**Prepared for:**

# City of Pickering
**Water Resources and Development Services**
**Tel: 905-420-4660**

## Schedule B Municipal Class Environmental Assessment – Project File
## Pine Creek Erosion Assessment

Submitted by:

# Aquafor Beech Ltd.

in association with

# AMICK Consultants Ltd.

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# Executive Summary

## Introduction

In 2009, the City of Pickering completed the Frenchman's Bay Stormwater Management Master Plan (FBSMMP), which included geomorphic risk assessments for all of Frenchman's Bay's major tributaries. The assessment of the Pine Creek tributary identified signs of degradation within the ravine corridor as a result of urbanization induced stressors on watershed hydrology. As part of the FBSMMP study, the Mountcastle Crescent Outfall Tributary of Pine Creek was identified as a mass erosion site in needed of restoration to protect municipal infrastructure and private property. A detailed erosion control and channel rehabilitation design was later undertaken, with construction of the restoration works completed in 2017.

Following the completion of the Master Plan, the geomorphic stability of Pine Creek has continued to deteriorate overtime with City staff and the public reporting a series of erosion related risks and concerns. The City has therefore elected to complete an erosion assessment of Pine Creek between Kingston Road/Regional Road Highway 2 and Fairport Road to identify high priority erosion sites where there are risks to infrastructure or private property, and develop conceptual designs to mitigate erosion and protect the natural heritage of the surrounding areas. The study area includes the riparian corridor predominantly located within lands owned by the City of Pickering.

The Pine Creek Erosion Assessment was completed under the Municipal Class Environment Assessment framework as a Schedule B project, following Phases 1 and 2 of the planning and design process. Aquafor Beech Limited were retained to led the completion of technical assessments and the development of the Project File report on the City's behalf.

## Study Objectives

The intent of the study was to assess the existing conditions within the study area and develop alternatives to address the erosion hazards at identified risk sites. In developing these alternatives, the study team took into consideration the following objectives

1. Develop long-term erosion protection strategies that are compatible with the natural tendencies of the creek;
2. Maintain or improve the hydraulic capacity of the creek;
3. Provide environmental enhancements wherever possible;
4. Realize opportunities to improve fish habitat and fish passage;
5. Decrease property and infrastructure loss; and
6. Implement high-value solutions that will minimize costs (both capital and maintenance)

## Phase I: Identification of Problems and Opportunities

Urbanization within the watershed has altered the natural hydrologic regime, inducing erosion and creating risks to private property and infrastructure located within, or adjacent to, the channel corridor. In considering the constraints related to the physical extents of the study areas, several opportunities have been investigated, including:

- Replacement of failing bank protection treatments with new enhanced bank protection treatments;
- Channel realignment and use of natural channel materials (bioengineering) where property constraints allow;
- Natural channel design;
- Enhancement of aquatic habitat;
- Improvement of riparian cover through planting of native trees and shrubs.

**Phase II: Evaluation of Alternative Solutions**

A total of twenty-five (25) erosion risk sites were identified. Three (3) alternatives were developed to address the erosion concerns at each of the identified erosion sites, including:

- **Alternative 1: Do Nothing –** This alternative involves leaving the site as it is and allowing erosional processes to continue within the watercourse corridor. Under this alternative, it should be expected that maintenance, or possibly emergency works, may have to be undertaken to address damage to property or infrastructure caused by the continued erosion. Damage from erosion may occur gradually over time or suddenly due to a high magnitude flood event.

- **Alternative 2: Local Restoration Works –** This alternative consists of localized channel bank and/or bed work to address erosion issues at the site. While it is understood that local erosion protection works may require ongoing maintenance, occasional repairs, or eventual replacement, this alternative is often still preferred to limit the economic cost and the environmental impact of large-scale channel engineering and stream restoration works.

- **Alternative 3: Extended Works –** This alternative consists of a comprehensive approach, which is typically completed on a reach or sub-reach scale, to address erosion issues at the site. Reach-scale engineering focuses on minimizing the risks of erosion and flooding in highly constrained urban watercourses. This alternative will apply a combination of "hard" channel engineering approaches for erosion control and natural channel techniques to mimic natural channel features such as riffles and pools to enhance the riparian environment.

A set of criteria were then developed to evaluate the alternatives:

- Physical / Natural Environment
    - Mitigation of existing erosion risks;
    - Impacts to aquatic habitat;
    - Impacts to terrestrial habitat and vegetation
    - Impacts to Species at Risk
    - Resiliency to Climate Chage
- Social / Cultural Environment
    - Impacts to Public Safety
    - Landowner / Community Disruption
    - Benefit to the Community and Expected Public Acceptance
    - Archaeological Impacts

    - Aesthetic Value
- Economic Environment
    - Capital costs;
    - Operation and maintenance costs;
    - Life cycle costs;
    - Overall cost effectiveness.
- Technical and Engineering
    - Regulatory agency acceptance
    - Impact on Existing Infrastructure
    - Flooding impacts
    - Technical feasibility;
    - Expected lifespan of the proposed works;

**Public Consultation**

An in-person Public Information Centre (PIC) was held on May 18th, 2023. A series of presentation slides were presented which outlined the study background, problems, opportunities, alternatives, and the preliminary alternative evaluation. In general, attendees were in support of the preliminary preferred alternatives for each erosion site. The Region of Durham, TRCA and local First Nations were also consulted throughout the study and their comments and inputs are considered and incorporated into the EA.

**Selection of Preferred Alternatives**

Based on the results of the alternative evaluation and consultation with the City and the public, the twenty-five erosion (25) sites were bundled into eleven (11) groups based on their spatial proximity. The preferred alternatives for the eleven (11) site groupings are listed below:

- Erosion Sites 1 - 4: Alternative 2 – Local Works
- Erosion Sites 5 - 8: Alternative 2 – Local Works
- Erosion Sites 9 - 10: Alternative 3 – Extended Works
- Erosion Site 11: Alternative 2 – Local Works
- Erosion Site 12: Alternative 2 – Local Works
- Erosion Sites 13 - 16: Alternative 3 – Extended Works
- Erosion Sites 17 - 18: Alternative 2 – Local Works
- Erosion Site 19: Excluded from further assessment as the site is located entirely on Private Property
- Erosion Sites 20 – 21: Alternative 2 – Local Works
- Erosion Site 22: Alternative 2 – Local Works
- Erosion Sites 23 – 24: Alternative 3 – Extended Works
- Erosion Site 25: Alternative 2 – Targeted Corridor Rehabilitation

**Priority Ranking and Estimated Costs**

The preferred alternatives have been prioritized into eleven (11) capital works projects and the estimated costs are summarized in the table below. While the project cost estimates and time horizon are to provide the City with direction on project priorities, decisions on the actual order and implementation of projects should also give consideration to overall City priorities, budgets, and stakeholder interests.

***Project Priority Ranking for the Pine Creek Erosion Assessment EA***

| Priority Number | Project Name | Priority Sites - Risk Description | Preferred Alternative | Cost Estimate (Design and Construction) | Recommended Planning Horizon |
|---|---|---|---|---|---|
| 1 | Culvert Replacement at Lynn Heights Drive | Site #22 - Erosion Risk to Culvert and Lynn Heights Drive | Local Works | $2,505,600.00 | 0 - 5 Years |
| 2 | Restoration of Kitley Ravine | Site #25 - Erosion Risk to Private Properties | Targeted Corridor Rehab | $1,944,000.00 | 0 - 5 Years |
| 3 | Restoration of Pine Creek Downstream of Finch Avenue | Site #13 - Erosion Risk to Private Property<br><br>Site #14 - Erosion Risk to Private Property<br><br>Site #15 - Erosion Risk to Storm Sewer Outfall<br><br>Site #16 - Erosion Risk to Private Property and Finch Avenue | Extended Works | $1,296,000.00 | 0 - 5 Years |
| 4 | Restoration of Pine Creek Downstream of Kitley Avenue | Site #9 - Erosion Risk to Multi-Use Trail and Private Property<br><br>Site #10 - Erosion Risk to Multi-Use Trail and Private Property | Extended Works | $1,008,000.00 | 0 - 5 Years |
| 5 | Restoration of Pine Creek Upstream of Dixie Road | Site #12 - Erosion Risk to Dixie Road | Local Works | $604,800.00 | 0 - 5 Years |
| 6 | Restoration of Pine Creek Upstream of Finch Avenue - East Branch | Site #23 - Erosion Risk to Private Property<br><br>Site #24 - Erosion Risk to Private Property | Extended Works | $2,160,000.00 | 5 - 10 Years |
| 7 | Restoration of Pine Creek Upstream of Finch Avenue - West Branch | Site #17 - Erosion Risk to Private Property<br><br>Site #18 - Risk to Finch Avenue | Local Works | $921,600.00 | 5 - 10 Years |
| 8 | Restoration of Pine Creek Downstream of Fairport Road | Site #20 - Erosion Risk to Private Property<br><br>Site #21 - Erosion Risk to Storm Sewer Outfall | Local Works | $1,036,800.00 | 5 - 10 Years |

| Priority Number | Project Name | Priority Sites - Risk Description | Preferred Alternative | Cost Estimate (Design and Construction) | Recommended Planning Horizon |
|---|---|---|---|---|---|
| 9 | Localized Restoration of Pine Creek Upstream of Kingston Road | Site #1 - Erosion Risk to Kingston Road and Storm Sewer Infrastructure<br><br>Site #2 - Erosion Risk to Private Property<br><br>Site #3 - Erosion Risk to Storm Sewer Infrastructure<br><br>Site #4 - Erosion Risk to Pedestrian Bridge | Local Works | $878,400.00 | 5 - 10 Years |
| 10 | Erosion Control Works Downstream of Dixie Road to Protect at Risk Culvert Crossing | Site #11 - Erosion Risk to Culvert | Local Works | $345,600.00 | 5 - 10 Years |
| 11 | Localized Restoration of Pine Creek Upstream of Glenanna Road | Site #5 - Erosion Risk to Glenanna Culvert Crossing<br><br>Site #6 - Erosion Risk to Parkland<br><br>Site #7 - Erosion Risk to Parkland<br><br>Site #8 - Erosion Risk to Parkland | Local Works | $518,400.00 | 10 - 15 Years |

**Conclusions and Recommendations**

The eleven (11) proposed capital works projects achieve the study goals to reduce erosion and preserve/enhance the natural environment. Following completion of this report, detailed design and construction will be undertaken to implement the preferred alternatives and remedy the identified problems.

Recommendations for site investigations and implementation measures should be taken into consideration during the detailed design and include the following items:

- Obtain Permission to Enter Agreements where temporary access through privately owned property is required.
- For projects 1, 5 & 6, where works are proposed on private property, the property owner will be advised of the ongoing erosion issues and associated risks on their property. Each individual property owner will ultimately be responsible for undertaking the necessary measures to mitigate the identified erosion related risks on their property using the concepts outlined in this EA or alternative methods (subject to all associated regulatory approvals at the detailed design stage).

Alternatively, the City may give future consideration to an easement acquisition in order to complete creek restoration works on select private properties.

- Undertake a geotechnical investigation and chemical soil testing for each proposed restoration project;
- Undertake higher level SUE investigations as needed to confirm possible utility conflicts;
- Undertake a detailed topographic survey at each project site to reflect the current site conditions;
- Complete a detailed tree inventory for each proposed project site;
- Facilitate permitting with TRCA, DFO and MECP as part of the detailed design process;
- Undertake Stage 2 Archaeological Assessments for projects 1, 2, 4, 5, 9, 10 and 11. For projects 1 & 5, where works are proposed on private property it will be the private property owner's responsibility to address identified erosion risks. This will include undertaking additional archaeological assessment work where required. Alternatively, should the City elect to secure an easement from the private property to undertake the erosion control works themselves, the City may then give consideration to coordinating select archaeological works themselves as required.
- Engage First Nations for their field liaison representation during the Stage 2 Archaeological Assessment;
- Complete a geomorphic analysis of channel hydraulics and tractive forces to size erosion control materials;
- Confirm appropriate construction staging, access and erosion and sediment controls;
- Completion of a post-construction monitoring program and preparation of as-built construction drawings.

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# 1 INTRODUCTION

## 1.1 Project Overview

Aquafor Beech Limited (Aquafor), with subconsultant AMICK Consultants Ltd., were retained by the City of Pickering to complete the Pine Creek Erosion Assessment under the Municipal Class Environmental Assessment (EA) framework. The Municipal Class EA study was conducted as a Schedule B project, including consultation with the public to evaluate alternative solutions.

In 2009, the City of Pickering completed the Frenchman's Bay Stormwater Management Master Plan (FBSMMP), which included geomorphic risk assessments for all of Frenchman's Bay's major tributaries. The assessment of the Pine Creek tributary identified signs of degradation within the ravine corridor as a result of urbanization induced stressors on watershed hydrology. As part of the FBSMMP study, the Mountcastle Crescent Outfall Tributary of Pine Creek was identified as a mass erosion site in needed of restoration to protect municipal infrastructure and private property. A detailed erosion control and channel rehabilitation design was later undertaken, with construction of the restoration works completed in 2017.

Following the completion of the Master Plan, the geomorphic stability of Pine Creek has continued to deteriorate overtime with City staff and the public reporting a series of erosion related risks and concerns. The City has therefore undertaken this EA to define the existing environmental conditions of Pine Creek, identify high priority erosion sites where there are risks to infrastructure or private property, and develop conceptual designs to mitigate erosion and protect the natural heritage of the surrounding areas. Key objectives of the Pine Creek Erosion Assessment EA include:

1. Develop long-term erosion protection strategies that are compatible with the natural tendencies of the creek;
2. Maintain or improve the hydraulic capacity of the creek;
3. Provide environmental enhancements wherever possible;
4. Realize opportunities to improve fish habitat and fish passage;
5. Decrease property and infrastructure loss; and
6. Implement high-value solutions that will minimize costs (both capital and maintenance)

This Project File is intended to document the Municipal Class EA process, including delineating how a preferred restoration strategy was selected for each of the identified high priority erosion risk sites. The project study area is approximately three (3) kilometers in length, extending from Kingston Road (downstream extent) upstream to Fairport Road. While parts of Pine Creek do extend further upstream, and downstream, of the study area, these segments of the ravine corridor were excluded from this EA study as these portions of the creek are situated on privately owned lands. The general study area extents are illustrated below in **Figure 1-1**.

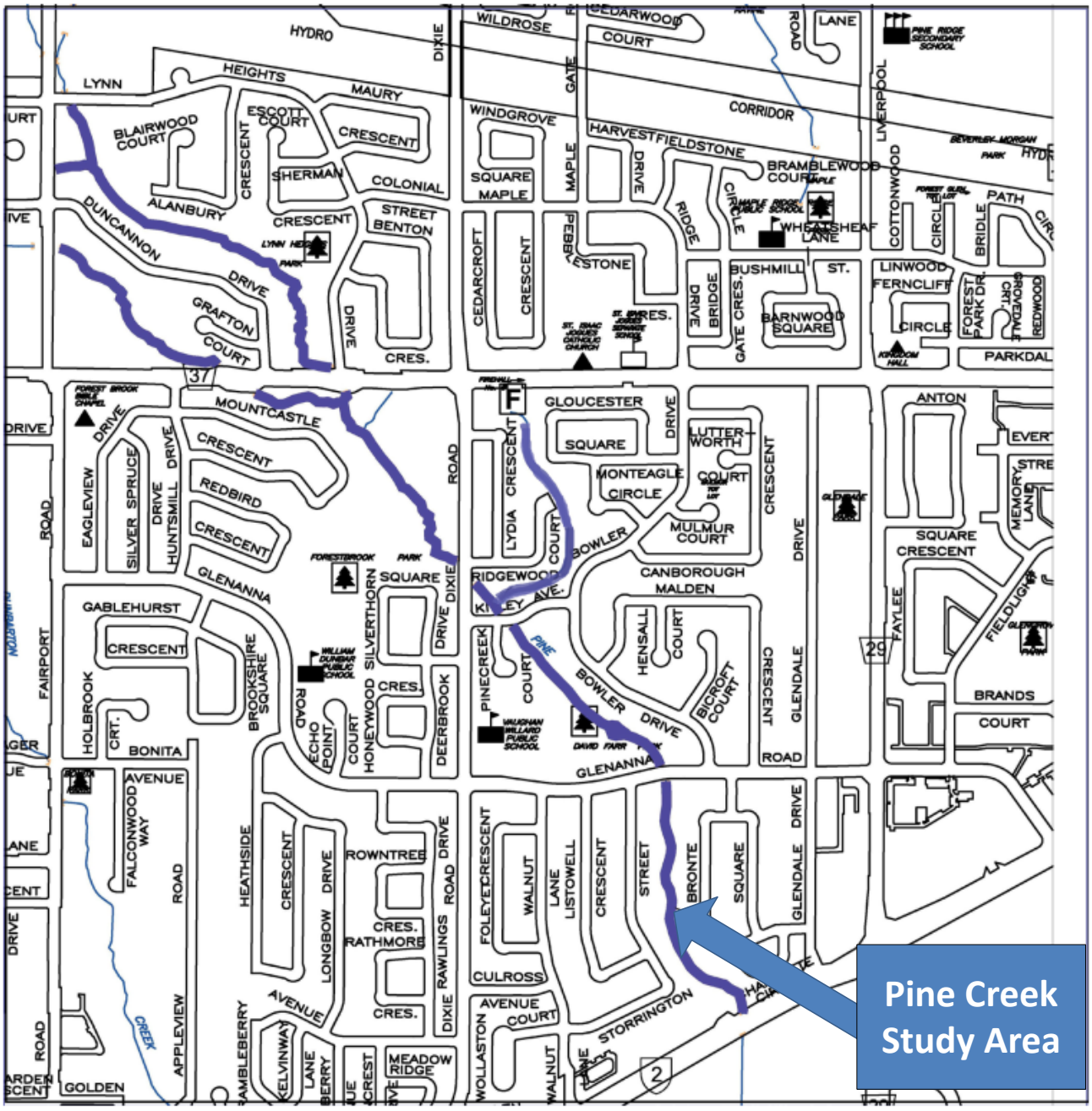



**Figure 1-1: Study Area Extents from Kingston Road to Fairport Road**

## 1.2 Class Environmental Assessment Process

This study will examine a series of design alternatives through the Municipal Class EA process (schedule B) to identify a solution to mitigate erosion related risks to private properties as well as municipal (Pickering) and regional (Durham) managed infrastructure within the project study area. Consideration will also be given to naturalization and minor realignment of the existing watercourse system. These solutions may involve localized protection works at critical areas by retrofitting existing measures, as well as a complete reach-scale rehabilitation using a combination of traditional engineered solutions in conjunction with more natural approaches.

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 Control 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."

The Pine Creek Erosion Control Assessment is classified as a Schedule B project and follows Phases 1 and 2 of the planning and design process with Phase 5 to follow at a subsequent stage. This report outlines Phases 1 and 2 of the EA process.

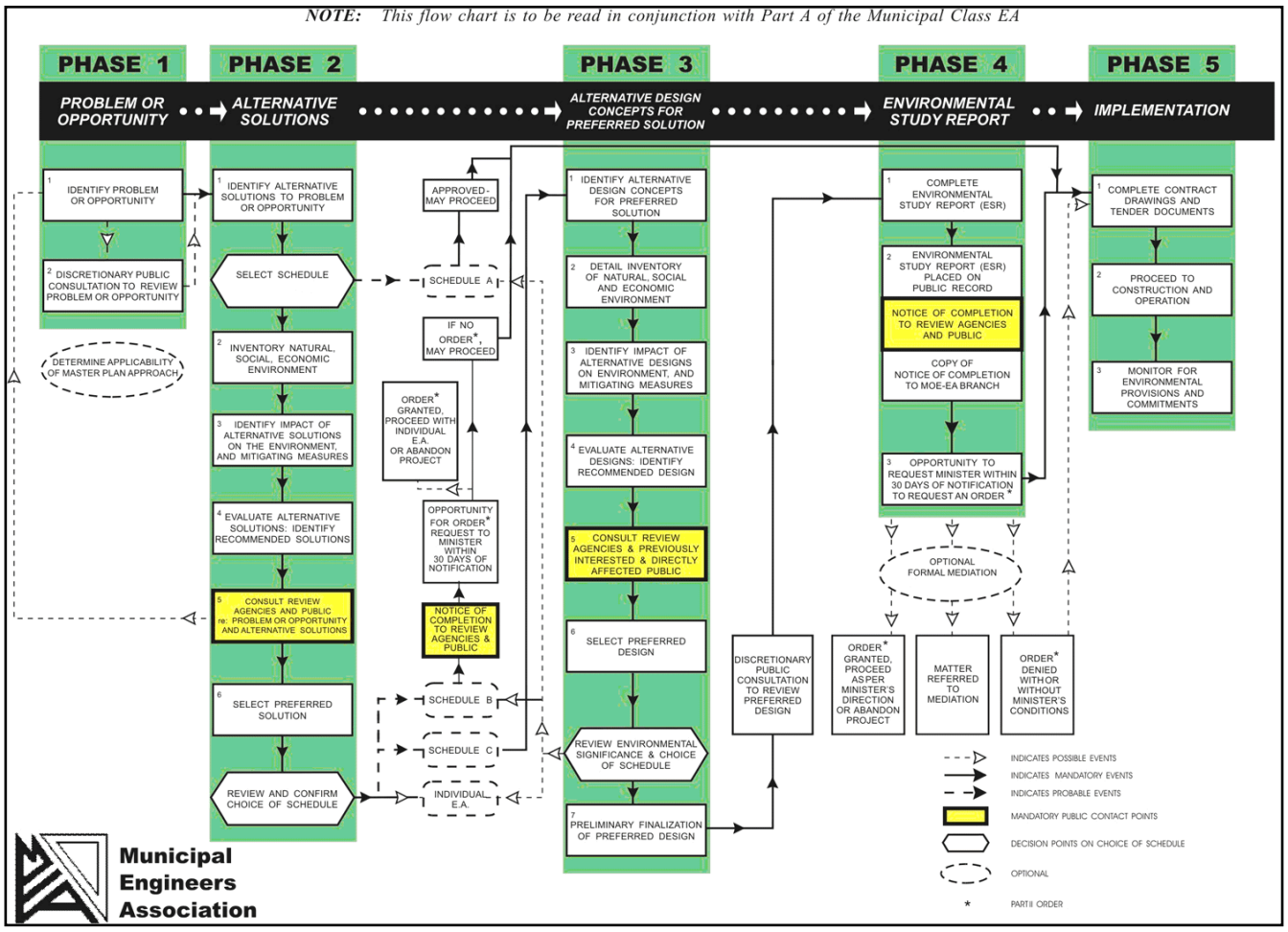



**Figure 1-2: Municipal Class Environmental Assessment Planning and Design Process**

# 2 IDENTIFICATION OF PROBLEMS & OPPORTUNITIES

## 2.1 Problem Identification & Background

The Pine Creek sub watershed has a drainage area of approximately 8.1 $km^2$ and is located entirely within the City of Pickering. The watershed drains from North to South, ultimately discharging to Frenchman's Bay just south of Highway 401. While the headwaters of the creek are located in agricultural areas, the majority of the watershed, in particular everything downstream of Fairport Road, is highly urbanized. Rapid urbanization, starting in mid-late 1980's, has increased watershed imperviousness, decreased opportunities for infiltration and retention of runoff by natural processes and ultimately redefined the watershed's hydrologic regime. In the present day, the rainfall-runoff response within the watershed if characterized by frequent, intense, peak flows resulting in accelerated erosion processes as the channel enlarges it's cross-sectional area to accommodate higher peak flow rates. The consequences of this accelerated erosion are readily apparent throughout the EA study area, where ongoing channel widening and incision has created a series of erosion related risks to private property as well as municipal and regional infrastructure.

To accommodate urban growth various aspects of the watercourse has been anthropogenically altered including the installation of uncontrolled storm sewer outfalls contributing to local scour and erosion, channel straightening, installation of intermittent engineered treatments in various states of repair (i.e., gabion baskets, Armourstone retaining walls, etc.), and channelization and confinement of the watercourse at major road crossings. Aquafor has performed a series of detailed site investigations to document key issues observed within the watershed. These keys issue include:

- Channel incision and lowering of the channel bed;
- Widespread bank erosion contributing to the formation of unstable slopes;
- Degradation of existing erosion control structures;
- Uncontrolled watercourse enlargement and widening;
- Unmanaged accumulation of channel debris;
- Loss of vegetation within the riparian corridor;
- Deterioration of aquatic and terrestrial habitat conditions; and
- Creation of barriers to fish migration.

These issues represent risks to municipal and regional infrastructure, roadway embankments, private properties, as well as the natural environment.

In total, twenty-five (25) areas of risk were identified within the study area based on the completed field investigations, with the general spatial distribution of these risk sites illustrated in **Figure 2-1**. Descriptions and photos of each erosion site are included in the sub-sections below. For reporting purposes, risk sites have been grouped together based on their spatial proximity and associated levels of risk. While the erosion sites denoted below include identified risks to both Regional and Privately owned Infrastructure, the development of restoration alternatives associated with this EA have been generally scoped to limit planned restoration works to municipally owned lands, such that all projects align with the City of Pickering's mandate for the implementation of capital works projects.

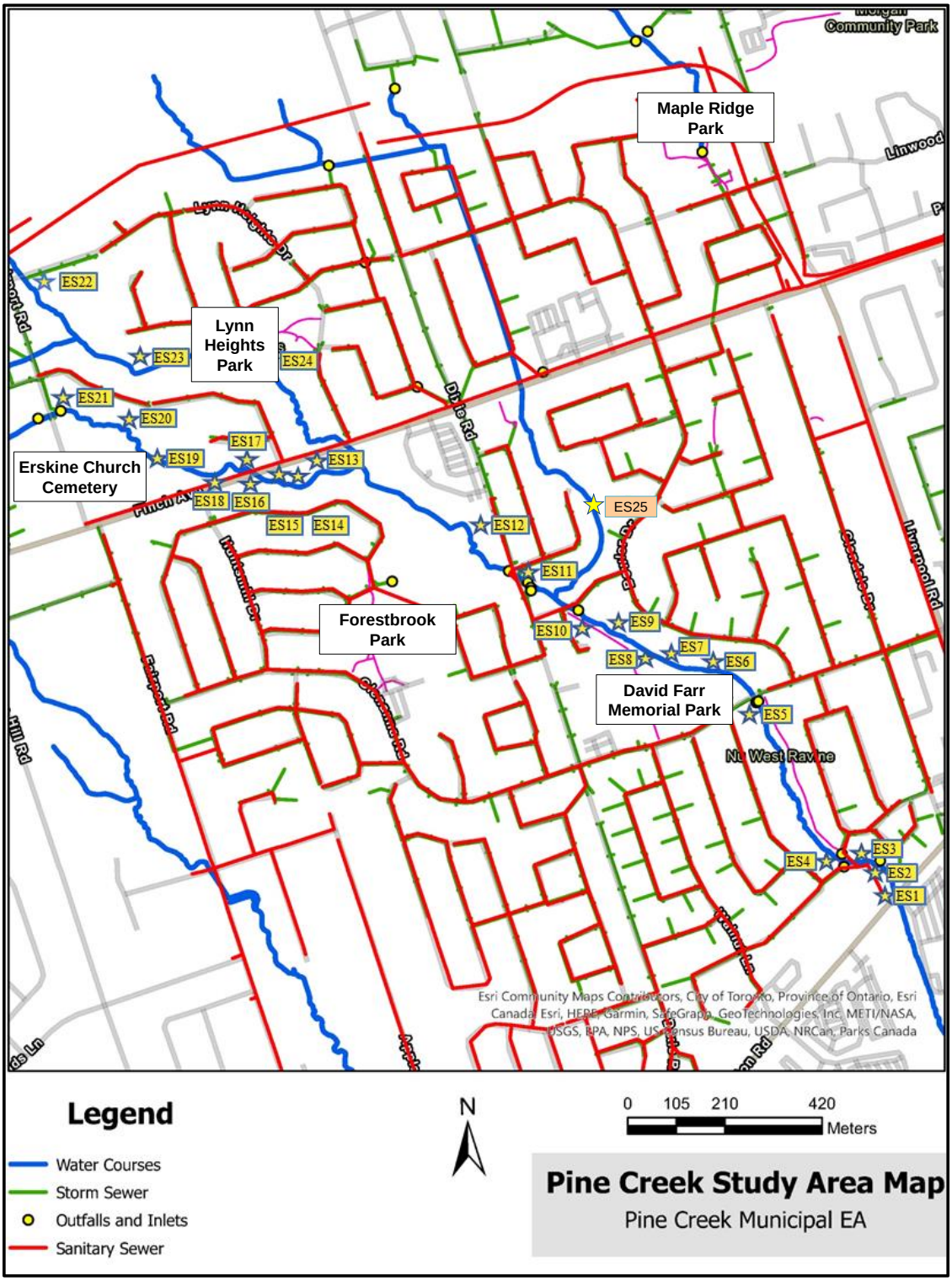



**Figure 2-1: Spatial Distribution of Erosion Sites within the Pine Creek Erosion Assessment EA Study Area**

## 2.2 Study Objective

This study is being carried out to assess the erosion related risks to private property and public infrastructure within the Pine Creek valley corridor, with the intent of providing recommendations to reduce erosion and protect the natural heritage of the area.

## 2.3 Erosion Sites #1 – 4

Erosion Sites #1-4, are located at the downstream extent of the project study area, in municipally owned parks lands immediately north of Kingston Road/Regional Road HWY2. There is significant beaver activity in this area contributing to the loss of mature riparian vegetation and the formation of a small beaver dam upstream of Kingston Road.
A number of erosion related risks to municipal and regional infrastructure are present including undermining of the gabion basket retaining wall that adjoins Kingston Road (Erosion Site #1 – **Figure 2-2**), outflanking of a 1,700 mm diameter storm sewer outfall headwall (Erosion Site #3 – **Figure 2-4**), and active bank erosion beneath a pedestrian bridge crossing leading to exposure of the bridge footings (Erosion Site #4 – **Figure 2-5**). Backwatering upstream of the beaver dam has also contributed to saturation and sloughing of the upstream channel banks creating an erosion risk to the private properties that border the channel corridor (Erosion Site #2 – **Figure 2-3**). It should be noted that proposed rehabilitation works to address the risks identified at Site #1 are included in the detailed design of the BRT project, which is currently being undertaken by the Region of Durham. These works will be coordinated between the City of Pickering and the Region to ensure that improvements effectively mitigate long-term erosion.

Any future works completed by the City of Pickering will be limited to channel restoration and erosion protection works on City owned lands.

**Figure 2-2: Erosion Site #1 – Undermined Gabion Baskets Upstream of Kingston Rd.**

**Figure 2-3: Erosion Site #2 – Bank Erosion Risk to Private Properties**

**Figure 2-4: Erosion Site #3 – Outflanking of Concrete Wingwalls due to Erosion.**

**Figure 2-5: Erosion Site #4 – Scouring & Erosion around Bridge Footings**

**Figure 2-6** provides an overview of the existing site conditions at Erosion Sites #1-4. High quality renderings of the existing conditions drawings for all erosion sites are provided in **Appendix A**.

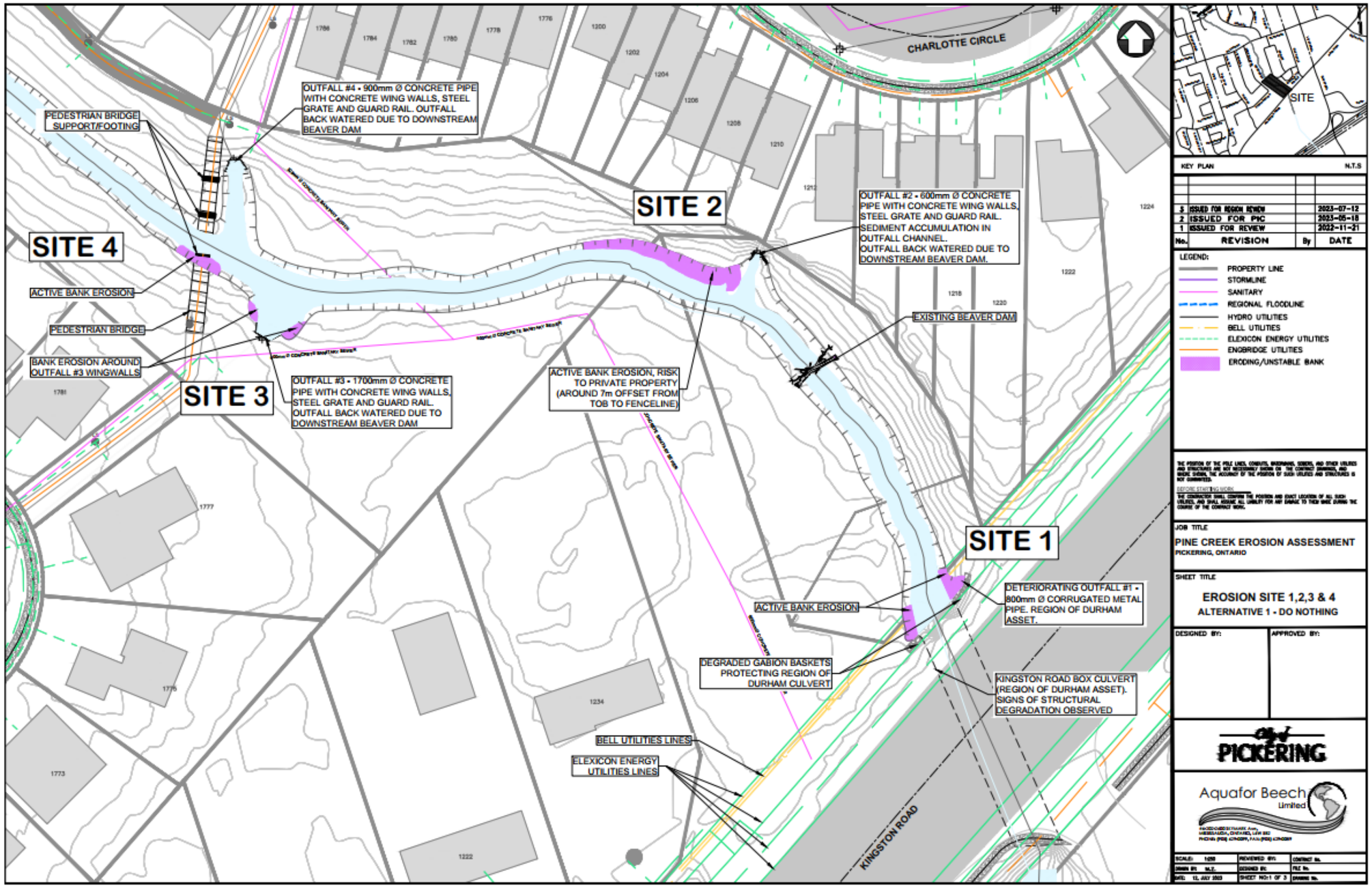



**Figure 2-6: Erosion Site #1-4: Existing Site Conditions**

## 2.4 Erosion Sites #5 – 8

Erosion Sites #5-8, are primarily located in the downstream extents of David Farr Park, where mowing of vegetation within the riparian corridor up to top of bank line has contributed to widespread bank erosion and the formation of a series of minor debris jams. With respect to specific erosion risks, active erosion within this segment of Pine Creek has resulted in minor bank erosion along the face of the Glenanna Road Culvert crossing at it's upstream and downstream extents (Erosion Site 5 – **Figure 2-7**). Moreover, widening of the channel has also created unmitigated risks to public parkland at a several locations including Erosion Site #6 (**Figure 2-8**) and Erosion Site #7 (**Figure 2-9**). In some locations attempts to limit bank erosion through the placement of rip-rap bank treatments have failed and are in need of future repair (Erosion Site #8 – **Figure 2-10**).

**Figure 2-7: Erosion Site #5 – Minor Bank Erosion Downstream of the Glenanna Road Culvert Crossing.**

**Figure 2-8: Erosion Site #6 – Minor Bank Erosion Creating Risk to Parkland.**

**Figure 2-9: Erosion Site #7 – Over Encroachment into the Riparian Corridor Leading to Bank Erosion and a Risk to Parkland.**

**Figure 2-10: Failure of Rip-Rap Bank Treatment Intended to Prevent a Loss of Parkland due to Active Erosion Processes.**

**Figure 2-11** provides an overview of the existing site conditions at Erosion Sites #5-8.

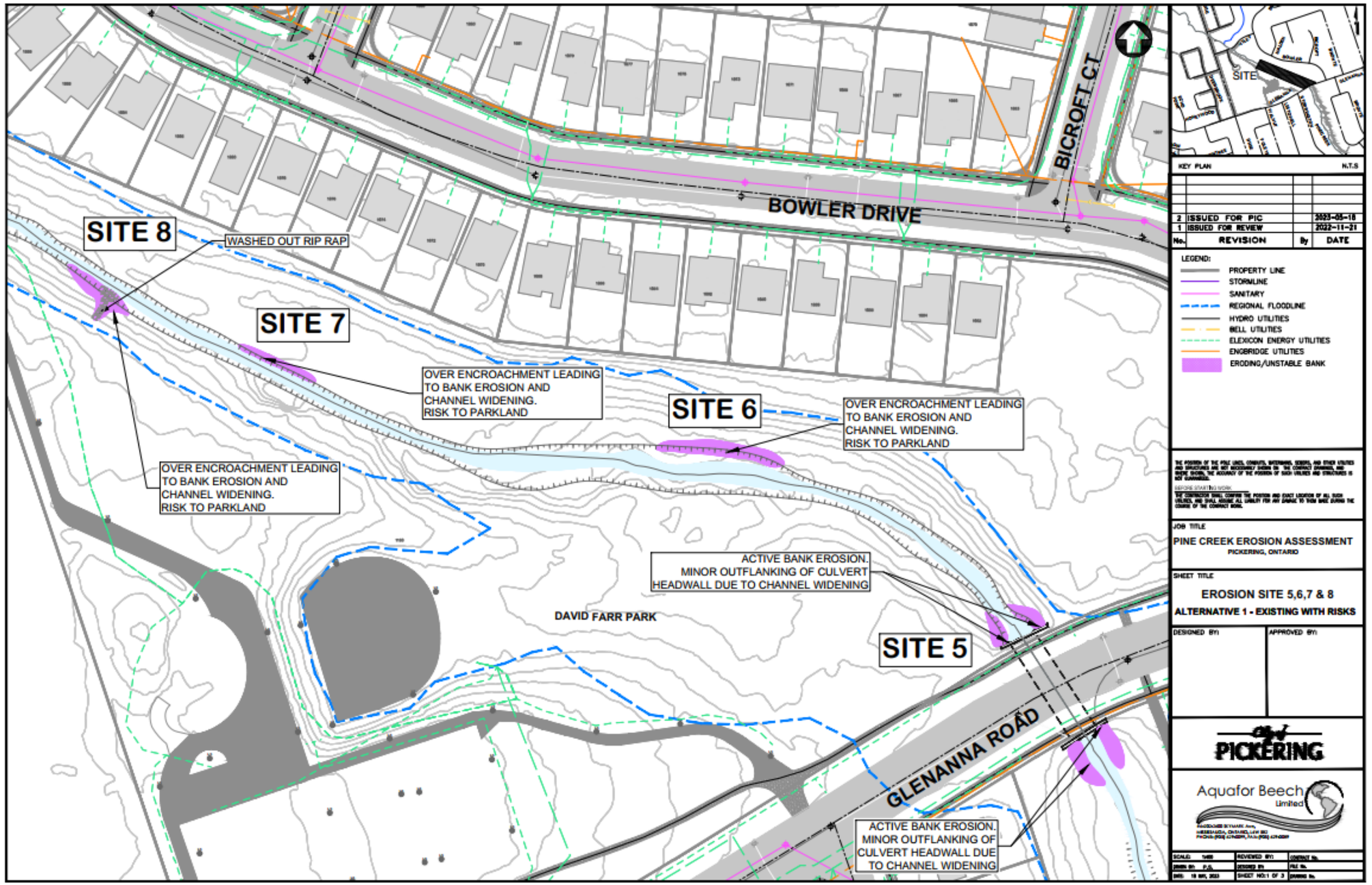



**Figure 2-11: Erosion Site #5-8: Existing Site Conditions**

## 2.5 Erosion Sites #9 – 10

Erosion Sites #9-10, are situated immediately downstream of Kitley Avenue at the upstream most extents of David Farr Park. The confluence of flows from the Kitley Avenue culvert and a 2,400 mm diameter storm sewer outfall have contributed to active channel widening downstream. Continued erosion of the western channel bank represents a risk to the multi-use trail system that connects David Farr Park to Kitley Avenue, the associated municipal trail lighting infrastructure and, to a less immediate effect, the private properties on the east side of Pinecreek Court. There are two locations (Erosion Site #9 – **Figure 2-12** & Erosion Site #10 – **Figure 2-13**) where large erosion scars have formed. The crest of these scars is offset only a few meters from the edge of trail (**Figure 2-14** and **Figure 2-15**). There is potential for future undermining of the trail system and the creation of a significant public safety hazard. It is therefore highly recommended that erosion mitigation works be applied in the near future to mitigate risks to both public safety and trail infrastructure.

**Figure 2-12: Erosion Site #9 – Active Bank Erosion Adjacent to a Multi-Use Trail System**

**Figure 2-13: Erosion Site #10 – Major Erosion Scar Adjacent to a Multi-Use Trail**

**Figure 2-14: Erosion Site #9 – Minimal Offset from the Edge of Trail and Top of Erosion Scar**

**Figure 2-15: Erosion Site #10 – Bank Erosion Actively Encroaching Towards the Existing Multi-Use Trail**

**Figure 2-16** provides an overview of the existing site conditions at Erosion Sites #9-10.

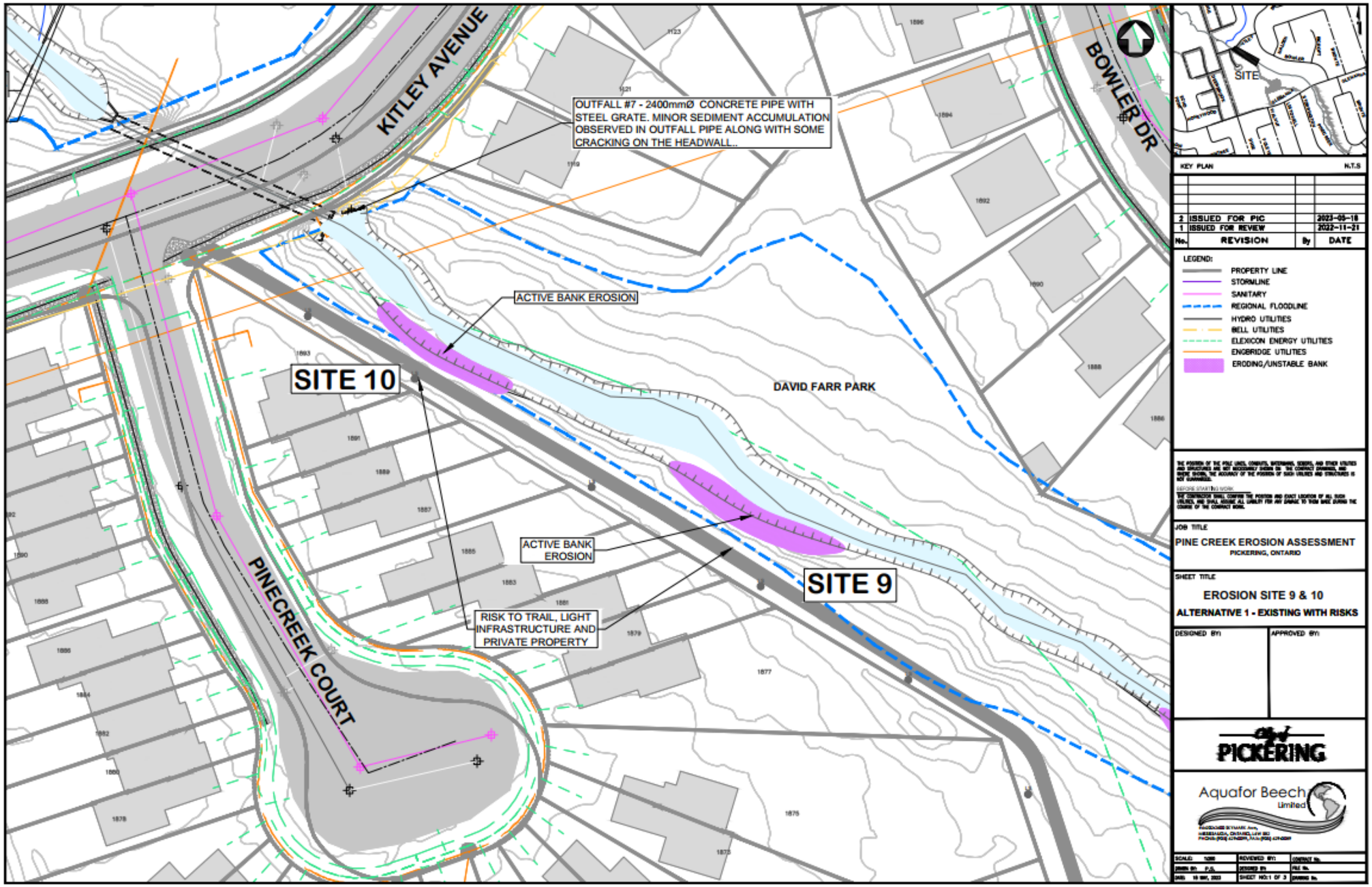



**Figure 2-16: Erosion Site #9-10: Existing Site Conditions**

## 2.6 Erosion Sites #11 - 12

The contraction and expansion of flows through the Dixie Road Culvert Crossing creates a risk of downstream scour and erosion. This penchant for erosion has been historically mitigated through the application of energy dissipation blocks downstream of the culvert, coupled with gabion basket retaining walls along the downstream channel banks. However, overtime age and exposure to hydrodynamic forces have led to the failure of the aforementioned gabion baskets (Erosion Site #11 – **Figure 2-17** & **Figure 2-18**).

Upstream of Dixie Road, the main branch of Pine Creek runs north through a large parcel of undeveloped municipally owned lands. In general, this segment of Pine Creek is sufficiently setback from adjacent private properties and infrastructure resulting in minimal erosion risks. The one exception occurs approximately 75-100 m upstream of the Dixie Road culvert where a debris jam has formed forcing the channel to erode to the east. The creek is now setback less than 10 m from the Dixie Road sidewalk (Erosion Site #12 – **Figure 2-19** and **Figure 2-20**). Future restoration works are required to protect the sidewalk and Dixie Road from potential undermining.

**Figure 2-17: Erosion Site #11 – Gabion Baskets Downstream of Dixie Road**

**Figure 2-18: Erosion Site #11 – Observed Gabion Basket Failure**

**Figure 2-19: Erosion Site #12 – Mass Debris Jams Forcing Channel to Erode Eastward**

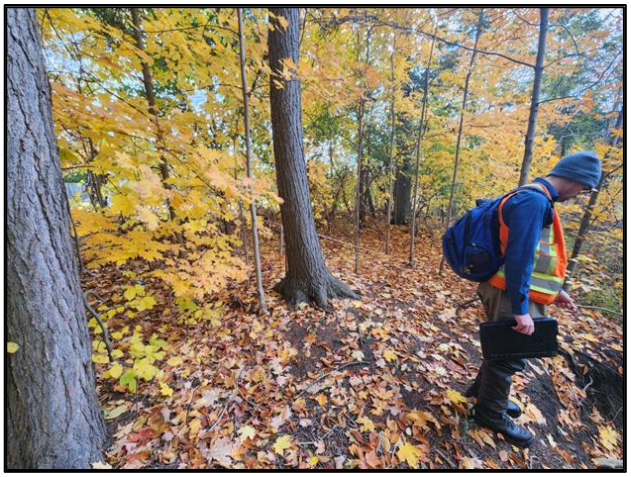


**Figure 2-20: Erosion Site #12 – Minimal Offset (<10 m) between Dixie Road Sidewalk and Top of Erosion Scar.**

**Figure 2-21** provides an overview of the site conditions at Erosion Sites #11-12.

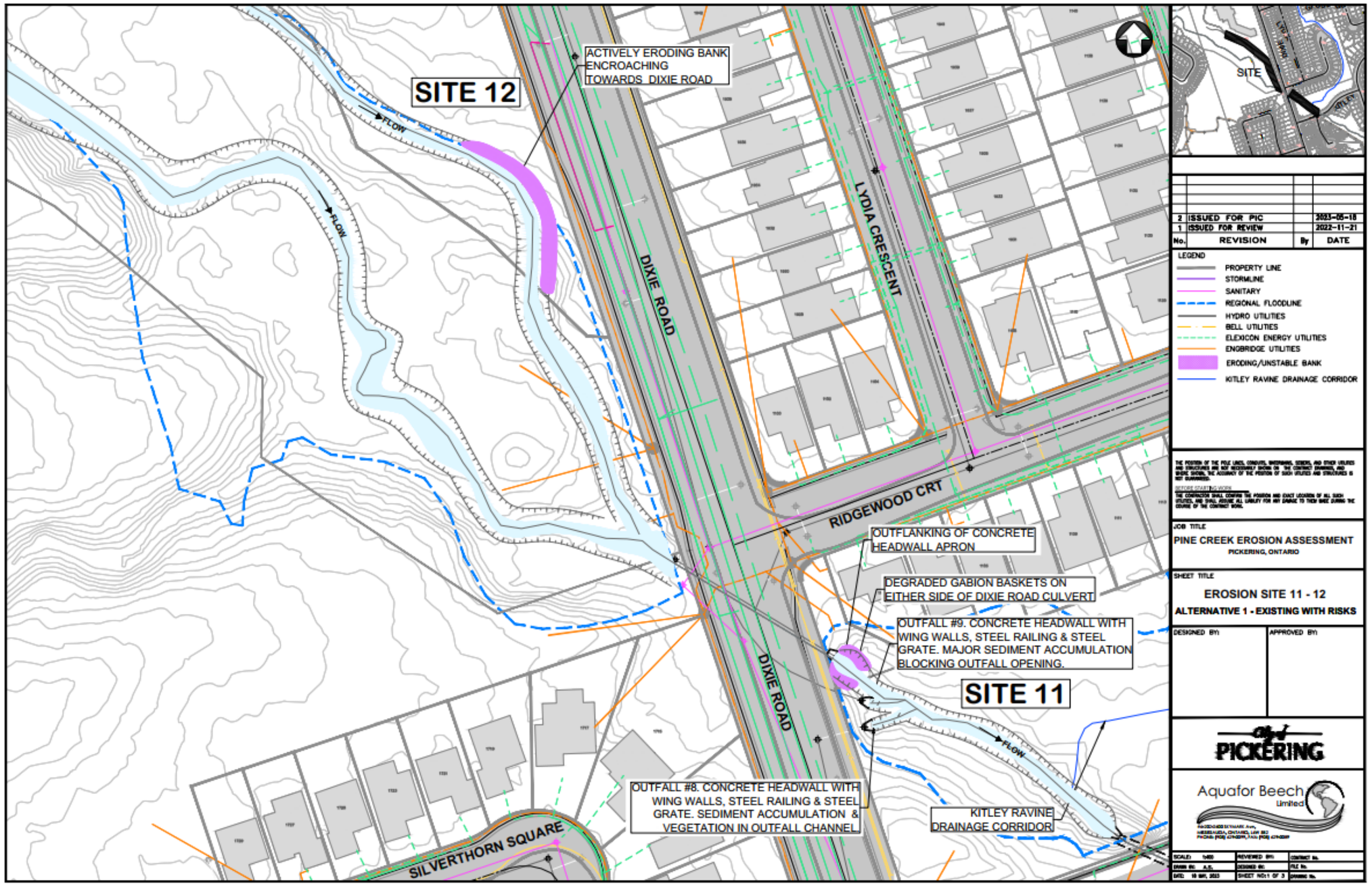



**Figure 2-21: Erosion Site #11-12: Existing Site Conditions**

## 2.7 Erosion Sites #13-16

Erosion Sites #13-16, are located downstream of Finch Avenue along the western branch of Pine Creek. Significant widening and downcutting of the channel have undercut a series of mature trees leading to their failure and the formation of several large debris jams. The presence of these debris jams has forced the creek to cut into the valley walls, causing toe erosion and creating potential risks to private properties on Mountcastle Crescent as a result of potential slope instability (Erosion Site #13 – **Figure 2-22** & Erosion Site #14 – **Figure 2-23**). A series of erosion risks to municipal and regional infrastructure were also observed along this segment of Pine Creek, including an eroding outfall channel downstream of a municipal storm sewer outfall (Erosion Site #15 – **Figure 2-24**) and an undermined deformed CSP culvert underneath Finch Avenue(Erosion Site #16 – **Figure 2-25**). There is also a heavily eroded outfall channel running parallel to Finch Avenue that conveys drainage from the roadside ditch down into the valley corridor. It should be noted that as Finch Avenue is Regional Road 37, restoration of the CSP culvert and roadside ditch outlet channel, while recommended, is outside the purview of the City of Pickering. The Region of Durham may give consideration to completing these works at a future date.

**Figure 2-22: Erosion Site #13 – Toe Erosion Creating Risk to Private Property.**

**Figure 2-23: Erosion Site #14 – Observed Debris Jams and Bank Erosion.**

**Figure 2-24: Erosion Site #15 – Eroding Outfall Channel**

**Figure 2-25: Erosion Site #16 – Undercutting of Deformed CSP Culvert**

**Figure 2-26** provides an overview of the site conditions at Erosion Sites #13-16.

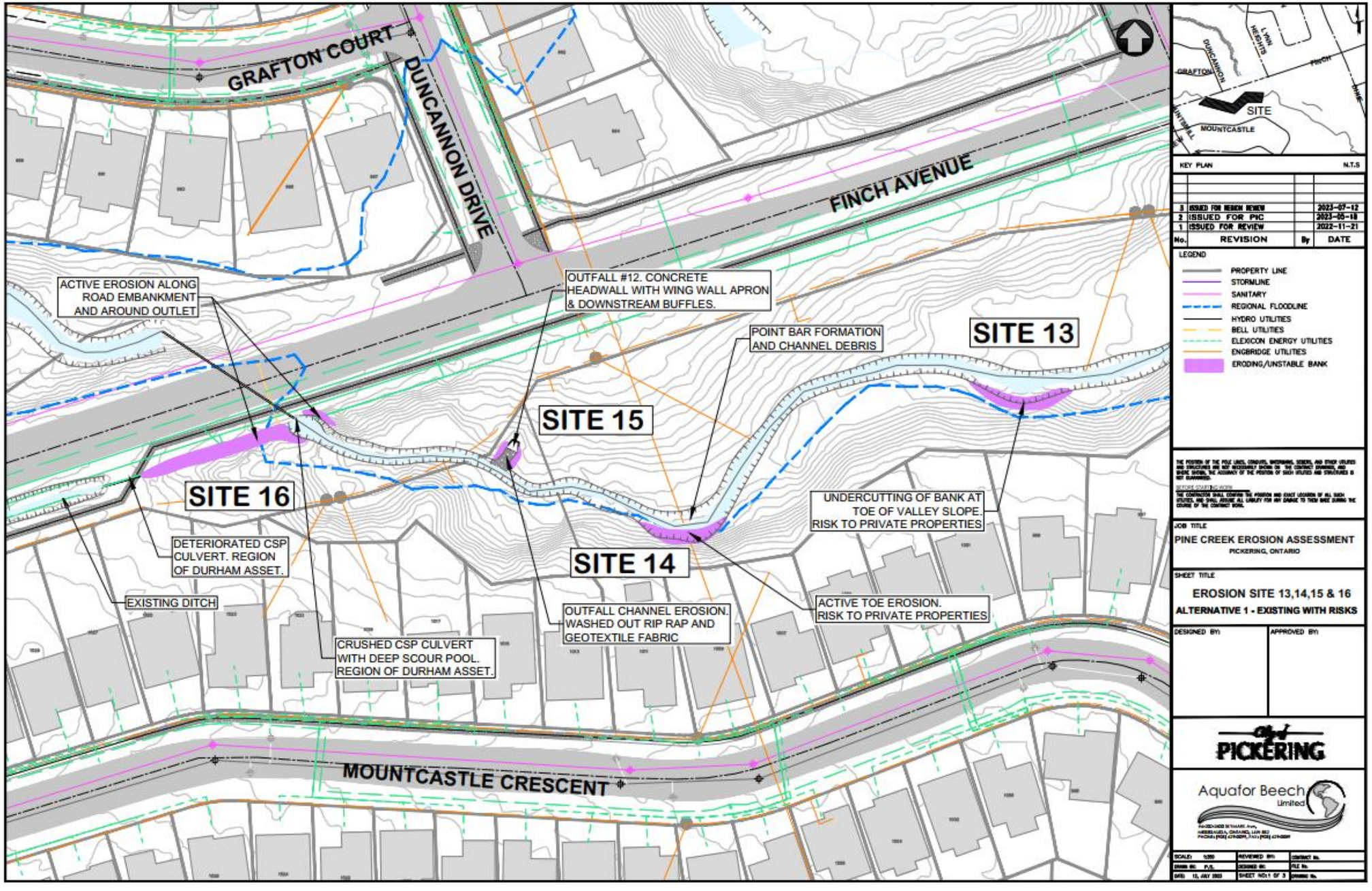



**Figure 2-26: Erosion Site #13-16: Existing Site Conditions**

## 2.8 Erosion Sites #17-21

Erosion Sites #17-21 are situated along the western branch of Pine Creek between Fairport Road and Finch Avenue. Immediately upstream of Finch Avenue, widening of the channel corridor has led to erosion at the toe of the valley slope creating a risk to private properties on Grafton Court (Erosion Site #17 – **Figure 2-27**) as well as the Finch Avenue right-of-way (Erosion Site #18 – **Figure 2-28**). During Aquafor's field investigation, scouring on either side of a privately owned culvert was observed and identified as Erosion Site #19. Since this erosion site is located entirely on Private Property, further assessment of the site and the development of candidate erosion mitigation alternatives was excluded from the scope of this EA study. Further upstream of the private crossing, additional toe erosion at the base of the valley corridor was observed behind private properties on Duncannon Drive (Erosion Site #20 – **Figure 2-29**). Lastly significant scouring was observed downstream of the Fairport road outfall, creating a risk of future undermining of the headwall structure (Erosion Site #21 – **Figure 2-30**).

**Figure 2-27: Erosion Site #17 – Toe Erosion Creating Risk to Private Property on Grafton Court.**

**Figure 2-28: Erosion Site #18 – Observed Debris Accumulation and Bank Erosion Adjacent to Finch Avenue.**

**Figure 2-29: Erosion Site #20 – Toe Erosion Creating Risk to Private Property on Duncannon Drive.**

**Figure 2-30: Erosion Site #21 – Significant Scouring Observed Downstream of Fairport Road Outfall.**

**Figure 2-31** provides an overview of the site conditions at Erosion Sites #17-21.

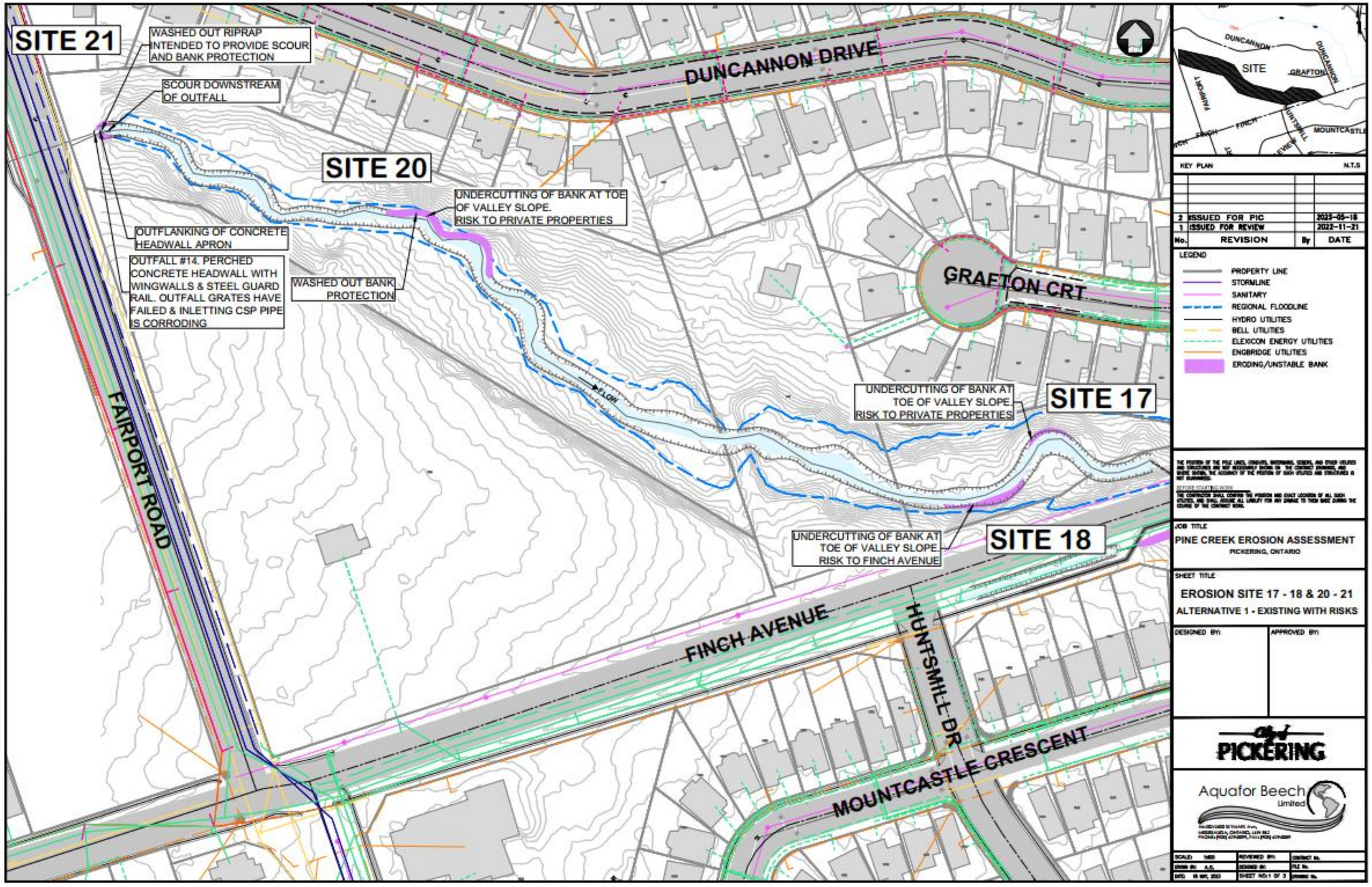



**Figure 2-31: Erosion Site #17-21: Existing Site Conditions**

## 2.9 Erosion Site #22

Hydrodynamic forces associated with the contraction and expansion of flows passing through the Lynn Heights Drive Culvert crossing have contributed to significant scouring and erosion on either side of the existing Corrugated Steel Pipe (CSP) culvert structure. Several large debris jams have formed downstream of the culvert (**Figure 2-32**), which have in turn further accelerated upstream scouring at the culvert outlet. The existing culvert structure is undercut (**Figure 2-33**) and is also exhibiting signs of structural degradation due to corrosion of the CSP material (**Figure 2-34**). Wooden support posts have been placed inside the structure (**Figure 2-35**), potentially to provide vertical support against possible buckling. Factoring in the degraded condition of the existing culvert as well as the upstream and downstream channel conditions, full replacement of the culvert is recommended in conjunction with channel restoration / erosion mitigation works on either side of the new replacement structure.

**Figure 2-32: Erosion Site #22 – Debris Jam Downstream of the Lynn Heights Drive Culvert.**

**Figure 2-33: Erosion Site #22 – Observed Scouring Downstream of the Lynn Heights Culvert.**

**Figure 2-34: Erosion Site #22 – Observed Structural Degradation at the Culvert Outlet.**

**Figure 2-35: Erosion Site #22 – Wooden Support Posts Observed within the Lynn Heights Drive Culvert.**

**Figure 2-36** provides an overview of the site conditions at Erosion Site #22.

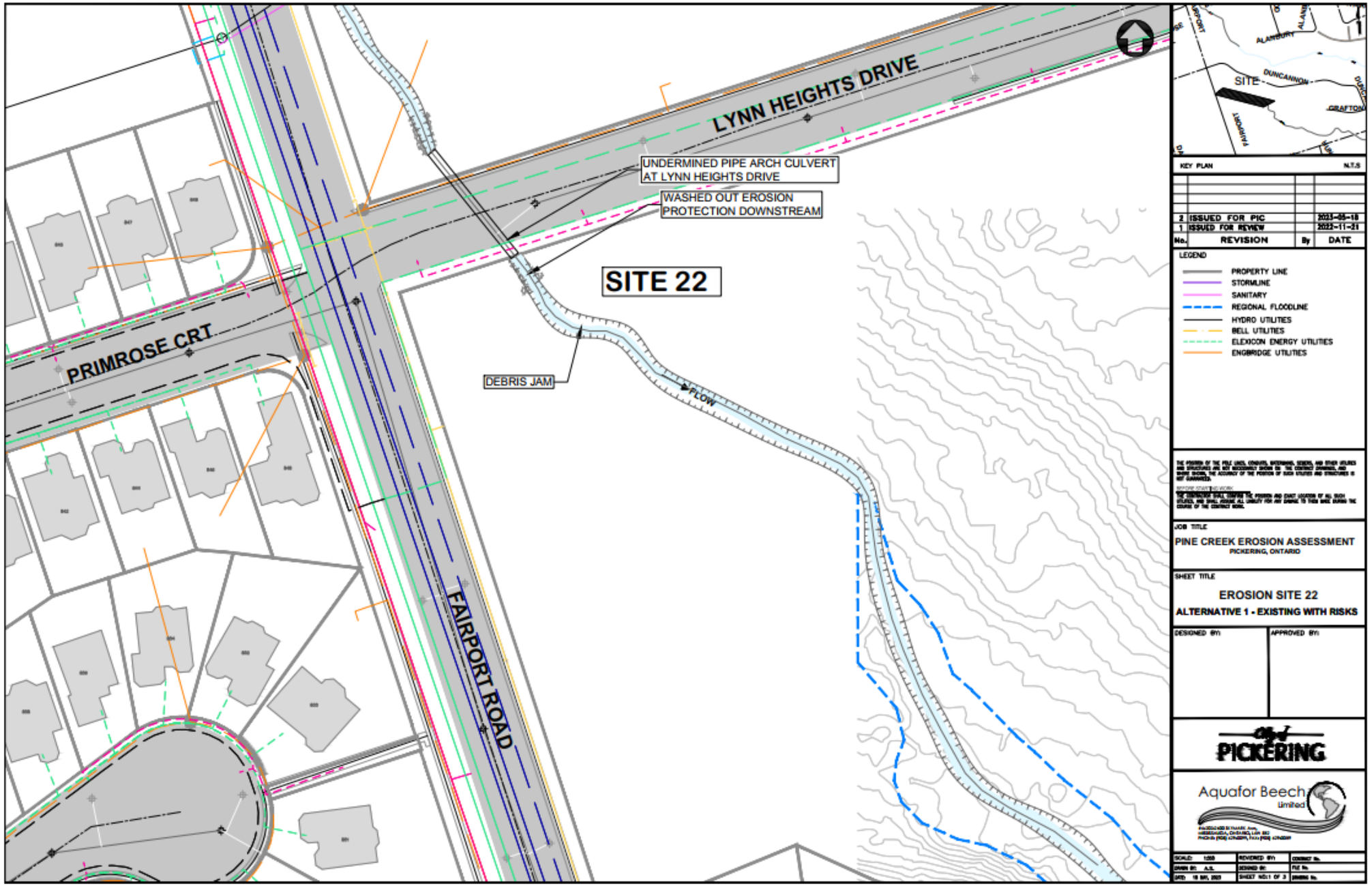



**Figure 2-36: Erosion Site #22: Existing Site Conditions**

## 2.10 Erosion Sites #23-24

Erosion Sites #23-24 are located along the eastern branch of Pine Creek, upstream of Finch Avenue within Lynn Heights Park. At these locations, unmitigated widening of the channel, in response to urbanization induced pressures on watershed hydrology, has eroded the toe of the valley slope (**Figure 2-37**). Several large trees have been undercut and uprooted leading to the formation of a series of debris jams (**Figure 2-38**), further accelerating erosion within the valley corridor. Two instances of significant toe erosion were observed creating risks to private properties on Duncannon Drive (Erosion Site #23 – **Figure 2-39** and Erosion Site #24 – **Figure 2-40**). Future restoration works are recommended to remove the accumulated debris and implement toe erosion control measures to enhance slope stability and protect private property.

**Figure 2-37: Observed Channel Widening and Bank Erosion within Lynn Heights Park.**

**Figure 2-38: Observed Uprooted Fallen Trees Creating a Debris Jam in Lynn Heights Park.**

**Figure 2-39: Erosion Site #23 – Observed Toe Erosion Creating Risk to Private Property on Duncannon Drive**

**Figure 2-40: Erosion Site #24 – Actively Eroding Bank behind Duncannon Drive Properties.**

**Figure 2-41** provides an overview of the site conditions at Erosion Sites #23-24.

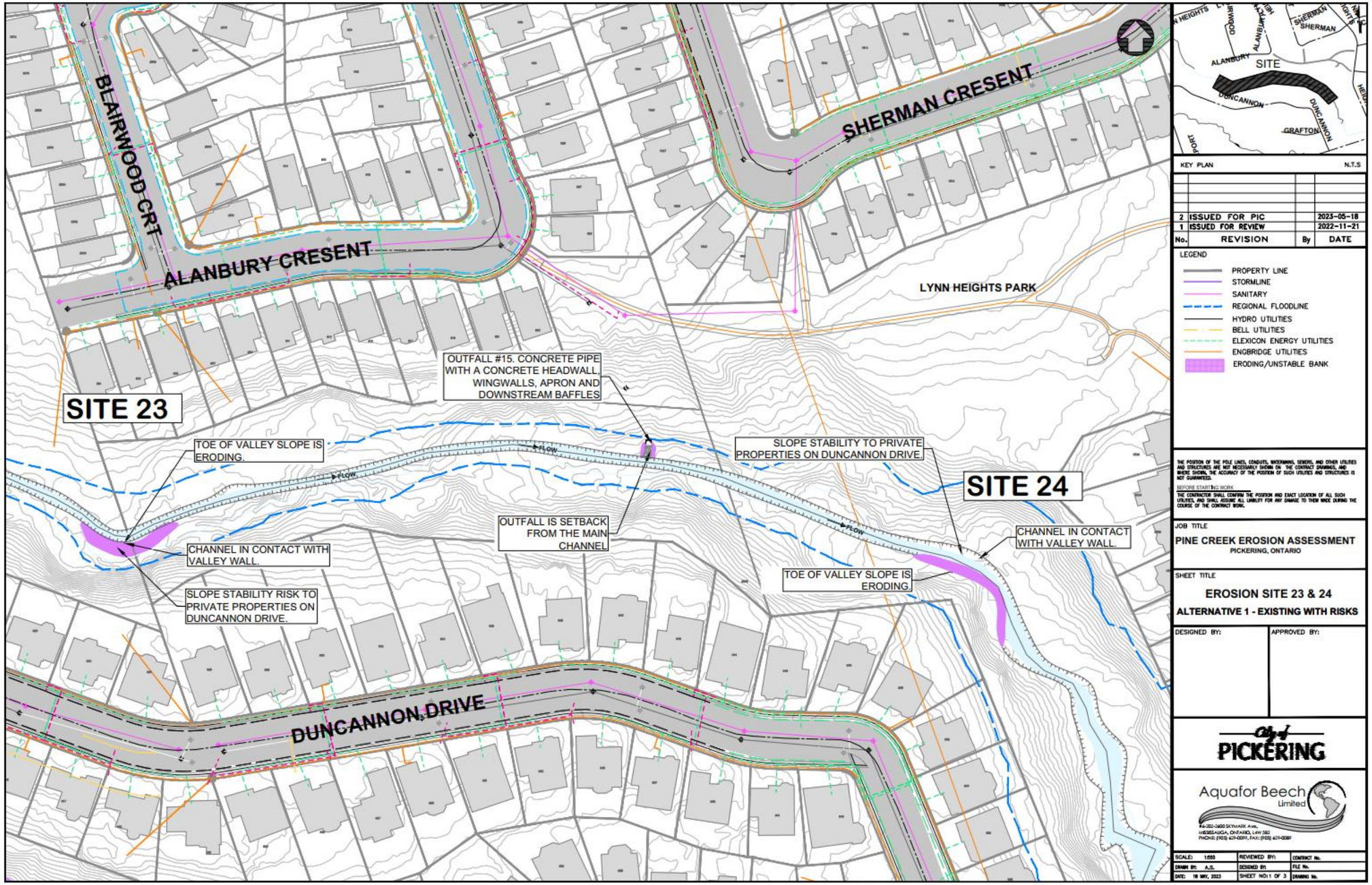



**Figure 2-41: Erosion Site #23-24: Existing Site Conditions**

## 2.11 Erosion Site #25

Taking into account public feedback received through the EA process, a twenty fifth erosion site was added encompassing the whole of the Kitley Ravine corridor. The Kitley Ravine is an approximately 500 m long storm sewer outfall channel that conveys flows from a source outfall behind Pickering Fire Station #6 downstream to the main branch of Pine Creek. The corridor is confined by private residential properties on either side as well as an informal multi-use trail. A central drainage ditch is poorly defined leading to areas of erosion (**Figure 2-42**), the accumulation of debris (**Figure 2-43**), ponding (**Figure 2-44**) and encroachment into private property (**Figure 2-45**). Through the EA process several residents noted concerns regarding the degraded state of the corridor and expressed interest in restoration works being undertaken to improve drainage conditions; provided that measures are taken to limit vegetation removals and disturbances to the existing natural environment.

**Figure 2-42: Erosion Site #25 – Observed Bank Erosion and Undercutting of Trees in the Kitley Ravine Corridor.**

**Figure 2-43: Erosion Site #25 – Observed Debris Jams within the Kitley Ravine Corridor.**

**Figure 2-44: Erosion Site #25 – Ponding within the Kitley Ravine Corridor**

**Figure 2-45: Erosion Site #25 – Encroachment of the Kitley Ravine Drainage Ditch towards Private Property.**

**Figure 2-46** provides an overview of the site conditions at Erosion Site #25.

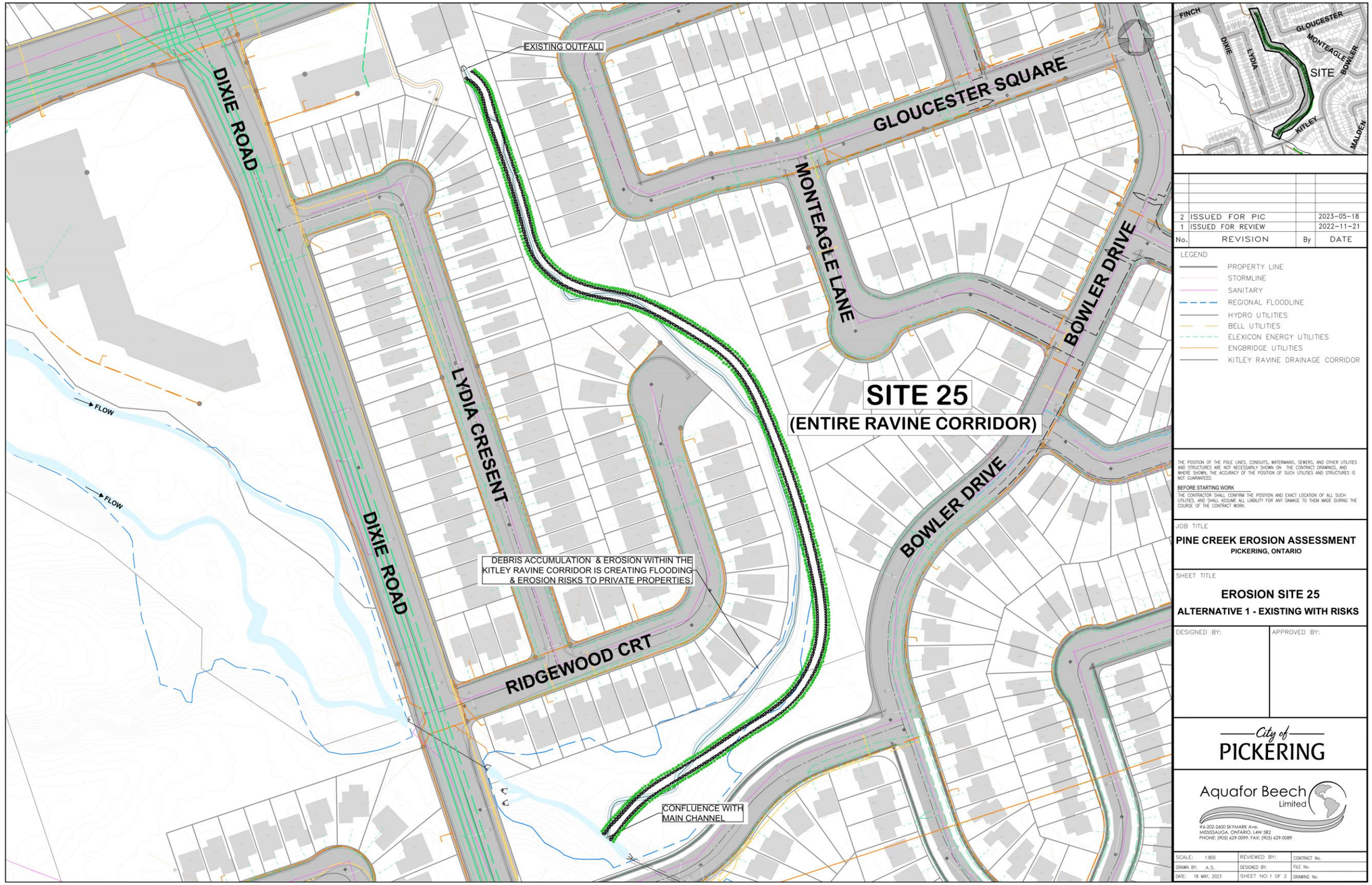



**Figure 2-46: Erosion Site #25: Existing Site Conditions**

## 2.12 Site Summaries and Restoration Opportunities

As outlined above, twenty-five (25) erosion sites were identified through the Pine Creek Erosion Assessment EA. At each of these sites, there is an identifiable erosion related risk to one of the following assets:

- Private property;
- Municipal infrastructure;
- Region of Durham infrastructure;
- Public parklands; and/or
- The city maintained multi-use trail system.

**Table 2-1** below, summarizes the identified project sites and the risks currently presented by ongoing erosion. A general level of risk (i.e., Low, Medium, High) is also reported for each site based on the results of the field erosion assessment.

### 2.12.1 *Opportunities*

In light of the existing conditions observed within the study area, there are several opportunities to mitigate the identified erosion risks, protect infrastructure and private properties, and also improve terrestrial and aquatic habitat conditions. These opportunities include:

- Replacement of failing erosion control structures with alternative bank treatments including armourstone, vegetated buttresses, rock toe protection, and/or vegetated banks;
- Protection of municipal infrastructure assets and private properties through minor channel realignment and erosion control measures;
- Restoration of floodplain access by cutting back channel banks where feasible;
- Restoring the channel banks and bed with softer soil bioengineering approaches and minimizing the application of harder engineering methods;
- Enhancement of aquatic and terrestrial habitat through removal of fish barriers and placement of rounded substrate, rib structures, and riparian plantings;
- Removal of accumulated channel debris; and
- Replanting of the riparian corridor with native species.

In considering the possible alternatives for the stabilization and rehabilitation of Pine Creek within the study area, each of the above-listed opportunities were considered on a site-by-site basis.

**Table 2-1: Summary of Risks at Identified Erosion Sites**

| Site # | Private Property Risk | Municipal Infrastructure Risk | Regional Infrastructure Risk | Public Parklands Risk | Multi-Use Trail Risk | Comments | Level of Risk |
|---|---|---|---|---|---|---|---|
| 1 | | | X | | | Risk to Kingston Road/HWY2 Box Culvert and a CSP Storm Sewer Outfall. Both Assets are Located on Region of Durham Property.<br><br>All Future Restoration Works, if any, to be Coordinated by the Region of Durham. | **Medium** |
| 2 | X | | | | | Risk to Private Properties on Charlotte Circle | **Medium** |
| 3 | | X | | X | | Minor Risk to Municipal Storm Sewer Outfall and Adjacent Parklands | **Low** |
| 4 | | X | | X | X | Minor Risk to Municipal Pedestrian Bridge, Adjacent Trail and Adjacent Parklands | **Low** |
| 5 | | X | | X | X | Minor Risk to Glenanna Road Box Culvert, Public Parklands and the Adjacent Multi-Use Trail | **Low** |
| 6 | | | | X | | Minor Risk to Parklands in David Farr Park | **Low** |
| 7 | | | | X | | Minor Risk to Parklands in David Farr Park | **Low** |
| 8 | | | | X | | Minor Risk to Parklands in David Farr Park | **Low** |
| 9 | | | | X | X | Risk to Multi Use Trail and Parklands in David Farr Park | **High** |
| 10 | | | | X | X | Risk to Multi Use Trail and Parklands in David Farr Park | **High** |
| 11 | | X | | | | Minor Risk to Dixie Road Culvert | **Medium** |
| 12 | | X | | | | Risk to Dixie Road | **Medium** |
| 13 | X | | | | | Risk to Private Properties on Mountcastle Crescent | **High** |
| 14 | X | | | | | Risk to Private Properties on Mountcastle Crescent | **High** |
| 15 | | X | | | | Risk to Municipal Storm Sewer Outfall | **Medium** |
| 16 | | | X | | | Risk to Regional CSP Culvert Crossing and Finch Avenue/Regional Road 37 Roadside Ditch. Both Assets are Located on Region of Durham Property.<br><br>All Future Restoration Works, if any, to be Coordinated by the Region of Durham. | **High** |
| 17 | X | | | | | Risk to Private Properties on Grafton Court | **Medium** |
| 18 | | | X | | | Risk to Finch Avenue/Regional Road 37 | **Medium** |
| 19 | X | | | | | Risk to Private Culvert and Access Road.<br><br>All Future Restoration Works, if any, to be Coordinated by Private Property Owner. | **Low** |
| 20 | X | | | | | Risk to Private Properties on Duncannon Drive | **Medium** |
| 21 | | X | | | | Risk to Municipal Outfall Culvert | **Medium** |
| 22 | | X | | | | Risk to Lynn Heights Drive Culvert Crossing | **High** |
| 23 | X | | | | | Risk to Private Properties on Duncannon Drive | **Medium** |
| 24 | X | | | | | Risk to Private Properties on Duncannon Drive | **Medium** |
| 25 | X | | | X | | Risk to Private Properties on Ridgewood Court, Lydia Crescent, Gloucester Square and Monteagle Lane as well as loss of Parkland in the Kitley Ravine. | **Medium** |

# 3 EXISTING CONDITIONS & SITE-SPECIFIC INVENTORIES

Site-specific studies were conducted to support the selection and design of the preferred alternative for each set of erosion sites. A summary of the site-specific inventories that were conducted in support of the Pine Creek Erosion Assessment EA is provided below.

## 3.1 Geomorphic Assessments

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. As such, the watercourse within the study area has been categorized into different reaches to better understand the factors taking place. As part of the stream erosion inventory and assessment for Pine Creek within the City of Pickering, about 4 kilometers of the creek were walked to visually assess the channel and the surrounding area. The reach delineation was confirmed and refined in the field during creek walks to fully account for geomorphically significant changes in channel conditions.

A synoptic level fluvial geomorphic field assessment was completed in Fall 2022. During the field walk, existing conditions within Pine Creek were noted, and erosion site identification and photographic inventory for watercourse reach conditions were collected. The extent of the assessed watercourse reaches is shown in **Figure 3-1**. In order to maintain consistency from previous studies conducted within the same study area, particularly, the Frenchman's Bay Storm Water Management Master Plan (2009), the same reach names have been assumed (PC3 and PC4) where the reaches are further divided into subsections (PC3a, PC3b, PC3c, PC3d, PC4a, and PC4b) so as to provide a higher level of detail. Erosion is present throughout the study area. While inherent erosion processes are expected in a natural watercourse; erosion can be exacerbated by urbanization within a catchment area through alteration of the watercourse and changes in the rainfall-runoff response due to decreased infiltration. The existing fluvial conditions for each reach have been summarized in the sections below, accompanied by representative photographs.

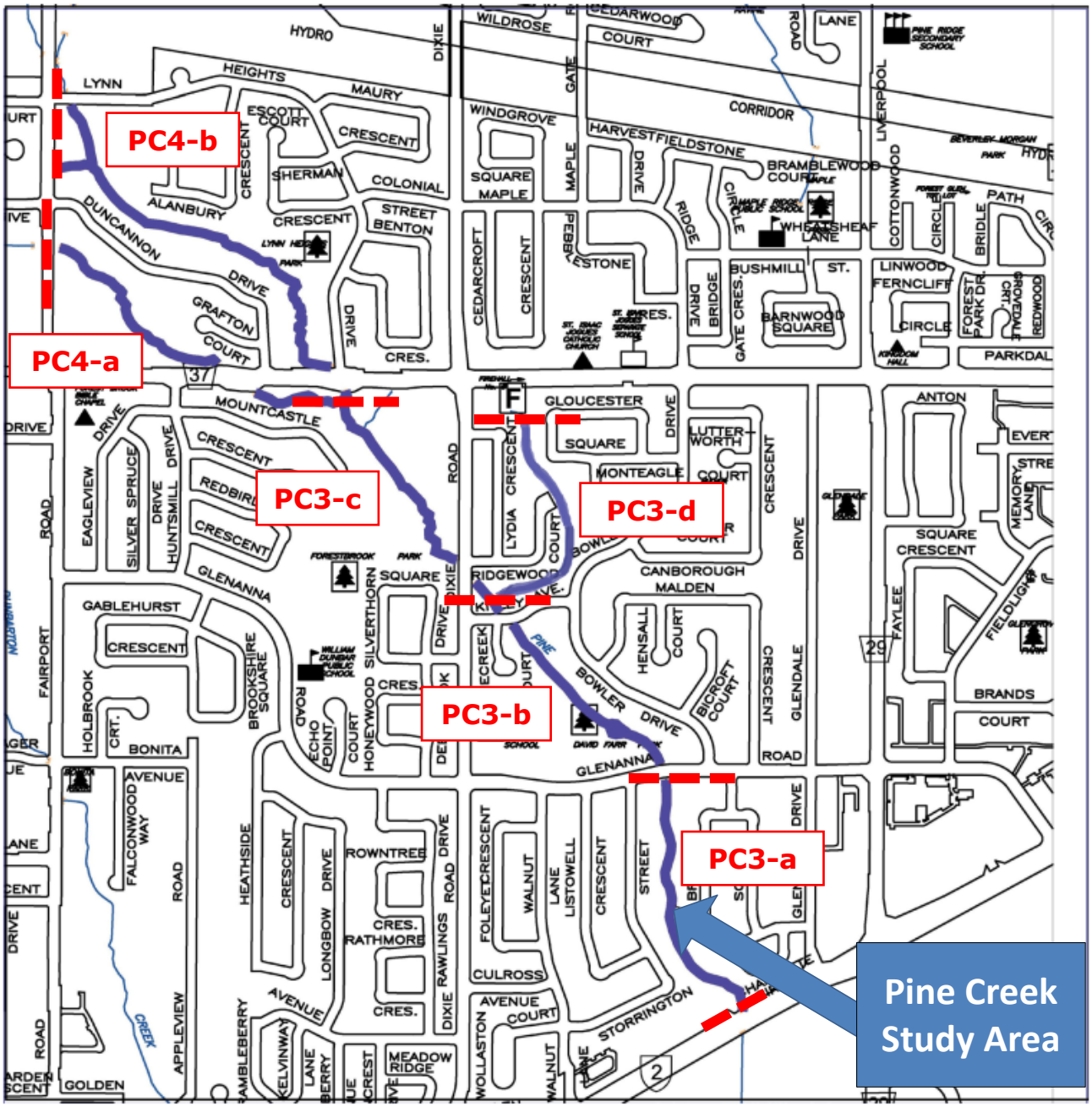



**Figure 3-1: Delineated Management Reaches within the Pine Creek Study Area**

### 3.1.1 *Reach PC3a – Kingston Road to Glenanna Road*

Reach PC3a is approximately 560 m in length and extends from the Kingston Road bridge crossing to the Glenanna Road crossing. The bank material predominantly ranges from very fine and fine sand with some areas containing very fine pebbles throughout the reach. The bed material consists of cobble sized stones downstream, however, transitions to fine sand increasing in clay content with the clay bed of the channel exposed towards the upstream extent of the reach. The bankfull width ranges from 6 – 8 m and the average bankfull depth is 1.5 m. This reach has low to moderate sinuosity with a sinuosity index of 1.15.

This reach of Pine Creek is surrounded by city owned riparian corridor and residential land use on either side where residential properties line the top of the slope in some areas. The reach is channelized with a narrow floodplain and the channel exhibits pool – riffle morphology. **Figure 3-2** shows a part of the straightened channel looking upstream towards the Kingston Road culvert with dense vegetation lining the banks of the channel. Recent beaver activity has resulted in a beaver dam located approximately 50 m upstream of the Kingston Road culvert as seen in **Figure 3-3**. This barrier has significantly backwatered the channel immediately upstream and is having an impact on the function of storm water outfalls within the reach and is resulting in channel widening as seen in **Figure 3-4**. Fracture lines along the bank are also present immediately downstream of the storm outfall and pedestrian bridge where channel widening and erosion is evident. The channel widening poses a risk to private properties lining the top of the slope as cutbanks are forming on the sandy banks as shown in **Figure 3-5**.

**Figure 3-2: Riprap Lined Channel with Dense Riparian Overbank near Kingston Road Culvert.**

**Figure 3-3: Beaver Dam Upstream of Kingston Road Culvert Causing Backwatering of the Reach Upstream.**

**Figure 3-4: Backwater Effects from Beaver Dam Affecting Storm Outfall and Pedestrian Bridge Abutments Upstream.**

**Figure 3-5: Unlined Channel with Sandy Banks Eroding at Meander less than 5m from Private Property.**

### 3.1.2 *Reach PC3b – Glenanna Road to Confluence Upstream of Kitley Avenue*

Reach PC3b extends from the Glenanna Road culvert to the confluence upstream of Kitley Avenue. This reach has been channelized and confined to a narrow corridor where it borders residential land use upstream and the channel extends through an open parkland downstream towards Glenanna Road. The channel exhibits pool – riffle morphology throughout the reach. The bankfull width ranges from 4 – 8 m and the average bankfull depth is 1.2 m. The bank material is made of very fine to fine sand and the bed material ranges from medium silt to fine sand. The channel has been lined with small cobbles which have been washing out downstream. Also present are small to medium boulders in riffles throughout the reach. Clay material is exposed on the channel bed and banks towards the upstream extent of the reach. This straight reach has a sinuosity index of 1.03.

This reach of Pine Creek is also surrounded by city owned riparian corridor and residential land use on either side. The channel has pool – riffle morphology with small to medium boulders present within the channel bed as shown in **Figure 3-6**. Bank erosion is present throughout the reach and can be seen on either bank of the straight channel in **Figure 3-7**. This reach has over steepened banks extending from the middle of the reach to the upstream end at Kitley Avenue (**Figure 3-8**) where erosion is taking place at the toe of the bank. These over steepened banks pose a risk to city infrastructure such as the multi-use trail which lines the top of the slope at the upstream extent shown in **Figure 3-9**. The surrounding city property has varying ground conditions ranging from manicured grasses to thickly wooded areas. Throughout the reach, the landscaping extends towards the banks decreasing the riparian corridor and promoting bank erosion. Some of these segments have been protected by channel treatment and stabilization measures. Most notable is the limited riprap application allowing for a more natural bedform, which is primarily composed of medium sized cobbles. The channel is moderately incised and degraded exposing the clay bed as a result of urbanization in the watershed.

**Figure 3-6: Looking Downstream at a Meander Bend with Dense Riparian Overbank Visible and Small to Medium Boulders Present within the Channel Bed.**

**Figure 3-7: Looking Upstream at the Straight Channel where Bank Erosion Present Throughout the Reach can be Seen on Either Bank of the Channel**

**Figure 3-8: Looking Upstream at the Steep Slope Adjacent to City Owned Trail on the North Easterly Bank**

**Figure 3-9: Looking Downstream from Trail Which is Within 2.0 m of Channel. Erosion Taking Place at the Toe of the Over Steepened Bank.**

### 3.1.3 *Reach PC3c – Confluence Upstream of Kitley Avenue to Confluence Downstream of Finch Avenue*

This reach extends from the confluence upstream of Kitley Avenue to the confluence downstream of Finch Avenue. The reach, towards the downstream extent, is characterized by shallow banks however, transitions into a deeply incised channel with pool – riffle morphology at the upstream extent. This reach is surrounded by different types of land use including a wide riparian corridor with limited erosion hazard risks, as well as segments in which the channel passes through a wetland (**Figure 3-10**). The average bankfull width is 3.4 m and the average bankfull depth is 0.9 m. The bed material ranges from silt to coarse sand with fine pebbles and the bank material ranges from clay to very fine upper sand, coarsening downstream to fine to medium sand. This reach has low to moderate sinuosity with a sinuosity index of 1.1.

Within this section of the creek, the riparian corridor is unmaintained and filled with dense trees and shrubs which provide some resistance to erosion and increased boundary roughness to the channel during high discharge events (**Figure 3-11**). The energy dissipation block structures located downstream of the Dixie Road culvert are causing sediment accumulation to occur which is resulting in aggradation of the bed and active channel widening with bank erosion taking place on both sides of the channel as seen in **Figure 3-12**. Large woody debris jams are observed at many locations within the reach. Along the upstream extent of this reach, erosion on the outside of the meander bend from lateral channel migration is notable. Exposed tree roots are prevalent within the eroded cutbanks and many fallen trees are visible as seen in **Figure 3-13**. Geomorphic adjustment is occurring as a result of urban hydromodification which drives channel widening and downcutting in response to higher peak flows, greater runoff volumes, and more frequent flow events.

**Figure 3-10: Looking Upstream at Wetland Through Which the Channel Passes.**

**Figure 3-11: Looking Upstream at the Densely Vegetated Banks Where Erosion at the Toe of Bank can be Observed on the Left Bank**

**Figure 3-12: Sediment Accumulation Occurring Downstream of Energy Dissipation Blocks at the Dixie Road Culvert Causing Aggradation of the Bed and Active Channel Widening.**

**Figure 3-13: Looking Upstream at Natural Riparian Corridor Filled with Dense Trees and Shrubs. Bank Erosion Taking Place and Large Woody Debris Fallen into the Channel Obstructing Flow.**

### 3.1.4 *Reach PC3d – Kitley Ravine Corridor*

Reach PC3d is approximately 570 m in length and extends from the confluence upstream of Kitley Avenue to the Finch Avenue crossing, encompassing the entirety of the Kitley Ravine Corridor. The bank material consists of clay loam and the bed material consists of fine to medium sand and sandy loam (**Figure 3-14**). The bankfull width ranges from 3 – 6 m and the average bankfull depth is 0.5 m. This reach has moderate to high sinuosity with a sinuosity index of 1.25.

This reach lacks pool – riffle morphology and consists of low-lying areas where the watercourse transitions between channelized and un-channelized forms (**Figure 3-15**). Overall, the reach is characteristic of a poorly defined urban drainage ditch, with a heterogenous cross-sectional area along its length and intermittent access to the adjacent floodplain. There has been a significant accumulation of debris within the ravine corridor (**Figure 3-16**) as a result of local dumping and the failure of mature vegetation due to active erosion processes. The aforementioned debris jams are contributing to increased erosion and migration of the channel centerline, which has in turn caused encroachment towards private property (**Figure 3-17**) leading to a series of residential complaints related to erosion and flooding issues.

**Figure 3-14: Looking Upstream Near the Midpoint of the Reach. Note bed materials consisting of fine to medium sand and sandy loam.**

**Figure 3-15: Looking Upstream at a Segment of the Kitley Ravine where the Channel Corridor is Poorly Defined.**

**Figure 3-16: Looking Downstream Towards Accumulated Debris.**

**Figure 3-17: Looking Upstream near the Midpoint of the Reach. Note Encroachment of the Channel Towards Private Property.**

### 3.1.5 *Reach PC4a – Confluence downstream of Finch Avenue to Fairport Road*

Reach PC4a extends from the confluence downstream of Finch Avenue northeast to Fairport Road upstream. The reach is surrounded by open grassland on one side and residential land use on the other. This reach transitions between the watercourse being in contact with the steep valley walls to the channel having access to a wide floodplain (**Figure 3-18**). Throughout the extent of the reach, the bed material consists of fine gravel to small cobbles with a higher concentration of medium to coarse sand towards the downstream extent, and an increase in clay content towards the upstream extent. The bank material is composed of silt to fine upper sand with very little clay. The bankfull width ranges from 3 – 6 m and the average bankfull depth is 0.5 m. This reach is considered to be moderately sinuous with a sinuosity index of 1.16.

Along this reach, several cutbank erosion scars are notable, exposed tree roots are prevalent within the eroded banks, and large woody jams are observed as seen in **Figure 3-19**. This photo also shows that severe undermining of the toe of slope is present throughout the extent of the reach. Also present are areas of extensive bank slumping where channel planform migration and erosion has occurred (**Figure 3-20**). Island formation has taken place due to the large woody debris in the channel obstructing flow and causing sediment accumulation (**Figure 3-21**). The watercourse has full access to its floodplain through most of the reach, however; the channel is partially confined with steep valley walls through some areas. Geomorphic adjustment is taking place as a result of urban hydromodification which drives processes of channel widening, planform adjustment, and degradation in response to higher peak flows, greater runoff volumes, and more frequent flow events.

**Figure 3-18: Looking Upstream at Channel with Shallow Banks Where Channel has Access to a Wide Floodplain**

**Figure 3-19: Looking Downstream at Steep Valley Slope where Cutbank Erosion Scars are Notable as well as Leaning and Fallen Trees within the Channel**

**Figure 3-20: Looking Downstream at Channel Where Bank Erosion is Occurring on Meander Bends and Steep Valley Slopes**

**Figure 3-21: Looking Upstream at Large Woody Debris Obstructing Flow. Island Formation Taken Place Due to the Resulting Sediment Accumulation.**

### 3.1.6 *Reach PC4b – Lynn Heights Drive to Confluence Downstream of Finch Avenue*

Reach PC4b extends from Lynn Heights Drive to the confluence downstream of Finch Avenue. The reach consists of a heavily vegetated channel where the riparian corridor is unmaintained, filled with dense trees and shrubs, and has multiple debris jams throughout the extent of the reach (**Figure 3-22**). The bed material ranges from of silt to fine sand and coarse gravel to small boulders. The bank material consists of silt to fine upper sand. The bankfull width ranges from 3 – 6 m and the bankfull depth ranges from 0.5 – 1.5 m. The reach has moderate to high sinuosity with a sinuosity index of 1.21.

Along this reach, severe cutbank erosion scars are notable (**Figure 3-23**). There are several areas with extensive bank slumping occurring due to the steep slopes where channel planform migration and erosion is evident (**Figure 3-24**). Exposed tree roots are prevalent within the eroded banks and many fallen trees are present (**Figure 3-25**). Through this reach, the channel has varying access to the floodplain. Due to the densely vegetated banks towards the upstream extent of the reach, the channel has become intensely entrenched and does not have access to its floodplain. The watercourse towards the middle of the reach and sparsely throughout the downstream extent however, has access to a wide floodplain where the banks are shallow.

Geomorphic adjustment is occurring throughout the reach where channel widening and severe downcutting is evident. The watercourse is attempting to meander which is resulting in channel widening and severe bank erosion that is causing trees to fall in creating woody debris jams at many locations within the reach.

**Figure 3-22: Looking Downstream at Heavily Vegetated Channel. Multiple debris jams throughout the reach.**

**Figure 3-23: Looking Downstream at Channel where 1.2 m Deep Cutbank Erosion Scar can be Seen on the Right Bank and Another on the Left Bank in the Background.**

**Figure 3-24: Looking Upstream of Channel Where Exposed Tree Roots Through the Banks are Visible.**

**Figure 3-25: Erosion on the Outside of the Meander Bend Looking at the North Easterly Bank. Leaning Trees and Exposed Tree Roots Visible.**

### 3.1.7 *Geomorphic Stability Assessment*

The Rapid Geomorphic Assessment (RGA) 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, in transition, 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 "in regime", "in transition", or "in adjustment" depending on the stability index value as described in **Table 3-1**.

**Table 3-1: Rapid Geomorphic Assessment Descriptions Based on Index Value**

| Stability Index Value | Stability Class | Description |
|---|---|---|
| 0 - 0.20 | 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. |
| 0.25 – 0.40 | In Transition | Channel morphology is within the expected range of variance but with evidence of stress. Significant channel adjustments have occurred and additional adjustment may occur. |
| 0.40 – 1.0 | 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. |

RGA stability results for the six reaches described above are listed in **Table 3-2**, while the actual RGA evaluation sheets are contained in **Appendix B**.

**Table 3-2: RGA Values for the Six Reaches Associated with the Pine Creek Erosion Assessment EA**

| Reach | RGA Stability Index | RGA Stability | RGA Dominant Process | Number of Erosion Sites |
|---|---|---|---|---|
| PC3a | 0.49 | In Adjustment | Widening | 4 |
| PC3b | 0.36 | In Transition | Widening | 6 |
| PC3c | 0.34 | In Transition | Aggradation | 2 |
| PC3d | *Not Assessed* | | | 1 |
| PC4a | 0.36 | In Transition | Widening | 9 |
| PC4b | 0.51 | In Adjustment | Aggradation | 3 |

The RGA scores highlighted in **Table 3-2** reveal that reaches PC3a and PC4b are in adjustment and are undergoing widening and aggradation respectively, whereas, PC3b, PC3c, and PC4a are in transition but are dominated by widening and aggradation, respectively.

**Reach PC3a** has a stability index of 0.49 and although it is dominated by the process of widening, the process of aggradation is also influencing the channel as there is ample evidence of siltation in the pools. Evidence of the widening is very prominent as, along with the pedestrian bridge footings being outflanked, the presence of basal scour can be observed through more than 50% of the reach.

**Reach PC3b**, having a stability index of 0.36, is also being influenced by both factors, however, widening is the dominating process as evidence of exposed tree roots, fracture lines along top of bank, and basal scour is present through the extent of the reach.

**Reach PC3c** has a stability index of 0.34 and comprises a single thread channel with pool – riffle channel morphology. The dominant process taking place within this reach is aggradation but the channel is also undergoing widening. The process of aggradation is evidenced from the formation of lobate bars, accretion on point bars, and severe siltation of the bed whereas extensive leaning and fallen trees, and exposed tree roots are evident indicating channel widening.

**Reach PC3d** was not assessed using the RGA tool, at this reach is a poorly defined engineered drainage ditch that does not receive consistent base flow contributions or exhibit typical creek morphology.

**Reach PC4a** has a stability index of 0.36 and is in transition with widening being the dominating process. This reach is characterized by steep valley walls where the channel is incising into the banks. Occurrence of large organic debris, exposed tree roots, and fallen or leaning trees is present all throughout the reach evidencing the process of widening is taking place. The channel through this reach is also impacted by some degradation as scour pools are forming downstream of storm sewers.

**Reach PC4b**, having a stability index of 0.51, is undergoing channel adjustment. This reach is dominated by the process of aggradation, however, evidence of channel widening and the process of degradation is also significant within this reach. The reach is characterized by steep valley walls where the channel is incising into the banks on both sides of the channel. Steep cut banks are present on the meander bends throughout the channel. Along with severe debris jams, the channel is incising and occurrence of basal scour on inside the meander bends is prevalent throughout the extent of the reach.

None of the six (6) reaches are in regime or "stable" but instead, are in transition or adjustment indicating significant geomorphic instability, likely due to the effects of urbanization and the reduction of infiltration throughout the watershed which has caused considerable change to the hydraulic regime of Pine Creek.

## 3.2 Storm Sewer Outfall Inventory

As part of the Pine Creek Erosion Assessment EA, stormwater outfalls that discharge directly into the creek were identified and inventoried in the field. Key outfall parameters were recorded including size, material, and condition. A total of fifteen (15) outfalls were inventoried through the EA assessment, with key results reported in **Table 3-3** below.

Each outfall was assigned an overall condition score according to the following ratings:

- **Good:** The outfall is reasonably well maintained and in good overall condition. No significant signs of structural degradation or risk of failure due to channel erosion processes were identified.

- **Fair:** The outfall is still generally functioning as intended but is starting to exhibit notable signs of structural degradation or is at moderate risk of failure due to ongoing erosion processes.

- **Poor:** The outfall is approaching the end of its service life and is exhibiting significant signs of deterioration. The outfall is at risk of complete failure due to structural degradation or ongoing channel erosion processes. It is expected that within the relatively near term that the outfall will no longer be able to perform it's intended function.

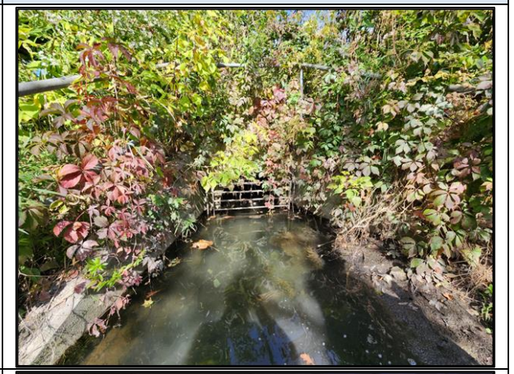
- **Failure:** The outfall is no longer functioning as intended. This ranking is typically reserved for outfalls that have become fully detached from their inletting storm sewers or are buried and are no longer able to provide sufficient drainage.

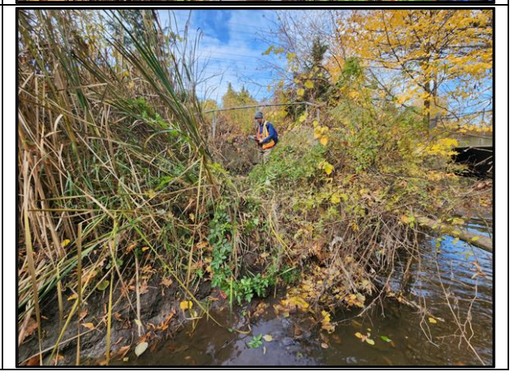
Overall, nine (9) of the fifteen (15) assessed outfalls were found to be in relatively good condition, with the condition of remaining outfalls assessed as either fair (3 outfalls) or poor (3 outfalls). Of the outfalls rated as poor, two (2) can be considered to be in a failed condition as a result of significant sedimentation (Outfall #9) or complete detachment from the upstream storm sewer pipe (Outfall #13).

Copies of the field sheets used for the Storm Sewer Outfall Inventory are included in **Appendix C**.

**Table 3-3: Storm Sewer Outfall Inventory Results**

| Outfall # | Reach | Asset ID | Diameter (mm) | Material | Construction Year | Condition | Headwall | Erosion Protection Works | Comments | Photo |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | PC3-a | Unknown | 800 | CSP | Unknown | **Poor** | Mitered to Gabion Basket Retaining Wall | Gabion Baskets on Either Side | The CSP is located directly upstream of Kingston Road.<br><br>CSP exhibits signs of corrosion and structural degradation.<br><br>Restoration of this CSP pipe is accounted for the Region of Durham planned BRT project.<br><br>The outfall channel is heavily vegetated and poorly defined.<br><br>No grate. |  |
| 2 | PC3-a | SIO-53-0002 | 600 | Concrete | 1978 | **Good** | Concrete Headwall with Flared Wingwalls and Steel Railing | None | Some minor cracking near the pipe invert connection<br><br>Sedimentation on the concrete apron<br><br>~100 mm backwatering at low flow due to downstream beaver dam.<br><br>Steel Grate in good condition. |  |
| 3 | PC3-a | SIO-53-0001 | 1,700 | Concrete | 1976 | **Good** | Concrete Headwall with Flared Wingwalls and Steel Railing | None | Minor Outflanking of Outfall Wingwalls (Erosion Site #3)<br><br>Visible degradation of the Steel Grate<br><br>~560 mm backwatering at low flow due to downstream beaver dam |  |

| Outfall # | Reach | Asset ID | Diameter (mm) | Material | Construction Year | Condition | Headwall | Erosion Protection Works | Comments | Photo |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | PC3-a | SIO-53-0003 | 900 | Concrete | 1976 | **Fair** | Concrete Headwall with Flared Wingwalls and Steel Railing | None | Significant Sedimentation observed within the Outfall Channel<br><br>~350 mm backwatering at low flow due to the downstream beaver dam<br><br>Steel grate in good condition. |  |
| 5 | PC3-a / PC3-b | SIO-63-0003 | 1,200 | Concrete | 1976 | **Good** | None – Outlets inside the Glenanna Road Culvert | None | ~100 mm backwatering at low flow<br><br>Steel grate in good condition |  |
| 6 | PC3-a / PC3-b | SIO-63-0002 | 1,350 | Concrete | 1976 | **Good** | None – Outlets inside the Glenanna Road Culvert | None | ~100 mm backwatering at low flow<br><br>Steel grate in good condition |  |

| Outfall # | Reach | Asset ID | Diameter (mm) | Material | Construction Year | Condition | Headwall | Erosion Protection Works | Comments | Photo |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | PC3-b | SIO-63-0001 | 2,400 | Concrete | 1977 | **Good** | Mitered to Downstream Face of the Kitley Road Culvert | None | ~100 mm backwatering at low flow<br><br>Steel grate in good condition<br><br>Minor Sediment Accumulation inside the Outfall Pipe<br><br>Some Minor Cracking Observed around the Pipe Invert |  |
| 8 | PC3-c | SIO-72-0006 | 600 | Concrete | 1986 | **Good** | Concrete Headwall with Flared Wingwalls and Steel Railing | None | Moderate Sediment Accumulation and Vegetation Observed in the Outfall Channel.<br><br>Steel grate in good condition. |  |
| 9 | PC3-c | SIO-72-0004 | 1,650 | Concrete | 1984 | **Poor / Failed** | Concrete Headwall with Flared Wingwalls and Steel Railing | None | Major sediment accumulation / debris blockage. Approximately 80-90% of the opening area is blocked. |  |

| Outfall # | Reach | Asset ID | Diameter (mm) | Material | Construction Year | Condition | Headwall | Erosion Protection Works | Comments | Photo |
|---|---|---|---|---|---|---|---|---|---|---|
| 10 | Mountcastle Tributary | SIO-71-0001 | 1,050 | Concrete | 1987 | **Good** | Concrete Headwall with Flared Wingwalls and Steel Railing | Energy Dissipation Blocks Downstream of Outfall<br><br>Engineered Armourstone Plunge Pool | Outfall protected through previous channel restoration works identified as part of the Frenchman's Bay Stormwater Management Master Plan |  |
| 11 | PC3-c | Unknown | 900 | CSP | Unknown | **Fair** | None – CSP Pipe Projecting from Slope | None | Appears to be a private outfall servicing the Plaza at the Intersection of Finch Avenue and Dixie Road<br><br>Signs of Corrosion observed within the CSP Pipe<br><br>Outfall is significantly setback from the main channel |  |
| 12 | PC4-a | Unknown | 450 | Concrete | Unknown | **Good** | Concrete Headwall with Flared Wingwalls | Energy Dissipation Blocks Downstream of Outfall<br><br>Rip-rap lined outfall channel | Outfall is not included on City base-mapping and is setback from the main channel<br><br>Downstream erosion protection works are starting to fail (Erosion Site #15) |  |

| Outfall # | Reach | Asset ID | Diameter (mm) | Material | Construction Year | Condition | Headwall | Erosion Protection Works | Comments | Photo |
|---|---|---|---|---|---|---|---|---|---|---|
| 13 | PC4-a | Unknown | 600 | CSP | Unknown | **Poor / Failed** | None | None | Failed CSP culvert that Conveys Flows from the Roadside Ditch Along Finch into the Ravine Corridor.<br><br>Downstream is heavily eroded and is starting to outflank the main CSP culvert that conveys the west branch of Pine Creek under Finch Avenue (Erosion Site #16). |  |
| 14 | PC4-a | Unknown | 1,250<br><br>900 | CSP<br><br>Concrete | Unknown | **Fair** | Concrete Headwall with Flared Wingwalls and Steel Railing | None | Concrete Headwall with Two Pipes (One CSP and One Concrete)<br><br>Steel Grate has Failed<br><br>Significant Corrosion Observed within the CSP Pipe<br><br>Scouring and Erosion Observed Downstream of the Headwall (Erosion Site #21) |  |
| 15 | PC4-b | Unknown | 500 | Concrete | Unknown | **Good** | Concrete Headwall with Flared Wingwalls | Engineered Energy Dissipation Blocks | This outfall is located in Lynn Heights Park, immediately Southeast of 923 Alanbury Crescent<br><br>Steel Grate in Good Condition<br><br>Outfall is setback from the Main Channel<br><br>Minor Erosion Observed Around the Concrete Wingwalls |  |

## 3.3 Hydrologic and Hydraulic Assessment

A review of the study area hydrological and hydraulic conditions was undertaken to determine the existing flood levels / flood lines of Pine Creek within the project 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.

### 3.3.1 *Overview of Pine Creek Hydrology*

At the onset of the study, a hydraulic (HEC-RAS) model was obtained from TRCA which addresses a range of hydrologic conditions (i.e., flood flow scenarios), including the regional event and return period events for the 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: Overview of Pine Creek Hydrology within the EA Study Area**

| Profile | Reach PC4-a Flow Rate ($m^3/s$) | Reach PC4-b Flow Rate ($m^3/s$) | Reach PC4-c Flow Rate ($m^3/s$) | Reach PC3-b Flow Rate ($m^3/s$) | Reach PC3-a Flow Rate ($m^3/s$) |
|---|---|---|---|---|---|
| 2-Year | 0.73 | 0.72 | 4.36 | 11.36 | 12.33 |
| 5-Year | 1.09 | 1.49 | 6.56 | 17.07 | 19.77 |
| 10-Year | 1.39 | 2.12 | 8.18 | 21.34 | 24.34 |
| 25-Year | 1.76 | 3.00 | 10.76 | 27.86 | 31.76 |
| 50-Year | 2.09 | 3.74 | 12.65 | 33.88 | 38.35 |
| 100-Year | 2.6 | 4.51 | 14.80 | 39.65 | 45.27 |
| Regional | 9.53 | 16.24 | 39.8 | 67.35 | 73.80 |

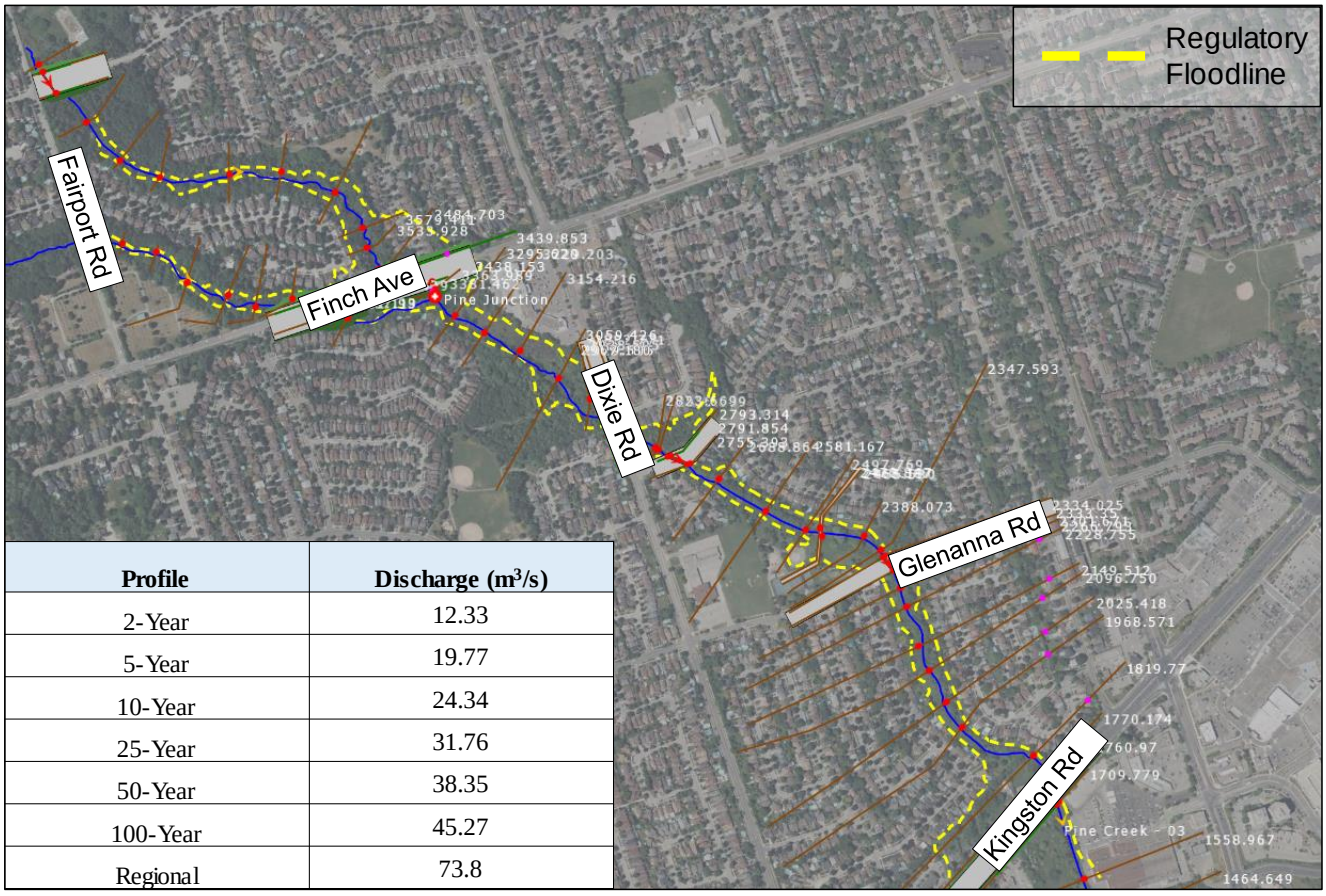
### 3.3.2 *Overview of Pine Creek Hydraulics*

For the purposes of this EA, the Pine Creek HEC-RAS model obtained from TRCA was used to define the existing hydraulic conditions within the study area. The schematics and cross-section arrangement of the existing HEC-RAS model within the study area boundary are depicted in **Figure 3-26**, along with the regional flood line. The model was run under a subcritical flow regime, with a summary of the key hydraulic modeling results for each of the various flood flow events provided in **Appendix D.**

The results of the hydraulic assessment demonstrate that Pine Creek experiences moderately 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 3-5**. These threshold values were then compared to the range of velocities modelled within the Pine Creek sub watershed, a visual summary of which is provided in **Figure 3-27** as a box plot. A comparison between the values reported in **Table 3-5** and the box plot presented in **Figure 3-27** 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. It is worth noting however, that the modelled velocities within Pine Creek are generally within the permissible range of velocities that bioengineering bank treatments, such as a vegetated buttress, are designed for and that consequently there are likely opportunities to limit the use of harder engineering solutions (i.e., Armourstone or concrete retaining walls) in the development of the proposed restoration alternatives.




| Profile | Discharge ($m^3/s$) |
|---|---|
| 2-Year | 12.33 |
| 5-Year | 19.77 |
| 10-Year | 24.34 |
| 25-Year | 31.76 |
| 50-Year | 38.35 |
| 100-Year | 45.27 |
| Regional | 73.8 |

**Figure 3-26: Existing HEC-RAS Schematic Showing Regional Floodline Extents and Model Cross-Section Locations**

**Table 3-5: Erosion Thresholds for Stream Bed and Bank Materials (Fischenich, 2001)**

| Material | Permissible Shear Stress Minimum ($N/m^2$) | Permissible Shear Stress Maximum ($N/m^2$) | Permissible Velocity Minimum (m/s) | Permissible Velocity Maximum (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 |

| Material | Permissible Shear Stress Minimum ($N/m^2$) | Permissible Shear Stress Maximum ($N/m^2$) | Permissible Velocity Minimum (m/s) | Permissible Velocity Maximum (m/s) |
|---|---|---|---|---|
| **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 | |

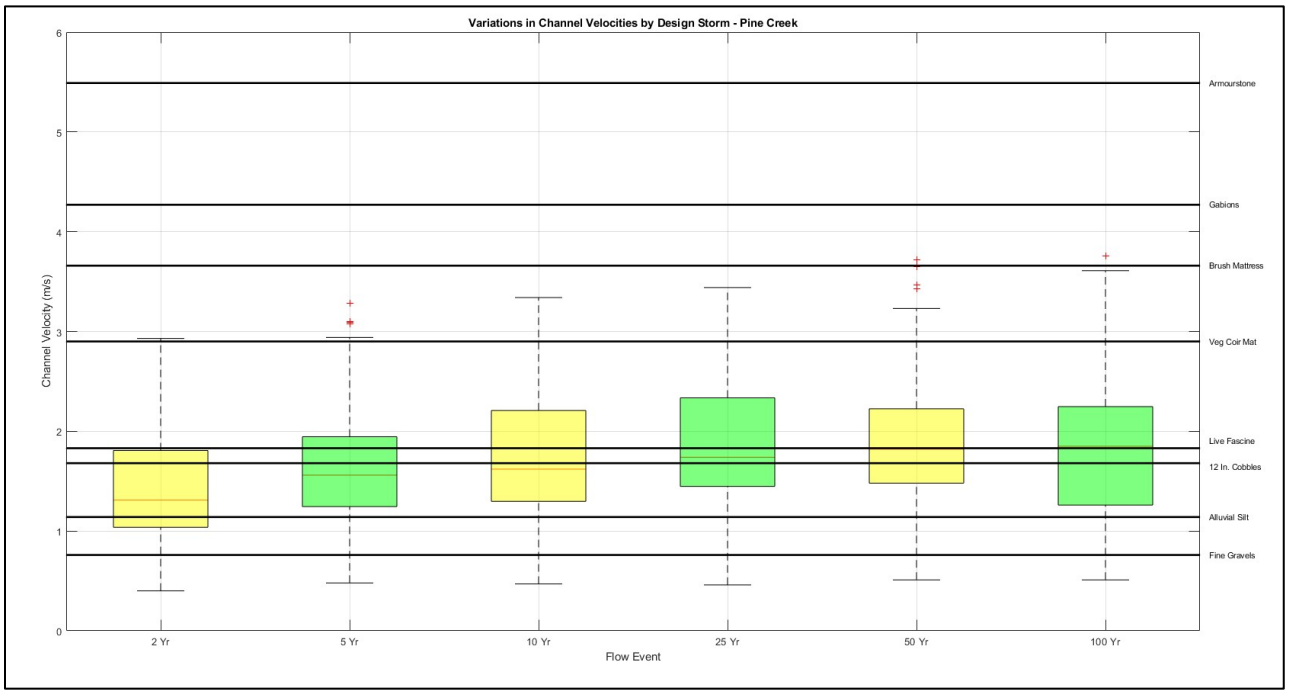



**Figure 3-27: Box and Whisker Plot Illustrating Variations in Channel Velocity by Design Storm for the Main Branch of Pine Creek. Permissible Minimum Velocities for Varying Materials as per Fischenich (2001) Shown on the Right.**

## 3.4 Source Water Protection

In compliance with the Clean Water Act (2006), the Credit Valley Conservation Authority, Toronto and Region Conservation Authority and Central Lake Ontario Conservation Authority have collaborated on the CTC (Credit Valley-Toronto and Region-Central Lake Ontario) Source Protection Plan (2022). The CTC source protection plan outlines the policies and procedures developed to protect existing and future municipal drinking water sources within the CTC region.

As per the CTC source protection plan, the EA project study area is not located within an intake protection zone (**Figure 3-28**) or wellhead protection area. As such, it is generally expected that the implementation of the stream restoration projects associated with this EA will be of low risk to source water resources. Nevertheless, the prescribed drinking water threats listed in the CTC source protection plan were also reviewed. It is expected that the activities associated with the implementation of the proposed projects may involve at least one potential threat to drinking water sources, which is the handling and storage of fuel. To mitigate this risk to source water, at the construction phase of the project, contractors will be required to handle and store all fuel at least thirty (30) meters from Pine Creek or any other natural waterbodies. Contractors will also be responsible for developing, and implementing as needed, a Spill response plan to address any potential spills of deleterious substances into the natural environment.

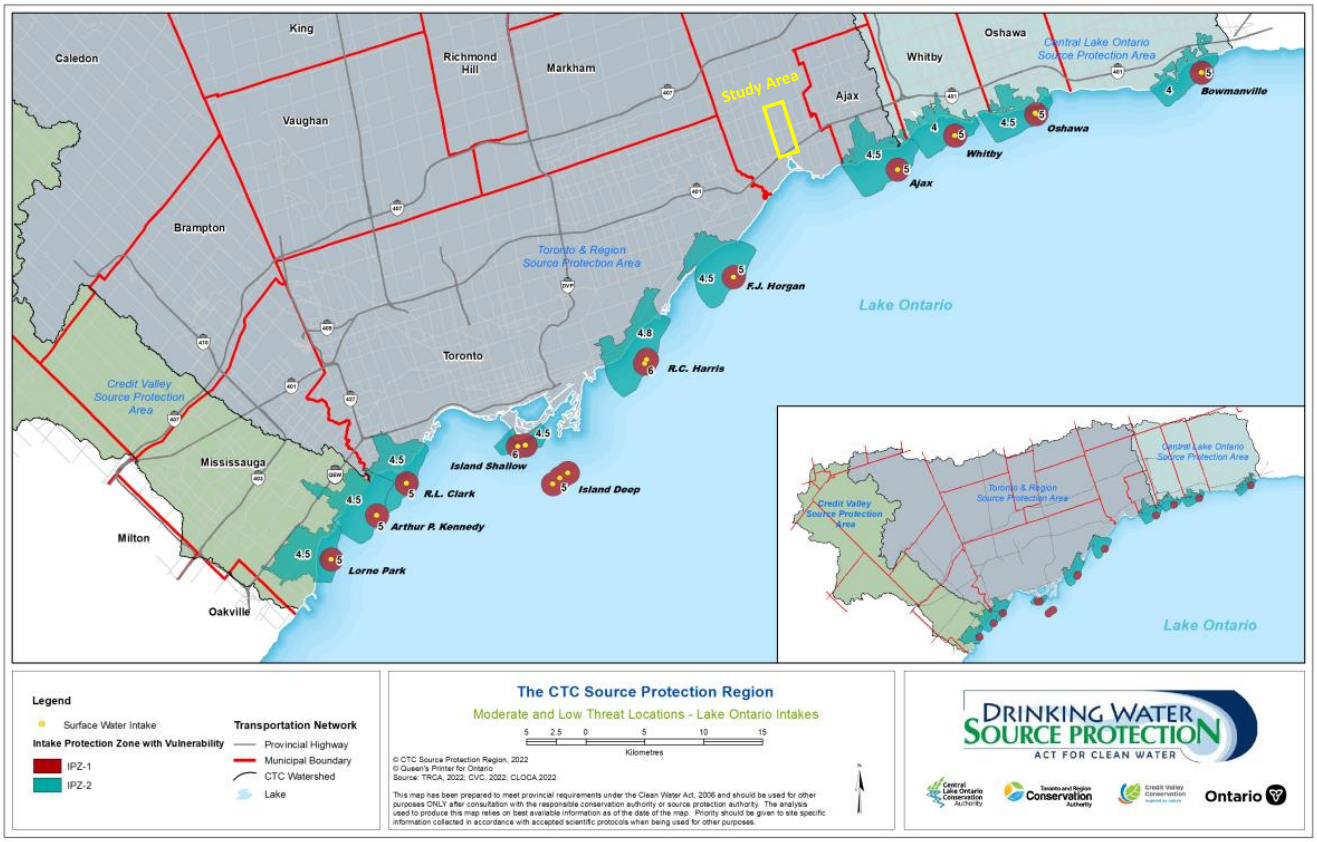



**Figure 3-28: CTC Intake Protection Zones (CTC Source Protection Plan, 2022)**

## 3.5 Geology, Physiology, and Soils

A geological cross-section of the Frenchman's Bay Watershed, in the North-South direction, is presented below as **Figure 3-29**. As per **Figure 3-29**, the project study area is underlain by the Halton Till and Newmarket Till geological formations, which are comprised of glacial sediment laid down between 12,000 and 70,000 years ago. Both till formations are founded on top of gently sloped shale bedrock, known as the Whitby Formation with an estimated age of 440 million years.

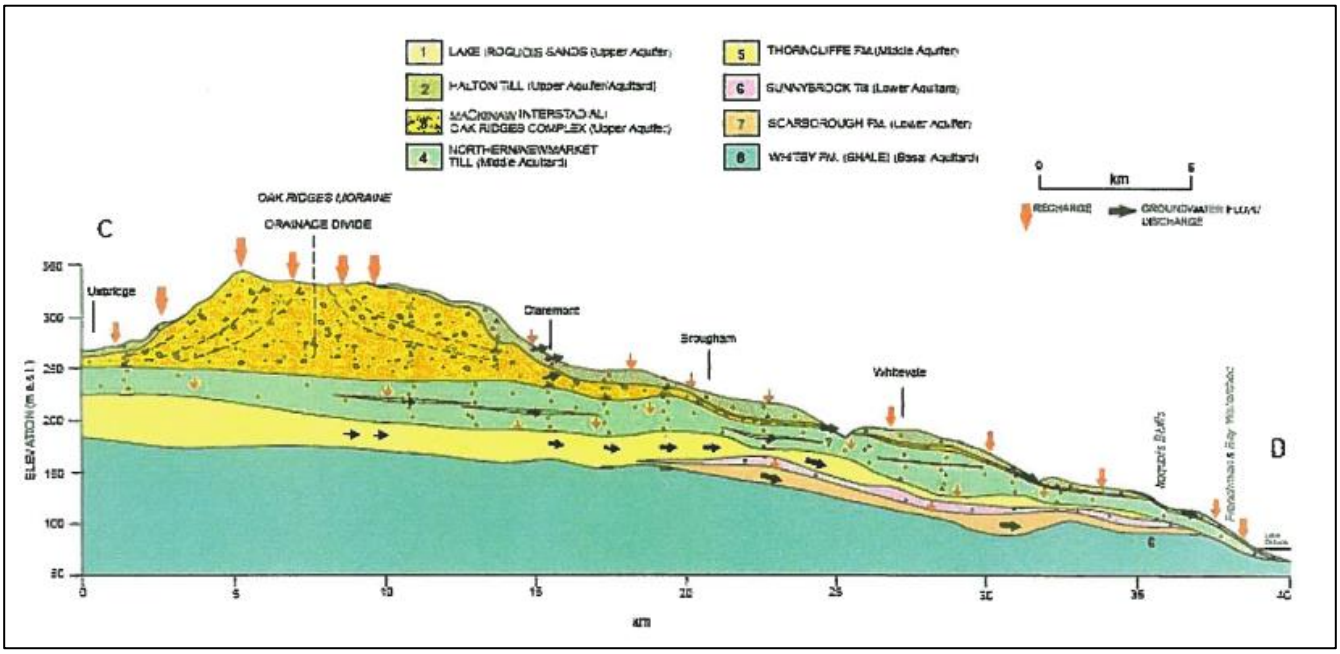



**Figure 3-29: Geological Cross-Section of the Frenchman's Bay Watershed in the North-South Direction (Eyles et al., 2003)**

Groundwater flows in the watershed originate in the Oak Ridges Moraine, draining south towards Lake Ontario. With respect to the subject study area, groundwater flow from the foot of the Iroquois Bluffs plays a key role in providing baseflow to Pine Creek. With regards to surficial geology, the lower half of the study area is dominated by a mixture of clay and silt material with the upper reaches characterised by till overburden material as illustrated in **Figure 3-30**.

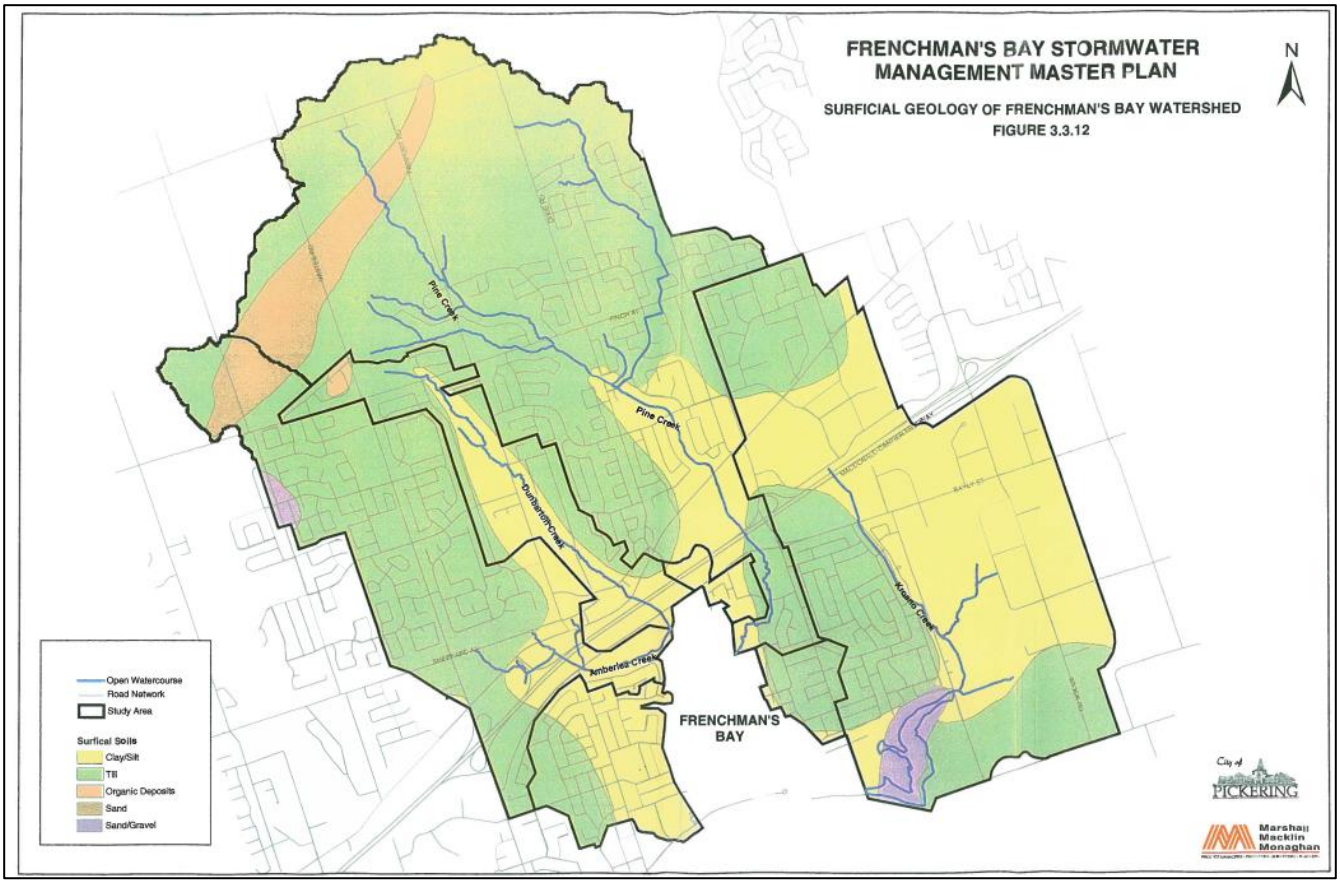



**Figure 3-30: Surficial Geology of the Frenchman's Bay Sub watershed (Marshall, Macklin, Monaghan & City of Pickering, 2009)**

## 3.6 Terrestrial Natural Heritage Assessment

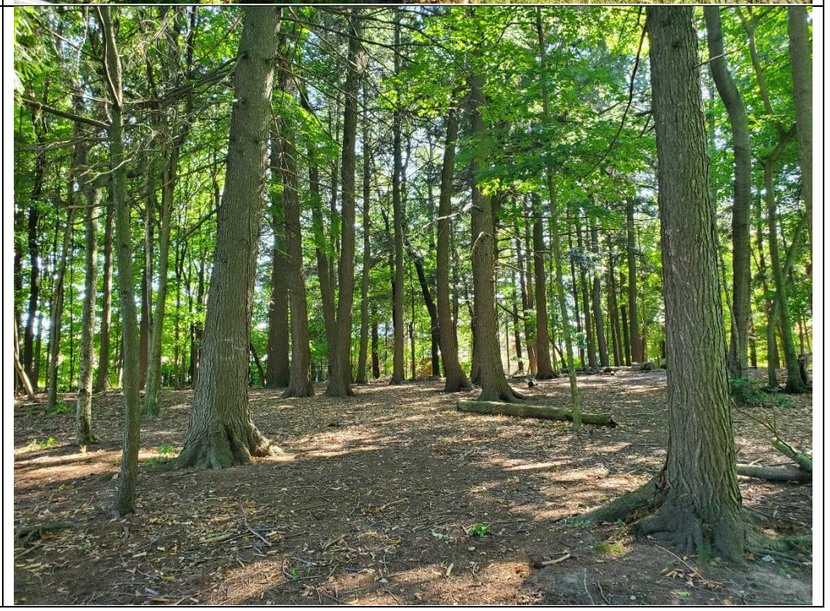
Aquafor completed field investigations on September 8th and 9th, 2022, to review site conditions and characterize habitat that may be impacted by the proposed works. The following subsections provide the results of those investigations combined with relevant information gained from a comprehensive review of background resources.

### 3.6.1 *Vegetation Communities*

The entirety of the river valley corridor contains naturalized vegetation that ranges from forest/woodland to wetland type habitats with varying amounts of anthropogenic influence. The surrounding lands are mainly residential and recreational facilities.

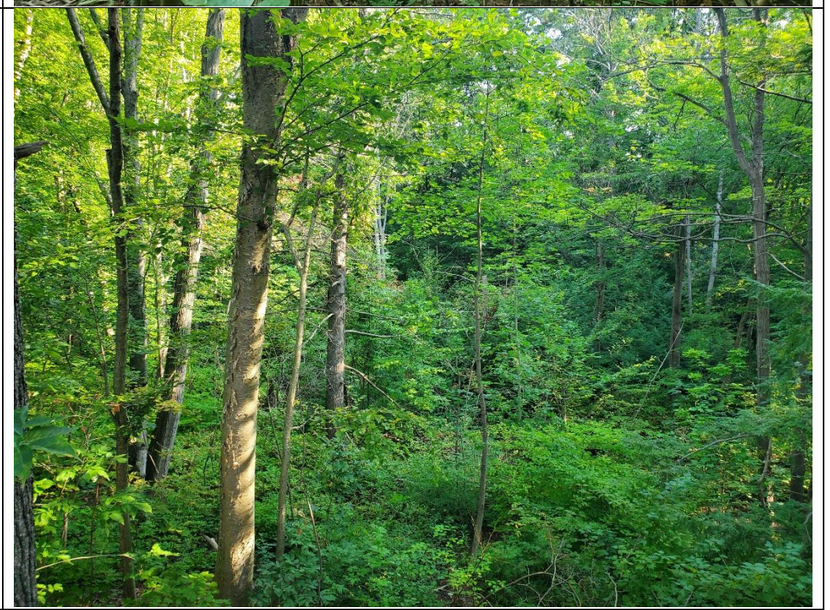
Vegetation communities were assessed according to Ecological Land Classification (ELC) for Southern Ontario, First Approximation (Lee et al., 1998). Where a suitable community description was not available per the First Approximation, classification was supplemented from the 2008 Draft version for Southern ELC, or a suitable vegetation community code in the TRCA jurisdiction (TRCA, 2017) - most equivalent 1998 code is provided in brackets where this applies. Communities are illustrated in **Figure 3-31 – Figure 3-33** and described in **Table 3-6**, below. A botanical inventory was conducted concurrent with the ELC assessment; a total of 144 vascular plants were identified within the study area, 11 of which were only identified to genus due to a lack of diagnostic features at the time of survey. A complete annotated list of plant species is provided in **Appendix E**.

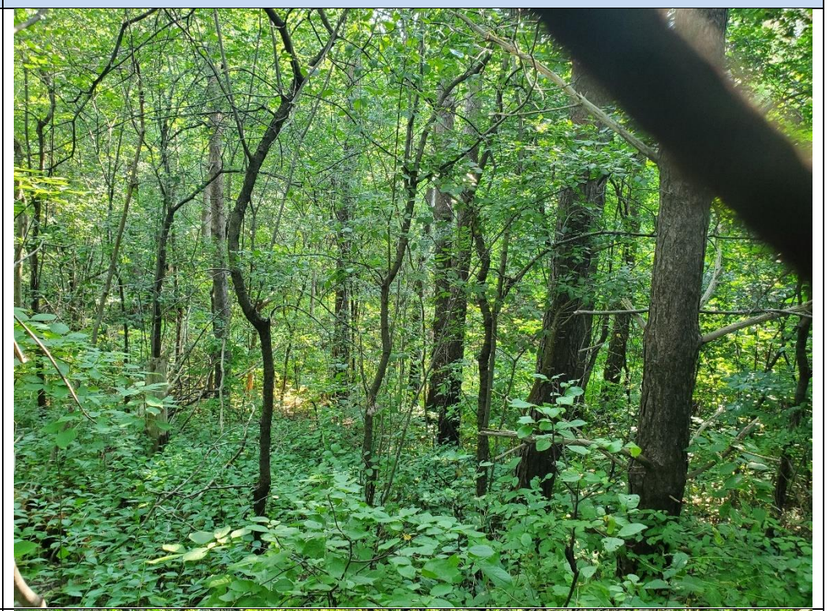
**Table 3-6: Vegetation Community Descriptions**

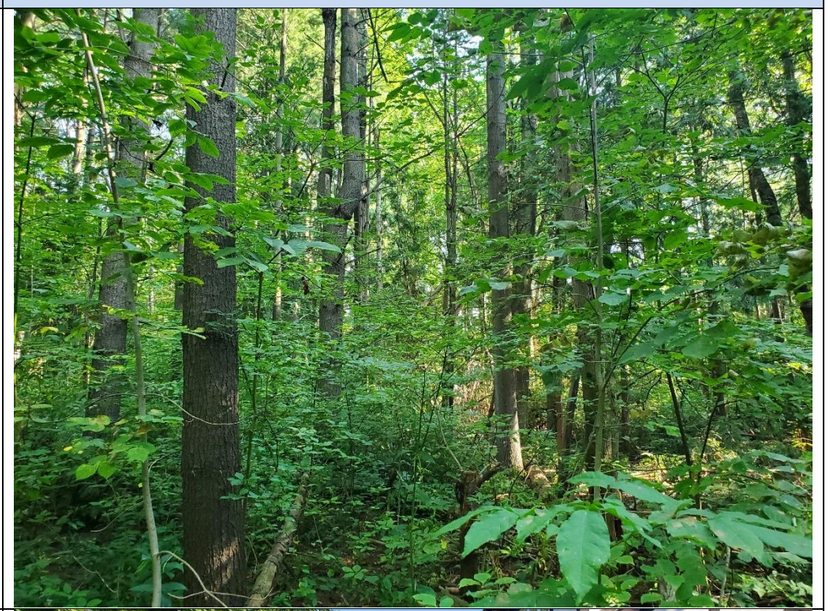
| Polygon # | Community Code | Rank (S-rank/ TRCA-rank) | Description | Representative Photos |
|---|---|---|---|---|
| 1 | CUW1-A3 (CUW1)<br><br>Native Deciduous Successional Woodland<br><br>(Mineral Cultural Woodland) | - / L5 | A strip of this semi-open community surrounds Pine Creek south of Kitley Avenue. The canopy and subcanopy contain a mixture of species, although Silver Maple and Manitoba Maple (*Acer negundo* and *A. saccharinum*) compete for overall dominance. A wide variety of other trees are also present, examples including Norway Maple (*Acer platanoides*), American Elm (*Ulmus americana*), Willows (*Salix* spp.), Basswood (*Tilia americana*), White Mulberry (*Morus alba*), plus many others. The understory contained an abundance of regenerating White and Green Ash (*Fraxinus americana* and *F. pennsylvanica*), along with invasive European Buckthorn (*Rhamnus cathartica*) and other common cultural woodland species such as Multiflora Rose (*Rosa multiflora*), Dogwoods (*Cornus* spp.), Tatarian Honeysuckle (*Lonicera tatarica*), European Privet (*Ligustrum vulgare*), etc. The ground layer was a variable mix, but often had patches of dense Dog-strangling Vine (*Vincetoxicum rossicum*), Honewort (*Cryptotaenia canadensis*), Avens (*Geum* sp.), or other disturbance tolerance forbs and grasses. Some area showed evidence that they had previously undergone restoration, indicated by the presence of common planted species or species often included in seed mixes that would unlikely be present otherwise, such as the presence of the provincially rare Cup Plant (*Silphium perfoliatum* – S2). |  |
| 2 | FOM3-2<br><br>Dry – Fresh Sugar Maple – Hemlock Mixed Forest Type | S4S5 / L4 | This community is located within Forestbrook Park and contains mainly Eastern Hemlock (*Tsuga canadensis*) with a high content of Sugar Maple (*Acer saccharum*) in the canopy. The subcanopy by contrast contains primarily Sugar Maple. Shrubs and groundcover are almost absent here, with the exception of the area directly along the Pine Creek system – this area receives a higher amount of sunlight and moisture, and therefore features some common riparian woodland species such as Dogwoods, Red Raspberry (*Rubus idaeus*), European Buckthorn, Dog-strangling Vine, Common Ragweed (*Ambrosia artemisiifolia*), Dame's Rocket (*Hesperis matronalis*), Avens, Spotted Jewelweed (*Impatiens capensis*), etc. The community overall likely experiences a fair amount of anthropogenic disturbance due to a network of trails observed throughout. |  |

| Polygon # | Community Code | Rank (S-rank/ TRCA-rank) | Description | Representative Photos |
|---|---|---|---|---|
| 3 | FOD5-1<br><br>Dry – Fresh Sugar Maple Deciduous Forest Type | S5 / L5 | A small patch of forest almost exclusively dominated by Sugar Maple is found in Forestbrook Park, directly north of the FOM3-2 Hemlock community. Alternate-leaved Dogwood (*Conrus alternifolia*), Red-Elderberry (*Sambucus canadensis*) and Maple-leaved Viburnum (*Viburnum acerifolium*) are examples of shrubs found in this area. The ground layer was moderately dense, and contained common upland species such as Zig-zag Goldenrod (*Solidago flexicaulis*), False Solomon's Seal (*Maianthemum racemosum*), Herb Robert (*Geranium robertianum*), Blue-stemmed Goldenrod (*Solidago caesia*), Spinulose Wood Fern (*Dryopteris carthusiana*), White Baneberry (*Actaea pachypoda*) and Sedges (*Carex* spp.). |  |

| Polygon # | Community Code | Rank (S-rank/ TRCA-rank) | Description | Representative Photos |
|---|---|---|---|---|
| 4 | MAM2-10<br><br>Mixed Forb Mineral Meadow Marsh Type | S4S5 / L5 | A large, open low patch at the northeast end of Forestbrook Park contains a mixture of common wetland forbs, mainly Purple Loosestrife (*Lythrum salicaria*) and Spotted Jewelweed. Other common species include True Forget-me-not *(Myosotis scorpioides*), Devil's Beggar-ticks (*Bidens frondosa*), Coltsfoot (*Tussilago farfara*), Reed-canary Grass (*Phalaris arundinacea*), Spotted Joe-Pyeweed (*Eutrochium maculatum*), Broad-leaved Cattail (*Typha latifolia*) and Swamp Aster (*Symphyotrichum puniceum*). Trees and shrubs were common around the perimeter, including Red-osier Dogwood (*Cornus sericea*), Wild Black Currant (*Ribes americanum*), European Buckthorn, Eastern White Cedar (*Thuja occidentalis*), Balsam Poplar *(Populus balsamifera*) and American Elm.<br><br>A substantial patch of Common Reed (*Phragmites australis spp. australis*) was noted at the southern tip of the community, as shown as a MASM1-12 (Common Reed Mineral Shallow Marsh Type) inclusion. |  <br>  |

| Polygon # | Community Code | Rank (S-rank/ TRCA-rank) | Description | Representative Photos |
|---|---|---|---|---|
| 5 | WOMM4-1/CUW1-A3 (CUW1)<br><br>Fresh - Moist White Cedar - Hardwood Mixed Woodland Type/ Native Deciduous Successional Woodland<br><br>(Mineral Cultural Woodland) | - / L5 | A large area in the northeast of Forestbrook Park, carrying on across to the east side of Dixie Road, is characterized by a mixed woodland with no clear dominance. Canopy coverage is variable but ultimately averages out at about 60%, the majority being made up of either Maples, Pines, or Eastern White Cedar depending on location. Common examples include Sugar, Norway, Manitoba and Red (*Acer rubrum*) Maples, White Pine (*Pinus strobus*), Black Walnut (*Juglans nigra*), White Spruce (*Picea glauca*), Black Cherry (*Prunus serotina*), Trembling Aspen (*Populus tremuloides*), Crack Willow (*Salix x fragilis*) and Paper Birch (*Betula papyrifera*). Some areas containing old dead Ash and Elm were also noted scattered throughout the community. The understory is generally thick, and often contains a mix of regenerating Ash, European Buckthorn and Chokecherry (*Prunus virginiana*). Dog-strangling Vine is common in the ground layer, as is Canada Goldenrod (*Solidago canadensis*). Wetland plants were also observed at lower elevations as the community transitioned into Mineral Meadow Marsh.<br><br>One Species at Risk – Butternut (*Juglans cinerea* - Endangered), was observed in this community, just south of Finch Avenue. |  |
| 6 | FOM2-2a<br><br>Dry – Fresh White Pine – Sugar Maple Mixed Forest Type | S5 / L4 | North of Finch Avenue the watercourse flows through Duncannon Ravine, adjacent to Erskine Cemetery. A mixed forest dominates the riparian area here, characterized by Sugar Maple, followed by White Pine and Eastern Hemlock in the canopy. Other common associates such as American Elm, White and Yellow Birch (*Betula alleghaniensis*), Red Oak (*Quercus rubra*) and American Beech (*Fagus grandifolia*) were noted throughout. The subcanopy contains mainly Sugar Maple. The subcanopy contained mainly young White Ash and Sugar Maple, as well as Chokecherry. The ground layer was a variable mixture, often containing patches of Dog-strangling Vine, English Ivy (*Hedera helix*), Periwinkle (*Vinca minor*) and Garlic Mustard (*Alliaria petiolata*). Other species such as Poison Ivy (*Toxicodendron radicans*), Dame's Rocket, Broad-leaved Enchanter's Nightshade (*Circaea canadensis*) and other woodland species were common. |  |

| Polygon # | Community Code | Rank (S-rank/ TRCA-rank) | Description | Representative Photos |
|---|---|---|---|---|
| 7 | FOM2-2b<br><br>Dry – Fresh White Pine – Sugar Maple Mixed Forest Type | S5 / L4 | Similar to Duncannon Ravine, the adjacent branch of the Pine Creek watercourse (abutting Lynn Heights Park) also contains Sugar Maple mixed with White Pine and Eastern Hemlock. Although this community is generally consistent with the aforementioned FOM2-2a community, a higher conifer content was noted here, with White Pine and Eastern White Cedar in particular being more abundant generally throughout the canopy and subcanopy. |  |
| 8 | WOMM4-1/CUW1-A1 (CUW1)<br><br>Fresh - Moist White Cedar - Hardwood Mixed Woodland Type/<br>White Cedar Successional Woodland<br><br>(Mineral Cultural Woodland) | - / L4 | This community is a mixed jumble of both deciduous and coniferous species. Poplars account for approximately 30 % of the cover above the main canopy. The main canopy by contrast is somewhat patchy and contains mainly young to mid-aged Eastern White Cedar with some younger Poplar, and an abundance of vines (e.g. Riverbank Grape - *Vitis riparia*, and Thicket Creeper - *Parthenocissus vitacea*). A thick layer of Young Ash and European Buckthorn dominate the shrub layer, along with vines. Where present, ground cover comprises mainly Dog-strangling vine with occasional patches of Sensitive Fern (*Onoclea sensibilis*) and sporadic woodland forbs such as Baneberry, Broad-leaved Enchanter's Nightshade, Sarsaparilla (*Aralia nudicaulis*), Panicled Aster (*Symphyotrichum lanceolatum*) and Garlic Mustard. A small patch of planted Scots Pine (*Pinus sylvestris*) is present in the northeast corner of the community. Overall, this community is heavily disturbed, as indicated by the high content of invasives (e.g. European Buckthorn and Garlic Mustard), and abundance of garbage dumping noted along the edges. |  |

| Polygon # | Community Code | Rank (S-rank/ TRCA-rank) | Description | Representative Photos |
|---|---|---|---|---|
| 9 | FOC1-2<br><br>Dry – Fresh White Pine – Red Pine Coniferous Forest Type | S4 / L3 | A small chunk of White Pine dominated forest was observed adjacent to the WOMM4-1 and FOM2-2 communities associated with Lynn Heights Park. As indicated, this community contained mainly White Pine, with some Trembling Aspen and Paper Birch in the canopy, and some White Cedar in the subcanopy. White Ash was prevalent in the shrub layer, with some young deciduous trees (e.g. Sugar Maple) and Alternate-leaved Dogwood. The ground layer contained large patches of Dog-strangling Vine, with some other sporadic woodland species such as Jack-in-the-Pulpit (*Arisaema triphyllum*), Broad-leaved Enchanter's Nightshade, Canada Mayflower (*Maianthemum canadense*), Garlic Muster, White Baneberry and others.<br><br>One Species at Risk – Butternut (Endangered), was observed in this community, just west of the Alanbury Crescent cul-de-sac. |  |
| - | ANTH<br><br>Anthropogenic | - | Lands used for anthropogenic purposes (e.g., roadways and paths, mown areas, parking lots). |  |


| Polygon # | Community Code | |
|---|---|---|
| 1 | CUW1-A3 (CUW1) | Native Deciduous Successional Woodland (Mineral Cultural Woodland) |
| 2 | FOM3-2 | Dry – Fresh Sugar Maple – Hemlock Mixed Forest Type |
| 3 | FODS-1 | Dry – Fresh Sugar Maple Deciduous Forest Type |
| 4 | MAM2-10 | Mixed Forb Mineral Meadow Marsh Type |
| 5 | WOMM4-1/CUW1-A3 (CUW1) | Native Deciduous Successional Woodland (Mineral Cultural Woodland) |
| 6 | FOM2-2a | Dry – Fresh White Pine – Sugar Maple Mixed Forest Type |
| 7 | FOM2-2b | Dry – Fresh White Pine – Sugar Maple Mixed Forest Type |
| 8 | WOMM4-1/CUW1-A1 (CUW1) | Native Deciduous Successional Woodland (Mineral Cultural Woodland) |
| 9 | FOC1-2 | Dry – Fresh White Pine – Red Pine Coniferous Forest Type |
| - | ANTH | Anthropogenic |

City of PICKERING

**Legend**

- StudyArea
- Ecological Land Classification
- Watercourse




Figure 1 - 1

Existing Conditions

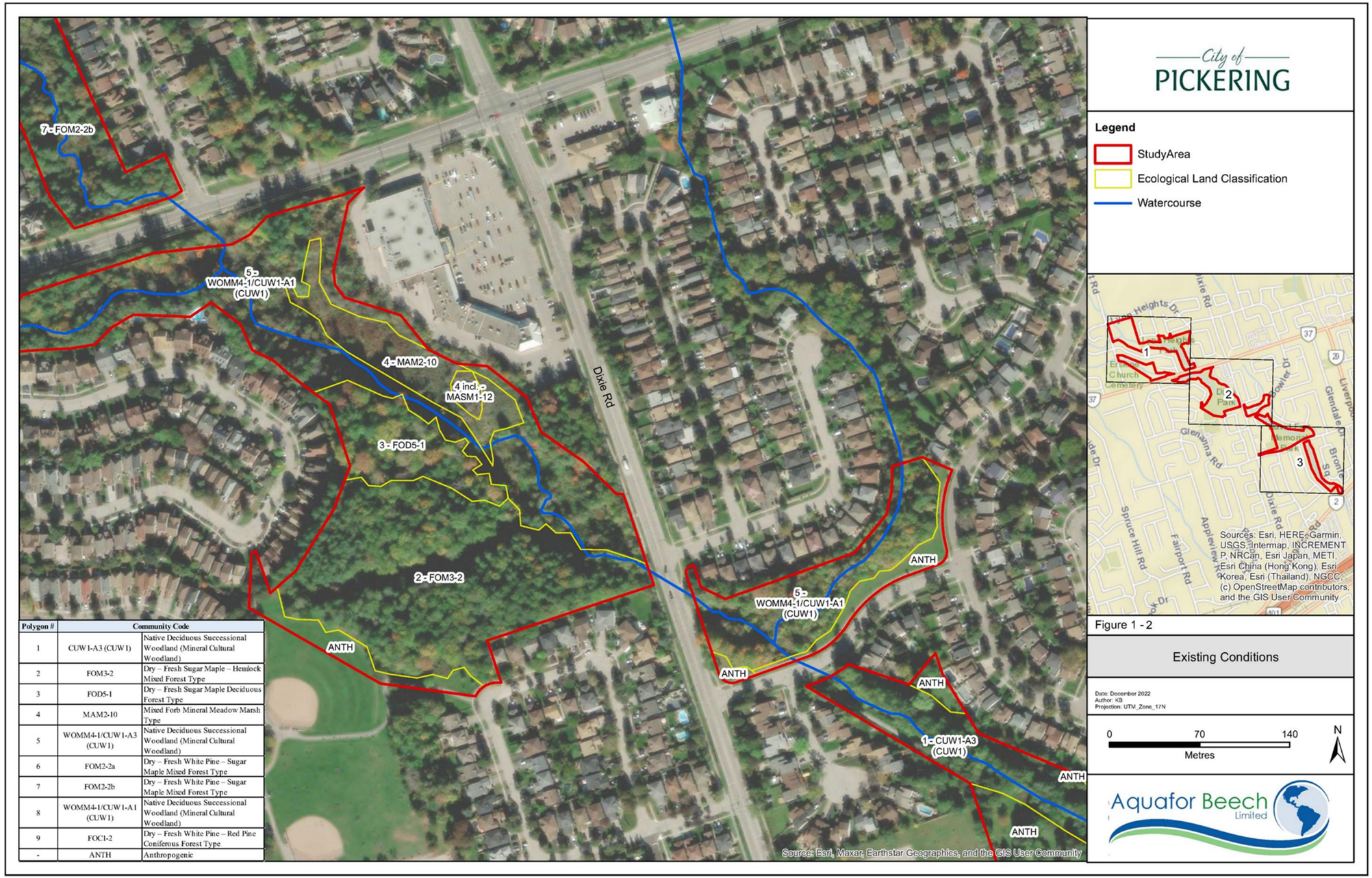
Date: December 2022
Author: KB
Projection: UTM_Zone_17N

0 70 140
Metres

N

Aquafor Beech Limited

**Figure 3-31: ELC Mapping – Reaches PC4-a & PC4-b**




| Polygon # | Community Code | |
|---|---|---|
| 1 | CUW1-A3 (CUW1) | Native Deciduous Successional Woodland (Mineral Cultural Woodland) |
| 2 | FOM3-2 | Dry – Fresh Sugar Maple – Hemlock Mixed Forest Type |
| 3 | FOD5-1 | Dry – Fresh Sugar Maple Deciduous Forest Type |
| 4 | MAM2-10 | Mixed Forb Mineral Meadow Marsh Type |
| 5 | WOMM4-1/CUW1-A3 (CUW1) | Native Deciduous Successional Woodland (Mineral Cultural Woodland) |
| 6 | FOM2-2a | Dry – Fresh White Pine – Sugar Maple Mixed Forest Type |
| 7 | FOM2-2b | Dry – Fresh White Pine – Sugar Maple Mixed Forest Type |
| 8 | WOMM4-1/CUW1-A1 (CUW1) | Native Deciduous Successional Woodland (Mineral Cultural Woodland) |
| 9 | FOCI-2 | Dry – Fresh White Pine – Red Pine Coniferous Forest Type |
| - | ANTH | Anthropogenic |

**Figure 3-32: ELC Mapping – Reaches PC3-c & PC3-d**


| Polygon # | Community Code | |
|---|---|---|
| 1 | CUW1-A3 (CUW1) | Native Deciduous Successional Woodland (Mineral Cultural Woodland) |
| 2 | FOM3-2 | Dry – Fresh Sugar Maple – Hemlock Mixed Forest Type |
| 3 | FODS-1 | Dry – Fresh Sugar Maple Deciduous Forest Type |
| 4 | MAM2-10 | Mixed Forb Mineral Meadow Marsh Type |
| 5 | WOMM4-1/CUW1-A3 (CUW1) | Native Deciduous Successional Woodland (Mineral Cultural Woodland) |
| 6 | FOM2-2a | Dry – Fresh White Pine – Sugar Maple Mixed Forest Type |
| 7 | FOM2-2b | Dry – Fresh White Pine – Sugar Maple Mixed Forest Type |
| 8 | WOMM4-1/CUW1-A1 (CUW1) | Native Deciduous Successional Woodland (Mineral Cultural Woodland) |
| 9 | FOCI-2 | Dry – Fresh White Pine – Red Pine Coniferous Forest Type |
| - | ANTH | Anthropogenic |

**Figure 3-33: ELC Mapping – Reaches PC3-a & PC3-b**

### 3.6.2 *Trees*

A tree inventory, arborist report, and tree preservation plan will need to be completed as part of the detailed design process to support permitting efforts with MECP and TRCA. Impacts to existing trees and any implications under the City's by-law (including any associated protection or replanting requirements related to those impacts) should be detailed upon the completion of the tree inventory and leveraged to prepare site restoration plans that satisfy the requirements of all regulatory review agencies.

### 3.6.3 *Terrestrial and Wildlife Habitat*

Aquafor's wildlife biologist attended the site in September of 2022 and documented all wildlife species that were seen or heard during those site visits (either via direct observation, or indirectly via tracks, dens, etc.). Opportunistic surveying for wildlife (i.e., basking surveys for turtles on the creek banks and other perches, reviewing beneath cover materials for reptiles and amphibians) was also carried out where possible. Due to the timing of site visits, the bird species assemblage that was documented mostly includes urban birds commonly seen throughout the year and is not representative of breeding diversity expected in the spring and summer months. Insects, as well as reptile and amphibian activity is also reduced in the fall, as many species are preparing for winter hibernation.

**Table 3-7**, below, provides an overview of Aquafor's site observations.

**Table 3-7: Wildlife Species List**

| Species Observed | | S Rank | L Rank | SAR Designation (ESA) |
|---|---|---|---|---|
| **Common Name** | **Scientific Name** | | | |
| ***Birds*** | | | | |
| American Crow | *Corvus brachyrhynchos* | S5 | L5 | - |
| American Goldfinch | *Spinus tristis* | S5 | L5 | - |
| American Redstart | *Setophaga ruticilla* | S5B | L4 | - |
| American Robin | *Turdus migratorius* | S5 | L5 | - |
| Black-capped Chickadee | *Poecile atricapillus* | S5 | L5 | - |
| Blue Jay | *Cyanocitta cristata* | S5 | L5 | - |
| Common Grackle | *Quiscalus quiscula* | S5 | L5 | - |
| Downy Woodpecker | *Picoides pubescens* | S5 | L5 | - |
| Gray Catbird | *Dumetella carolinensis* | S5B,S3N | L4 | - |
| House Sparrow | *Passer domesticus* | SNA | L+ | - |
| Northern Cardinal | *Cardinalis cardinalis* | S5 | L5 | - |
| Northern Flicker | *Colaptes auratus* | S5 | L4 | - |
| White Breasted Nuthatch | *Sitta carolinensis* | S5 | L4 | - |
| ***Mammals*** | | | | |
| American Beaver | *Castor canadensis* | S5 | L4 | - |

| Species Observed | | S Rank | L Rank | SAR Designation (ESA) |
|---|---|---|---|---|
| **Common Name** | **Scientific Name** | | | |
| Eastern Gray Squirrel | *Sciurus carolinensis* | S5 | L5 | - |
| Northern Raccoon | *Procyon lotor* | S5 | L5 | - |
| Red Fox | *Vulpes vulpes* | S5 | L4 | - |
| Red Squirrel | *Tamiasciurus hudsonicus* | S5 | L4 | - |
| ***Insects*** | | | | |
| Asian Lady Beetle | *Harmonia axyridis* | SNA | L+ | - |
| Cabbage White | *Pieris rapae* | SNA | L+ | - |
| Eastern Tailed-blue | *Cupido comyntas* | S5 | - | - |
| Monarch | *Danaus plexippus* | S2N,S4B | - | Special Concern |

Several species listed above are considered to be of regional concern within the TRCA's urban matrix – i.e., ranked L4; they inhabit forests and other such habitats which are much reduced or absent in urban landscapes. These include American Redstart, Gray Catbird, Northern Flicker, White Breasted Nuthatch, American Beaver, Red Fox and Red Squirrel. The majority of these species do not require habitats specific to those found in the study area, and may be found an any similar habitat up or downstream of the study area, or neighboring river corridors. Specific to beaver activity, beaver dams have been noted frequently by Public Works Staff in the Pine Creek corridor, particularly between Storrington Street and Bronte Square. Dam and debris removal activities have been on-going to protect private property in the adjacent areas and reduce tree damage.

One Species at Risk (SAR) insect; Monarch was observed incidentally within the study area. No other SAR or Species of Conservation Concern (SOCC) wildlife were observed. Notwithstanding, potential exists for additional SAR (discussed in further detail below), or numerous other common wildlife species to use the habitats types found here.

Based on the diversity of habitat in the corridor, the timing of field investigations, and high connectivity to other natural features, the study area and surrounding habitat likely supports a wider range of wildlife than could be confirmed during Aquafor's field investigations.

### 3.6.4 *Habitat and Connectivity*

The species diversity described in the previous sections indicates that the Pine Creek corridor at this location supports a healthy, diverse wildlife community. Local wildlife movement along the river corridor is expected to occur, and the overall corridor could provide habitat connectivity on the larger landscape as it functions as a direct corridor between Frenchman's Bay and undeveloped rural habitat to the north of the City. Provided natural features are restored to the disturbance area post constriction, impacts to wildlife movement through the corridor is likely to be temporary.

## 3.7 Significant Species, Features, and Areas

### 3.7.1 *Species at Risk Screening*

For the purposes of this study, SAR are defined as species designated Endangered, Threatened, or Special Concern under either the provincial *Endangered Species Act* (ESA) or federal *Species at Risk Act* (SARA).

Aquafor reviewed background sources (e.g.: prior occurrence records from the provincial Natural Heritage Information Center [NHIC] database; community science databases such as the eBird and iNaturalist websites; provincial species atlases; and the Fisheries and Oceans Canada online SAR mapping) to identify SAR that have previously been or could potentially be found in or adjacent to the study area. The Ontario Ministry of the Environment, Conservation and Parks (MECP) was also contacted to confirm whether they had additional species concerns for the area on August 22, 2022.

The resulting list of species was subsequently screened by comparing the habitat requirements of each species to the habitat that is available in the study area, and species determined to be presented or have some potential to be present are discussed in **Table 3-8** below. A complete screening of all SAR or Species of Conservation Concern (SOCC) with records in the vicinity of the study area is detailed in **Appendix F.**

**Table 3-8: Species at Risk Screening Results**

| Species Common Name | Species Scientific Name | Status | Data Source | Habitat Requirements | Discussion |
|---|---|---|---|---|---|
| *Plants* | | | | | |
| Butternut | *Juglans cinerea* | Endangered | NHIC | Generally grows in rich, moist, and well-drained soils often found along streams. It may also be found on well-drained gravel sites, especially those made up of limestone. It is also found, though seldomly, on dry, rocky and sterile soils. In Ontario, the Butternut generally grows alone or in small groups in deciduous forests as well as in hedgerows. | Species was confirmed in two locations within the study area (Polygon 2 and Polygon 9), and additional specimens may be present.<br><br>Protected habitat may extend up to a radius of up to 50 m from a pure, retainable Butternut and any trees that are found within 50 m of the proposed works should be subject to a Butternut Health Evaluation to determine their status. **Works affecting retainable Butternut will require registration through a Notice of Activity prior to commencing construction.** |
| *Birds* | | | | | |
| Barn Swallow | *Hirundo rustica* | Special Concern | NHIC | Prefers farmland, lake/river shorelines, wooded clearings, urban populated areas, rocky cliffs and wetlands. They nest inside or outside buildings, under bridges and in road culverts, or on rock faces and caves. | No Barn Swallow nests or signs of Barn Swallow were observed during field investigations. However, several box culverts at road crossings were noted throughout the Pine Creek corridor. Although there were no nests present at the time, these structures have potential to be used in the future.<br><br>As the proposed works will not involve any modifications to the aforementioned structures, any impacts to this species associated with the works are expected to be temporary sensory disturbance. |
| Eastern Wood-pewee | *Contopus virens* | Special Concern | NHIC | Associated with deciduous and mixed forests. Within mature and intermediate age stands it prefers areas with little understory vegetation as well as forest clearings and edges. | Habitat for this species is abundant throughout the creek corridor.<br><br>Since edge habitat is not limiting in the study area, the proposed works is not expected to have a significant effect on breeding opportunity for this species provided mitigation measures are followed. Destruction or damage of active nests can be avoided by limiting vegetation clearing to outside of the breeding bird window in any given year (April 1st to August 31st). |
| Wood Thrush | *Hylocichla mustelina* | Special Concern | NHIC | Nests mainly in second-growth and mature deciduous and mixed forests, with saplings and well-developed understory layers. Prefers large forest mosaics, but may also nest in small forest fragments. | Although not detected during field investigations, suitable habitat is present in the mature deciduous and mixed forest types (e.g. Polygon 6 and 7 - FOM2-2) at the northern end of the study area.<br><br>Destruction or damage to active nests can be avoided by limiting vegetation clearing to outside of the breeding bird window in any given year (April 1st to August 31st). |
| Yellow-breasted Chat | *Icteria virens* | Endangered | OBAA | Breeds in early successional, shrub-thicket habitats including woodland edges, regenerating old fields, railway and hydro right-of-ways, young coniferous reforestations, and wet thickets bordering wetlands. Tangles of grape (*Vitis* spp.) and raspberry (*Rubus* spp.) vines are features of most breeding sites. | Although not detected during field investigations, several thicket-type habitats are present in the study area, particularly around the perimeter of Polygon 4 wetland (MAM2-10) and in the vine heavy WOMM4-1 habitat at the north end of the study area (Polygon 8).<br><br>Destruction or damage to active nests can be avoided by limiting vegetation clearing to outside of the breeding bird window in any given year (April 1st to August 31st). **If this species is confirmed to be using any of the aforementioned habitats, works affecting those habitats will require registration through a Notice of Activity prior to commencing construction.** |
| *Reptiles and Amphibians* | | | | | |
| Eastern Milksnake | *Lampropeltis Triangulum* | Special Concern (federal) | ORAA | This habitat generalist may utilize a variety of different habitats including open or forested natural areas, but shows preference to sites that can provide hibernation | No specific hibernacula habitat was identified during field investigation, but due to the generalist nature of this species, any natural areas within the Pine Creek corridor may function for other life-history processes such as foraging. |

| Species Common Name | Species Scientific Name | Status | Data Source | Habitat Requirements | Discussion |
|---|---|---|---|---|---|
| | | | | opportunities (old foundations, mammal burrows, old logs, etc.) and are in close proximity to water. | Potential impacts can be mitigated through awareness and monitoring to avoid injury or mortality of snakes during construction. |
| Midland Painted Turtle | *Chrysemys picta marginata* | Special Concern (federal) | General Screening | Quiet, warm, shallow water with abundant aquatic vegetation such as ponds, large pools, streams, ditches, swamps, marshy meadows; eggs are laid in sandy places, usually in a bank or hillside, or in fields; basks in groups; not territorial. | This species may make use of the Pine Creek for various life cycle processes such as foraging, hibernation, basking and/or nesting activities.<br><br>Potential impacts to this species can be mitigated through awareness and monitoring to avoid injury or mortality of turtles during construction, and by avoiding the creation of soil stockpiles or other features which may attract nesting turtles in the spring and early summer. |
| Snapping Turtle | *Chelydra serpentina* | Special Concern | NHIC | Generally inhabit shallow waters where they can hide under the soft mud and leaf litter. Nesting sites usually occur on gravely or sandy areas along streams. Snapping turtles often take advantage of man-made structures for nest sites, including roads (especially gravel shoulders), dams and aggregate pits. | This species may make use of the Pine Creek for various life cycle processes such as foraging, hibernation, basking and/or nesting activities.<br><br>Potential impacts to this species can be mitigated through awareness and monitoring to avoid injury or mortality of turtles during construction, and by avoiding the creation of soil stockpiles or other features which may attract nesting turtles in the spring and early summer. |
| Western Chorus Frog | *Pseudacris triseriata* | Threatened (federal) | ORAA | Habitat typically consists of marshes or wooded wetlands, particularly those with dense shrub layers and grasses. Prefers fishless ponds with at least 10 cm of standing water for breeding. This species hibernates in terrestrial habitats under rocks, dead trees or leaves, in loose soil or in animal burrows. | Standing water in wetland areas (e.g. Polygon 4 – MAM2-10) provides the most suitable habitat for this species.<br><br>A wildlife rescue should be completed in any closed off areas associated with wetland habitat, prior to construction. Potential impacts can be mitigated through awareness and monitoring to avoid injury or mortality of frogs during construction. Disturbed wetland habitat should be restored post-construction to provide similar pooled habitat to what was removed. |
| *Insects* | | | | | |
| Monarch | *Danaus plexippus* | Special Concern | iNaturalist | Exist primarily where it's obligate larval host plant - milkweed (*Asclepias spp.*) and other wildflowers exist. This includes abandoned farmland, roadsides and other open spaces. | This species was confirmed within the study area. Habitat is present in any open, sunny areas that contain wildflowers for foraging, or milkweed for breeding.<br><br>Impact to this species can be reduced by avoiding vegetation clearing during the growing season (April and October of any given year), including a variety of native, pollinator friendly flowering flora in the restoration seed mix, and avoiding the use of pesticides. |
| *Mammals* | | | | | |
| Little Brown Myotis | *Myotis lucifugus* | Endangered | General Screening | Overwintering habitat: Caves and mines that remain above freezing.<br><br>Maternal roosts: Often associated with buildings (attics, barns, etc.). Occasionally found in trees (25-44 cm DBH). | Numerous large DBH trees were present throughout the study area, with a high likelihood that cavities, peeling bark and other suitable sheltering features are present. Leaf-off surveys would be required to document the full extent of Myotis habitat throughout the study area.<br><br>**Any proposed tree removals containing features suitable for roosting SAR bats require registration through a Notice of Activity prior to commencing construction.** Tree removals should be timed to avoid the bat maternity season which generally runs April 1 – October 1 of any given year. |
| Northern Myotis | *Myotis septentrionalis* | Endangered | General Screening | Overwintering habitat: Caves and mines that remain above 0°C.<br><br>Maternal Roosts: Often associated with cavities of large diameter trees (25-44 cm DBH). Occasionally found in structures (attics, barns etc.) | Numerous large DBH trees were present throughout the study area, with a high likelihood that cavities, peeling bark and other suitable sheltering features are present. Leaf-off surveys would be required to document the full extent of Myotis habitat throughout the study area.<br><br>**Any proposed tree removals containing features suitable for roosting SAR bats require registration through a Notice of Activity prior to commencing** |

| Species Common Name | Species Scientific Name | Status | Data Source | Habitat Requirements | Discussion |
|---|---|---|---|---|---|
| | | | | | **construction.** Tree removals should be timed to avoid the bat maternity season which generally runs April 1 – October 1 of any given year. |
| Tricoloured Bat | *Perimyotis subflavus* | Endangered | General Screening | Overwintering habitat: Caves and mines that remain above 0°C.<br><br>Maternal Roosts: Can be in trees or dead clusters of leaves or arboreal lichens on trees; oaks and maples preferred. May also use barns or similar structures. | Large-diameter maples and oaks with potential for Tricolored Bat habitat were present in wooded portions of the study area.<br><br>**Any proposed tree removals containing features suitable for roosting SAR bats require registration through a Notice of Activity prior to commencing construction.** Tree removals should be timed to avoid the bat maternity season which generally runs April 1 – October 1 of any given year. |

### 3.7.2 *Species of Conservation Concern and Regionally Rare Species Review*

Additional species which were reviewed as Species of Conservation Concern include those with Global Ranks of G1-G3 and/or Sub-National/Provincial ranks of S1-S3, and species considered rare within the TRCA watershed (L-Ranks 2017) or in Eco-region 7E-4 (Oldham, 2017), where those species were not already considered under the SAR assessment noted above.

One provincially significant plant species was confirmed in association with the study area – Cup Plant (*Silphium perfoliatum* – S2). Within the TRCA jurisdiction, this species is common (L5), and is considered secure in the region. Aquafor documented it in a narrow section of woodland corridor in the southern extent of the study area (Polygon 1 – CUW1). Several multi-stemmed pockets of this species were observed throughout this community, particularly is association with David Farr Park. There is some evidence that previous restoration efforts may have occurred in that stretch of the Pine Creek corridor, which suggests it may have been part of a planting plan.

Both TRCA's Annual Local Occurrence Score and Local Rank Update (2017) and Oldham's Vascular Plan List of Ontario's Carolinian Zone (2017) were referenced for regional rarity. All species with L-ranks of L1 through L3 are considered regionally rare in TRCA's jurisdiction, and species ranked L4 are considered rare in an urban setting. Similarly, Oldham (2017) lists species listed as Uncommon (U) or Rare (R) in Ecoregion 7E-4. The following 9 locally rare plant species were found within the study area:

- Canada Honewort - *Cryptotaenia canadensis* (U)
- Wood Nettle - *Laportea canadensis* (U)
- Tamarack – *Larix laricina* (R; L3)
- Great Blue Lobelia – *Lobelia siphilitica* (R; L3)
- Lopseed – *Phryma leptostachya* (R)
- White Spruce – *Picea glauca* (U; L3)
- Dwarf Clearweed – *pilea pumila* (U)
- White Oak - *Quercus alba* (L3)
- Maple-leaved Viburnum – *Vibernum acerifolium* (L3)

In instances where the proposed works will involve the destruction or removal of any of the above species, relocation efforts may be considered where feasible. Alternatively, inclusion of these species in the proposed planting plan will increase the likelihood that these species remain present locally post-construction.

No other SOCC with known records are thought likely to occur in the study area based on the habitat. A complete screening of all SAR or Species of Conservation Concern (SOCC) with records in the vicinity of the study area is detailed in **Appendix F.**

### 3.7.3 *Significant Natural Heritage Feature Consideration*

Significant Natural Heritage features include any natural feature formally identified as having policy or regulatory implications for proposed site alteration or development. These features may require additional ecological impact assessment or permitting to proceed with proposed works. The study area contains the following:

#### *3.7.3.1 Provincially Significant Features*

The study area does contain one mapped wetland according to the mapping layers maintained by the MNRF (as viewed through the "Make A Map: Natural Heritage Areas" website, December 2022). This wetland was confirmed during Aquafor's field investigations as MAM2-10 (Forb Mineral Meadow Marsh) with a MASM1-12 (Common Reed) inclusion. However, this wetland is not considered either provincially or locally significant.

There are no Areas of Natural and Scientific Interest within the study area, and it is not located within the provincial Greenbelt or the Oak Ridges Moraine Conservation Plan area.

#### *3.7.3.2 City of Pickering Official Plan*

Under the City of Pickering Official Plan (CPOP), the "Natural Areas" subcategory falls under the "Open Spaces" policy of the CPOP. Lands designated as part of the Open Space System (Schedule I) are intended to be used primarily for conservation, restoration, environmental education, recreation, and ancillary purposes and may include Key Natural Heritage and Key Hydrologic Features which have related minimum areas of influence and minimum vegetation protection zones. The study area contains several natural heritage features under this designation afforded protection under the Plan, including "Natural Heritage System" (Schedule IIIA) comprising Significant Woodland (Schedule IIIB), and Shorelines, Significant Valley Lands and Stream Corridors (Schedule IIIC).

Under the CPOP, works falling into Ontario's Natural Heritage System are subject to the stipulations of Durham Region Official Plan (DROP, 2020) in accordance with the Ontario's Provincial Policy Statement (2020). Under the DROP, the natural heritage features of the study area fall within Key Natural Heritage and Key Hydrologic Features (Schedule B - Map B1). Specific to the proposed works, Table 3 of the CPOP states the following with regards to permissible uses and site alteration within these Natural Areas, reflective of equivalent policy in the DROP (Policy 2.3.15):

*Conservation, environmental protection, restoration, education, passive recreation, and similar uses, subject to the provisions of the Regional Official Plan related to non-agricultural uses, and provided that development or site alteration may only be permitted in key natural heritage and/or key hydrologic features for the following purposes:*

*(ii) conservation and flood and erosion control and other similar environmental protection and restoration projects demonstrated to be necessary in the public interest and after all alternatives have been considered.*

As the proposed works are intended to address erosion control issues and intend to restore natural habitat post-construction, works within these features are permitted as per the CPOP (Table 3) and DROP (Policy 2.3.15). An Environmental Impact Study, in accordance with DROP Policy 2.3.43, is be required for any development or site alteration within 120 metres of a key natural heritage or hydrologic feature to demonstrate that there will be no negative impacts to these features or their ecological functions. The contents of this document serves to fulfill this requirement.

#### *3.7.3.3 Toronto and Region Conservation Authority Regulations and Guidelines*

Under the Conservation Authorities Act, Section 28.1 grants the TRCA the authority to regulate development, interference with wetlands, and alteration of shorelines and watercourses within the TRCA watershed. Given that the site includes Lake Ontario and associated coastal wetlands and is located within regulated lands, it is anticipated that a permit from TRCA will be required for the completion of the proposed works.

In addition to permitting within TRCA regulated lands, it is anticipated that restoration and/or compensation within any disturbed portions of the Frenchman's Bay PSW and surrounding lands will be required. The mitigation hierarchy (avoid, minimize, mitigate) must be applied before considering compensation for wetlands. If compensation if required, a 1:1 compensation ratio for marshes and meadows is required by the TRCA under their Ecosystem Compensation Guideline (TRCA, 2023). For swamp habitats, if present, the compensation ratio will be determined using the basal area method. Compensation within wooded areas is dependent on basal area or equivalent calculation as agreed upon by the TRCA based on these guidelines.

## 3.8 Aquatic Natural Heritage Assessment

Fish community and aquatic habitat within the Pine Creek study area was reported on in the 2009 Stormwater Management Master Plan for the Frenchman's Bay Watersheds, City of Pickering (MMM Group, 2009), with TRCA monitoring results provided in the Regional Watershed Monitoring Program Progress Report (TRCA, 2012). Site conditions along the Pine Creek corridor were confirmed as a part of this study September 14, 2022 by Aquafor Beech aquatic biology staff in accordance with Ontario Stream Assessment Protocol (OSAP), Section 4, Module 1: Rapid Assessment Methodology for Channel Structure (Stanfield, 2017). The aquatic components of the study area are described in the following subsections. Photographs from Aquafor's site visits are included.

### 3.8.1 *Aquatic Habitat Assessment*

Aquatic habitat characteristics, as described hereafter, are major determinants for biotic composition, which is an indicator of aquatic ecosystem health. The habitat characteristics investigated within the constructed corridor and study area include:

- Bank characteristics;
- Stream width and depth (wetted and bankfull);
- Instream cover (e.g., substrate type, woody material, undercut banks, boulders, vegetation);
- Riparian cover (vegetation composition, quality and width); and
- Physical barriers to fish movement (e.g., woody or debris jams, knickpoints, etc.)

Monitoring locations are depicted below in **Figure 3-34** with results provided thereafter.

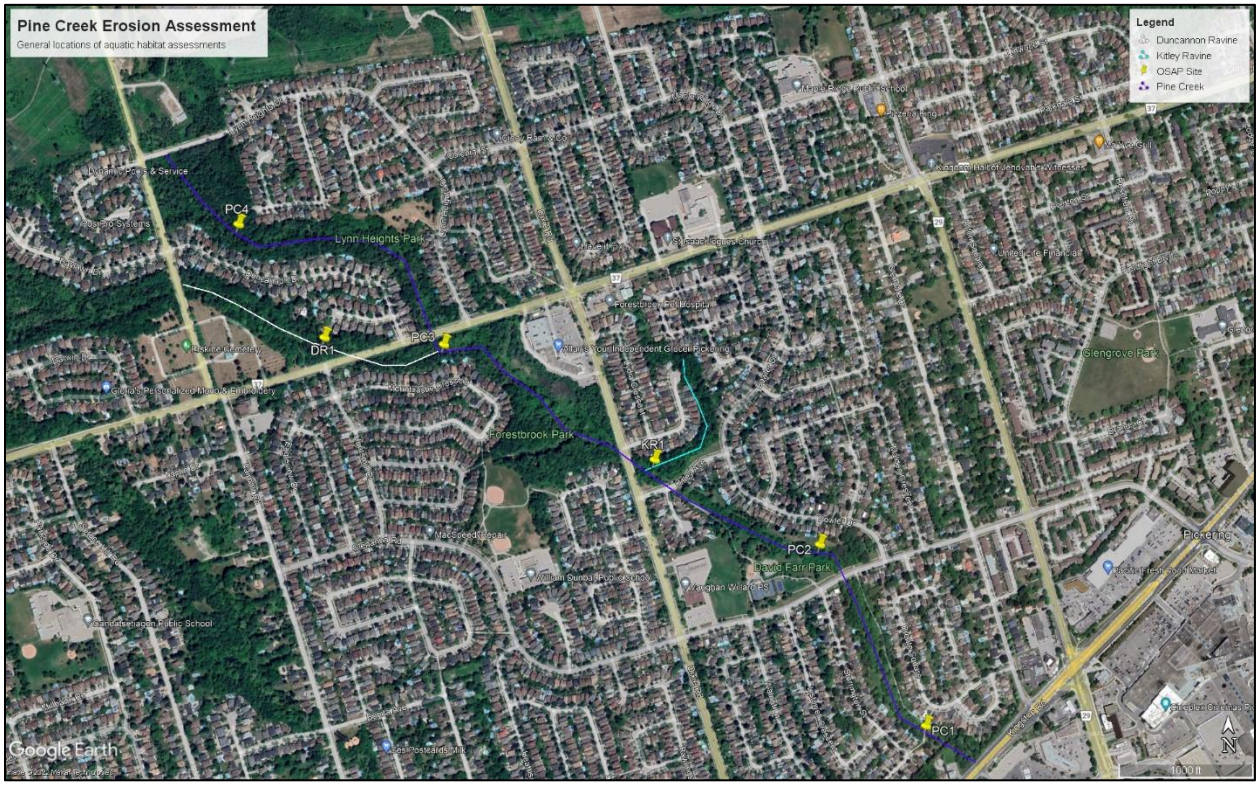



**Figure 3-34: Aquatic Monitoring Locations**

The study area for the Pine Creek aquatic habitat assessment, located within the Frenchman's Bay watershed, extended from Kingston Road upstream to the Lynn Heights Drive and Fairport Road, including the main branch of Pine Creek as well as

any other contributing features identified through aerial imagery and field work. Contributing features identified were the Kitley Ravine bound by Kitley Ave and the Duncannon Ravine bound by Duncannon Drive. Throughout the study reach, multiple crossings intersected the watercourse, Kingston Road, Glenanna Road, Kitley Ave, Dixie Road, Finch Ave, and the upstream Fairport Road and Lynn Heights Drive. These crossings will be referenced throughout the following description for site context. This assessment area was selected to provide a representative view of the watercourse and the general study area. Where possible, monitoring and assessment information as provided in background information from the Toronto and Region Conservation Authority (TRCA) was used to offer insights into long-term monitoring results and habitat considerations. One TRCA monitoring site (FB003WM) was noted within Pine Creek, although downstream of the study area. The study area relative to the TRCA background information, in particular aquatic and fisheries monitoring, is shown in **Figure 3-35**.

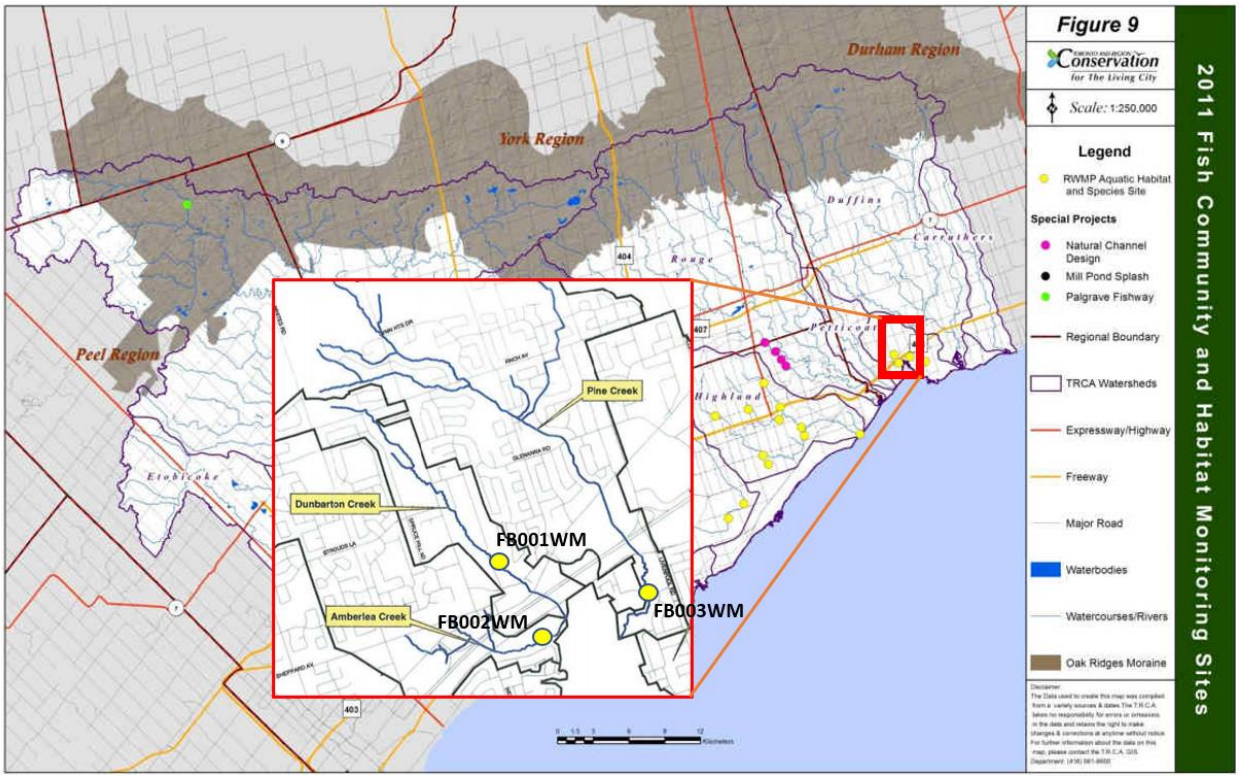



**Figure 3-35: TRCA Land use Mapping**

Pine Creek is a part of the Frenchman's Bay watershed within the TRCA jurisdiction. This section of the Pine Creek subwatershed falls within the Pickering city centre, with much of the watercourse representative of an urban-impacted watercourse. The Master Plan noted that Pine Creek and its associated riparian habitat within the study area has been largely developed, with the urban landuse resulting in fragmented open riverine habitat (MMM Group, 2009). The Master Plan also noted that the Pine

Creek subwatershed demonstrated degradation in aquatic habitat evidence of active erosion and downcutting, with the TRCA citing a regularly anoxic water with high temperatures and turbidity, water quality parameters in exceedance of the Provincial Water Quality Objectives for the Protection of Aquatic Life, and "Very Poor" water quality based on the Hilsenhoff Index of benthic macroinvertebrates with "Likely severe organic pollution present" (MMM Group, 2009). Through the reach examined as a part of this study, Pine Creek is bordered by a very narrow, fragmented swath of natural heritage cover. OSAP findings and habitat characteristics for the study area are detailed in **Table 3-9**. OSAP photos are provided below and field sheets in **Appendix G**.

**Table 3-9: Aquatic Habitat Characteristics**

| Assessment Location | General UTM Coordinates | Site Location | Site Characteristics | Habitat Description | Substrate Composition | Bank Stability | Instream and Riparian Vegetation | Fish Barriers and Other Disturbances |
|---|---|---|---|---|---|---|---|---|
| **Pine Creek 1 (PC1)** | 17 T<br>653179 m E<br>4855237 m N | Site 1 (PC1) was the furthest, most downstream site within the main Pine Creek branch, located adjacent to Bronte Square and approximately 140 m upstream of Kingston Road and 1.35 km to where the creek empties into Frenchman's Bay. This site is the closest to the TRCA monitoring site (FB003WM). | Site length was ~40 m. Average wetted width was ~6 m. The average depth at crossovers was 500 mm with the maximum depth observed over 1 m due to downstream beaver activity and backwatering. The site observed engineered features with evidence of past restoration efforts, such as historic straightening to accommodate adjacent outfalls, a well-used pedestrian crossing with concrete abutments extending into the creek, and encroaching residences. The site fell adjacent to a busy public walking trail. | This site was dominated by medium depth glides (**Figure 3-36**), with habitat largely limited due to downstream beaver activity and backwatering (<br><br>**Figure** 3-37). Cover was provided upstream of the pedestrian crossing by moderate canopy cover, as well as some large woody material and rooted macrophytes. Sedimentation was evident, with turbid water and little evidence of larger cobbles to contribute to instream cover. | This site was largely contributed by fines, with some gravels observed. Areas of sedimentation were observed adjacent to multiple outfalls downstream of the pedestrian crossing. Little to no instream cover was provided by substrate. | Erosion and downcutting was observed on both banks throughout the entire length of the site, with reaches upstream of the pedestrian crossing exacerbated by manicured lawn encroaching onto the creek banks. | Instream vegetation was moderate throughout this site, limited to some rooted macrophytes. Riparian vegetation was limited, with both of the left and right bank consisting scrubland for ~5-10 m before transitioning to maintained parkland and residential lawn. A small buffer adjacent to the creek was observed downstream of the pedestrian crossing before transitioning to manicured park lawn. | No crossings outside of the pedestrian crossing existed within the immediate area, although multiple residential areas and residential developments bordered the site with maintained lawns encroaching on the watercourse. Multiple signs of beaver activity, including posted signage (**Figure 3-38**) and wiring were observed. Discussions with locals pointed to downstream beaver activity which led to the apparent backwatering in the creek. Multiple outfalls were observed downstream of the pedestrian crossing (**Figure 3-39**). A well-used park and trail existed on the right bank with maintained lawn beyond the narrow riparian zone. No fish barriers were observed. |
| **Pine Creek 2 (PC2)** | 17 T<br>652988 m E<br>4855642 m N | Site 2 (PC2) was approximately 0.5 km upstream of PC1, within the David Farr Parklands, and within the main Pine Creek branch. | Site length was ~90 m. Average wetted width at the time of sampling was ~3 m. The average depth at crossovers was 100 mm and the maximum depth sampled was ~800 mm. The site observed signs of past engineering and channel restoration, with large substrate introduced and active riparian plantings to buffer from the adjacent, busy public park (David Farr Park). | This site was delimited by two riffles (**Figure 3-40** & **Figure 3-41**), with the remainder of the habitat throughout represented by well-distributed pools (**Figure 3-42**) and glides (**Figure 3-43**). Cover was contributed by round cobbles introduced during past channel restoration works, with in-stream vegetation very limited. Cover was largely contributed by overhanging canopy cover immediately adjacent to the bank(s). | This site largely consisted of sands and gravels, with cobbles observed in riffle structures and areas of consolidated clay where flows had stripped the top layer of substrate. The maximum particle size was greater than 1 m in size and was contributed by engineered materials. | The banks consisted almost entirely of silt with some larger cobbles and boulders observed throughout, likely introduced by past engineering efforts. Both the right and left bank had erosion contributed by encroaching park land and foot traffic, with fines held stable by well-established mixed scrubland. | Instream vegetation was moderate, consisting of moss, filamentous and attached algae, and some rooted macrophytes. Riparian vegetation consisted of narrow mixed deciduous scrubland up to 10 m. Manicured parkland and lawn was beyond the narrow riparian buffer. | The site was adjacent to a well-used park with pedestrian trails and unofficial crossings throughout, which likely contributed to nutrients and pollutant loading within the site and system. Other contributions were likely adjacent lawns, as well as upstream residential areas and residential developments. No barriers to fish were observed, with fish observed in pools and adjacent to undercut banks. |

| Assessment Location | General UTM Coordinates | Site Location | Site Characteristics | Habitat Description | Substrate Composition | Bank Stability | Instream and Riparian Vegetation | Fish Barriers and Other Disturbances |
|---|---|---|---|---|---|---|---|---|
| **Kitley Ravine 1 (KR1)** | 17 T 652547 m E 4855826 m N | The Kitley Ravine site (KR1), located within a contributing feature to the main Pine Creek, was approximately 30 m upstream of Kitley Ave ( **Figure 3-44**). The site was on municipal property bound by private residential property surrounded by a thin riparian corridor. The site was dry at the time of assessment with no indication of ground water contribution ( **Figure 3-45**). OSAP could not be performed due to the intermittent flow regime. No fish were observed within the feature; however, the watercourse was fairly well-defined within the mixed deciduous forest block and appeared to contribute to downstream catchments. Although no fish were observed within the feature, the Kitley Ravine should still be considered fish habitat despite the intermittent nature as it would convey sediment and food supply as well as flow during runoff events, indirectly contributing to the downstream catchments. | | | | | | | |
| **Pine Creek 3 (PC3)** | 17 T 652064 m E 4856075 m N | Pine Creek 3 (PC3) was approximately 40 m downstream of the Finch Ave right of way and at the confluence of Duncannon Ravine, within the main Pine Creek branch. | Site length was ~40 m. Average wetted width was ~3 m. The average depth at crossovers was 80 mm and the maximum depth sampled was observed at the confluence with Duncannon Ravine ( **Figure 3-46**). The site fell downstream of a busy municipal right of way serviced by a large CSP culvert ( **Figure 3-48**). A well-established riparian buffer contributed by mixed-deciduous and cedar forest provided ample habitat and protection against pedestrian traffic. | This site varied in form and function, largely contributed by shallow glides and slow riffles, with a moderate depth pool found at the confluence with the Duncannon Ravine feature. Woody material and was abundant throughout ( **Figure 3-47**), with areas of deposition observed contributing to a braided composition ( **Figure 3-49**). The site was consistent with a cedar swamp watercourse, with ample cover provided by overhanging canopy as well as large woody material. | Substrate was poorly sorted, consisting of fines, gravels and cobbles. Some cobbles contributed to instream cover throughout. Evidence of sedimentation was observed throughout with aggradation and island forms. Fine substrate was observed in abundance at the Finch ROW. The maximum particle size was observed at ~100 mm. | Evidence of bank instability was observed throughout the site, with steep angles observed on both banks and a riverbed elevation well below the top of bank indicating downcutting. Undercuts were observed on both banks, although the well-established cedar and mixed deciduous forest provided some stability. | Aquatic vegetation was minimal at the time of observation. Canopy cover was abundant throughout, with 100% of the stream shaded from mixed deciduous and cedar swamp riparian cover. | The site was approximately immediately downstream of Finch Ave, a well-travelled regional road which likely contributed to nutrients and pollutant loading within the site and system. Other contributions, such as the adjacent residential development on the left bank beyond the ~45 m riparian zone were observed with debris and garbage accumulating in the channel. Upstream residential areas were also likely contributors as well as an upstream cemetery and parks. No barriers to fish were observed, although the Finch Ave ROW may contribute to a barrier. |

| Assessment Location | General UTM Coordinates | Site Location | Site Characteristics | Habitat Description | Substrate Composition | Bank Stability | Instream and Riparian Vegetation | Fish Barriers and Other Disturbances |
|---|---|---|---|---|---|---|---|---|
| **Duncannon Ravine 1 (DR1)** | 17 T<br>651796 m E<br>4856084 m N | The Duncannon Ravine site was immediately upstream of the Finch Ave right-of-way within a contributing feature to the main Pine Creek branch, approximately 270 m upstream of the confluence and PC3. | Site length was ~45 m. Average wetted width was ~1.5 m. The average depth at crossovers was 20 mm and the maximum depth sampled was ~50 mm, downstream of a knickpoint created by woody material and substrate changes ( **Figure 3-50**). The site fell within a natural area ravine with a residential area ~40 m beyond the channel on the right bank and a cemetery on the left bank. Another, larger natural area and ravine (Bylawn Drive Ravine) was upstream of the Fairport Rd ROW. | This site was largely contributed by slow riffles and pool habitat. Aquatic vegetation cover was non-existent at the time of observation, with all instream cover provided by round cobbles and woody material. | Substrate was moderately sorted contributed mainly by gravels and cobbles, with some areas of fine sediments in deposition zones. The maximum particle size was observed at ~850 mm. | Some evidence of bank instability was observed throughout the site, with steep angles observed on both banks and fines observed in deposition zones ( **Figure 3-51**). No undercuts were observed despite this evidence likely due to the well-established riparian habitat. | Instream vegetation was non-existent. Riparian vegetation consisted of mixed deciduous forest on both banks, with abundant forest canopy cover provided on both banks. | The site was located within a well-buffered natural area, upstream of the last major ROW (Finch Ave) in the City. The site observed little to no foot traffic, however, dumping was observed adjacent to abutting resident fences on the right bank. No barriers to fish were observed within the site, however the Finch Ave ROW, serviced by a CSP culvert, could contribute as a barrier. No fish were observed within the site. |
| **Pine Creek 4 (PC4)** | 17 T<br>651600 m E<br>4856332 m N | Pine Creek 4 (PC4) was the furthest most upstream site in the study area and was approximately 620 m upstream of PC3, and approximately 240 m downstream of the Lynn Heights Dr right-of-way within the main Pine Creek branch. | Site length was ~45 m. Average wetted width was ~0.8 m. The average depth at crossovers was ~20 mm and the maximum depth sampled was ~50 mm. The site fell within a natural area bound by residential areas on both banks outside of the well-established riparian area. Little development was observed upstream of the site. | This site was contributed by slow riffles, glides and a deep pool between the extents ( **Figure 3-52**). Cover was provided by large woody debris throughout and instream cobbles throughout ( **Figure 3-53** & **Figure 3-54**). Aquatic vegetation cover was non-existent at the time of observation. | Substrate demonstrated poor sorting, consistent with downstream sites. Similar to downstream sites, cobbles represented up to the D50 for point substrate, with observed throughout and areas of deposition on both banks and in pool habitat. The maximum particle size was ~850 mm observed near the upstream extent. | Evidence of bank instability was observed throughout the site, with steep angles observed on both banks throughout the site and areas of deposition likely contributed by fines entering the system from erosion. | Instream vegetation was non-existent. Riparian vegetation consisted of mixed deciduous forest on both banks, with abundant forest canopy cover provided on both banks. | The site was located within a well-buffered natural area and near the urban boundary of the City. The site had a small, unofficial trail leading to the channel, however little signs of foot traffic was observed along the channel itself. No barriers to fish were observed within the site, however the upstream extent was observed with very little water contributing to the downstream habitat ( **Figure 3-55**). Fish were observed within the pool habitat throughout the site. |

### 3.8.2 *Fish Community Assessment*

The TRCA data provided by MMM Group in the Master Plan (MMM Group, 2009) notes that Pine Creek provides habitat to Blacknose dace (*Rhinichthys atratulus*) and Creek chub (*Semotilus atroomaculatus*), both of which are common, secure in status and moderately to highly tolerant to disturbance typical of cool-warmwater thermal regimes. Contributing features to the Pine Creek subwatershed, such as Kitley Ravine and Duncannon Ravine did not have fish community studies, although it can be assumed that these channels would provide habitat to similar species outside of limitations from low baseflow and habitat fragmentation. MNRF data confirms the presence of these species and suggests that additional species, such as Central Mudminnow (*Umbra limi*), Common Shiner (*Luxilus cornutus*), Logperch (*Percina caprodes*) and White Sucker (*Catostomus commersonii*), may also exist where habitat is present (MNRF, 2015).

#### *3.8.2.1 In-Water Timing Window*

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 of any given year. This restriction is aimed to protect the species listed above 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.

#### *3.8.2.2 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 study area does contain fish at any time during any given year. Therefore, the *Fisheries Act* applies to works conducted in or near water at the site.

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 (Department of Fisheries and Oceans, 2019). Based on field investigations conducted by Aquafor staff and background information provided by the TRCA, the study area does contain fish at any time during any given year. It is therefore the opinion of Aquafor Beech Limited 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.

**Figure 3-36: DS Extent of PC1, Looking DS**

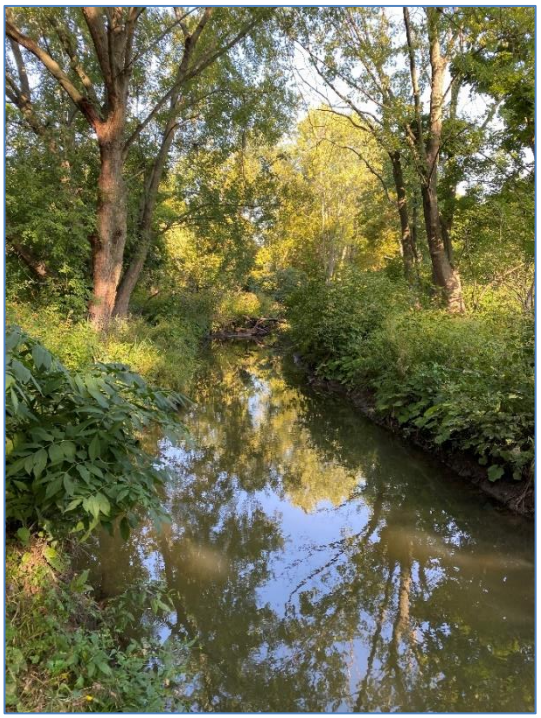


**Figure 3-37: US Extent of PC1, looking US**


**Figure 3-38: Beaver Activity Signage at PC1**

**Figure 3-39: OF DS of Pedestrian Bridge at PC1, Right Bank**

**Figure 3-40: DS Extent of PC2, Looking DS**

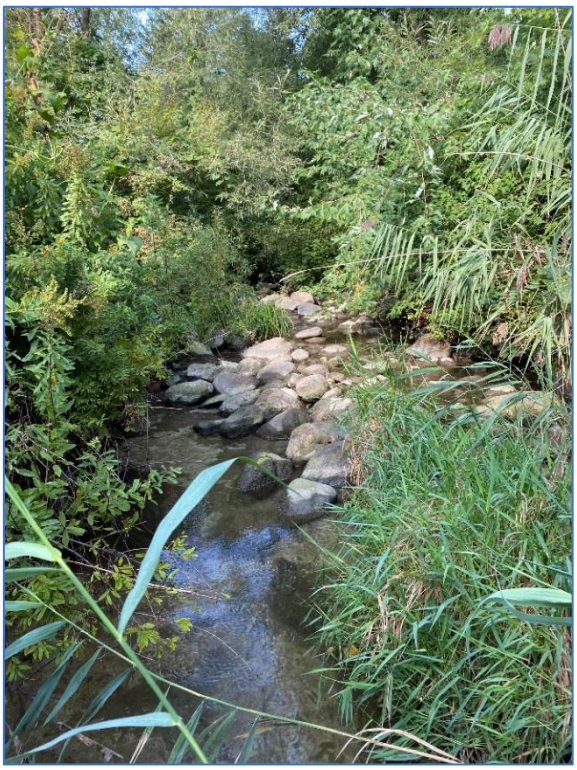


**Figure 3-41: US Extent of PC2, Looking US**

**Figure 3-42: Pool Habitat and Undercut Bank at PC2**

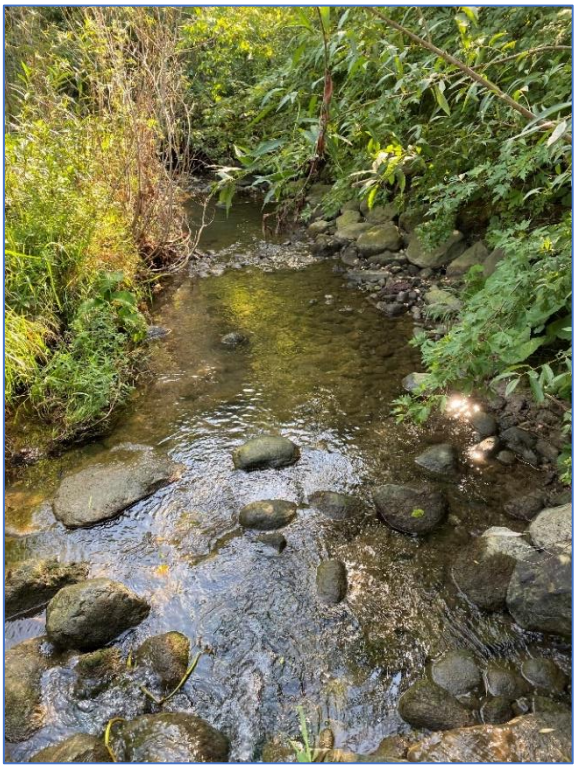


**Figure 3-43: Typical Habitat at PC2**

**Figure 3-44: DS Extent of KR1 at Pine Creek**

**Figure 3-45: Typical Habitat in KR1**

**Figure 3-46: Pool at Confluence with Duncannon Ravine (LB)**

**Figure 3-47: DS Extent of PC3, Looking DS**

**Figure 3-48: US Extent of PC3 at Finch Ave ROW**

**Figure 3-49: Typical Habitat in PC3**

**Figure 3-50: Typical Habitat at DR1, Looking US**

**Figure 3-51: Typical habitat at DR1, Looking DS**

**Figure 3-52: Typical Habitat at PC4, Looking US**

**Figure 3-53: Typical habitat at PC4, Looking DS**

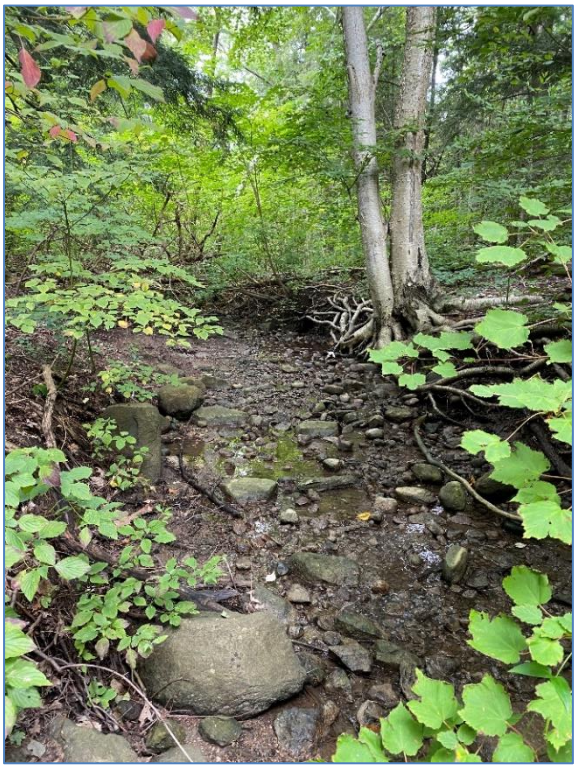


**Figure 3-54: Typical Habitat at PC4, Looking US**

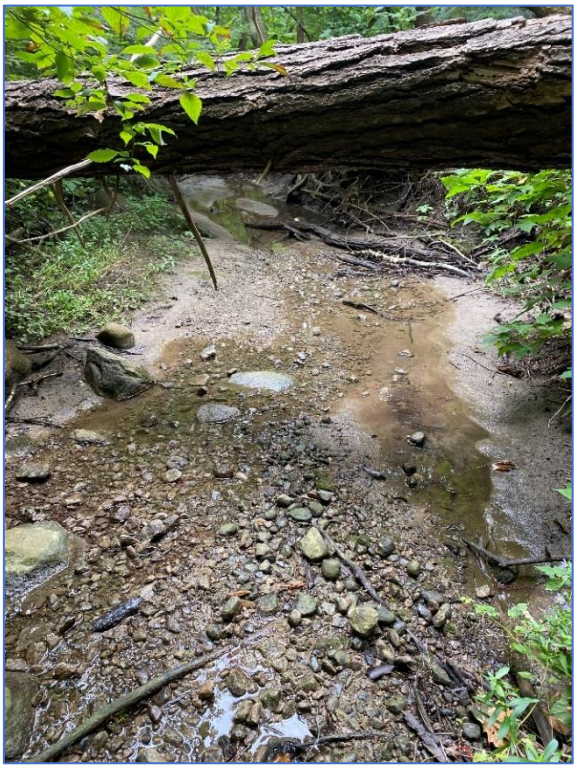


**Figure 3-55: Typical habitat at PC4, Looking DS**

## 3.9 Archaeological and Cultural Heritage Assessment

Amick Consultants Limited completed a Stage 1 Archaeological Assessment of the project study area from 2022 – 2023. All archaeological assessment works were completed in conformity with the Ontario Ministry of Tourism and Culture (MTC) *Standards and Guidelines for Consultant Archaeologists* (MTC 2011) and the *Ontario Heritage Act* (RSO 1990a).

The entirety of the study area was subject to a desktop Stage 1 Archaeological Background Study, completed November 11th, 2022. A property inspection and photographic documentation of the study area was completed on December 2nd, 2022. Based on the results of these assessments, some areas within the study area have been identified as exhibiting major landscape alterations and subsurface disturbances which include major grading to mitigate flooding, fill to facilitate road construction, pathways and underground electrical infrastructure and retaining walls to mitigate erosion. Other parts of the study area are made up of steep slopes in excess of 30 degrees, and seasonally flooded areas, limiting their archaeological potential. All of these areas are considered to have no potential to yield archaeological deposits of Cultural Heritage Value or Interest (CHVI).

However, select areas within the study area do have high potential to yield archaeological deposits of Cultural Heritage Value or Interest based largely on their proximity to Pine Creek or the previous discovery of archaeological sites nearby. The spatial distribution of these areas is illustrated below in **Figure 3-56**. Completion of a Stage 2 archaeological assessment is recommended at the detailed design stage for any proposed projects where the proposed area of disturbance overlaps with an identified area of high CHVI.


**Figure 3-56: Aerial Map of the Study Area Illustrating the Spatial Distribution of Sites with Stage 2 Archaeological Potential**

## 3.10 Utilities

Aquafor undertook a Subsurface Utility Engineering (SUE) Quality Level D investigation, including a review of Municipal and Regional Base mapping, as-built drawings and completion of an Ontario One Call Planning Level assessment. The identified utilities within the general proximity of the project study area include: municipal storm sewers and storm sewer outfalls; Region of Durham sanitary sewers; York Region sanitary sewer infrastructure; municipal lighting infrastructure; Bell and Rogers telecommunication lines; Hydro One and Elexicon Energy Hydro Infrastructure; and Enbridge Gas Lines.

Utility base mapping is included in the Existing Conditions Drawings appended to **Appendix A** of this report. Additional subsurface utility investigations (Level C, B or A) should be completed at the detailed design stage as needed to identify potential utility conflicts and ensure appropriate utility protection measures are implemented at the construction phase.

## 3.11 Social-Economic Environment

### *3.11.1.1 Land Use*

As defined in the City of Pickering's official plan, land use within the project study area is delineated as a natural corridor surrounded by low density urban residential development (**Figure 3-57**). There are three (3) major parks located within the EA project area: David Farr Memorial Park, Forestbrook Park and Lynn Heights Park, along with two natural areas

denoted as the Duncannon Ravine and the Kitley Ravine corridors. The proposed projects associated with this EA are not expected to result in any change in land use designations.

#### *3.11.1.2 Transportation*

As per the City of Pickering's Official Plan, the road crossings within the project study area include Type B Arterial Roads (Kingston Road and Finch Avenue), Type C Arterial Roads (Glenanna Road, Dixie Road and Fairport Road), and Collector Roads (Kitley Avenue, and Lynn Heights Drive). Through the EA erosion risks to Finch Avenue (a Region of Durham owned Type B Arterial Road), Dixie Road (a Municipally owned Type C Arterial Road) and Lynn Heights Drive (a Municipally Owned Collector Road) were identified. There are no significant utility corridors within the project study area. A map showing the City's Transportation System with the EA study area extents overlain is provided below as **Figure 3-58**.

#### *3.11.1.3 Ownership*

Within the EA study area, the majority of the Pine Creek Corridor is contained within City owned lands. Some of the identified erosion sites are located on, either entirely or partially, lands owned by the Region of Durham or Private Landowners. Furthermore, there are some proposed projects associated with the EA where the recommend solutions extend onto privately owned lands. In these instances, property owners will be advised of the ongoing erosion issues and associated risks on their property. Each individual property owner will ultimately be responsible for undertaking the necessary measures to mitigate the identified erosion related risks on their property using the concepts outlined in this EA or alternative methods (subject to all associated regulatory approvals at the detailed design stage).

Alternatively, the City may give future consideration to an easement acquisition in order to complete creek restoration works on select private properties.

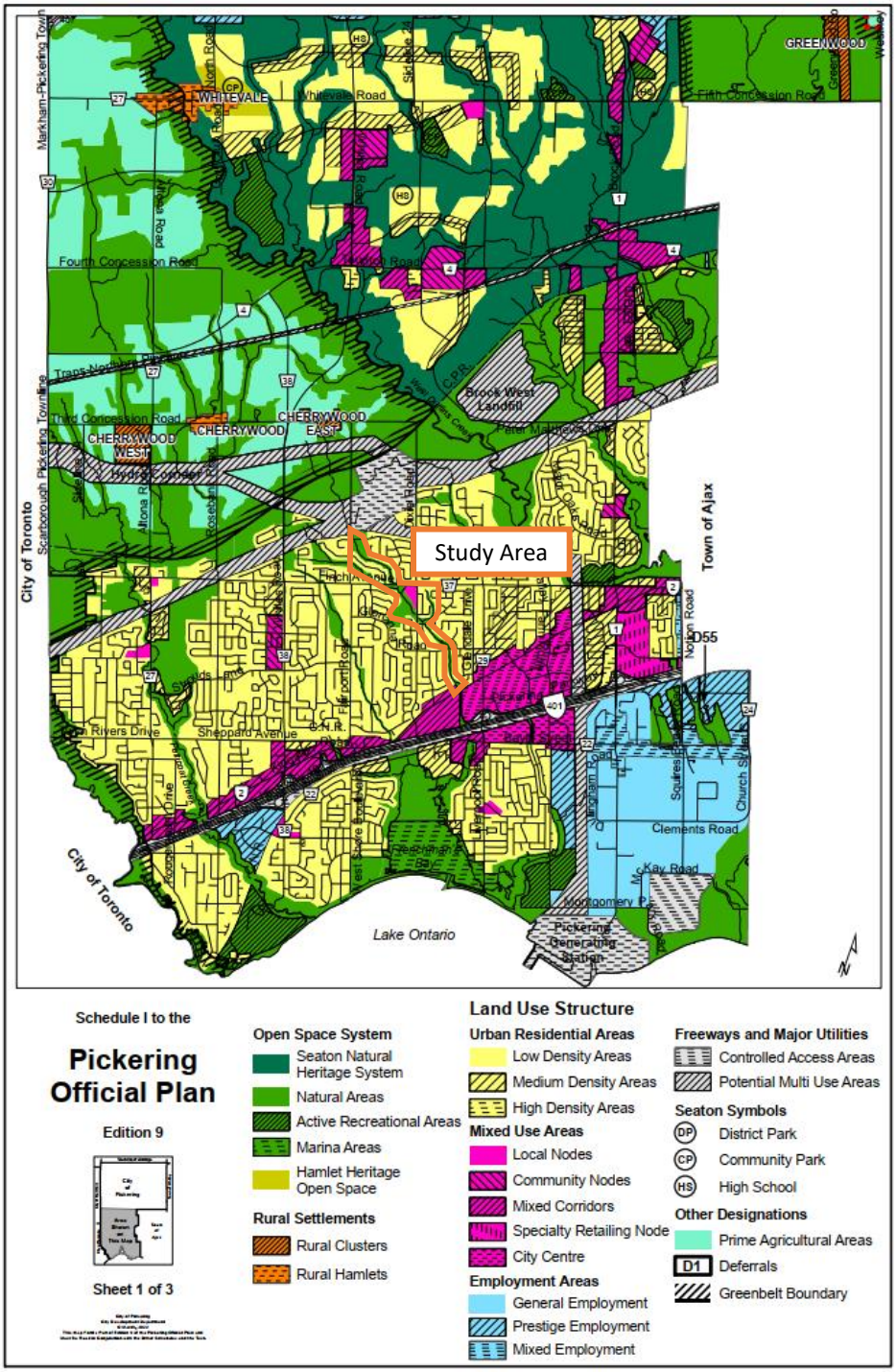



**Figure 3-57: Land Use within the City of Pickering (City of Pickering, 2022)**

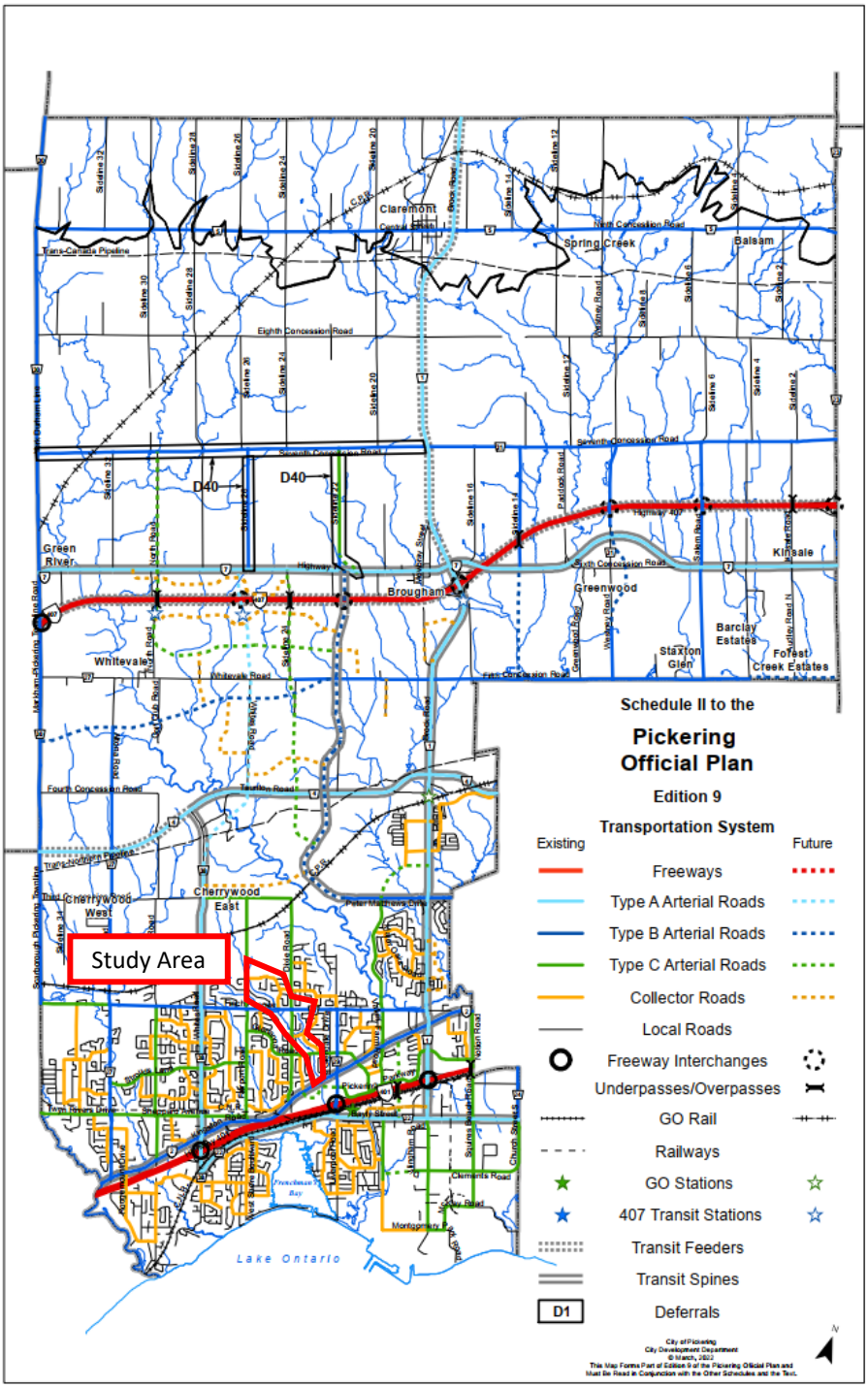



**Figure 3-58: Transportation System Network within the City of Pickering (City of Pickering, 2022)**

# 3.12 Climate Change Mitigation and Adaptation Assessment

### *3.12.1.1 Climate Change Mitigation*

Mitigation refers to actions that reduce the greenhouse gas emissions that cause climate change, such as switching to clean energy and being energy efficient.

A qualitative approach has been taken to assess climate change mitigation noting that the primary impact of the proposed EA restoration, from a climate change perspective, will be the generation of greenhouse gas emissions during the detailed design, construction and post-construction monitoring phases. It is recommended that at the detailed design stage a Climate Lens GHG Mitigation assessment report be completed for each project, consistent with the requirement's defined in Infrastructure Canada's Climate Lens – General Guidance Document (Infrastructure Canada, 2019). Preparation of this report will allow for an assessment of candidate mitigation measures to reduce greenhouse gas emissions during each phase of the project. At this stage the following mitigation measures are recommended for future consideration:

- **Detailed Design and Post-Construction Monitoring Phase:** Car-pooling to site, wherever feasible, to reduce greenhouse gas emissions associated with onsite field investigations.
- **Construction Phase:** Exploring opportunities to reuse materials onsite wherever feasible to reduce emissions associated with the transport of materials to and from site. As a secondary mitigation measure, consideration may be given to requiring contractor's to use fuel efficient construction equipment to further reduce greenhouse gas emissions.

#### *3.12.1.2 Climate Change Adaptation*

Climate change adaptation refers to actions that manage and reduce the risk of climate change impacts such as infrastructure upgrades, flood protection, disaster management, and business continuity planning. All of the proposed restoration alternatives will improve the watershed's resiliency to climate change by helping to mitigate erosion, reduce flooding and protect at-risk infrastructure and private property. Moreover, this EA has given specific consideration to climate change resiliency through the evaluation of alternatives process as outlined in **Section 4.2** below.

Further consideration should also be given at the detailed design stage to account for climate change in the design of the proposed restoration works. This should include accounting for climate change related impacts to watershed hydrology and hydraulics to ensure all proposed erosion control materials are appropriately sized and adequate flood mitigation measures are established.

# 4 EVALUATION OF ALTERNATIVE SOLUTIONS

A series of alternatives were developed to specifically address the erosion concerns documented in the twenty-five (25) erosion sites identified in **Section 2**. Factoring in the relative spatial proximity and risk level associated with the twenty-five identified erosion sites, sites have been grouped into nine (9) interest areas for the purposes of developing and evaluating conceptual design alternatives. These alternatives are described in general below with specifics related to each particular grouping of sites following thereafter.

- **Alternative 1: Do Nothing** – This alternative involves leaving the site as it is and allowing erosional processes to continue within the watercourse corridor. Under this alternative, it should be expected that maintenance, or possibly emergency works, may have to be undertaken to address damage to property or infrastructure caused by continued erosion. Damage from erosion may occur gradually over time or suddenly due to a high magnitude flood event.

- **Alternative 2: Local Restoration Works** – This alternative consists of localized channel bank and/or bed work to address erosion issues at the site. While it is understood that local erosion protection works may require ongoing maintenance, occasional repairs, or eventual replacement, this alternative is often still preferred to limit the economic cost and the environmental damage of large-scale channel engineering and stream restoration works.

- **Alternative 3: Extended Works** – This alternative consists of a comprehensive approach, which is typically completed on a reach or sub-reach scale, to address erosion issues at the site. Reach-scale engineering focuses on minimizing the risks of erosion and flooding in highly constrained urban watercourses. This alternative will apply a combination of "hard" channel engineering approaches for erosion control and natural channel techniques to mimic natural channel features such as riffles and pools to enhance the riparian environment.

High-resolution drawings of the alternatives for each interest area can be found in **Appendix H**.

## 4.1 Description of Alternatives

### 4.1.1 Erosion Sites #1 - #4

**Alternative 1: Do Nothing –** Erosional process will continue to pose a risk to city property, municipal and regional infrastructure, and private properties. Specifically, ongoing risks include destabilization of the roadway embankment along the upstream side of Kingston Road (Site #1), loss of private property along Charlotte Circle (Site #2), outflanking of the Storrington Street outfall structure (Site #3), and further exposure of the pedestrian bridge footings (Site #4).

**Alternative 2: Local Restoration Works –** This alternative will consist of localized channel bank and minor repair works to address erosion issues at each of these four sites, including; The use of vegetated buttresses for bank protection directly upstream of Kingston Road (Site #1) , repairs to an outfall pipe and headwall structure combined with installation of a buried Armourstone retaining wall bank upstream to protect private

properties on Charlotte Circle (Site #2); patchwork repairs to outfall pipe and headwall structure combined with vegetated buttress bank treatments for the Storrington Street outfall (Site #3); and repairs to the bridge supports combined with vegetated buttress bank treatments to protect the pedestrian bridge (Site #4). Furthermore, with respect to Site #1, it should be noted that the proposed culvert rehabilitation works are included in the detailed design of the BRT project, which is currently being undertaken by the Region of Durham. Any works completed by the City of Pickering will be limited to channel restoration and erosion protection works on City owned lands. Lastly, implementation of the proposed works for Site #2 may require a Permission to Enter Agreement be obtained from the Region of Durham for the area outlined in the Proposed Alternatives Figure. This temporary Permission to Enter agreement may be needed to allow for construction of the buried Armourstone retaining wall behind the Charlotte Circle properties.

**Alternative 3: Extended Works** – Apply comprehensive reach-based natural channel design using riffle-pool morphology, including; installation of vegetated buttresses to mitigate channel erosion upstream of Kingston Road (Site #1), repairs to an outfall pipe and headwall structure combined with installation of a buried Armourstone retaining wall to provide protection for the private properties at risk behind Charlotte Circle (Site #2), repairs to outfall pipe and headwall structure combined with vegetated buttress bank treatments for the Storrington Street outfall (Site #3), and protection of pedestrian bridge abutments using vegetated buttresses (Site #4). Additionally, the alternative includes the establishment of a pocket wetland to promote floodplain connectivity and plant biodiversity, and the staged removal of the beaver dam. Furthermore, with respect to Site #1, it should be noted that the proposed rehabilitation works are included in the detailed design of the BRT project, which is currently being undertaken by the Region of Durham. Any works completed by the City of Pickering will be limited to channel restoration and erosion protection works on City owned lands.

### 4.1.2 Erosion Sites #5 - #8

**Alternative 1: Do Nothing** – City property, municipal infrastructure, private property and public safety will continue to be at risk from erosion and the failure of existing erosion control structures. Ongoing risks include the outflanking of the Glennana Road culvert headwall (Site #5), loss of parkland within David Farr Park (Sites #6, #7, #8).

**Alternative 2: Local Restoration Works** – This alternative will consist of localized channel bank and minor repair works to address erosion issues at each of these four sites, including; Regrading and restoring eroded slopes directly upstream and downstream of Glennana Road (Site #5), and regrading and revegetation of the riparian corridor in select areas (Sites #6, #7, #8).

**Alternative 3: Extended Works** – Apply comprehensive reach-based natural channel design using riffle-pool morphology, including; restoration and regrading of slopes directly upstream and downstream of Glennana Road (Site #5), regrading and revegetation of the riparian corridor along study area, combined with boulder toe protection in select areas (Sites #6, #7, #8). This design is intended to tie into the downstream extent of the proposed extended works for Sites #9 and #10.

### 4.1.3 Erosion Sites #9 - #10

**Alternative 1: Do Nothing** – City property, private property, municipal infrastructure, and public safety will continue to be at risk from erosion and the failure of existing erosion control structures. Ongoing risks include erosion risks to multi-use trail infrastructure, lighting infrastructure, and private property (Sites #9, #10). Additionally, sediment accumulation and cracking of the headwall will continue to prevail within the Kitley Avenue outfall structure.

**Alternative 2: Local Restoration Works** – This alternative will consist of the localized application of vegetated buttresses bank protection at each site (Sites #9, #10).

**Alternative 3: Extended Works –** Apply comprehensive reach-based natural channel design using riffle-pool morphology, including; regrading and revegetation of the entire riparian corridor (Site #9), a minor channel realignment to protect multi-use trail, lighting infrastructure and private properties (Site #10), patchwork repairs to and removal of sediment from the Kitley Avenue outfall structure, and an engineered scour pool downstream of the Kitley Avenue culvert.

### 4.1.4 Erosion Sites #11 - #12

**Alternative 1: Do Nothing** – City property, private property, municipal infrastructure, and public safety will continue to be at risk from erosion and the failure of existing erosion control structures. Ongoing risks include deterioration of the Dixie Road culvert crossing through outflanking of the headwall apron and failing gabion baskets (Site #11), as well as active bank erosion encroaching towards Dixie Road (Site #12). Additionally, sediment will continue to accumulate within the two identified Dixie Road outfall structures and corresponding outfall channels.

**Alternative 2: Local Restoration Works** – This alternative will consist of patchwork repairs to the Dixie Road culvert crossing (Site #11), and the localized application of vegetated buttresses bank protection reinforced with a buried Armourstone wall (Site #12). Additionally, sediment will be removed from both of the Dixie Road outfall structures and channels.

The restoration work proposed at Site #12 includes work on Private Property. Property owners will be advised of the ongoing erosion issues and associated risks on their property. Each individual property owner will ultimately be responsible for undertaking the necessary measures to mitigate the identified erosion related risks on their property using the concepts outlined in this EA or alternative methods (subject to all associated regulatory approvals at the detailed design stage). Alternatively, the City may give future consideration to an easement acquisition in order to complete creek restoration works on select private properties.

**Alternative 3: Extended Works** – Apply comprehensive reach-based natural channel design using riffle-pool morphology, including; repairs to the Dixie Road culvert crossing complete with the removal of accumulated sediment and the replacement of failed gabion baskets with vegetated buttresses (Site #11), as well as a minor channel realignment away from Dixie Road combined with a vegetated buttresses bank protection reinforced with a buried Armourstone wall (Site #12). Additionally, accumulated debris from failed erosion

control structures will be removed along the length of the restoration works. Furthermore, the upstream extent of the works will tie into the existing wetland area.

The restoration work proposed at Site #12 includes work on Private Property. Property owners will be advised of the ongoing erosion issues and associated risks on their property. Each individual property owner will ultimately be responsible for undertaking the necessary measures to mitigate the identified erosion related risks on their property using the concepts outlined in this EA or alternative methods (subject to all associated regulatory approvals at the detailed design stage). Alternatively, the City may give future consideration to an easement acquisition in order to complete creek restoration works on select private properties.

### 4.1.5 Erosion Sites #13 - #16

**Alternative 1: Do Nothing** - City property, municipal infrastructure, private property and public safety will continue to be at risk from erosion and the failure of existing erosion control structures. Ongoing risks include active toe erosion placing private properties along Moutcastle Crescent at risk (Sites #13, #14), outfall channel erosion from the Finch Avenue outfall (Site #15), and active erosion along the Finch Avenue roadway embankment (Site #16).

**Alternative 2: Local Restoration Works –** This alternative will consist of localized channel bank and minor repair works to address erosion issues at each of these four sites, including; Apply vegetated buttress toe protection and regrade and re-vegetate slopes (Sites #13, #14), repair concrete headwall and apply rip-rap lined swale for the Finch Avenue outfall (Site #15), and potentially replace the Finch Avenue culvert and apply an engineered sour pool downstream coupled with restoration of the Finch Avenue roadway swale (Site #16). It should be noted that the Site #16 proposed works are to be considered by the Region of Durham pending further review, and that any works completed by the City of Pickering will be limited to channel restoration and erosion protection works on City owned lands.

**Alternative 3: Extended Works** - Apply a comprehensive reach-based natural channel design using riffle-pool morphology, including; Apply vegetated buttress toe protection and regrade and re-vegetate slopes (Sites #13, #14), repair concrete headwall and apply rip-rap lined swale with an engineered scour pool for the Finch Avenue outfall (Site #15), and potentially replace the Finch Avenue culvert and apply an engineered sour pool downstream coupled with restoration of the Finch Avenue roadway swale (Site #16). Additionally, the proposed works will transition into the confluence with the east branch of Pine Creek at the downstream extent. Accumulated channel debris will also be removed from the corridor along the length of the proposed restoration works. It should be noted that the Site #16 proposed works are to be considered by the Region of Durham pending further review, and that any works completed by the City of Pickering will be limited to channel restoration and erosion protection works on City owned lands.

### 4.1.6 Erosion Sites #17 - #21

**Alternative 1: Do Nothing** - City property, municipal infrastructure, private property and public safety will continue to be at risk from erosion and the failure of existing erosion control structures. Ongoing risks include active bank erosion towards private properties on Grafton Court (Site #17), undercutting of the toe of bank adjacent to Finch Avenue (Site

#18), active bank erosion towards private properties on Duncannon Drive (Site #20), and deterioration of the Fairport Road outfall structure (Site #21).

**Alternative 2: Local Restoration Works -** This alternative will consist of localized channel bank and minor repair works to address erosion issues at each of these four sites, including; minor channel realignment and vegetated buttress bank protection (Site #17), vegetated buttress toe protection in addition to regrading and re-vegetation of adjacent slopes (Sites #18, #20), and patchwork repairs to an at-risk headwall structure combined with vegetated buttress bank protection (Site #21). Additionally, CCTV inspection of the CSP pipe crossing under Fairport Road is recommended as part of the Site #21 works to determine if a full replacement or CIPP lining of the pipe is required. Furthermore, it should be noted that implementation of the proposed solution for Site #17 may require a potential Permission to Enter Agreement from the Region of Durham to facilitate construction access and staging.

**Alternative 3: Extended Works** - Apply comprehensive reach-based natural channel design using riffle-pool morphology, including; An engineered scour pool with vegetated buttresses combined with minor channel realignment (Site #17), vegetated buttress toe protection in addition to regrading and re-vegetation of adjacent slopes (Sites #18, #20), patchwork repairs to an at-risk headwall structure combined with vegetated buttress bank protection (Site #21). Additionally, CCTV inspection of the CSP pipe crossing under Fairport Road is recommended as part of the Site #21 works to determine if a full replacement is required. Furthermore, it should be noted that implementation of the proposed solution for Site #17 may require a potential Permission to Enter Agreement from the Region of Durham to facilitate construction access and staging.

### 4.1.7 Erosion Site #22

**Alternative 1: Do Nothing** - City property, municipal infrastructure, and public safety will continue to be at risk from erosion and failed erosion protection measures. Ongoing risks include undermining of the pipe arch culvert at Lynn Heights Drive and washed out erosion protection measures directly downstream.

**Alternative 2: Local Restoration Works** - This alternative will consist of a scour pool on either side of the Lynn Heights Drive culvert. In addition, the downstream channel debris will be removed, and a culvert replacement or relining will be considered pending the results of the structural assessment at the detailed design stage. A potential Permission to Enter Agreement may be required on private property as part of these works.

**Alternative 3: Extended Works -** Apply comprehensive reach-based natural channel design using riffle-pool morphology downstream of the Lynn Heights Drive culvert, transitioning into the existing channel conditions. In addition to the extended channel rehabilitation works, a scour pool will be constructed on either side of the Lynn Heights Drive culvert. Furthermore, the downstream channel debris will be removed, and a culvert replacement or relining will be considered pending the results of a structural assessment at the detailed design stage. Lastly, a potential Permission to Enter Agreement may be required on private property as part of these works.

### 4.1.8 Erosion Sites #23 - #24

**Alternative 1: Do Nothing -** City property, municipal infrastructure, private property, and public safety will continue to be at risk from erosion and failed erosion protection measures. Ongoing risks include slope stability concerns to private properties on Duncannon Drive (Sites #23, #24).

**Alternative 2: Local Restoration Works** - This alternative will consist of vegetated buttress toe protection combined with regrading and re-vegetation of eroded slopes (Sites #23, #24).

The restoration work proposed at Site #23 includes work on Private Property. Property owners will be advised of the ongoing erosion issues and associated risks on their property. Each individual property owner will ultimately be responsible for undertaking the necessary measures to mitigate the identified erosion related risks on their property using the concepts outlined in this EA or alternative methods (subject to all associated regulatory approvals at the detailed design stage). Alternatively, the City may give future consideration to an easement acquisition in order to complete creek restoration works on select private properties.

**Alternative 3: Extended Works -** Apply comprehensive reach-based natural channel design using riffle-pool morphology, including vegetated buttress toe protection and re-vegetation of eroded slopes (Sites #23, #24), removal of accumulated channel debris, and the rehabilitation of an outfall structure. The proposed works will tie into existing conditions upstream and downstream of the study area.

The restoration work proposed at Site #23 includes work on Private Property. Property owners will be advised of the ongoing erosion issues and associated risks on their property. Each individual property owner will ultimately be responsible for undertaking the necessary measures to mitigate the identified erosion related risks on their property using the concepts outlined in this EA or alternative methods (subject to all associated regulatory approvals at the detailed design stage). Alternatively, the City may give future consideration to an easement acquisition in order to complete creek restoration works on select private properties.

### 4.1.9 Erosion Site #25

**Alternative 1: Do Nothing -** City property, municipal infrastructure, private property, and public safety will continue to be at risk from erosion and failed erosion protection measures. Ongoing risks include debris accumulation and erosion within the Kitley Ravine corridor which is creating flooding and erosion risks to the surrounding private properties on Ridgewood Court.

**Alternative 2: Targeted Corridor Rehabilitation** - This alternative will consist of recentering the drainage swale within the city owned parcel to reduce erosion and flooding risks to private properties. Efforts will be made to reduce the amount of tree removals and overall disturbances to the surrounding properties. Works will be scoped to targeted areas of the channel to achieve the desired alignment. Erosion control will be provided through the use of plantings and bioengineering measures. Work will be done with small equipment to reduce the disturbance area and minimize vegetation removals. Material from required vegetation removals will be reused on-site to provide erosion control where feasible.

**Alternative 3: Full Corridor Rehabilitation** – This alternative will consist of recentering the drainage swale within the city owned parcel to reduce erosion and flooding risks to private properties. These works would include the use of angular stone to line the channel, and would include significant tree removals. The intent of this solution is to establish a fixed drainage channel lined with angular stone material to prevent channel migration.

## 4.2 Evaluation Criteria

As a part of the Municipal Class Environmental Assessment Process, each alternative must be evaluated based on a set of physical, natural, social, cultural, and economic environmental criteria, as well as technical and engineering considerations. These set of criteria were developed by Aquafor and reviewed by the City of Pickering. The list of criteria and the associated description of the scoring rationale is presented in **Table 4-1**.

**Table 4-1. Alternative Evaluation Criteria**

| Criteria Category | Criteria | Description |
|---|---|---|
| **Physical/ Natural Environment** | Mitigation of Existing Erosion Risks | Alternatives are evaluated on their ability to mitigate erosion. Alternatives with the greatest erosion mitigation potential score highest. |
| | Aquatic Habitat | Alternatives are evaluated on their impact on fish passage and the overall quantity/quality of Aquatic habitat. Alternatives that improve aquatic habitat conditions score highest. |
| | Terrestrial Habitat | Alternatives are evaluated on their impact on connectivity, diversity and quantity/quality of terrestrial habitat. Alternatives that offer the greatest long-term benefit to terrestrial habitat conditions score highest. |
| | Terrestrial Vegetation | Alternatives are evaluated on their impact on existing woodlots; removals & restoration scheme. Typically, alternatives will a smaller disturbance area are preferred as they minimize vegetation removals. |
| | Impacts to Species at Risk | Alternatives are evaluated on their impact on terrestrial and aquatic habitat for Species at Risk, potentially affected temporarily or permanently. Alternatives that minimize disturbances to Species at Risk are favoured. |
| | Climate Change | Alternatives are evaluated on their ability to adapt to, and be resilient to, climate change. More resilient alternatives score higher. |
| **Social/ Cultural Environment** | Public Safety | Alternatives are evaluated on their impact on public safety. Alternatives that best mitigate risks to public safety in the short and long-term score highest. |
| | Landowner Impacts / Community Disruption | Alternatives are evaluated on their impact on private property, this includes giving consideration to both short-term disturbances (i.e., construction) as well as long-term benefits (i.e., erosion protection). |

| Criteria Category | Criteria | Description |
|---|---|---|
| | Benefit to Community and Public Acceptance | Alternatives that improve access to trails, enjoyment of surrounding lands are preferred. |
| | Archaeological Impacts | Less disturbance of areas with archaeological potential and cultural heritage resources scores higher |
| | Aesthetic Value | Alternatives are evaluated on their impact on existing and proposed aesthetic value. Alternatives that help increase the aesthetic value of the study area are favoured. |
| **Economic Environment** | Capital Costs | One time cost to City. Alternatives with a lower capital cost are favoured. |
| | Operations & Maintenance Costs | Requirement for regular, irregular or no maintenance activities and ensure effectiveness of implemented measures. Alternatives with lower Operation and Maintenance costs score highest. |
| | Life Cycle Costs | Lower life cycle costs relative to the other alternatives scores higher |
| | Cost Effectiveness | Ability to provide multiple improvements, at a cost less then the total of completing all the works separately. Accounts for the ability of the City to partner and share costs with other agencies (i.e., Region of Durham, TRCA, etc.) |
| **Technical/ Engineering Consideration** | Regulatory Agency Acceptance | Alternatives are evaluated on their ability to satisfy City, TRCA, DFO and MNR mandates. Alternatives that are more likely to achieve regulatory agency acceptance score highest. |
| | Impact on Existing Infrastructure | Alternatives are evaluated on how they provide protection for the potential exposure of infrastructure (buildings, bridges, properties, sewers). Alternatives that provide a higher level of protection are preferred. |
| | Flooding Impacts | Greater reduction of flooding risks to public and/or private lands for longer time score higher |
| | Technical Feasibility | Alternatives are evaluated regarding their associated complexity of implementing the Project, including constructability and need to manage construction related disturbances to other infrastructure / property. Alternatives that are more technically feasible score highest. |
| | Lifespan of Works | Expected lifespan / years of works before intervention needs to be repeated. Alternatives with a longer lifespan are preferred. |

A weighting factor was assigned to each category, which ensured that each category was valued appropriately, regardless of the number of sub-criteria presented within the larger category. The maximum points for each category are shown in **Table 4-2**.

**Table 4-2: Criteria Weighting Factors**

| Category | Maximum Points for Category |
|---|---|
| Physical and Natural Environment Criteria | 25 |
| Social/Cultural Environment | 25 |
| Economic Environment | 25 |
| Technical/Engineering Considerations | 25 |
| **TOTAL** | **100** |

For all the criteria, a score was applied ranging from 0 to 5 (**Table 4-3**), where:

- 0 = Unfavourable, no improvement or negative impact
- 3 = Acceptable
- 5 = Favourable, most improvement or most positive impact

**Table 4-3: Ranking Scheme for Criteria Evaluation of Each Alternative**

| Ranking Scale | | | | | | | |
|---|---|---|---|---|---|---|---|
| **No / Negative Impact** | 0 | 1 | 2 | 3 | 4 | 5 | **Ideal / Most Positive Impact** |

## 4.3 Evaluation of Alternatives

For each alternative and each grouping of erosions sites, the criteria were evaluated, where higher scores relate to varying degrees of positive effect that an alternative, for the defined criterion, would have on the outcome. The sum of the criterion scores was determined for each alternative and the alternative with the highest score was deemed to be preferred.

A summary of scores for each grouping of erosion sites is presented in **Table 4-4**. A detailed evaluation matrix for each grouping of Erosion Sites can be found in **Appendix I**.

**Table 4-4. Evaluation Scoring Summary**

| Erosion Site(s) | Alternative 1 – Do Nothing | Alternative 2 – Local Restoration Works | Alternative 3 – Extended Works |
|---|---|---|---|
| Erosion Sites #1 - #4 | 54 | 83 | 76 |
| Erosion Sites #5 - #8 | 55 | 82 | 77 |
| Erosion Sites #9 - #10 | 49 | 70 | 84 |
| Erosion Site #11 | 54 | 80 | 75 |
| Erosion Site #12 | 54 | 80 | 75 |
| Erosion Sites #13 - #16 | 48 | 63 | 83 |
| Erosion Sites #17 - #18 | 48 | 78 | 75 |
| Erosion Sites #20 - #21 | 48 | 78 | 74 |
| Erosion Site #22 | 48 | 83 | 73 |
| Erosion Sites #23 - #24 | 48 | 68 | 83 |
| Erosion Site #25 | 56 | 81 (Targeted Corridor Rehab) | 74 (Full Corridor Rehab) |

## 4.4 Selection and Description of the Preferred Alternative

The preferred alternatives were selected based on the evaluation criteria, and were then further refined and confirmed through consultation with the City and the public. The preferred alternatives are as follows:

### Erosion Sites #1 - #4: Alternative 2 – Local Restoration Works

For Site #1, use vegetated buttresses to restore and revegetate channel banks directly upstream of Kingston Road. Works within the Kingston Road corridor, such as any Kingston Road culvert repairs, corrugated steel pipe outfall removal, and gabion basket replacement are to be completed by Region of Durham through a separate project. These Site #1 works, in combination with Region of Durham works, will provide protection and stability to the adjacent roadway embankment and upstream channel. The erosion control works proposed within the Kingston Road corridor may differ from the works shown within the preferred alternative, depending on the results of the Region of Durham's detailed design work for the planned Kingston Road improvements.

With regard to Site #2, repair the Charlotte Circle outfall pipe and headwall structure, and construct an armourstone retaining wall buried behind a vegetated buttresses to provide bank protection directly upstream of the outfall. This solution will improve the lifespan of the Charlotte Circle outfall, as well as protect numerous private properties on Charlotte Circle.

For Site #3 works, repair the Storrington Street outfall pipe and headwall structure and provide vegetated buttress bank treatments directly upstream and downstream of the outfall. This solution will improve the lifespan of the Storrington Street outfall, in addition to providing erosion protection to the upstream pedestrian bridge.

Lastly, for Site #4, minor repairs to the pedestrian bridge supports and protect abutments with vegetated buttress bank treatments. These proposed works will extend the lifespan of the pedestrian bridge and ensure the safety of its users.

**Access and Staging:** The pedestrian walkways from Bronte Square or Storrington Street are the most likely points of access to all four sites. Staging is readily available within the City owned parklands adjacent to the Pine Creek Corridor. Smaller equipment will need to be used to allow for access through the walkways and care should be taken to protect the walkway and sidewalks from damage during construction.

There is also Region of Durham sanitary sewer & storm sewer infrastructure that runs through this part of the Pine Creek Corridor. Should work be required in close proximity to regional sewer infrastructure, appropriate protection measures (i.e., steel plates) must be put in place to protect the sewer infrastructure. At the detailed design stage an SUE investigation should be completed to confirm the location all buried infrastructure onsite. Any proposed protection measures will need to be approved by the Region of Durham, or the corresponding utility authority, prior to implementation onsite.

**Figure 4-1** illustrates the preferred alternative for Erosion Sites #1 - #4.

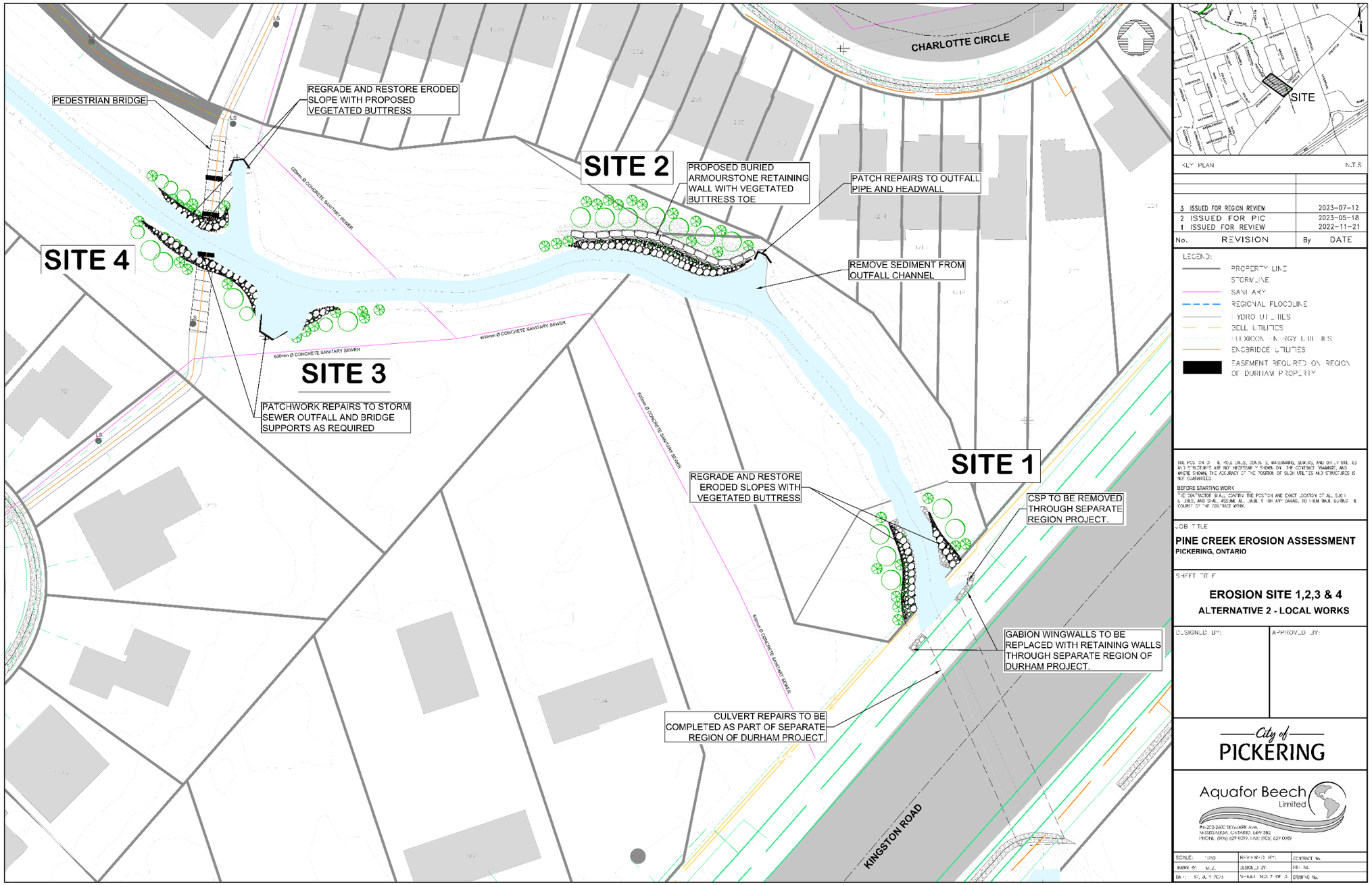



**Figure 4-1: Conceptual Drawing of Preferred Alternative for Erosion Sites #1 - #4 - Local Works**

## Erosion Sites #5 - #8: Alternative 2 – Local Restoration Works

For Site #5, apply engineered scour pools directly upstream and downstream of Glenanna Road to provide scour protection. A hydraulic analysis will be required to ensure appropriate stone sizing is achieved. Along the edge of both scour pools, vegetated buttresses are proposed to provide bank protection. These proposed works will help provide long-term protection and stability to Glenanna road.

With regard to Sites #6, #7, and #8, regrade the channel banks and revegetate the riparian corridor. Boulder toe protection at select areas is also proposed to mitigate bank erosion processes. For Site #8 the failed rip-rap swale should be re-establish and integrated into the proposed vegetated bank restoration works to provide long-term stability. The implementation of these works will help prevent loss of parklands within David Farr Park. The City should also give consideration to the removal of accumulated channel debris and changing their park mowing strategy to prevent over encroachment into the riparian corridor.

**Access and Staging:** Site #5 can be accessed directly from Glenanna Road, whereas Sites #6, #7, and #8 can be accessed via David Farr Park. Care should be taken to limit impact to Park infrastructure and operations, with appropriate safety barricades and fencing put in place to protect the public from construction operations.

**Figure 4-2** illustrates the preferred alternative for Erosion Sites #5 - #8.

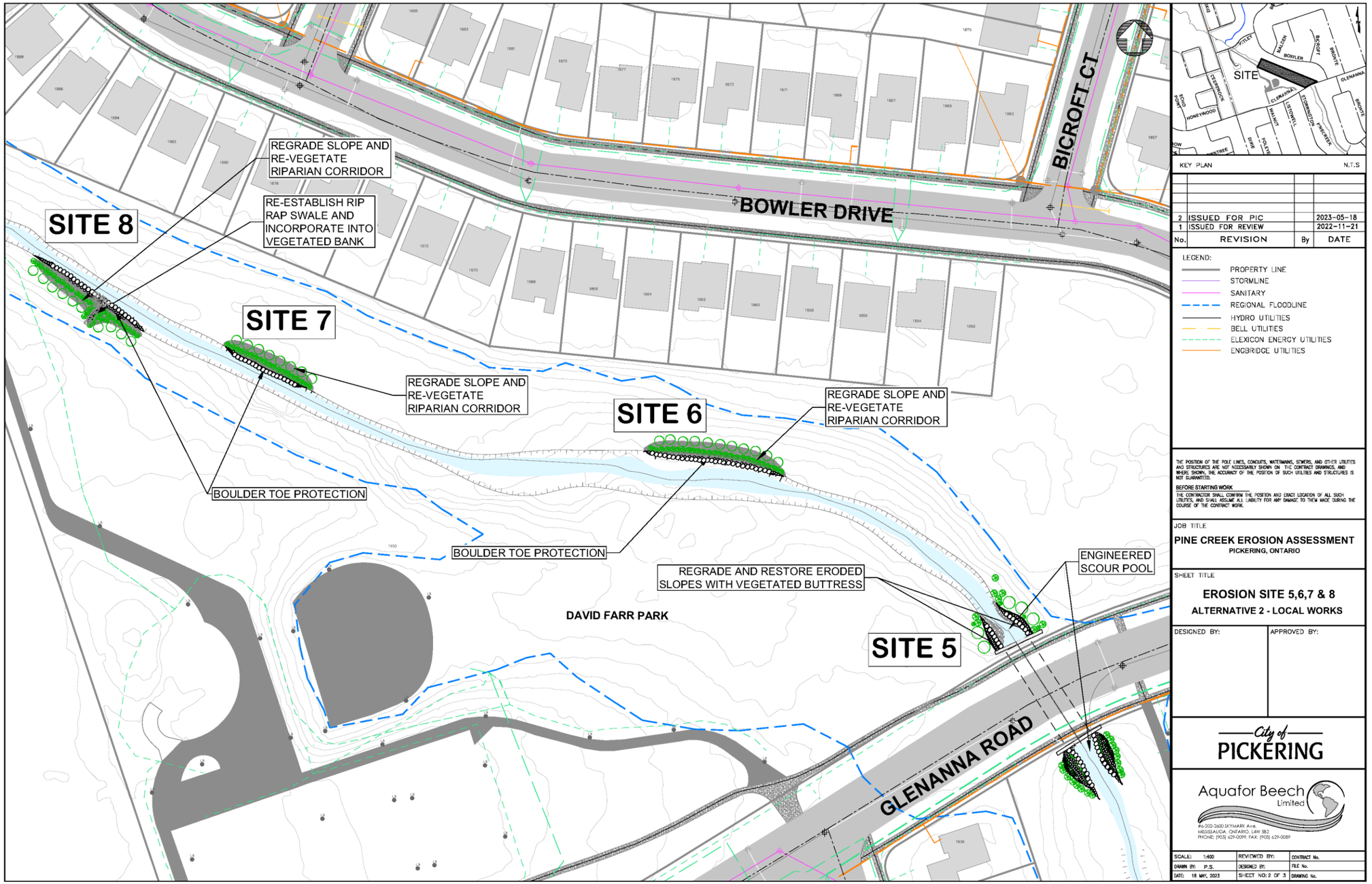



**Figure 4-2: Conceptual Drawing of Preferred Alternative for Erosion Sites #5 - #8 - Local Works**

## Erosion Sites #9 - #10: Alternative 3 – Extended Works

The proposed extended works solution consists of a comprehensive reach-based natural channel design using riffle-pool morphology extending from the Kitley Avenue culvert to approximately 150 m downstream. The channel will be realigned to increase the erosion buffer between the edge of the channel and the existing multi-use trail that runs parallel to private properties on Pinecreek Court. Vegetated buttresses will be installed along the western channel bank to provide enhanced erosion control and to prevent the channel from migrating back towards the at-risk multi-use trail.

An engineered scour pool will also be constructed downstream of Kitley Avenue to provide energy dissipation, while sediment and debris is removed from the Kitley Avenue Culvert and Storm Sewer Outfall to improve flow conveyance.

**Access and Staging:** The recommended access for this project is via the asphalt pedestrian trail connecting to Kitley Avenue where it intersects Pinecreek Court. A temporary trail closure at this location will likely be required to facilitate construction. Staging is available either on the Kitley Avenue right-of-way or within David Farr Park.

**Figure 4-3** illustrates the preferred alternative for Erosion Sites #9 - #10.

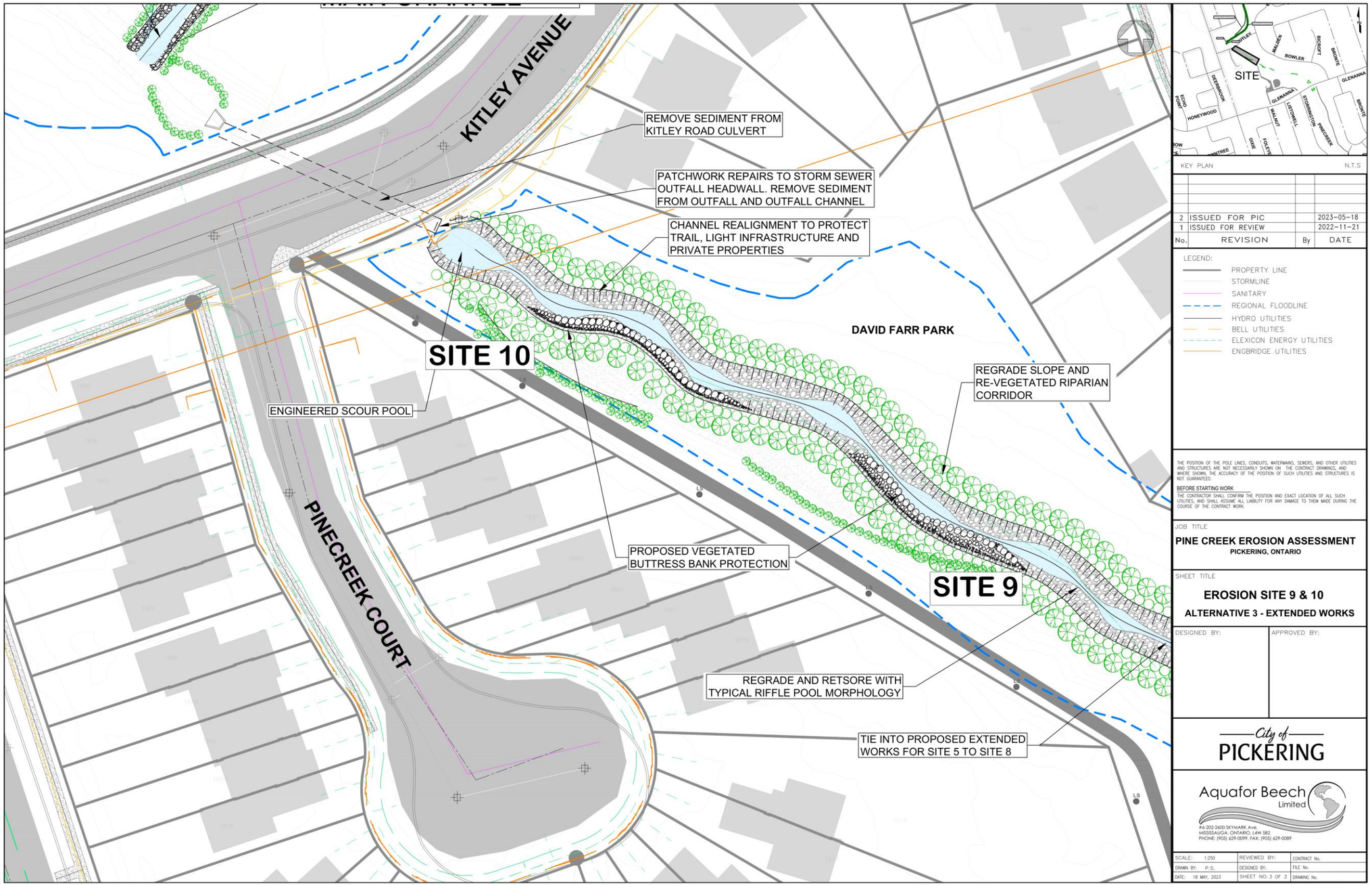



**Figure 4-3. Conceptual Drawing of Preferred Alternative for Erosion Sites #9 - #10 - Extended Works**

## Erosion Site #11: Alternative 2 – Local Restoration Works

This local works solution will consist of patchwork repairs to the downstream side of the Dixie Road culvert crossing. Failed gabion baskets lining the banks downstream of the Dixie Road culvert will also be removed and replaced with vegetated buttresses. Additionally, sediment will be removed from both of the Dixie Road outfall structures and channels to improve flow conveyance.

**Access and Staging:** Site #11 can be accessed directly from Dixie Road, with staging available on the Dixie Road Right-of-Way.

**Figure 4-4** illustrates the preferred alternative for Erosion Site #11.

## Erosion Site #12: Alternative 2 – Local Restoration Works

These proposed works consist of constructing a vegetated buttress, combined with a buried armourstone wall, designed to protect Dixie Road. The implementation of these proposed works may require a Permission to Enter Agreement with the commercial shopping plaza at 1900 Dixie Road for temporary access to City's infrastructure. Additionally, the large debris jam and other accumulated channel debris at this erosion site will be removed as part of the planned site restoration works.

The restoration work proposed at Site #12 includes work on Private Property. Property owners will be advised of the ongoing erosion issues and associated risks on their property. Each individual property owner will ultimately be responsible for undertaking the necessary measures to mitigate the identified erosion related risks on their property using the concepts outlined in this EA or alternative methods (subject to all associated regulatory approvals at the detailed design stage). Alternatively, the City may give future consideration to an easement acquisition in order to complete creek restoration works on select private properties.

It should be noted that this site is located in close proximity to a potential TRCA mapped wetland feature. At the detailed design stage, a site meeting should be held with TRCA to stake out the boundaries of the wetland feature west of Dixie Road. The staked out wetland boundary will then act as a constraint to guide the detailed design of the proposed local restoration works solution.

**Access and Staging:** Site #12 can be accessed directly from Dixie Road through City owned lands. The results of the tree inventory for this site should be referenced to develop an access and staging plan that limits the removal of mature trees and the overall area of environmental disturbance.

**Figure 4-4** illustrates the preferred alternative for Erosion Site #12.

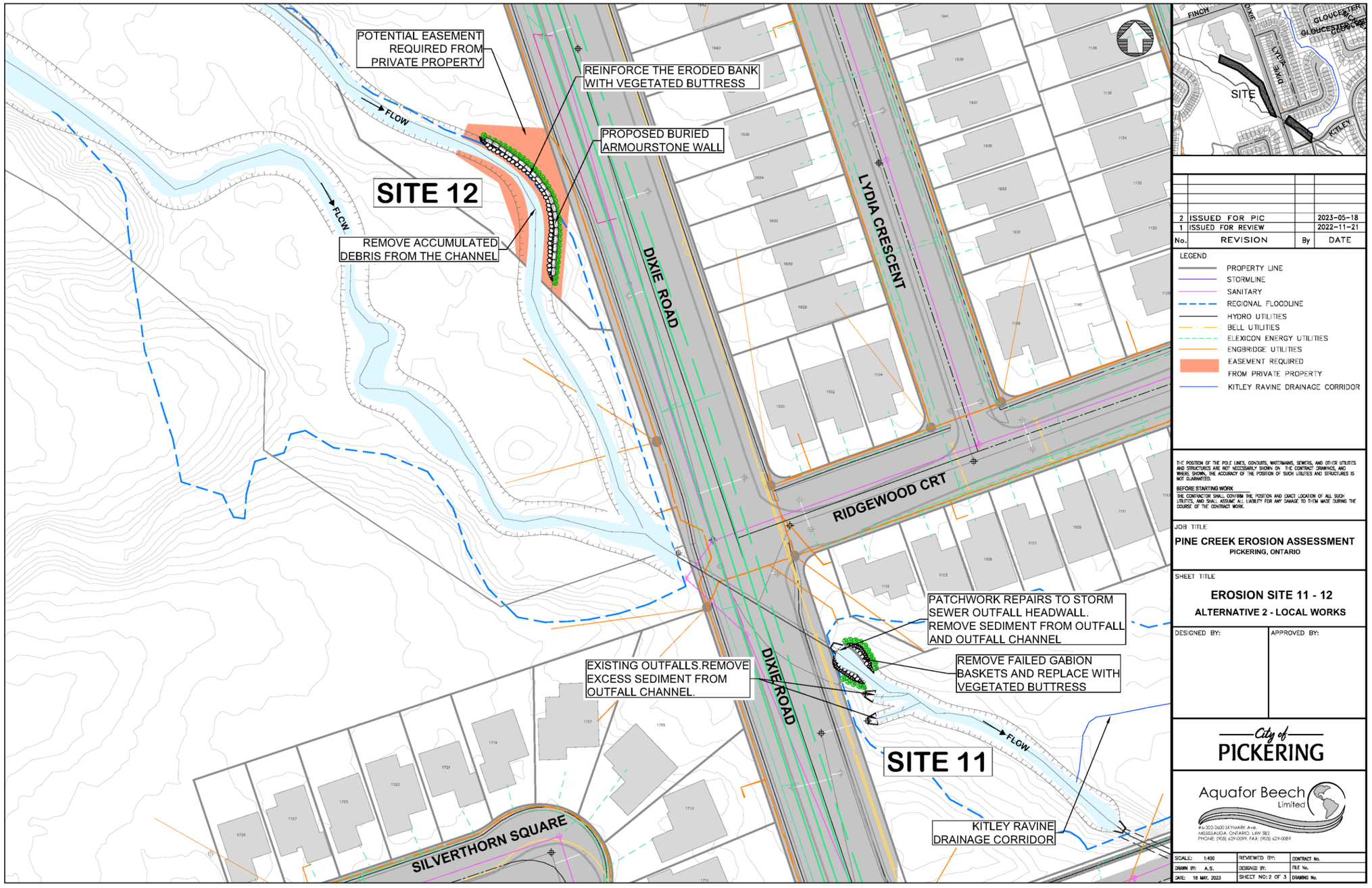



**Figure 4-4: Conceptual Drawing of Preferred Alternative for Erosion Sites #11 - #12 - Local Works**

## Erosion Sites #13 - #16: Alternative 3 – Extended Works

This proposed solution consists of a comprehensive reach-based natural channel design using riffle-pool morphology. The proposed channel works will extend from the northern boundary of the city owned property parcel south of Finch Avenue, downstream approximately 200 m to the confluence between the east and west branches of Pine Creek.

Additional site specific restoration will be undertaken along the length of the proposed channel rehabilitation works to provide enhanced erosion control at select priority sites. For sites #13 and #14, vegetated buttresses integrated into the regraded and revegetated slopes will provide toe of slope protection for private properties on Mountcastle Cresent. For Site #15, the Finch Avenue concrete headwall will be repaired, and the outfall channel will be rehabilitated through the placement of angular stone substrate.

With regard to Site #16, the proposed works will potentially involve the replacement of the degraded Finch Avenue CSP culvert, restoration of the Finch Avenue Swale and installation of an engineered sour pool to provide erosion mitigation where flows from the culvert and swale discharge to Pine Creek. These Site #16 works are to be considered by the Region of Durham pending further review. Restoration of the CSP culvert and roadside ditch outlet channel, while recommended, is outside the purview of the City of Pickering. Any channel restoration works completed by the City will be limited to City owned property.

**Access and Staging:** The proposed project site can be accessed from Finch Avenue. Access towards the downstream extent of the proposed restoration area is likely preferred given the topography of the area and the grade constraints associated with accessing the site near the Finch Avenue Culvert. The results of the tree inventory for this site should be referenced to develop an access and staging plan that limits the removal of mature trees and the overall area of environmental disturbance.

There is also Region of Durham sanitary sewer and storm sewer infrastructure that runs through this part of the Pine Creek Corridor. Should work be required in close proximity to regional sewer infrastructure, appropriate protection measures (i.e., steel plates) must be put in place to protect the sewer infrastructure. At the detailed design stage an SUE investigation should be completed to confirm the location all buried infrastructure onsite. Any proposed protection measures will need to be approved by the Region of Durham, or the corresponding utility authority, prior to implementation onsite.

**Figure 4-5** illustrates the preferred alternative for Erosion Sites #13 - #16.

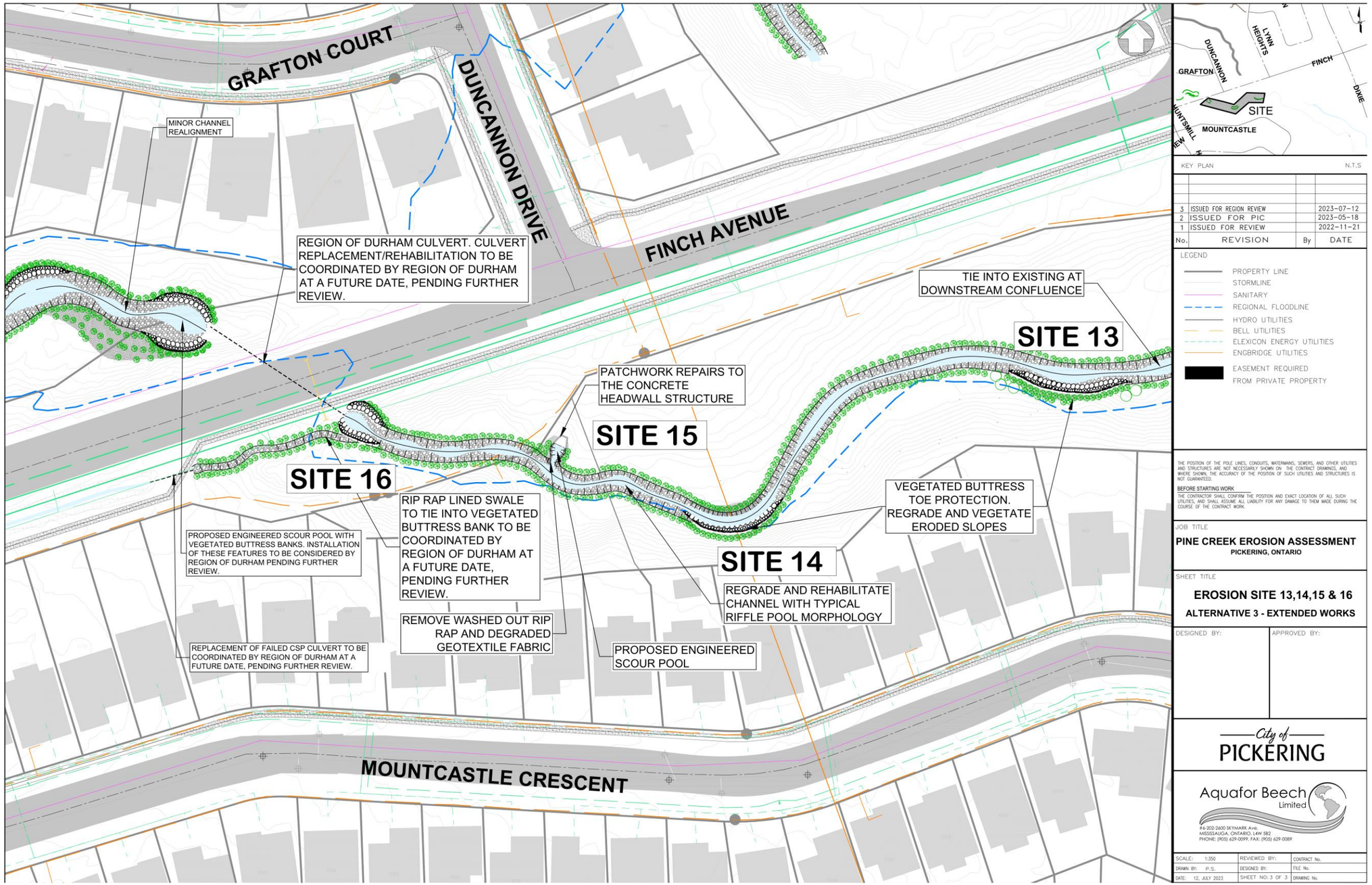



**Figure 4-5: Conceptual Drawing of Preferred Alternative for Erosion Sites #13 - #16 - Extended Works**

## Erosion Sites #17 - #18: Alternative 2 – Local Restoration Works

For Site #17, the proposed solution consists of a minor channel realignment and vegetated buttress bank protection to ensure the protection of private properties on Grafton Court. This work may require a Permission to Enter Agreement from the Region of Durham for the construction of the downstream most portion of the proposed restoration works. Any channel restoration works completed by the City will be limited to City owned property.

With regard to Site #18, vegetated buttress toe of slope protection is recommended to ensure the stability of the Finch Avenue Roadway embankment. Both of these proposed works involve the removal of debris and accumulated organic material from the channel area, to promote flow conveyance.

**Access and Staging:** Sites #17 and #18 can be accessed directly from Finch Avenue. The results of the tree inventory for this site should be referenced to develop an access and staging plan that limits the removal of mature trees and the overall area of environmental disturbance.

**Figure 4-6** illustrates the preferred alternative for Erosion Sites #17 - #18.

## Erosion Sites #20 - #21: Alternative 2 – Local Restoration Works

For Site #20, the proposed solution consists of vegetated buttress toe protection to provide slope stability for private properties on Duncannon Drive. Furthermore, this solution involves the removal of debris and accumulated organic material from the channel area, to promote flow conveyance.

With regard to Site #21, patchwork repairs to the Fairport Road headwall structure are recommended, to be combined with vegetated buttress bank protection and an engineered scour pool downstream of the outfall. At the detailed design stage, a CCTV inspection of the Fairport Road CSP outfall pipe is recommended to determine if pipe rehabilitation works are needed either in the form of CIPP lining or full pipe replacement.

**Access and Staging:** Site #20 can be accessed directly from Fairport Road. Access to Site #21 will be more challenging, requiring access along a steep valley corridor with a potential channel crossing. The initial point of access for Site #20 is likely either from the Fairport Road Right of Way or through the Erskine Church and Cemetery at which point a permission to enter agreement would be required. Lastly, the results of the tree inventory for these sites should be referenced to develop an access and staging plan that limits the removal of mature trees and the overall area of environmental disturbance.

**Figure 4-6** illustrates the preferred alternative for Erosion Sites #20 - #21.

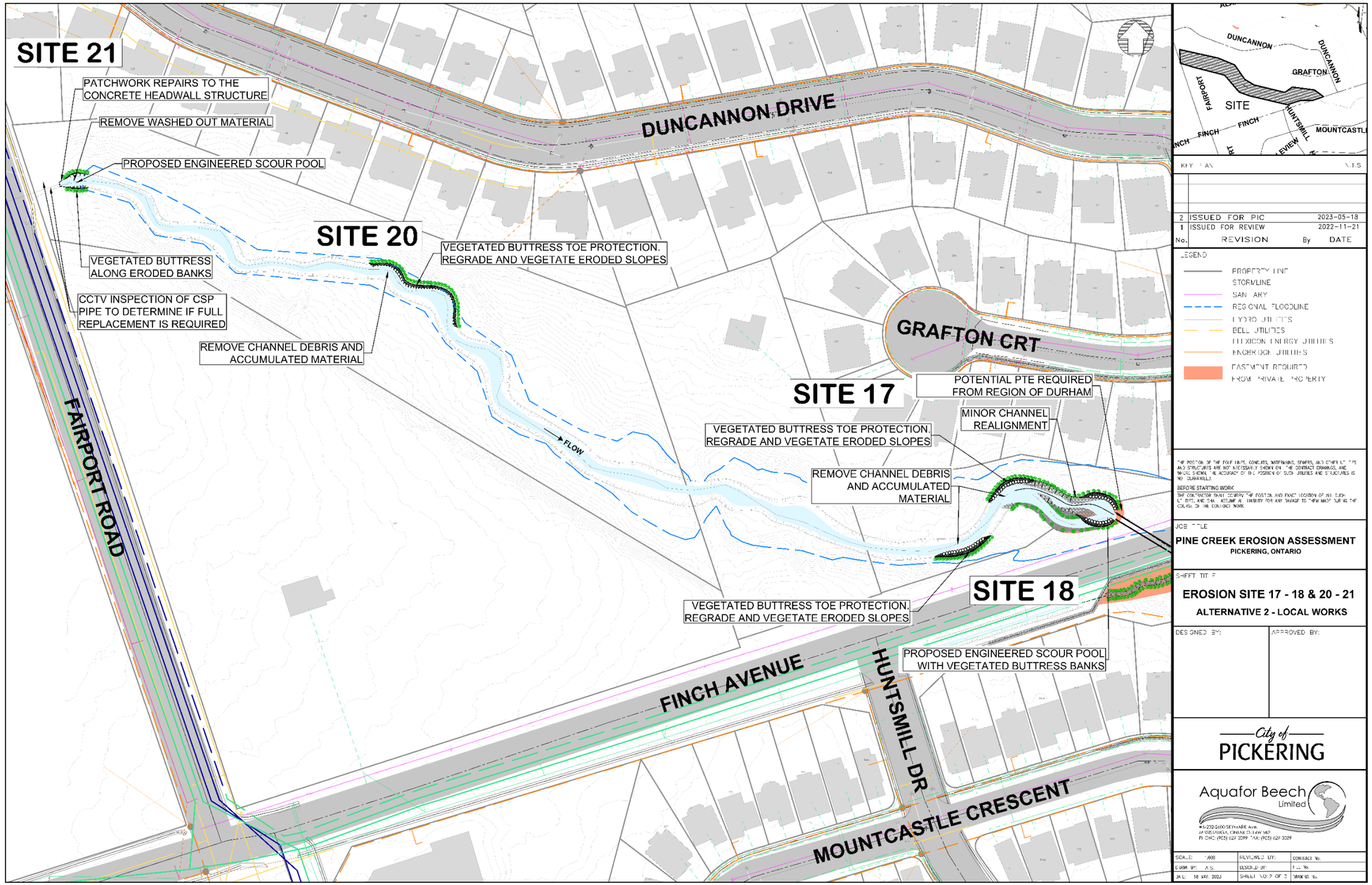



**Figure 4-6: Conceptual Drawing of Preferred Alternative for Erosion Sites #17 - #18, #20 - #21 – Local Works**

## Erosion Site #22: Alternative 2 – Local Restoration Works

At the detailed design stage, a comprehensive structural assessment of the Lynn Heights Drive culvert should be completed to determine if a full culvert replacement is required or if the culvert can be rehabilitated through CIPP lining or alternative means. Should a culvert replacement be required an SUE Level A investigation will be needed to identify potential utility conflicts. A detailed hydraulic analysis is also recommended to determine if the culvert needs to be upsized to meet current design standards for flow conveyance. A geotechnical investigation will also need to be completed to provide foundation recommendations for any proposed replacement structure. It is suggested that any potential culvert replacement look to improve fish and wildlife passage potential through the integration of nature substrate along the interior culvert bed.

The proposed local works solution also includes the construction of an engineered scour pool of either side of the Lynn Heights Drive culvert for erosion mitigation and removal of channel debris. While it may be possible to limit the extent of the proposed work area to the Municipally owned Right-of-way, if it is determined at the detailed design stage that extending the upstream and downstream channel works is required to achieve a geomorphically stable solution, then a Permission to Enter Agreement may need to be obtained from the upstream and downstream private property owners.

**Access and Staging:** Site #22 can be accessed directly from Lynn Heights Drive, with potential for staging within the Lynn Heights Drive Right of Way. Should a full culvert replacement be required, consideration should be given to constructing the culvert in two phases to avoid a full road closure and allow for half of the road to remain open to local traffic at a time.

**Figure 4-7** illustrates the preferred alternative for Erosion Site #22.

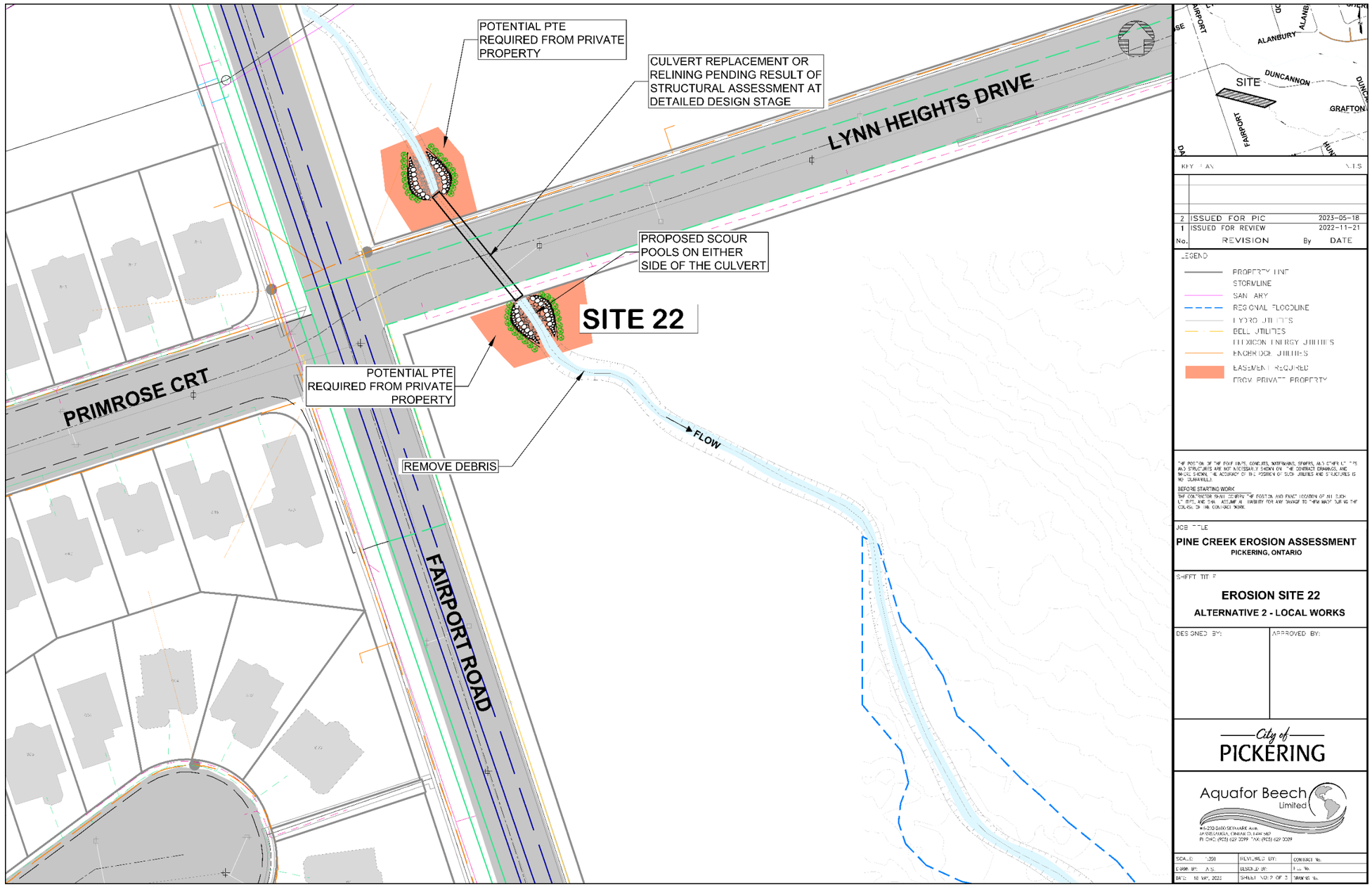



**Figure 4-7: Conceptual Drawing of Preferred Alternative for Erosion Site #22 – Local Works**

## Erosion Site #23 - #24: Alternative 2 – Extended Restoration Works

This proposed solution applies a comprehensive reach-based natural channel design using riffle-pool morphology, including vegetated buttress toe protection and re-vegetation of eroded slopes at key risk areas (i.e., Erosion Sites #23 and #24). The total length of the proposed channel restoration works is approximately 550 m. The primary focus of this work is to protect private properties on Duncannon Drive and to a lesser extent properties on Alanbury Crescent and Lynn Heights Drive. Accumulated channel debris will be removed at numerous locations throughout the study area, to improve flow conveyance and mitigate lateral bank erosion. Where feasible the channel should be realigned towards the center of the municipally owned parcel to increase the erosion buffer between the channel and at-risk private properties.

Where sufficient offsets from private properties exist, natural channel design principles can be applied to allow for future controlled rates of erosion and migration that mimic natural channel processes. In areas where the channel is more heavily constrained and risks to private property and infrastructure are greater, additional bioengineering or hardened erosion control approaches should be applied to establish a more fixed channel corridor. As part of the proposed restoration works a storm sewer outfall off of Alanbury Crescent will be restored along with it's associated outfall channel.

The restoration work proposed at Site #23 includes work on Private Property. Property owners will be advised of the ongoing erosion issues and associated risks on their property. Each individual property owner will ultimately be responsible for undertaking the necessary measures to mitigate the identified erosion related risks on their property using the concepts outlined in this EA or alternative methods (subject to all associated regulatory approvals at the detailed design stage). Alternatively, the City may give future consideration to an easement acquisition in order to complete creek restoration works on select private properties.

**Access and Staging:** Sites #23 and #24 can be accessed from Lynn Heights Drive through Lynn Heights Park. Care should be taken to limit impact to Park infrastructure and operations, with appropriate safety barricades and fencing put in place to protect the public from construction operations. Lastly, the results of the tree inventory for these sites should be referenced to develop an access and staging plan that limits the removal of mature trees and the overall area of environmental disturbance.

**Figure 4-8** illustrates the preferred alternative for Erosion Sites #23 - #24.

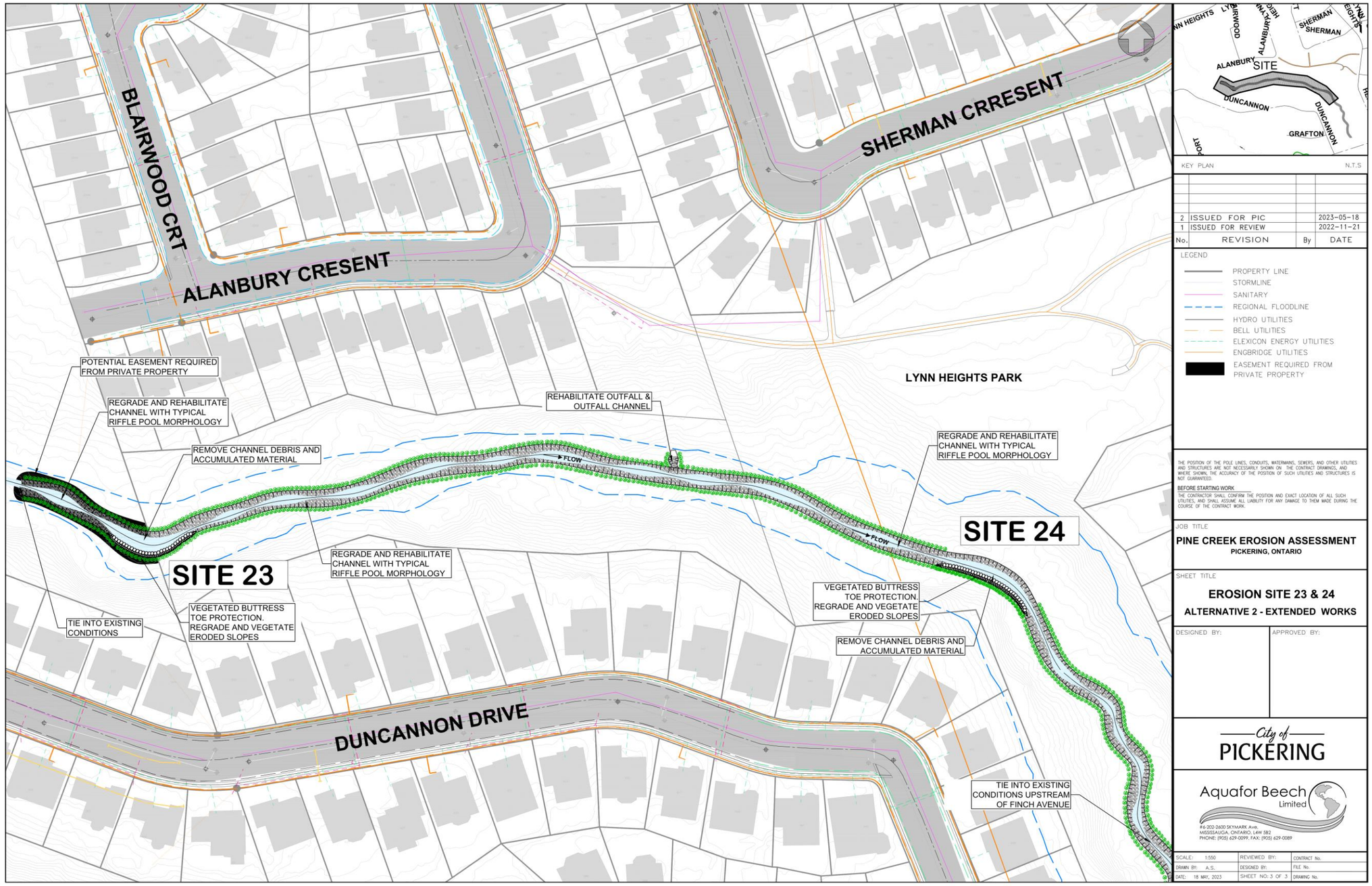



**Figure 4-8: Conceptual Drawing of Preferred Alternative for Erosion Sites #23 - #24 – Extended Works**

## Erosion Site #25: Alternative 2 – Targeted Corridor Rehabilitation

The proposed solution consists of recentering the drainage swale within the city owned parcel to reduce erosion and flooding risks to private properties. Taking into account feedback received from the public through the public information centre event, efforts will be made to reduce the amount of tree removals and overall disturbances to the natural environment.

Targeted areas of the channel with be realigned and regraded to achieve the desired alignment. A combination of plantings and bioengineering measures will be applied to provide erosion control, with the intent of maintaining and enhancing the natural aesthetic of the area. Work will be done with small equipment to reduce the disturbance area and minimize vegetation removals. Where feasible, material from required vegetation removals will be reused on-site to provide erosion control.

**Access and Staging:** Site #25 can be accessed from Kitley Avenue using the informal trail that runs through the Kitley Ravine. The park / open space area at the southern extent of the ravine can be used for staging.

**Figure 4-9** illustrates the preferred alternative for Erosion Site #25.

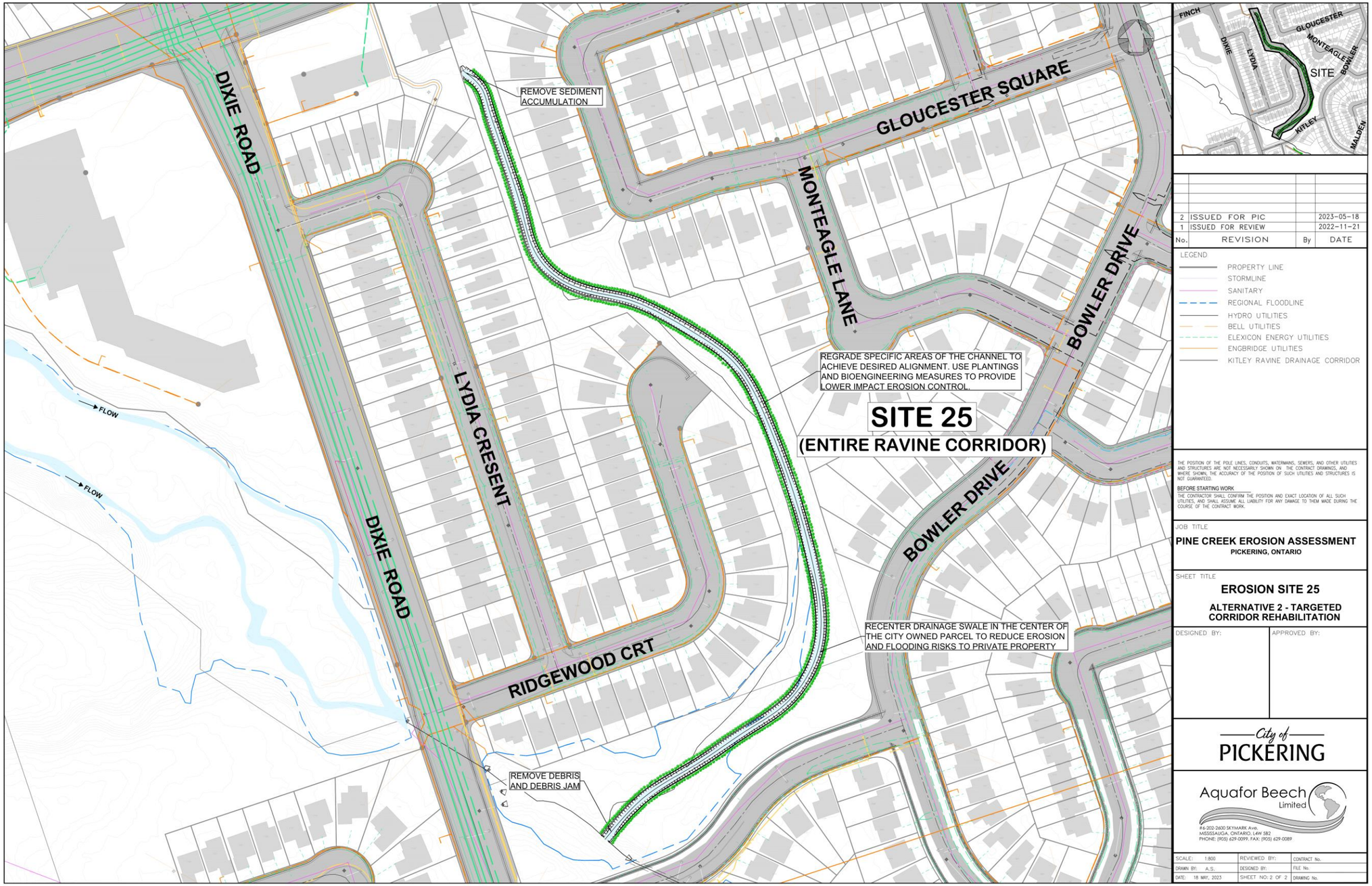



**Figure 4-9: Conceptual Drawing of Preferred Alternative for Erosion Site #25 – Targeted Corridor Restoration**

# 5 PRIORITIZATION AND PROJECT PHASING

Taking into account the dominant erosion processes and geomorphic trends observed within the Pine Creek sub watershed, and the relative levels of risk to infrastructure and private property, the preferred restoration alternatives presented above have been bundled and prioritized into a series of proposed capital works projects.

**Table 5-1** below, summarizes the key information associated with each project including the project name, erosion site number(s), a risk summary and risk rating on a scale of 1-5, reach ID, preferred alternative, property ownership impacts, cost estimates for engineering design and construction, and a recommended time horizon for implementation. While the project costs estimates and recommended time horizons are provided to assist the City with project prioritization, final decisions on the actual order and implementation of projects should give due consideration to overall City priorities, budgets and stakeholder interests.

For tentative planning and budgeting purposes only, a feasible implementation plan for the recommended erosion mitigation projects is organized into 0-5 years, 5-10 years and 10-15 years planning horizons.

The cost estimates provided below are preliminary and include a 20% contingency (rounded to the nearest $1,000). All cost estimates are exclusive of HST and do not account for any potential land or easement acquisition costs that may be required in some instances.

**Table 5-1: Proposed Prioritization and Phasing of Pine Creek Erosion Restoration Projects**

| Project Number | Project Name | Priority Sites - Risk Description | Risk Rating (1-5) | Reach ID | Preferred Alternative | Property Ownership | Construction Cost Estimate ($), including 20% Contingency | Consulting Cost Estimate ($), including 20% Contingency | Planning Horizon | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Culvert Replacement at Lynn Heights Drive | Site #22 - Erosion Risk to Culvert and Lynn Heights Drive | **5** | PC4-b | Local Works | City and Private | $2,088,000.00 | $417,600.00 | 0 - 5 Years | Cost Estimate assumes a full like for like culvert replacement and that no utility relocations will be required, only stabilization during construction |
| 2 | Restoration of Kitley Ravine | Site #25 - Erosion Risk to Private Properties | **5** | PC3-d | Extended Works | City | $1,620,000.00 | $324,000.00 | 0 - 5 Years | Area of Significant Public Concern |
| 3 | Restoration of Pine Creek Downstream of Finch Avenue | Site #13 - Erosion Risk to Private Property<br><br>Site #14 - Erosion Risk to Private Property<br><br>Site #15 - Erosion Risk to Storm Sewer Outfall<br><br>Site #16 - Erosion Risk to Private Property and Finch Avenue | **5** | PC4-a | Extended Works | City | $1,080,000.00 | $216,000.00 | 0 - 5 Years | Cost Estimate is inclusive of City Works only and does not account for possible future works by the Region of Durham to protect their infrastructure in this area. |
| 4 | Restoration of Pine Creek Downstream of Kitley Avenue | Site #9 - Erosion Risk to Multi-Use Trail and Private Property<br><br>Site #10 - Erosion Risk to Multi-Use Trail and Private Property | **5** | PC3-b | Extended Works | City | $840,000.00 | $168,000.00 | 0 - 5 Years | Area of Significant Public Concern<br><br>Interim monitoring at this site is recommended to document the rate of erosion. Should the bank erode faster than expected increasing the prioritization of this site is recommended. |
| 5 | Restoration of Pine Creek Upstream of Dixie Road | Site #12 - Erosion Risk to Dixie Road | **5** | PC3-c | Local Works | City and Private (1900 Dixie Road) | $504,000.00 | $100,800.00 | 0 - 5 Years | Interim monitoring at this site is recommended to document the rate of erosion. Should the bank erode faster than expected increasing the prioritization of this site is recommended. |

| Project Number | Project Name | Priority Sites - Risk Description | Risk Rating (1-5) | Reach ID | Preferred Alternative | Property Ownership | Construction Cost Estimate ($), including 20% Contingency | Consulting Cost Estimate ($), including 20% Contingency | Planning Horizon | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | Restoration of Pine Creek Upstream of Finch Avenue - East Branch | Site #23 - Erosion Risk to Private Property<br><br>Site #24 - Erosion Risk to Private Property | **4** | PC4-b | Extended Works | City and Private | $1,800,000.00 | $360,000.00 | 5 - 10 Years | Intended to provide long-term protection to private properties on Duncannon Drive and Alanbury Crescent.<br><br>May be opportunities to explore enhancements to Lynn Heights Park and the Communities Integration with the Creek System.<br><br>Comprehensive corridor maintenance, with local realignment and erosion mitigation at slope contacts. |
| 7 | Restoration of Pine Creek Upstream of Finch Avenue - West Branch | Site #17 - Erosion Risk to Private Property<br><br>Site #18 - Risk to Finch Avenue | **4** | PC4-a | Local Works | City | $768,000.00 | $153,600.00 | 5 - 10 Years | Cost Estimate is inclusive of City Works only and does not account for possible future works by the Region of Durham to protect their infrastructure in this area. |
| 8 | Restoration of Pine Creek Downstream of Fairport Road | Site #20 - Erosion Risk to Private Property<br><br>Site #21 - Erosion Risk to Storm Sewer Outfall | **4** | PC4-a | Local Works | City | $864,000.00 | $172,800.00 | 5 - 10 Years | If the budget allows it, could be bundled with Project #7 as one larger capital works project.<br><br>The cost estimate does not include for lining or replacement of the CSP culvert beneath Fairport Road. |
| 9 | Localized Restoration of Pine Creek Upstream of Kingston Road | Site #1 - Erosion Risk to Kingston Road and Storm Sewer Infrastructure<br><br>Site #2 - Erosion Risk to Private Property<br><br>Site #3 - Erosion Risk to Storm Sewer Infrastructure<br><br>Site #4 - Erosion Risk to Pedestrian Bridge | **4** | PC3-a | Local Works | City | $732,000.00 | $146,400.00 | 5 - 10 Years | Cost Estimate is inclusive of City Works only and does not account for possible future works by the Region of Durham to protect their infrastructure in this area. |

| Project Number | Project Name | Priority Sites - Risk Description | Risk Rating (1-5) | Reach ID | Preferred Alternative | Property Ownership | Construction Cost Estimate ($), including 20% Contingency | Consulting Cost Estimate ($), including 20% Contingency | Planning Horizon | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| 10 | Erosion Control Works Downstream of Dixie Road to Protect at Risk Culvert Crossing | Site #11 - Erosion Risk to Culvert | **4** | PC3-c | Local Works | City | $288,000.00 | $57,600.00 | 5 - 10 Years | If the budget allows it, could be bundled with any of Projects #1, #3 or #4 as one larger capital works project |
| 11 | Localized Restoration of Pine Creek Upstream of Glenanna Road | Site #5 - Erosion Risk to Glenanna Culvert Crossing<br><br>Site #6 - Erosion Risk to Parkland<br><br>Site #7 - Erosion Risk to Parkland<br><br>Site #8 - Erosion Risk to Parkland | **2** | PC3-b | Local Works | City | $432,000.00 | $86,400.00 | 10 - 15 Years | To be completed in conjunction with a change to Park Operations to limit excess mowing of riparian vegetation in David Farr Park |

# 6 PUBLIC CONSULTATION

Consultation is an essential requirement of the Municipal Class EA process. Consultation is the process of identifying interested and potentially affected parties and informing them about the project, soliciting knowledge of the local environment, and receiving input about key project decisions before those decisions are finalized. Consultation and outreach activities have included providing project information to, and requesting comments/feedback from members of the public, public agencies and other stakeholders.

Public engagement activities completed in support of the EA include the following:

- Notice of Commencement
- Online Engagement
- Public Information Centre
- Public and Stakeholder Correspondence
- Notice of Completion

A comprehensive communications log summarizing the public consultation process is provided at the end of this section in **Table 6-2.** Detailed descriptions of the key public consultation activities and milestones are provided below.

## 6.1 Notice of Commencement

A Notice of Commencement was prepared and distributed to residents and stakeholders on July 28th, 2022 by the consulting team and the City of Pickering. A copy of the Notice of Commencement is included in **Appendix J**. The purpose of the Notice of Commencement was to inform the public and stakeholders about the Pine Creek Erosion Assessment being undertaken to address erosion risks to infrastructure and public property within the Pine Creek corridor between Kingston Road and Fairport Road. Interested parties were given the opportunity to learn more about the study and engage directly with the City of Pickering and Aquafor Beech Limited through the contact information provided in the notice.

## 6.2 Online Engagement

A project webpage was hosted on the City of Pickering's website. Information related to the Class EA study was posted on this webpage, including a study overview, an overview of the Class EA process, study notices, Public Information Centre Materials, and contact information for questions or comments.

The link to the project webpage is provided below:

https://www.pickering.ca/en/city-hall/pine-creek-erosion-assessment-mcea-study.aspx

## 6.3 Online Engagement

A Stakeholder List was developed at the commencement of the Class EA Study, and updated throughout the study based on requests received. The list included Indigenous Communities identified by the Ministry of the Environment, Conservation and Parks (MECP), provincial government ministries, the Region of Durham, City of Pickering, Toronto and Region Conservation Authority, landowners adjacent to the study area, interest groups, and residents. A summary of the Stakeholder List is provided in **Table 6-1.**

Residents added to the list included those living adjacent to the study area and additional residents who requested to be included on the list. Resident names have not been included in this Project File report for privacy reasons.

**Table 6-1: Stakeholder List Summary**

| Stakeholder Group | Name |
|---|---|
| Indigenous Communities | Curve Lake First Nation<br>Mississaugas of Scugog Island First Nation<br>Alderville First Nation<br>Hiawatha First Nation<br>Rama First Nation<br>Chippewas of Georgina Island<br>Beausoleil<br>Huron-Wendat |
| Provincial Government Ministries | Ministry of the Environment, Conservation and Parks<br>Ministry of Natural Resources and Forestry<br>Ministry of Tourism, Culture and Sport |
| Region of Durham | Works Department<br>Emergency Medical Services<br>Paramedic Service<br>Planning and Economic Development Dept.<br>Regional Transit / Transportation Infrastructure |
| City of Pickering | Various Staff |
| Conservation Authority | Toronto and Region Conservation Authority (TRCA) |
| Utility Operators | Bell Canada<br>Rogers Telecommunications<br>Trans Canada Pipelines<br>Enbridge Gas<br>MTS Allstream<br>Hydro One |
| Interest Groups / Other Stakeholders | Ontario Provincial Police<br>Durham District School Board<br>Claremont and District Community Association<br>Claremont Public School |
| Residents | Residents adjacent to the study area<br>Residents who submitted a request to be added to the contract list |

## 6.4 Public Information Centre

An in-person 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 Notice of Public Information Centre was delivered by Mail to local residents and posted on the City Website on May 4th, 2023. A copy of the Notice of Public Information Centre is provided in **Appendix J**. The in-person PIC was later held on May 18th, 2023 from 6:00 – 8:00 pm at the Chestnut Hills Developments Recreation Complex. Copies of the PIC materials, including boards and comment sheets, were made available on the City's Webpage, with a comment submission window provided from May 18th, 2023 to June 2nd, 2023. Copies of the PIC comments sheets are provided in **Appendix J**.

The presented PIC boards outlined the study purpose, background, findings as well as next steps. A copy of the PIC boards is appended to **Appendix K**. The PIC boards outline the following items:

- The study area extents;
- The objectives of the study and the purpose of the PIC;
- The Municipal Class EA – Schedule B process;
- Natural heritage assessment and Species at Risk;
- Vegetation communities;
- Fisheries and aquatic habitat;
- The hydrology and existing conditions of Pine Creek within the study area;
- Erosion site inventory;
- The evaluation criteria for proposed alternatives;
- The evaluation approach;
- Alternative solutions;
- Problems and opportunities;
- Site-specific findings and proposed preliminary preferred alternatives;
- The next steps in the process.

A significant number of comments were received from the public during and after the PIC event. Three major areas of concern were identified by the public as noted below:

1. The public expressed significant concern regarding the erosion observed at priority sites #9 and #10, where active bank erosion is encroaching towards the multi-use trail downstream of Kitley Avenue creating a potential public safety hazard. The public generally supported the preliminary preferred alternative which recommended extended works be implemented to realign the channel and protect the eroded bank from failure.
2. Several members of the public also expressed concerns regarding the erosion observed at priority sites #13 – 16, where channel widening downstream of Finch Avenue is creating risks to private properties on Mountcastle Crescent. The public generally supported the preliminary preferred alternative which recommended extended works be implemented to rehabilitate this degraded section of Pine Creek.
3. The area of greatest public interest was the degraded state of the Kitley Ravine, identified through the EA as priority site #25. While the public supported rehabilitation of the ravine corridor, there were significant concerns about tree removals, potential disturbances to the natural environment and impacts to the informal trail system that runs through the ravine corridor. Taking into account public feedback, a new alternative, targeted corridor rehabilitation, was proposed to allow for a less intrusive restoration of the creek corridor.

## 6.5 Summary of Public & Stakeholder Comments and Responses

The public and all project stakeholders were given an opportunity to contact the project team with their comments by either email or phone call for the duration of the study. Several emails were received following the issuance of the Notice of Commencement and the PIC event. The public identified a number of erosion related risks to private property and municipal infrastructure, all of which were generally well captured through the Erosion Sites identified as part of the EA study. There is general public support towards the planned rehabilitation of Pine Creek to address erosion risks, although suggested areas of prioritization varied from stakeholder to stakeholder. The public also raised concerns about

construction related disturbances to the natural environment, particularly with respect to tree removals. **Table 6-2** below provides a summary of all public and stakeholder communications, with a detailed record of all correspondence provided in **Appendix J**.

## 6.6 Region of Durham

The Region of Durham operates and maintains significant infrastructure within the EA project study area, including the Kingston Road culvert crossing, the Finch Avenue culvert crossings, and a regional sanitary sewer that runs intermittingly through the valley corridor. Erosion Risks to Regional Infrastructure were identified through the EA process (Erosion Sites #1 and #16), and shared with the Region of Durham engineering team for information purposes. The Region of Durham has acknowledged receipt of these findings and noted that they may look to address these risks through their future capital works program. Ultimately, the projects proposed through this EA are scoped to address risks to City infrastructure and private property only. Any identified erosion related risks to Regional Infrastructure are to be addressed by the Region at their discretion.

## 6.7 Impact of Public Consultation on Selection of the Preferred Alternative

Based on the feedback received through the public consultation process described above, a new alternative was introduced for erosion site #25 (degradation of the Kitley Ravine Corridor). The new alternative is defined as "Targeted Corridor Rehabilitation" and encompasses a less intrusive restoration of the Kitley Ravine than the originally proposed "Full Corridor Rehabilitation" alternative. Under the targeted rehabilitation approach, less intrusive construction equipment will be used, tree removals will be minimized, areas of restoration will be scoped to only the highest priority areas to diminish the overall area of disturbance, and bioengineering measures will be used for erosion control in-lieu of the placement of angular stone substrate. "Targeted Corridor Rehabilitation" was ultimately selected as the preferred alternative taking into consideration the feedback received from the public. While this alternative was not presented to the public at the PIC, it most effectively addresses their concerns related to environmental disturbances, tree removals and a desire to maintain a natural channel aesthetic.

## Public Consultation - Communications Log

| Date (dd/mm/yy) | From | To | Medium (e.g., email, letter, call) | Communication Description - Nature of Concern(s) or Interest(s) | Response/Follow Up |
|---|---|---|---|---|---|
| 02-08-2022 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Residents and Stakeholders as Defined in the Project Stakeholder List. | Email, posting on City website, and posting in local newspapers | Notice of Study Commencement – Introduction to the Project | **Follow-up:** City of Pickering to invite residents and stakeholders to an open house to discuss the EA. |
| 02-08-2022 | **Antony Manoharan**<br>Project Manager – Stormwater Management<br>Regional Municipality of Durham | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email | Request to have Doug Robertson replaced with Antony Manoharan as the Region of Durham point of Contact for the EA Study. | **Follow-up:** Project stakeholder list updated as per the Region's Request. |
| 08-08-2022 | **Adam Kennedy**<br>Regional Planner<br>Ministry of Natural Resources and Forestry | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email | Provided MNRF Comments on the EA Circulation | **Follow-up:** Proponent and their agents to ensure MNRF comments are addressed / taken into account through the EA process.<br><br>Adam Kennedy added to Stakeholder List.<br><br>Consultant requested clarification from MNRF on their protocol for preventing conflicts with Beavers. |
| 09-08-2022 | **Adam Kennedy**<br>Regional Planner<br>Ministry of Natural Resources and Forestry | **Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email | Provided clarification on MNRF's protocol for preventing conflicts with Beavers. | **Follow-up:** Proponent and their agents to follow the appropriate protocol for dealing with Beavers. |

## Public Consultation - Communications Log

| Date (dd/mm/yy) | From | To | Medium (e.g., email, letter, call) | Communication Description - Nature of Concern(s) or Interest(s) | Response/Follow Up |
|---|---|---|---|---|---|
| 12-08-2022 | **Anthony Pigaidoulis**<br>Local Resident | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email | Notify the Proponent and their agents of ongoing erosion issues within the Kitley Ravine. | **Follow-up:** Noted erosion issues to be assessed and report on through the EA process. |
| 12-08-2022 | **Caroline Mugo**<br>Senior Planner<br>TRCA | **Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email | Request that Nathan Jenkins be added to the Stakeholder list as the primary point of contact for TRCA | **Follow-up:** Stakeholder list updated accordingly. |
| 16-09-2022 | **Mimi Santano Carrasco**<br>Regional Environmental Planner<br>MECP | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email | Provided MECP Comments on the EA Circulation | **Follow-up:** Proponent and their agents to ensure MECP comments are addressed / taken into account through the EA process.<br><br>Mimi Santano Carrasco added to Stakeholder List |
| 16-09-2022 | **Nathan Jenkins**<br>Planner,<br>TRCA | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email | Provided TRCA Comments on the EA Circulation | **Follow-up:** Proponent and their agents to ensure TRCA comments are addressed / taken into account through the EA process. |

# Public Consultation - Communications Log

| Date (dd/mm/yy) | From | To | Medium (e.g., email, letter, call) | Communication Description - Nature of Concern(s) or Interest(s) | Response/Follow Up |
|---|---|---|---|---|---|
| 18-10-2022 | **Dan Minkin**<br>Heritage Planner<br>Ministry of Citizenship and Multiculturalism | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email | Provided MCM Comments on the EA Circulation. | **Follow-up:** Proponent and their agents to ensure MCM comments are addressed / taken into account through the EA process. |
| 04-05-2023 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Residents as Defined in the Project Stakeholder List. | Email, Mail-out | Issue a Notice of Public Information Centre. PIC to be held in person Thursday May 18th, 2023 from 6:00 pm – 8:00 pm. | |
| 05-05-2023 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Non-Residential Stakeholders as Defined in the Project Stakeholder List. | Email | Issue a Notice of Public Information Centre. PIC to be held in person Thursday May 18th, 2023 from 6:00 pm – 8:00 pm. | |
| 08-05-2023 | **Antony Manoharan**<br>Project Manager<br>Region of Durham<br>Works Department | **Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email | Responded to Notice of PIC, asking to receive a copy of the PIC boards once they are posted for review. The Region with then review the boards and provide comments. | **Follow-up:** Project team to send the Region of Durham a copy of the PIC boards once they are posted for review. |

## Public Consultation - Communications Log

| Date (dd/mm/yy) | From | To | Medium (e.g., email, letter, call) | Communication Description - Nature of Concern(s) or Interest(s) | Response/Follow Up |
|---|---|---|---|---|---|
| 08-05-2023 | **Suzanne Harding**<br>Resident | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email | Acknowledged receipt of the PIC notice and requested that more information be provided on the project's environmental impacts. | **Follow-up:** Proponent/Agent provided a response with a copy of the PIC boards. |
| 09-05-2023 | **Paul Darby**<br>Resident | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering | Email | Sharing of concerns regarding observed erosion and flooding issues between Glenanna Road and Kingston Road. | **Follow-up:** Proponent/Agent provided a response with a copy of the PIC boards. |
| 18-05-2023 | **Jeannette Anderson**<br>Resident | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | PIC Comment Response Form | Made note of observed erosion downstream of Finch Street behind Mountcastle Crescent.<br><br>Made note of a natural spring located downstream of the western Finch Culvert.<br><br>Inquired who is responsible for addressing erosion in this area as part of the lands are owned by the City and the other part of the lands are owned by the Region? | **Follow-up:** Proponent/Agent to document PIC comment responses and take into account public input in the preparation of the project file report. |
| 18-05-2023 | **Suzanne Harding**<br>Resident | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | PIC Comment Response Form | Made note that debris in the channel needs to be removed to help mitigate erosion.<br><br>Reported that they support some erosion restoration work, but do not want to see a complete stripping of the natural environment. Very concerned about tree lose. | **Follow-up:** Proponent/Agent to document PIC comment responses and take into account public input in the preparation of the project file report. |

## Public Consultation - Communications Log

| Date (dd/mm/yy) | From | To | Medium (e.g., email, letter, call) | Communication Description - Nature of Concern(s) or Interest(s) | Response/Follow Up |
|---|---|---|---|---|---|
| 18-05-2023 | **Anonymous**<br>Resident | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | PIC Comment Response Form | Made note of concerns regarding beaver activity in Pine Creek and voiced support for the proposed EA alternatives. | **Follow-up:** Proponent/Agent to document PIC comment responses and take into account public input in the preparation of the project file report. |
| 23-05-2023 | **Adrian Bhagwandin**<br>Resident | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering | Email | Request to be added to EA Contact List and inquiry regarding alternatives that are being proposed near Silverthorn Square. | **Follow-up:** Proponent/Agent provided a copy of the PIC boards and added the Resident to the EA contact list. |
| 23-05-2023 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering | **Dale**<br>Resident | Email | Shared photos of the Mountcastle outfall restoration project (pre and post restoration). | |
| 29-05-2023 | **Chris Coniam**<br>Resident | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email | Shared information regarding ongoing Erosion behind Lydia Crescent. Requested to be added to the project mailing list, and asked who they need to speak to about getting permission to build a private retaining wall structure. | **Follow-up:** Proponent/Agent added the Resident to the EA contact list and provided TRCA contact information to allow the resident to follow-up with TRCA about the process for getting a permit to construct a retaining wall. |

# Public Consultation - Communications Log

| Date (dd/mm/yy) | From | To | Medium (e.g., email, letter, call) | Communication Description - Nature of Concern(s) or Interest(s) | Response/Follow Up |
|---|---|---|---|---|---|
| 31-05-2023 | **Martin Herzog**<br>Resident | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email / Letter | Provided background on the history of erosion in Pine Creek and recent proliferation of erosion downstream of Kitley Avenue.<br><br>Provided recommendations for implementation of extended erosion control and stream rehabilitation works at sites 9, 10, & 12 as well as the Kitley Ravine.<br><br>Made note that the EA should specify smaller equipment be used during construction to limit tree removals. | **Follow-up:** Proponent/Agent to document PIC comment responses and take into account public input in the preparation of the project file report. |
| 31-05-2023 | **Paul Dalton**<br>Resident | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email | Shared questions about the preferred restoration alternative for Erosion Site #25 and asked to be added to the stakeholder list. | **Follow-up:** Proponent/Agent added the Resident to the EA contact list and provided answers to the Resident's questions regarding the nature of the proposed restoration alternatives. |
| 02-06-2023 | **Jeannette Anderson**<br>Resident | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email | Shared a description of erosion concerns behind Mountcastle Crescent. Inquired about TRCA planting program. | **Follow-up:** Proponent/Agent to document PIC comment responses and take into account public input in the preparation of the project file report. |
| 02-06-2023 | **Anthony Pigaidoulis**<br>Resident | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Online Form Submission | Response to PIC comment form comments, with an emphasis on discussing erosion along the Kitley Ravine. | **Follow-up:** Proponent/Agent to document PIC comment responses and take into account public input in the preparation of the project file report. |

# Public Consultation - Communications Log

| Date (dd/mm/yy) | From | To | Medium (e.g., email, letter, call) | Communication Description - Nature of Concern(s) or Interest(s) | Response/Follow Up |
|---|---|---|---|---|---|
| 05-06-2023 | **Janet Mosher**<br>Sr. Project Manager<br>Region of Durham<br>Works Department | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering | Email | Asked that moving forward the Region be given a copy of materials presented to the public for their review and approval prior to publication, if any of the materials involve Region of Durham Infrastructure. | **Follow-up:** Proponent clarified that the EA alternatives will be revised and scoped to only include for works to protect city infrastructure and private property. |
| 07-06-2023 | **Antony Manoharan**<br>Project Manager<br>Region of Durham<br>Works Department | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email | Provided the Region of Durham's comments on the PIC boards. | **Follow-up:** Proponent and their agents to ensure Region of Durham comments are addressed / taken into account through the EA process. |
| 12-06-2023 | **Paul Leithwood**<br>Planner<br>TRCA | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email | TRCA provided their comments on the PIC Boards. | **Follow-up:** Proponent and their agents to ensure TRCA comments are addressed / taken into account through the EA process. |
| 01-02-2024 | **Jacob Ursulak**<br>Water Resources Analyst<br>Aquafor Beech Limited | **Antony Manoharan**<br>Project Manager<br>Region of Durham<br>Works Department | Email | Provided a copy of the Draft Project File Report for Region of Durham Review | **Follow-up:** Region of Durham to review the draft project file report and provide any comments before the report is published. |

## Public Consultation - Communications Log

| Date (dd/mm/yy) | From | To | Medium (e.g., email, letter, call) | Communication Description - Nature of Concern(s) or Interest(s) | Response/Follow Up |
|---|---|---|---|---|---|
| 01-02-2024 | **Jacob Ursulak**<br>Water Resources Analyst<br>Aquafor Beech Limited | **Paul Leithwood**<br>Planner<br>TRCA | Email | Provided a copy of the Draft Project File Report for TRCA Review | **Follow-up:** TRCA to review the draft project file report and provide any comments before the report is published. |
| 08-02-2024 | **Jacob Ursulak**<br>Water Resources Analyst<br>Aquafor Beech Limited | **Gavin Battarino**<br>A/Supervisor<br>Project Review Unit, Environmental Assessment Services Section<br>Environmental Assessment Branch<br>Ministry of the Environment, Conservation and Parks | Email | Provided a copy of the Draft Project File Report for MECP Review | **Follow-up:** MECP to review the draft project file report and provide any comments. |
| 14-02-2024 | **Chunmei Liu**<br>Regional Environmental Planner<br>Ministry of the Environment, Conservation and Parks | **Jacob Ursulak**<br>Water Resources Analyst<br>Aquafor Beech Limited | Email | MECP noted they had reviewed the draft Project File report and also noted they had no comments. | |
| 22-02-2024 | **Antony Manoharan**<br>Project Manager<br>Region of Durham<br>Works Department | **Jacob Ursulak**<br>Water Resources Analyst<br>Aquafor Beech Limited | Email | Region of Durham provided their comments on the draft project file report. | **Follow-up:** Project team to update the draft project file report to address Region of Durham comments prior to publishing the final report for public review. |

## Public Consultation - Communications Log

| Date (dd/mm/yy) | From | To | Medium (e.g., email, letter, call) | Communication Description - Nature of Concern(s) or Interest(s) | Response/Follow Up |
|---|---|---|---|---|---|
| 19-04-2024 | **Paul Leithwood**<br>Planner<br>TRCA | **Irina Marouchko**<br>Manager, Water Resources<br>City of Pickering | Email / Letter | TRCA provided their comments on the draft project file report. | **Follow-up:** Project team to update the draft project file report to address TRCA comments prior to publishing the final report for public review. |
| 08-05-2024 | **Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | **Antony Manoharan**<br>Project Manager<br>Region of Durham<br>Works Department | Email / Letter | Provided comment responses to the Region of Durham addressing their comments on the draft project file report. | |
| 08-05-2024 | **Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | **Paul Leithwood**<br>Planner<br>TRCA | Email / Letter | Provided comment responses to the TRCA addressing their comments on the draft project file report. | |
| 10-05-2024 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Residents and Stakeholders as Defined in the Project Stakeholder List. | Email, posting on City website, and posting in local newspapers | Notice of Study Completion | **Follow-up:** Comments on the Project File Report to be provided to the City's Project Manager, Irina Marouchko, by Monday June 10th, 2024. |

# 7 INDIGENOUS ENGAGEMENT

Based on consultation with the Ministry of the Environment, Conservation and Parks (MECP) it was determined that the City of Pickering should notify and consult with indigenous communities about the proposed project and any potential impacts on existing land or credibly-asserted Aboriginal and treaty rights. As per the MECP's direction the following Indigenous Communities were engaged:

1. Curve Lake First Nation
2. Mississaugas of Scugog Island First Nation
3. Alderville First Nation
4. Hiawatha First Nation
5. Rama First Nation
6. Chippewas of Georgina Island
7. Beausoleil
8. Huron-Wendat

An engagement summary log is provided in **Table 7-1** below, with detailed correspondence records appended to **Appendix L**. A summary of key consultation milestones is provided below.

## 7.1 Project Notification Letters

Letters addressed to each First Nations community with a copy of the project Notice of Commencement appended to the end were distributed on December 8th, 2022 by the consulting team and the City of Pickering. The purpose of these project introduction letters was to inform the Indigenous Communities about the Pine Creek Erosion Assessment being undertaken to address erosion risks to infrastructure and public property within the Pine Creek corridor between Kingston Road and Fairport Road. Each First Nations was given the opportunity to learn more about the study and engage directly with the City of Pickering and Aquafor Beech Limited through the contact information provided in the project notification letter. Copies of the project notifications letters are included in **Appendix L**.

Responses to the Notification Letters were received from the Alderville First Nation and the Chippewas of Rama First Nation. Both groups acknowledged the study, and asked to be kept informed as the EA process moves forward.

## 7.2 Notice of Public Information Centre

The Notice of Public Information Centre was emailed to each First Nation Community on May 5th, 2023. A copy of the Notice of Public Information Centre is provided in **Appendix L**. A response to the Notice of PIC was provided by the Hiawatha First Nation correcting the incorrect Salutation used in the notification email. The Hiawatha First Nation asserted that they are not stakeholders but rather inherent rights and treaty holders. They also noted they would review the PIC materials and provided any comments if they had any concerns with the study. Since the completion of the PIC event on May 18th, 2023 no further comments were received from the Hiawatha First Nation or any of the other First Nations Communities.

## 7.3 Sharing of the Stage 1 Archaeological Assessment Report

As a third point of contact, the project team shared a copy of the finalized Stage 1 Archaeological Assessment report with each of the eight First Nations. A copy of the Stage 1 Archaeological Assessment Report is provided in **Appendix M**.

# First Nations Consultation - Communications Log

| Date (dd/mm/yy) | From | To | Medium (e.g., email, letter, call) | Communication Description - Nature of Concern(s) or Interest(s) | Response/Follow Up |
|---|---|---|---|---|---|
| 08-12-2022 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Alderville First Nation | Email | Notice of Study Commencement – Introduction to the Project | **Follow-up:** City of Pickering provide an invitation to an open house to discuss the EA. |
| 08-12-2022 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Beausoleil First Nation | Email | Notice of Study Commencement – Introduction to the Project | **Follow-up:** City of Pickering provide an invitation to an open house to discuss the EA. |
| 08-12-2022 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Chippewas of Georgina Island First Nation | Email | Notice of Study Commencement – Introduction to the Project | **Follow-up:** City of Pickering provide an invitation to an open house to discuss the EA. |
| 08-12-2022 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Chippewas of Rama First Nation | Email | Notice of Study Commencement – Introduction to the Project | **Follow-up:** City of Pickering provide an invitation to an open house to discuss the EA. |

# First Nations Consultation - Communications Log

| Date (dd/mm/yy) | From | To | Medium (e.g., email, letter, call) | Communication Description - Nature of Concern(s) or Interest(s) | Response/Follow Up |
|---|---|---|---|---|---|
| 08-12-2022 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Curve Lake First Nation | Email | Notice of Study Commencement – Introduction to the Project | **Follow-up:** City of Pickering provide an invitation to an open house to discuss the EA. |
| 08-12-2022 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Hiawatha First Nation | Email | Notice of Study Commencement – Introduction to the Project | **Follow-up:** City of Pickering provide an invitation to an open house to discuss the EA. |
| 08-12-2022 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Huron-Wendat First Nation | Email | Notice of Study Commencement – Introduction to the Project | **Follow-up:** City of Pickering provide an invitation to an open house to discuss the EA. |
| 08-12-2022 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Mississaugas of Scugog Island First Nation | Email | Notice of Study Commencement – Introduction to the Project | **Follow-up:** City of Pickering provide an invitation to an open house to discuss the EA. |

# First Nations Consultation - Communications Log

| Date (dd/mm/yy) | From | To | Medium (e.g., email, letter, call) | Communication Description - Nature of Concern(s) or Interest(s) | Response/Follow Up |
|---|---|---|---|---|---|
| 08-12-2022 | **Dave Simpson**<br>Alderville First Nation | **Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email | Acknowledged receipt of the Notice of Commencement and asked to be kept posted of progress as the project moves forward. | |
| 19-12-2022 | **Samantha Craig-Currow**<br>Associate General Counsel, Legal<br><br>Chippewas of Rama First Nation | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email | Provided an updated email address to use for consultation purposes. | **Follow-up:** First Nations contact listed updated to reflect the updated email address for consultation purposes. |
| 05-05-2023 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Alderville First Nation | Email | Notice of Public Information Centre (PIC) | |
| 05-05-2023 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Beausoleil First Nation | Email | Notice of Public Information Centre (PIC) | |

# First Nations Consultation - Communications Log

| Date (dd/mm/yy) | From | To | Medium (e.g., email, letter, call) | Communication Description - Nature of Concern(s) or Interest(s) | Response/Follow Up |
|---|---|---|---|---|---|
| 05-05-2023 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Chippewas of Georgina Island First Nation | Email | Notice of Public Information Centre (PIC) | |
| 05-05-2023 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Chippewas of Rama First Nation | Email | Notice of Public Information Centre (PIC) | |
| 05-05-2023 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Curve Lake First Nation | Email | Notice of Public Information Centre (PIC) | |
| 05-05-2023 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Hiawatha First Nation | Email | Notice of Public Information Centre (PIC) | |

# First Nations Consultation - Communications Log

| Date (dd/mm/yy) | From | To | Medium (e.g., email, letter, call) | Communication Description - Nature of Concern(s) or Interest(s) | Response/Follow Up |
|---|---|---|---|---|---|
| 05-05-2023 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Huron-Wendat First Nation | Email | Notice of Public Information Centre (PIC) | |
| 05-05-2023 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Mississaugas of Scugog Island First Nation | Email | Notice of Public Information Centre (PIC) | |
| 05-05-2023 | **Tom Cowie**<br>Lands/Resources Consultation<br><br>Hiawatha First Nation | **Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Email | Corrected the Salutation used in the Notice of PIC email, noting that the Hiawatha First Nation are not stakeholders, and are instead inherent rights and treaty holders.<br><br>It was noted the Hiawatha Nation is reviewing the information provided and that they will provide comments if they have any concerns. | **Follow-up:** Rob Amos responded noting appreciation for the correction on the incorrectly applied salutation while also noting that the project team looks forward to receiving and incorporating any input the Hiawatha First Nation may have. |
| 10-05-2024 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Alderville First Nation | Email / Letter | Notice of Study Completion | **Follow-up:** Comments on the Project File Report to be provided to the City's Project Manager, Irina Marouchko, by Monday June 10th, 2024. |

# First Nations Consultation - Communications Log

| Date (dd/mm/yy) | From | To | Medium (e.g., email, letter, call) | Communication Description - Nature of Concern(s) or Interest(s) | Response/Follow Up |
|---|---|---|---|---|---|
| 10-05-2024 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Beausoleil First Nation | Email / Letter | Notice of Study Completion | **Follow-up:** Comments on the Project File Report to be provided to the City's Project Manager, Irina Marouchko, by Monday June 10th, 2024. |
| 10-05-2024 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Chippewas of Georgina Island First Nation | Email / Letter | Notice of Study Completion | **Follow-up:** Comments on the Project File Report to be provided to the City's Project Manager, Irina Marouchko, by Monday June 10th, 2024. |
| 10-05-2024 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Chippewas of Rama First Nation | Email / Letter | Notice of Study Completion | **Follow-up:** Comments on the Project File Report to be provided to the City's Project Manager, Irina Marouchko, by Monday June 10th, 2024. |
| 10-05-2024 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Curve Lake First Nation | Email / Letter | Notice of Study Completion | **Follow-up:** Comments on the Project File Report to be provided to the City's Project Manager, Irina Marouchko, by Monday June 10th, 2024. |

# First Nations Consultation - Communications Log

| Date (dd/mm/yy) | From | To | Medium (e.g., email, letter, call) | Communication Description - Nature of Concern(s) or Interest(s) | Response/Follow Up |
|---|---|---|---|---|---|
| 10-05-2024 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Hiawatha First Nation | Email / Letter | Notice of Study Completion | **Follow-up:** Comments on the Project File Report to be provided to the City's Project Manager, Irina Marouchko, by Monday June 10th, 2024. |
| 10-05-2024 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Huron-Wendat First Nation | Email / Letter | Notice of Study Completion | **Follow-up:** Comments on the Project File Report to be provided to the City's Project Manager, Irina Marouchko, by Monday June 10th, 2024. |
| 10-05-2024 | **Irina Marouchko**<br>Sr. Water Resources Engineer<br>City of Pickering<br><br>**Rob Amos**<br>Consultant Project Manager<br>Aquafor Beech Limited | Mississaugas of Scugog Island First Nation | Email / Letter | Notice of Study Completion | **Follow-up:** Comments on the Project File Report to be provided to the City's Project Manager, Irina Marouchko, by Monday June 10th, 2024. |

# 8 IMPLEMENTATION PLAN

## 8.1 Detailed Design and Investigations

Upon completion of the EA, each recommended capital works project will require a detailed design process prior to construction. The detailed design will include additional technical investigations and inventories, with the primary deliverable to be a design package used for construction. This package will be subject to regulatory review and permitting. A brief overview of the additional inventories and deliverables to be completed in support of each detailed design package is summarized below.

For each project a detail design package will include the preparation of 60%, 90% and final design drawings for review by the City, TRCA and relevant stakeholders. Each detailed design package will include the following components:

- **General plan - Existing Conditions and Removals:** Outlines project extents, property ownership and proposed site removals;
- **General plan - Proposed Conditions:** Delineates the proposed restoration designs including the proposed length of channel rehabilitation works and any proposed erosion control structures;
- **Plan and profile drawings:** Defines alterations to the planimetric alignment and longitudinal profile of Pine Creek;
- **Cross-Sections:** Outlines proposed changes to the cross-sectional configuration of Pine Creek;
- **Site Access and Staging Plan:** Delineates the recommended site access, staging and stockpile areas;
- **Erosion and sediment control plan**: Defines ESC requirements as per the Erosion and Sediment Guidelines for Urban Construction, GGHACA, as well as applicable TRCA standards and guidelines. Should also include proposed flow management solutions to establish a dry working condition. Flow management solutions may include such measures as bypass pumping, implementation of a bypass flume or installation of longitudinal coffer dams.
- **Landscape restoration plans:** Includes tree removal, preservation and planting plans. The development of restoration plans should take into account impacts areas associated with different Ecological Land Classifications as well as TRCA guidelines;
- **Construction details:** Outlines the construction requirements for key design components; and
- **Associated design brief:** Provides supplementary design information to support the permitting and construction process.

As part of the design process, additional inventories and plans will be required to further inform the design.

### 8.1.1 *Hydraulic Assessment*

A hydraulic assessment of the proposed conditions will need to be undertaken for each project to facilitate permitting with the TRCA. The results of each assessment will be included in the various project design briefs. Computation of peak velocities, shear stresses and stream powers for bank full and peak floods (i.e., 2–100-year events and Regional Storm) shall be included and incorporated into evaluation of the proposed remedial measures. The assessment will be used to confirm that no negative flooding or erosion

impacts will result from the proposed works, a condition of TRCA permits, and to size the material for the channel bed and bank restoration works. To facilitate permitting, an existing and proposed conditions model will need to be prepared to allow for a comparison of the proposed designs impacts on water surface elevations as well as channel velocities, shear stresses and stream power values.

When using the results from the hydraulic modelling assessment to adjust the cross-sectional design of the channel, efforts should be made to promote floodplain connectivity. Ideally, the bankfull depth of the channel should be exceeded for all storms events greater than the 2-year return period flow. In instances where this is infeasible due to site constraints, best efforts should be made such that the level of floodplain connectivity is either maintained or enhanced through implementation of the proposed design solution. As a TRCA permitting requirement, incremental and cumulative riparian storage volumes may need to be assessed at 0.3 m increments for both existing and proposed model conditions. The results of this assessment should confirm that there is no loss in riparian storage volumes as a result of the implementation of the proposed works.

Consideration should also be given on a project-by-project basis to explore opportunities for the installation of wetland pockets to help attenuate flows, create new habitat and reduce erosion. Pocket wetlands may be constructed adjacent to channel rehabilitation works or in line with storm sewer outfall channels.

### 8.1.2 *Geomorphic Assessment*

A detailed geomorphic assessment should be undertaken at the detailed stage to build on the findings of this report and ensure all proposed channel restoration works are designed accounting for dominant geomorphic trends and key fluvial geomorphology principles. Particular care should be taken at transition regions between proposed works and existing conditions to ensure these vulnerable areas remain geomorphically stable in the long-term.

### 8.1.3 *Geotechnical Investigation*

A geotechnical investigation should be undertaken to determine the engineering properties of the existing soils for bank protection works. The details of the geotechnical investigation are to be determined by a qualified geotechnical engineer in consultation with the stream restoration consultant.

Borehole logs containing appropriate and sufficient data should be prepared. Information from the boreholes is to be used for assessments of slope stability, soil properties for channel design, soil contamination, and any other geotechnical recommendations for engineered structures. Furthermore, soil chemical testing should be undertaken to provide recommendations for the disposal of excess material offsite in accordance with O.Reg. 406/19.

### 8.1.4 *Utilities Confirmation*

Further SUE investigations will be required to confirm the impact of each proposed restoration design on the utilities and underground services within the proposed restoration areas. The utilities may include, but are not limited to, electricity, natural gas, cable television, telephone, water, sanitary sewer, and storm sewer.

SUE investigations should be completed in sufficient detail to identify all above ground and buried infrastructure within each project site. Prior to the start of construction, utility protection measures will need to be confirmed with each corresponding utility authority.

### 8.1.5 *Tree Inventory*

A tree inventory, arborist report, and tree preservation plan will need to be completed as part of the detailed design process for each project to support permitting efforts with MECP and TRCA. Impacts to existing trees and any implications under the City's by-law (including any associated protection or replanting requirements related to those impacts) should be detailed upon the completion of the tree inventory and leveraged to prepare site restoration plans that satisfy the requirements of all regulatory review agencies. Tree inventories should include the full expected area of construction related disturbance, including proposed access and staging areas. Every effort should be made to design access and staging areas that will minimize tree removals and environmental impacts.

### 8.1.6 *Natural Heritage System*

The mitigation measures discussed above in **Section 3.6 - 3.8** should be reviewed and further developed for implementation as part of the detailed design and construction tender. Agency consultation and related approvals should be pursued including, as required, the DFO Request for Review and MECP consultation regarding Endangered Species via the submission of an IGF.

#### *8.1.6.1 General Mitigation Measures*

**Erosion and Sediment Control**

Erosion and sedimentation control techniques are necessary precautions to minimize sediment entry into surrounding creeks and/or storm sewer pipes. Installation of construction fencing and erosion & control silt fence are required well in advance of construction activities. Construction fencing and access routes shall be clearly delineated and appropriate setbacks maintained from private property for the duration of construction works. Sediment and erosion control measures should remain in place until vegetation has become established.

Sediment and erosion control measures should also act as wildlife exclusion fencing to prevent small mammals and herpetofauna from entering disturbance areas.

Public lands should be restored with woody vegetation as a part of bank stabilization efforts.

Potential sources for sedimentation related to construction activities include sediments disturbed and deposited by construction vehicles and blowing sand and dust. The following mitigating measures are proposed:

- Place sediment traps to receive storm runoff during construction;
- Provide tire washing facilities for construction vehicles that exit the site;
- Install silt fencing along the perimeters of the work sites where appropriate to prevent migration of sediment-laden storm runoff;
- Cover exposed excavated material to prevent erosion by rain and wind; and
- Water or other dust suppressants to be employed during construction to control release of dust particles to the air.

An erosion and sediment control plan will be prepared and the selection of appropriate measures will be addressed during the detailed design stage. The erosion and sediment controls indicated are the minimum that are required. It is necessary to ensure that all erosion and sediment control measures are functional prior to and throughout the duration of construction.

**Fuel Spills**

Fuel spills may occur during the onsite refueling of construction equipment, and may potentially contaminate surface and groundwater as well as soils. Recommended mitigation measures include the following:

- Refueling in designated areas outside of the NHS;
- Spill containment for on-site storage tanks; and
- Develop and Implement as needed a spill clean-up contingency plan.

### 8.1.7 *Stage 2 Archaeological Assessment*

Stage 2 Archaeological Assessment work is required for Projects 1, 2, 4, 5, 9, 10 and 11. The Stage 1 report (AMICK, 2023) recommends the following with respect to the Stage 2 archaeological assessment:

1. A portion of the Study Area exhibits archaeological potential. These lands require Stage 2 archaeological assessment by test pit survey at five-meter intervals, prior to any proposed impacts;
2. The remainder of the Study Area does not retain archaeological potential on account of deep and extensive land disturbance, slopes in excess of 20 degrees or being previously assessed. These lands do not require further archaeological assessment; and,
3. Should the proposed work extend beyond the current Study Area, further Stage 1 archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

Engagement with the First Nations is recommended via field liaison representation during the Stage 2 Archaeological Assessment;

### 8.1.8 *Permissions to Enter*

Within the study area, Pine Creek is located on both public and private property. For select projects, Permission to Enter Agreements are required for a temporary construction access / staging.

Where works are proposed on private property, the property owner will be advised of the ongoing erosion issues and associated risks on their property. Each individual property owner will ultimately be responsible for undertaking the necessary measures to mitigate the identified erosion related risks on their property using the concepts outlined in this EA or alternative methods (subject to all associated regulatory approvals at the detailed design stage). Alternatively, the City may give future consideration to an easement acquisition in order to complete creek restoration works on select private properties.

## 8.2 Permits

Prior to construction it will be necessary to coordinate the environmental approvals and permits necessary to complete the intended works. At this time, it is Aquafor's

understanding that reviews or approvals from TRCA, MECP, and DFO may be required. A brief summary of permits and approvals is included below:

TRCA – Section 28.1 Permit - TRCA permits will be required at the detailed design stage under Section 28.1 of the Conservation Authorities Act. This typically involves two submissions (60% & 90% design), and will include supporting design brief information.

DFO – Assessment under the Federal Fisheries Act – A certified fisheries biologist will complete a Self-Assessment based on the detailed design for the proposed works. Based on similar experiences, at minimum a Letter of Advice may will be required from DFO.

MECP Species at Risk Permit – Under the evolving MECP policy regarding SAR Habitat, a regulatory exemption clause has been published for "non-imminent threats to health and safety" under O.Reg. 242/08 (23.18) to the *Endangered Species Act*, which allows certain works to proceed without a permit regardless of their potential impacts, including:

- *Work to **maintain, repair, remove or replace an existing structure or any infrastructure** [specifically: a communications system; an electric power system, oil or gas pipeline, alternative energy system or renewable energy system; a road or railway system; water works, wastewater works, stormwater works and associated facilities; or drainage works designed to control surface water runoff, other than a drainage work to which section 23.9 applies], including the decommissioning of a mine, **or to upgrade an existing structure or any of the aforementioned infrastructure to meet a safety standard**, **if**:*
    - *i. **the maintenance, repair, removal, replacement, decommissioning or upgrade does not require:***
        - ***a temporary or permanent change to the location of the structure or infrastructure, or***
        - ***a temporary or permanent extension of the area the structure or infrastructure occupies**, except in the case of the replacement of an existing culvert with a new culvert that is larger than the one it replaces,*
    - *ii. in the case of work to maintain, repair, replace or upgrade a structure or infrastructure, the work does not alter the way in which the structure or infrastructure is used or operated.*

- *Work to protect against drought, flooding, forest fires, **unstable slopes and erosion as long as the protection does not include the building of new infrastructure**."*

As part of the proposed works, one culvert replacement is planned at the north end of the study area (replacing an existing structure with a new structure of a similar size). New erosion control works (armourstone walls, buttresses) will be installed at all sites to protect existing infrastructure. No new sewer or road infrastructure is planned at this time. As such, the proposed works qualify for this exemption, as they are emergency measures intended to prevent against unstable slope and erosion and do not involve the building of new infrastructure.

As part of the exemption, a Notice of Activity must be submitted through the provincial website (ONe-key) to register the project prior to commencing the proposed works. Although there are no associated additional approval application or review as part of this process, the proposed works are still obligated to minimize their effects on SAR (e.g.,

providing mitigation such as timing restriction on vegetation removal, following in-water works timing windows and standard DFO mitigation measures to prevent harm to fish, as well as providing habitat restoration/compensation as appropriate). A mitigation plan should be prepared, and records of the activity maintained, should the MECP request a review at a later date.

## 8.3 Construction Services

All tender documentation will be completed applicable to the City of Pickering or TRCA 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. The consulting engineer will typically assist the City during the tendering and procurement period as required, providing responses and clarification to bidders during the procurement process.

Inspection and administration services during construction under the guidance of a professional engineer (or geomorphologist) who has been integrated in the design and is well versed in similar construction projects is required. Tasks undertaken as part of the supervision role will include:

- Attend regular (bi-weekly) progress meetings, including pre-construction meeting, prepare and distribute meeting minutes within 5 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., Erosion and Sediment Control 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.

## 8.4 Monitoring Program

A 2-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 project ecologist. Both the monitoring and warranty will be defined to suit the detailed design, and satisfy City, TRCA and other agency requirements.

## 8.5 As-Constructed Drawings and Analysis

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

The HEC-RAS model should be updated to match as-built conditions (should the comparative analysis to the design highlight differential conditions), and the updated HEC-RAS model should be applied accordingly to confirm no negative impacts to flooding.

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