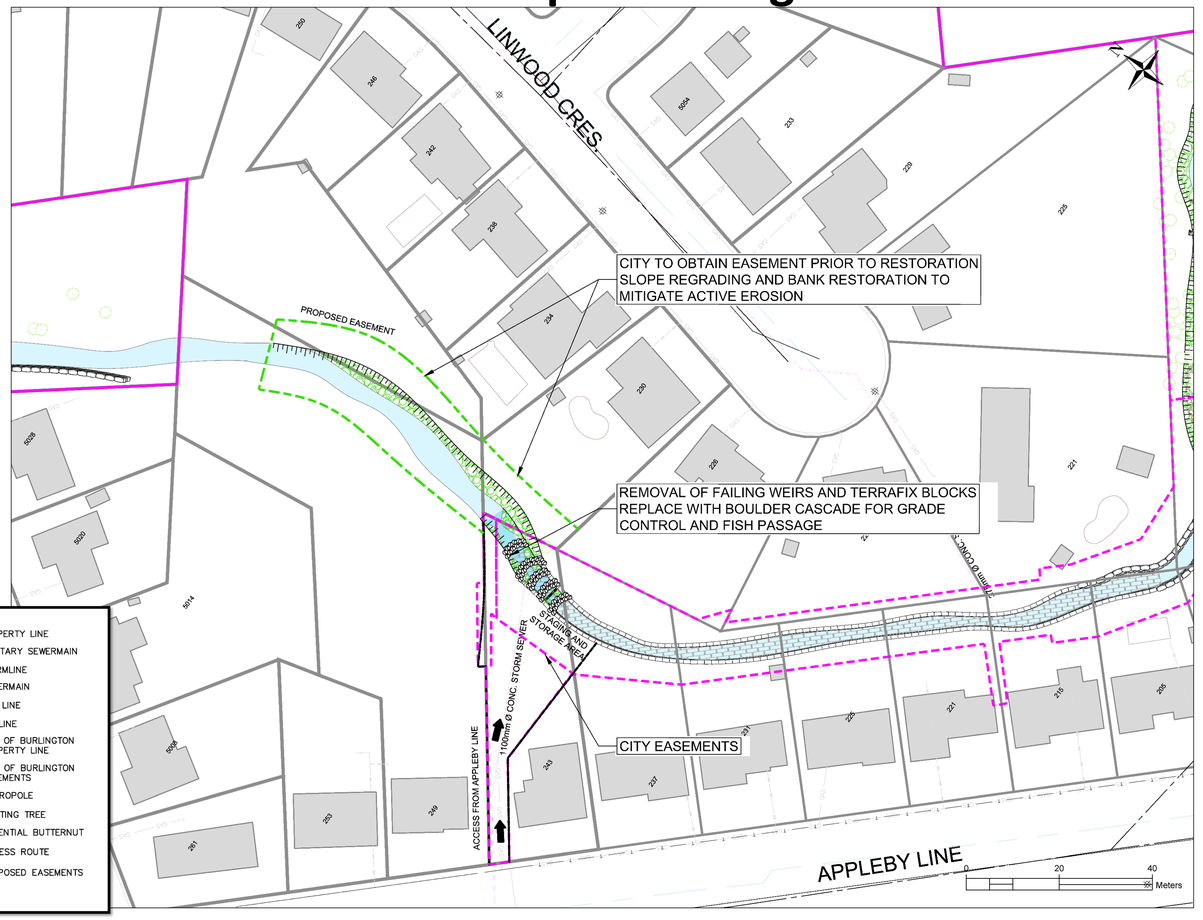



Photo A – Double Concrete Weir with Deteriorating Terrafix Bed


Photo B – Exposed Fence Post Foundation and Tree Roots Due to Erosion


Photo C – Bank Erosion with Evidence of Planform Adjustment

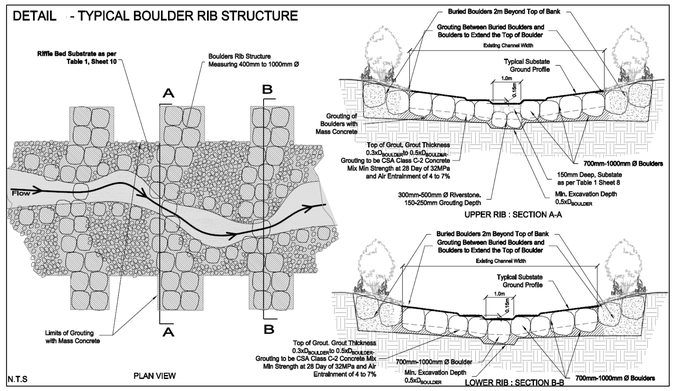
Risks to private property and aquatic habitat due to:

- Active bank erosion resulting in undermined trees and exposed fence pole foundation
- Deteriorating terrafix channel bed between concrete weirs

Level of risk: high

Other issues:

- Existing fish barrier at the double concrete weir
- Missing back-flow prevention covers for sewer outfalls within the concrete block wall reach




An Example of Channel Grade Control with Boulder and Armourstone Enhanced Cascade

Conceptual design notes:

- Selective works
- Slope regarding and stabilization to limit creek within City easement
- Boulder cascade structure for grade control and fish passage
- Roundstone riffle-pool features for erosion control and enhance fish habitat

Recommended maintenance work:

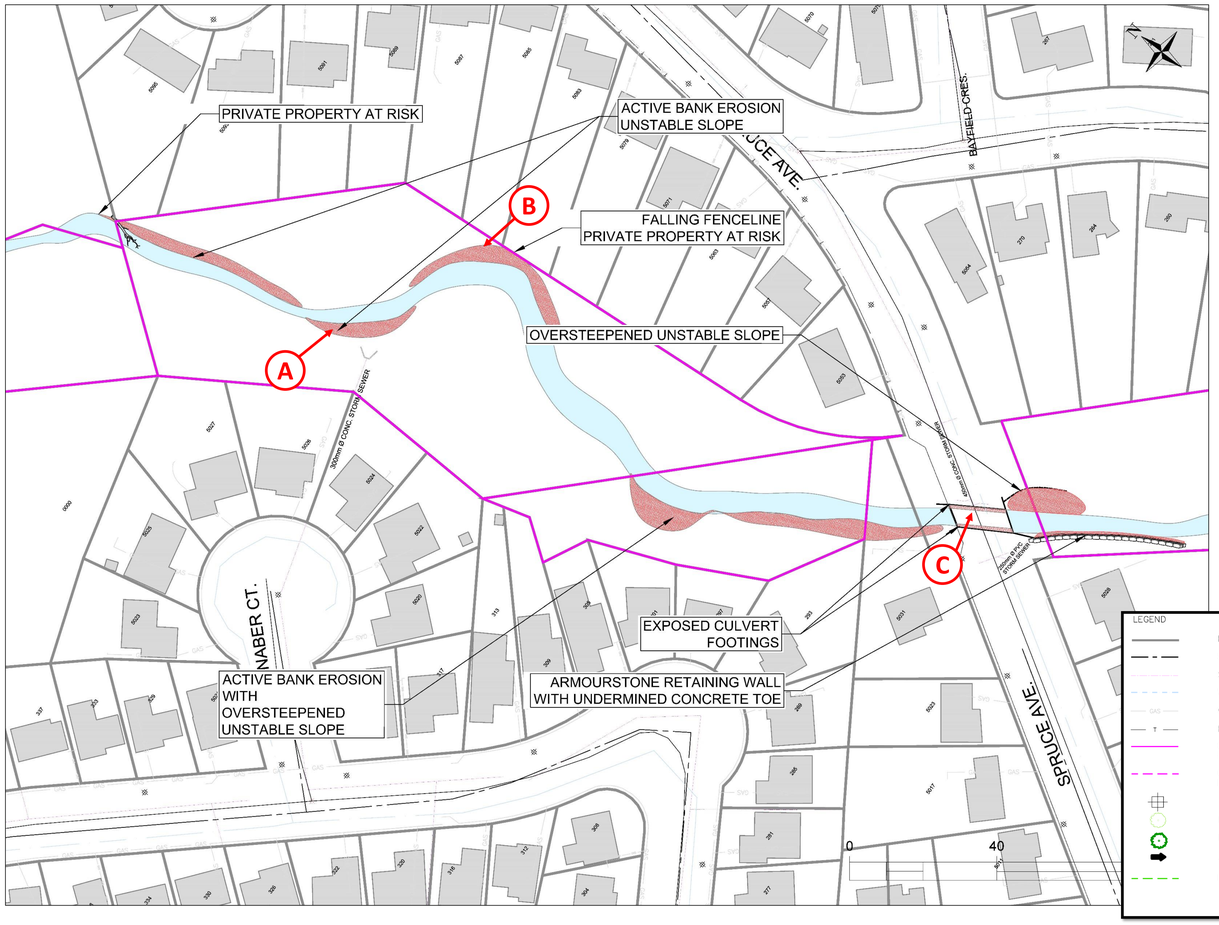
- Replace missing back-flow covers

EROSION SITE 4 & 5

Aquafor Beech Limited | City of Burlington

Appleby Creek Erosion Control Environmental Assessment

Existing Conditions



Conceptual Design

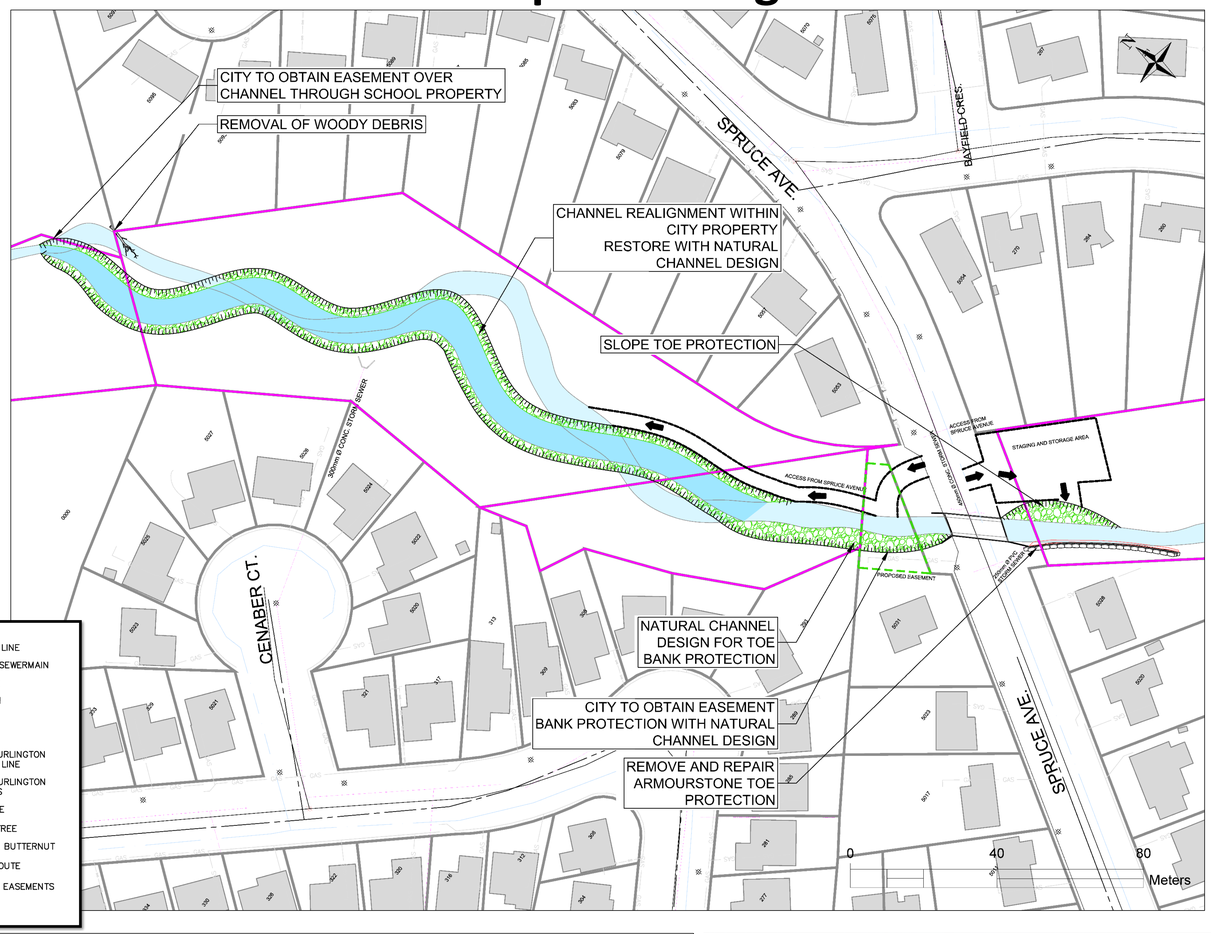
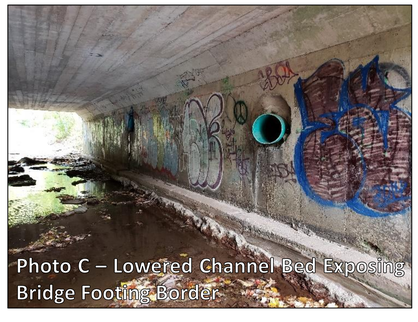
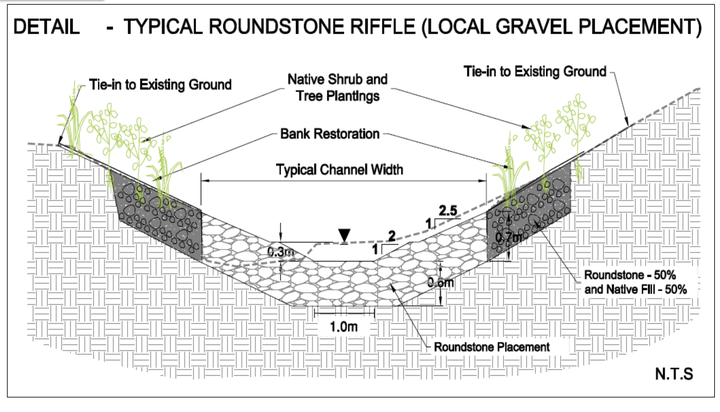



Photo A – Oversteepened Unstable Slope Downstream of the Bridge


Photo B – Exposed Footings with Lowered Shale Bedrock


Photo C – Lowered Channel Bed Exposing Bridge Footing Border




An Example of Natural Channel Design Enhanced with Vegetation Buffer

Risks to private property, municipal infrastructure and aquatic habitat due to:

- Active bank erosion and over-steepened slope, undermined trees
- Shale bedrock lowering
- Failed bank protection measures

Risk Level: low

Conceptual design notes:

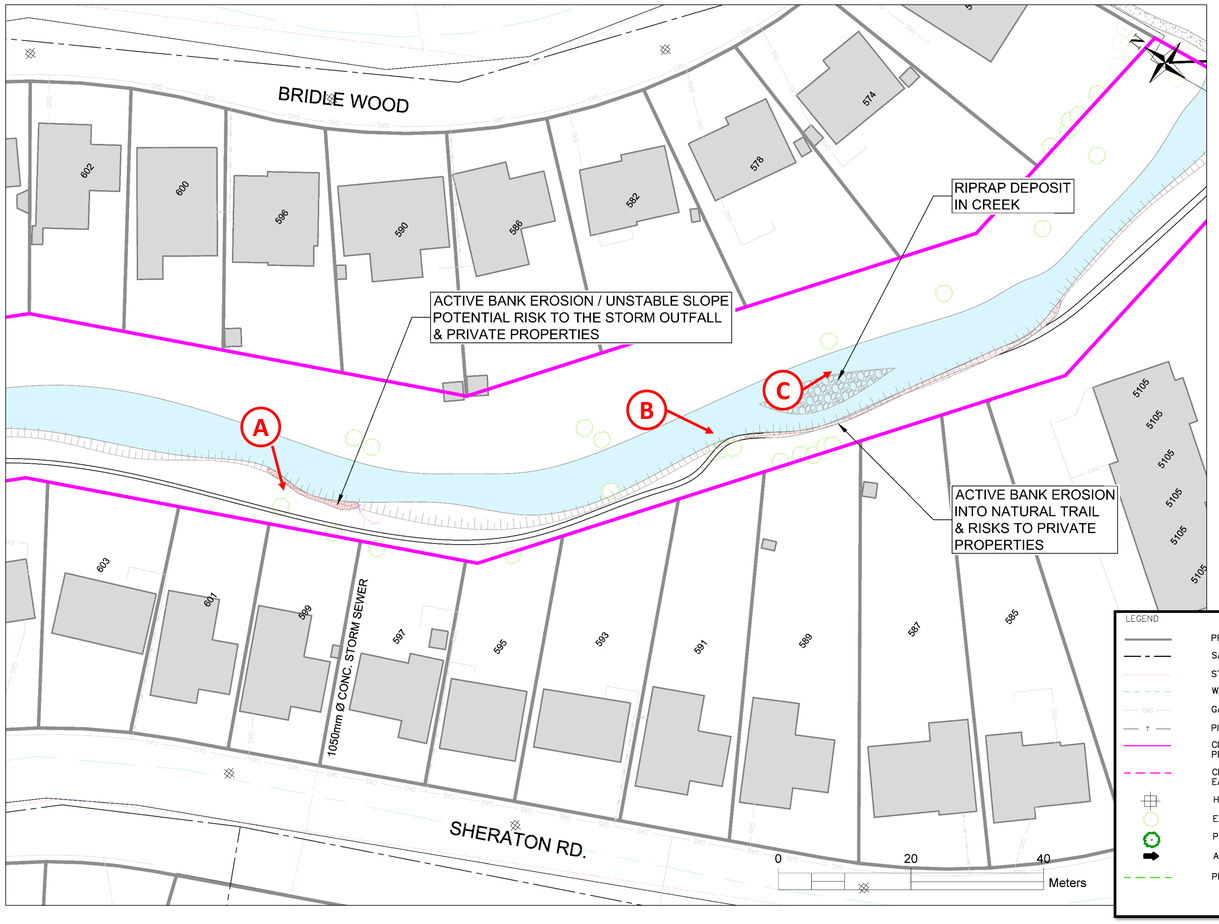
- Selective works
- Channel realignment to re-centralize the creek within City property and mitigate risks to private properties
- Natural channel design to provide erosion protection while enhancing creek riparian

EROSION SITE 6

Aquafor Beech Limited | CITY OF Burlington

Appleby Creek Erosion Control Environmental Assessment

Existing Conditions



Conceptual Design

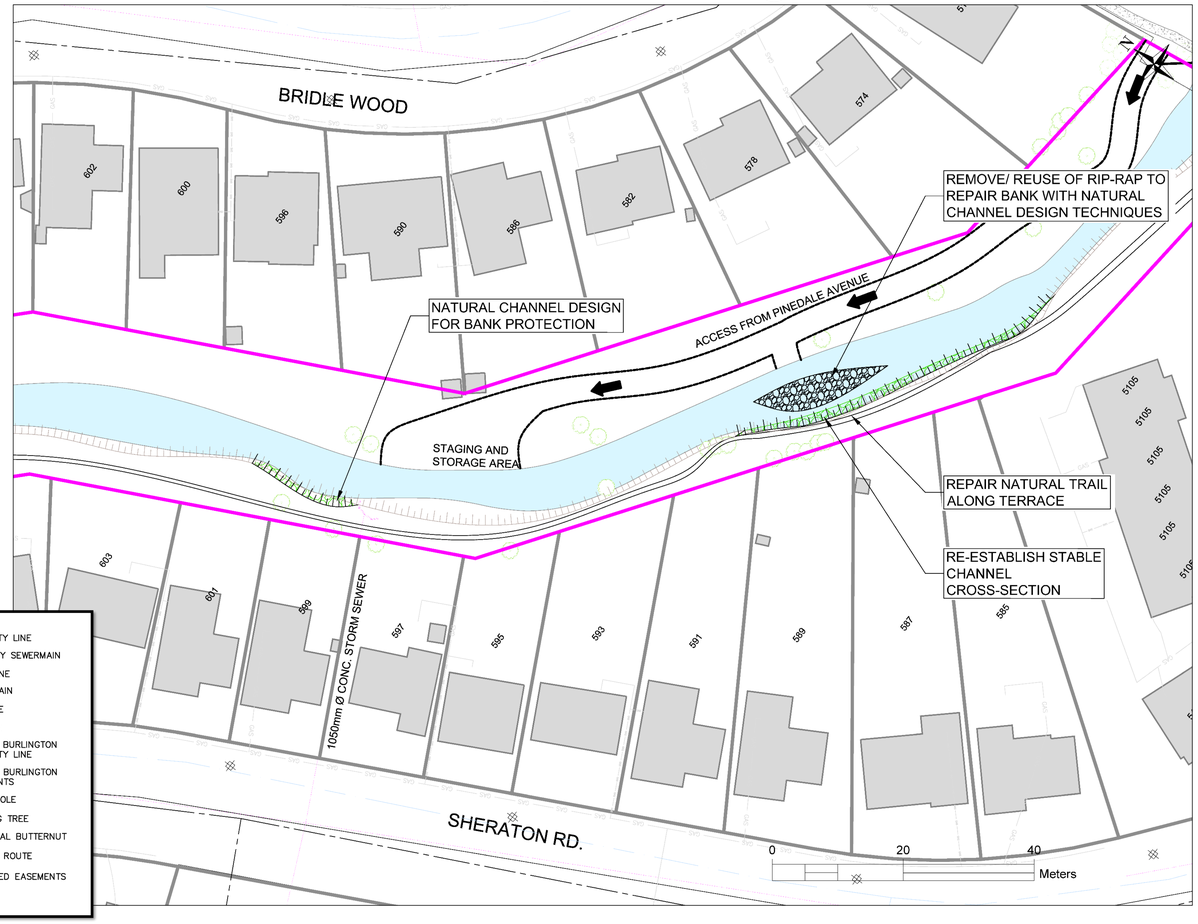
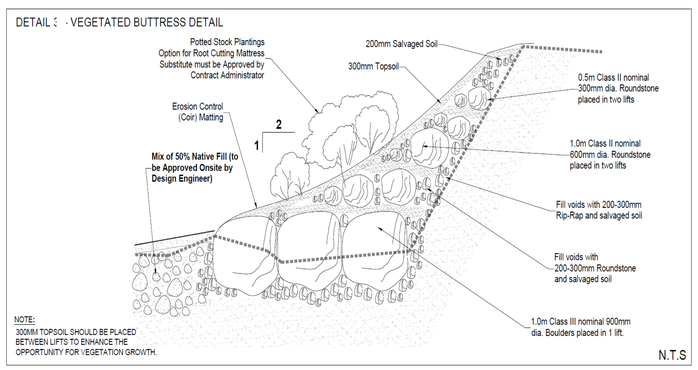



Photo A – Bank Erosion Upstream of Storm Outfall


Photo B – Active Bank Erosion into Natural Trail


Photo C – Rip-rap Deposit in the Creek




An Example of Bank Restoration with Vegetated Buttress

Risks to private property, public safety, municipal infrastructure and aquatic habitat due to:

- Active bank erosion into natural trail
- Undermining of storm outfall
- Riprap deposits in the creek

Level of risk: medium

Conceptual design notes:

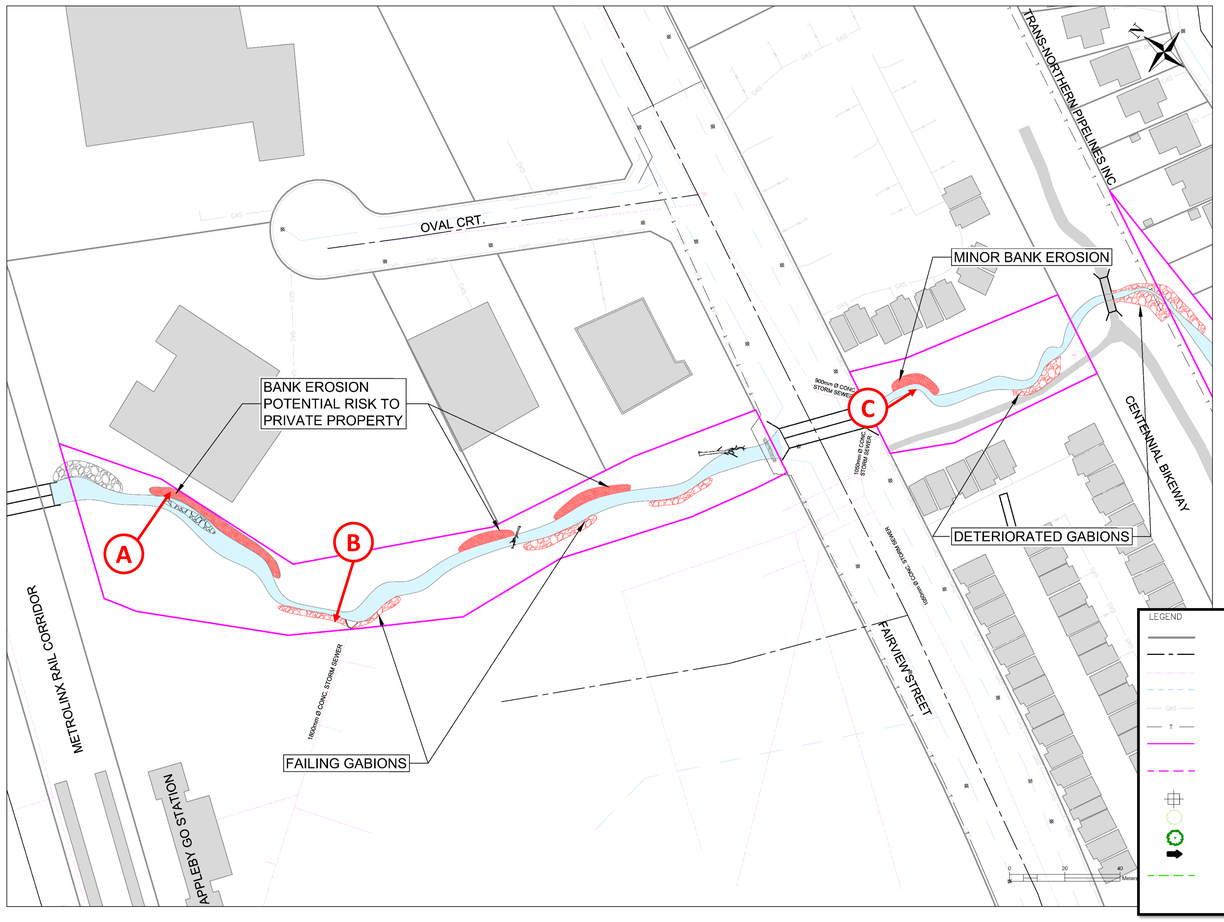
- Selective works
- Bank restoration with natural channel design to provide erosion protection while enhancing creek riparian habitat
- Remove / reuse rip-rap material for bank restoration

EROSION SITE 7

Aquafor Beech Limited | City of Burlington

Appleby Creek Erosion Control Environmental Assessment

Existing Conditions



Conceptual Design

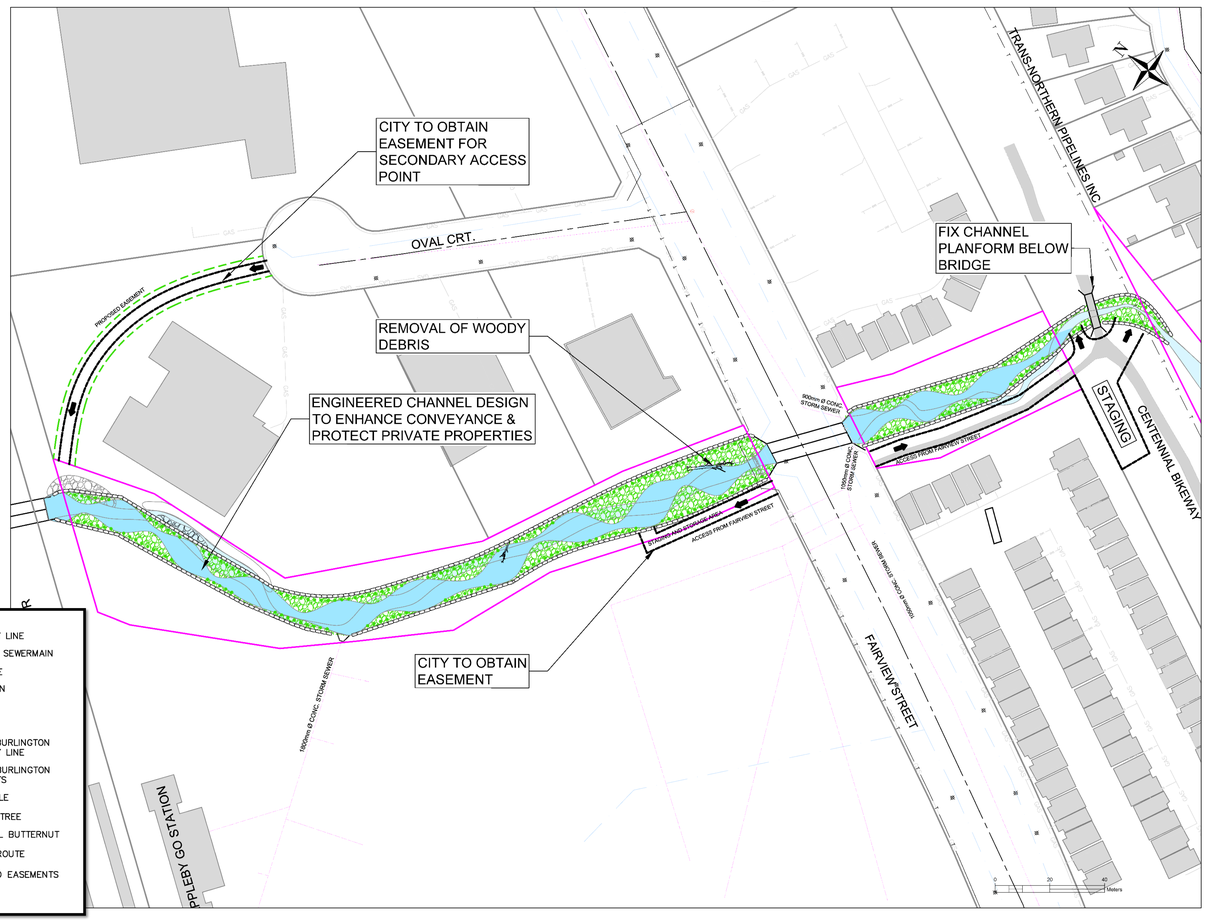
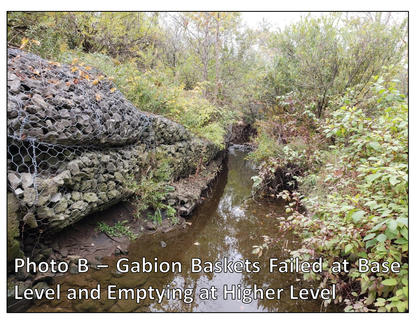
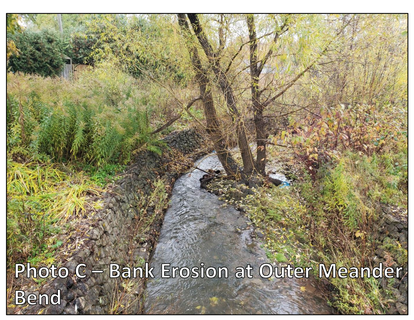
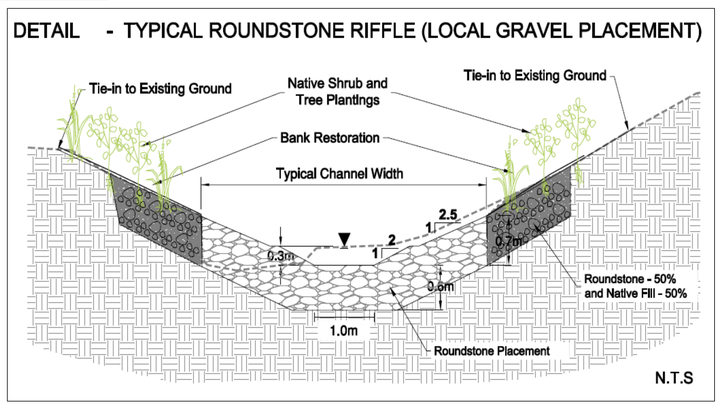



Photo A – Active Bank Erosion in Close Proximity to Private Property


Photo B – Gabion Baskets Failed at Base Level and Emptying at Higher Level


Photo C – Bank Erosion at Outer Meander Bend




An Example of Natural Channel Design Enhanced with Vegetation Buffer

Risks to private property, municipal infrastructure and aquatic habitat due to:

- Active bank erosion in close proximity to private property
- Failed gabion baskets adjacent to storm outfall and other locations

Level of risk: high

Conceptual design notes:

- Reach-based works
- Bank restoration with armourstone wall, roundstone riffle-pool, and in-creek vegetation buffer to provide erosion protection while enhancing creek riparian

EROSION SITE 8

Existing Conditions

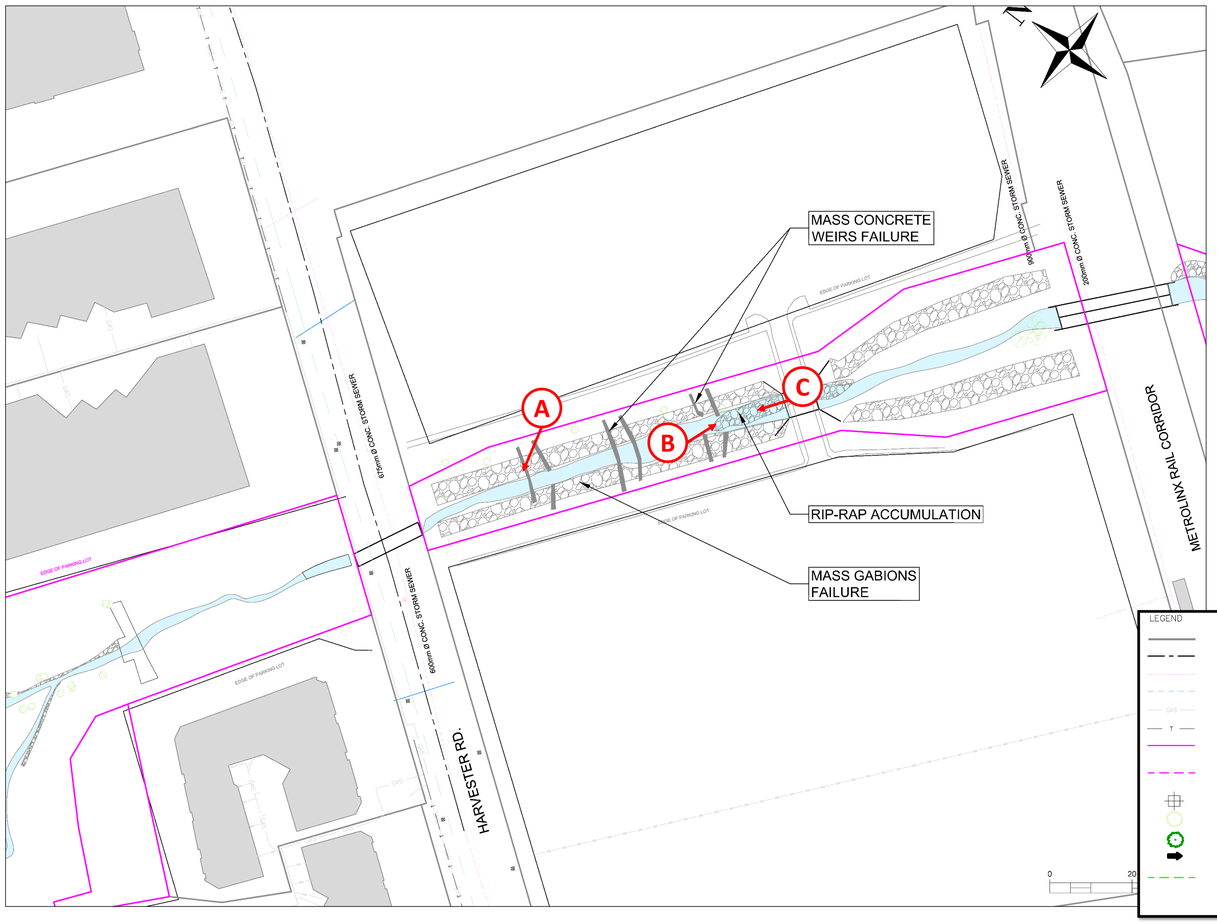



Photo A – Deteriorating Concrete Weir and Failed Gabion Baskets


Photo B – Failed Gabion Deposited in the Creek

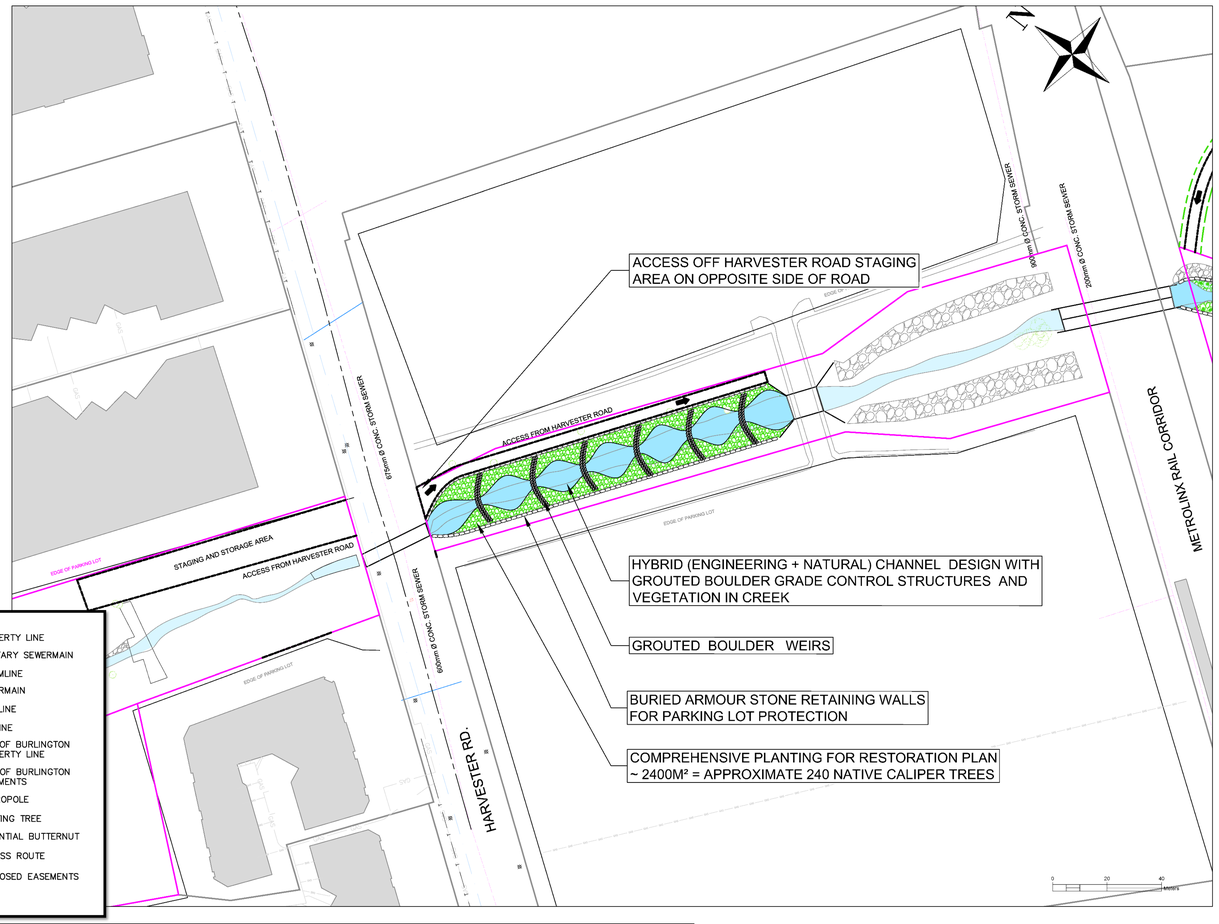

Photo C – Overview of Gabion Lined Channel, Looking Upstream

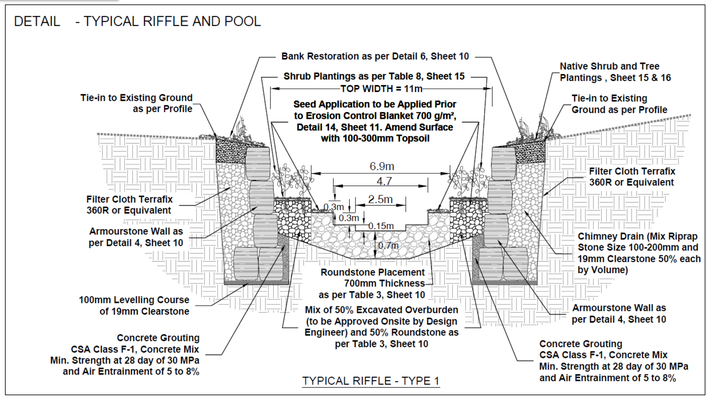
Risks to private property and aquatic habitat due to:

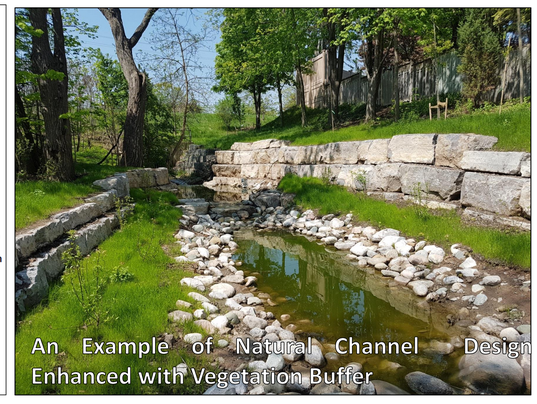
- Gabion baskets in poor conditions, with failure at multiple locations
- Failed and deteriorating concrete weirs
- Gabion basket debris deposits in the creek, obstructing flow conveyance

Level of risk: medium

Conceptual Design






An Example of Natural Channel Design Enhanced with Vegetation Buffer

Conceptual design notes:

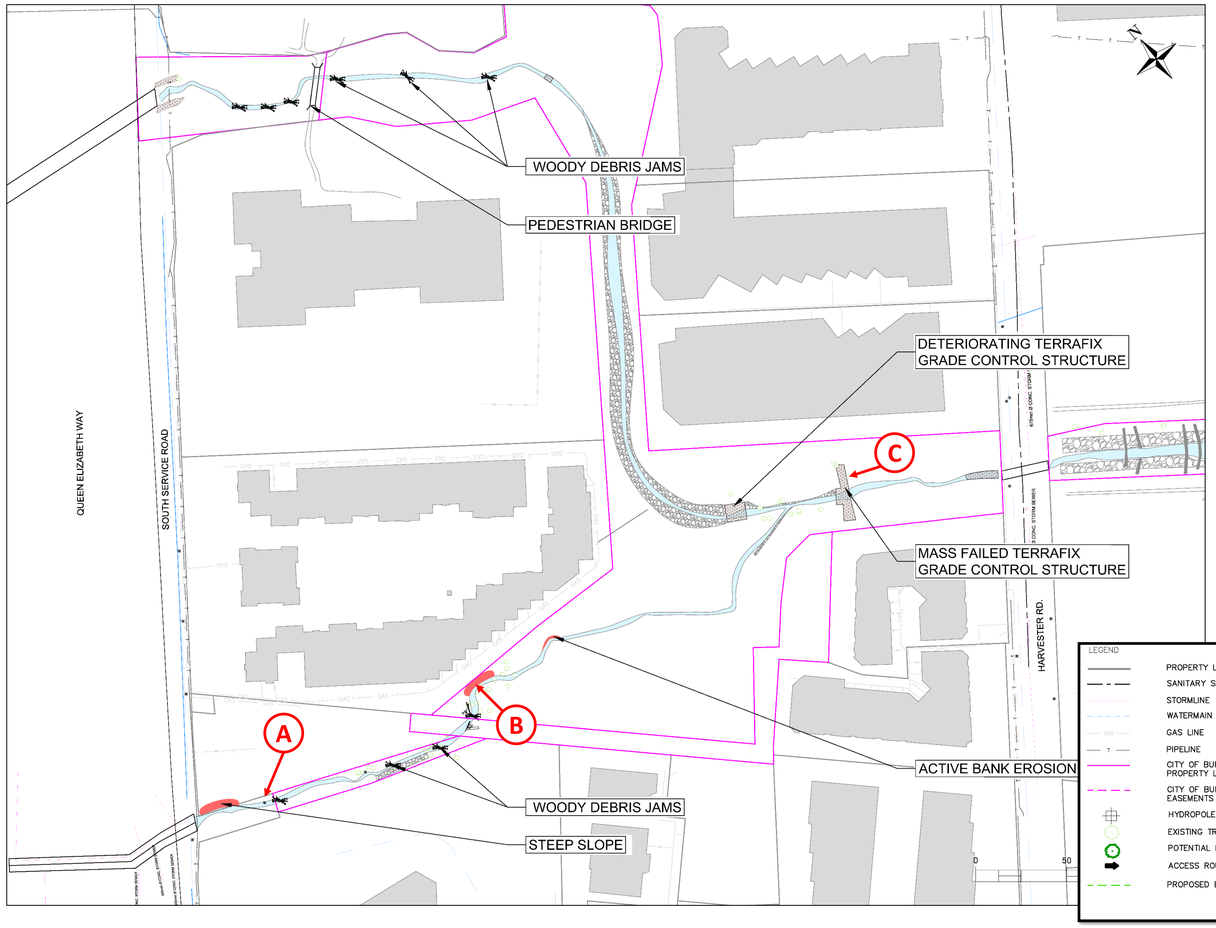
- Reach-based works
- Boulder cascade structure for grade control and fish passage
- Bank restoration with armourstone wall, roundstone riffle-pool, and in-creek vegetation buffer to provide erosion protection while enhancing creek riparian

EROSION SITE 9 & MAINTENANCE SITE 3

Aquafor Beech Limited | CITY OF Burlington

Appleby Creek Erosion Control Environmental Assessment

Existing Conditions



Conceptual Design

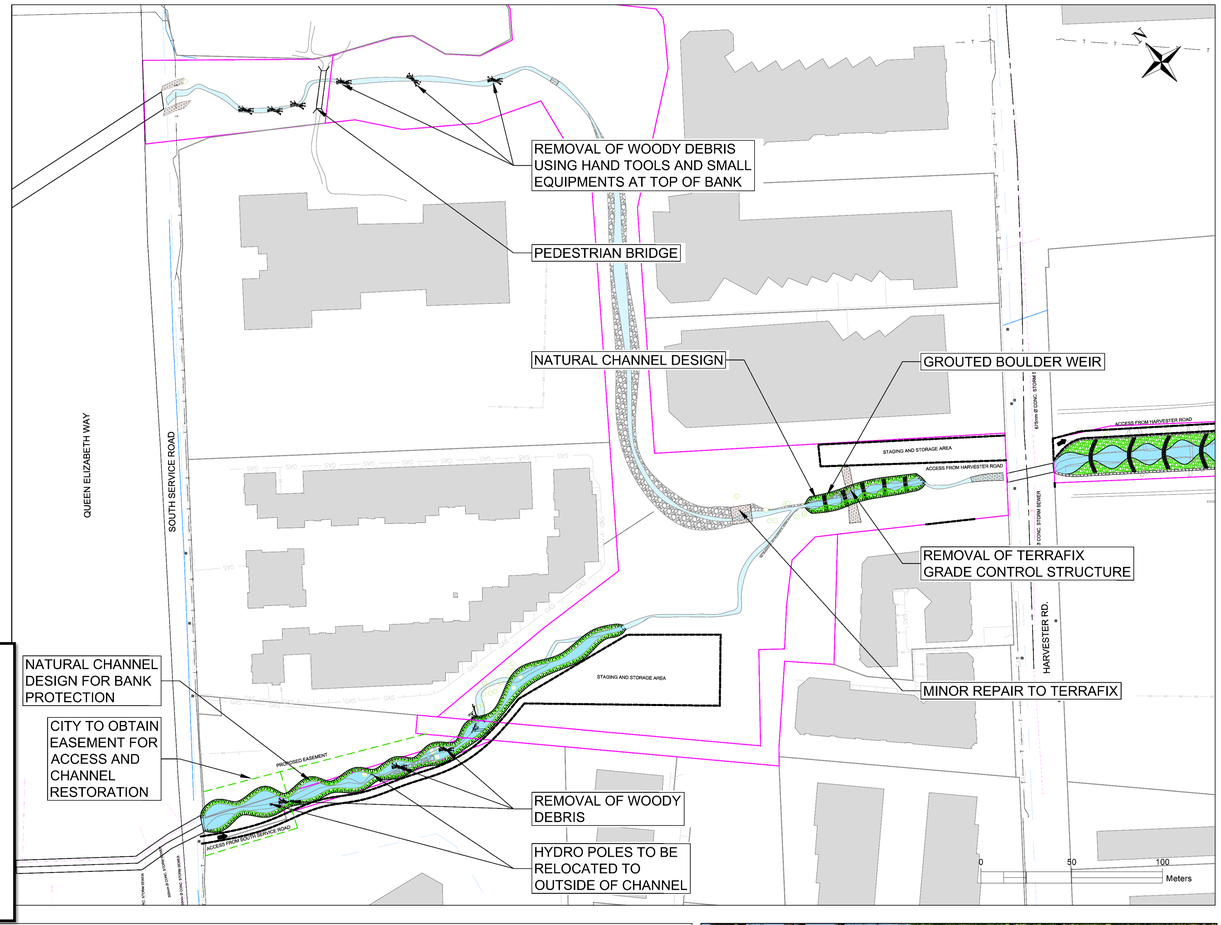
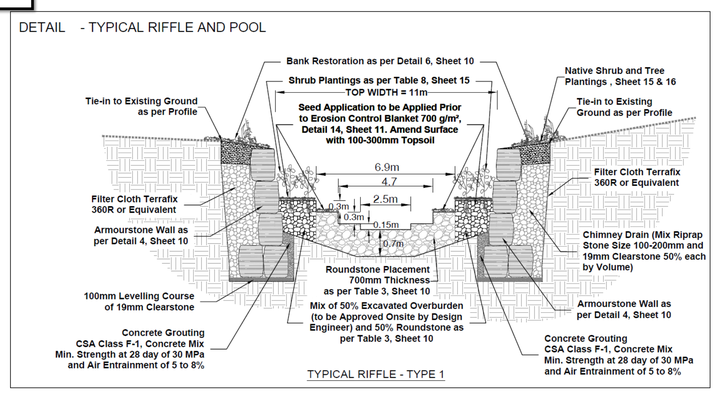
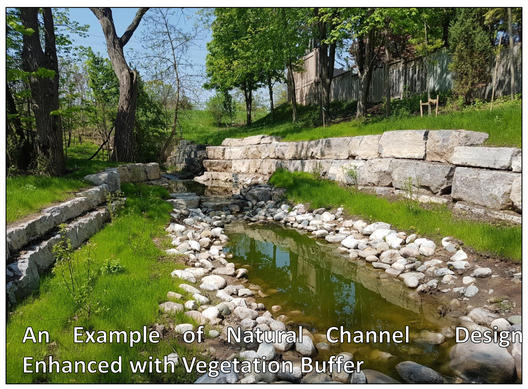



Photo A – Hydro Pole in Creek


Photo B – Over-steepened Slope Due to Erosion, Adjacent to Private Property


Photo C – Failed Gabion and Terrafix Grade Control Structure




An Example of Natural Channel Design Enhanced with Vegetation Buffer

Risks to private property, municipal infrastructure, and aquatic habitat due to:

- Active bank erosion resulting in over-steepened and unstable slopes
- Failed gabion and terrafix grade control structure
- Hydro poles inside the creek
- Woody debris at multiple locations obstructing flow conveyance

Level of risk: high

Conceptual design notes:

- Reach-based works
- Boulder cascade structure for grade control and fish passage
- Bank restoration with armourstone wall, roundstone riffle-pool, and in-creek vegetation buffer to provide erosion protection while enhancing creek riparian
- Hydro poles to be relocated outside of creek

Recommended maintenance work:

- Removal of woody debris

NEXT STEPS

PUBLIC CONSULTATION – FEBRUARY, 2019

- Comment forms available for input.
- Compile and review feedback. Confirm or adapt preliminary preferred alternatives.

SUBMIT EA PROJECT FILE AND OBTAIN AGENCY APPROVALS – SUMMER 2019

- EA Project file posted for 30 day review period.

DETAILED DESIGN & IMPLEMENTATION

- Construction timing dependant on City of Burlington Capital Planning.

TO PROVIDE COMMENT, OR TO BE ADDED TO THE STUDY STAKEHOLDER LIST, PLEASE CONTACT:

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THANK YOU

FOR PARTICIPATING IN THE APPLEBY CREEK EROSION CONTROL ENVIRONMENTAL ASSESSMENT STUDY