



Mill Creek Ravine Pedestrian Bridge Replacements (B304-314)- Environmental Impact Assessment

City of Edmonton | 15616
Final Report

August 2020

Report: CR_00031



ISL Engineering and Land Services Ltd. Is an award-winning full-service consulting firm dedicated to working with all levels of government and the private sector to deliver planning and design solutions for transportation, water, and land projects.

Concordance Table

Response to Comments Received August 17, 2020.

Table 2.2: Bridge Locations

Review Comment	Response	EIA Report Section Reference
EPCOR Drainage Services (Water and Sewer Servicing)		
Our records indicate that no water and/or sewer services exist within the area of the proposal directly off EPCOR mains.	No response required	n/a
EPCOR Drainage Services (Drainage Planning and Engineering)		
No Drainage concerns, however I did notice the hydrology/drainage effects while listed in the table weren't in either summary which was slightly misleading as there are effects and mitigations that need to be put in place.	Mitigation measures are provided in Table 5.1, and the impacts to drainage have been added to the Summary Assessment in Section 7.1	Table 5.1 Section 7.1
Business Planning and Support (Engineering Services)		
Geotechnical completed a technical review of the 2020 Thurber geotechnical report referenced in the EIA. The 2020 Thurber geotechnical report was comprehensive in nature and appeared to provide the requisite information to address geotechnical issues for the project. As such, it is anticipated that geotechnical issues that may arise during subsequent phases of this project can be mitigated through on-going support of the Geotechnical Engineer of Record (Thurber).	No response required	n/a
City Planning (Growth Planning, Urban Growth and Open Space Strategy)		
As noted in the EIA (page 9) the bridge identified as B314 falls within the Altalink corridor. At this time, I'm not certain whether the City has specific agreements with Altalink, or whether this would result in additional requirements/procedures for access to the site and repair of the bridge. I didn't see this detailed in Section 2.5 Regulatory Framework or elsewhere in the report.	Updated EIA to indicate that B314 is within an Altalink Corridor, and that the City will ensure all agreements are in place prior to construction.	Section 2.5.2
City Planning (Open Space Network and Assembly, Urban Growth and Open Space Strategy)		
Please confirm the rare plant survey and related results are provided under the EIA report	No response required in EIA. A Rare Plant Survey was completed as part of the EIA Vegetation Assessment (see Section 4.5.2) and no Rare Plants were observed by the Professional Biologist.	n/a
Please confirm the restoration plan and adoption of bioengineering whenever possible for consideration at next stages	No response required in EIA. A restoration plan will be developed for the Project, separate from the EIA, for approval through Natural Areas.	n/a
Tree protection and conservation plan should be developed and shared prior to the construction for Natural Area Team review and approval.	No response required in EIA. A Tree Preservation Plan is being developed for the Project, separate from the EIA, for approval with Natural Areas.	n/a
Ensure best construction practice to reduce vegetation removal and safe handling of creek banks to reduce sedimentation and erosion	No response required in EIA. The Contractor shall have to follow all best construction practices and outline their work plan within their ECO plan to protect Mill Creek and reduce sediment and erosion.	n/a

Review Comment	Response	EIA Report Section Reference
The EIA should provide a clear outline including the work required to be completed during and post construction with a clear role and responsibilities. It includes but is not limited to ECO plan, restoration and landscaping work, monitoring of such work including CCC/FAC, tree protection and conservation plan etc.	Updated EIA to be clear on roles and responsibilities of the Contractor, such as completion of ECO plan, restoration work, CCC/FAC, and following of tree protection and restoration plan	Section 2.4.2
Please ensure environmental risk assessment and required mitigation plans are being considered for the required site if there exists any potential contamination given the replacement of wooden infrastructure. The project should be responsible for specific site treatment and mitigation if contamination is reported within the existing bridge locations.	No response required in EIA. A thorough ESA has been completed for potential contamination on site, and no results of concerns have been noted. The Contractor will be required to have a contaminant discovery plan within their ECO Plan.	n/a
Please ensure any other jurisdictional approvals and follow up if required as a part of this project. Also it is the project team's responsibility to ensure other City requirements e.g. required land access, URW and ROW permit if applicable.	No response required in EIA.	n/a
Community and Recreation Facilities (River Valley Parks and Facilities)		
No comments or concerns.	n/a	n/a
Comments from Parks and Roads Services (Natural Area Operations)		
We appreciated the detail provided in the Fisheries Habitat Mapping and uPLVI mapping	n/a	n/a
Please aim to minimize vegetation removal where possible, particularly the mature coniferous trees surrounding the bridge areas.	No response required in EIA. Bridge alignments have been altered to protect numerous mature coniferous trees and a Tree Preservation Plan is being developed for the Project	n/a
NAO will be completing some tree risk mitigation along the access trails and around the bridges this fall to reduce hazards and improve access in some areas.	No response required in EIA	n/a
Please ensure that any landscaping/restoration plans are reviewed by naturalareaoperations@edmonton.ca prior to approval. Restoration will be very important where any disturbance is to occur to help minimize any weed/invasive species establishment.	No response required in EIA. A Restoration Plan is being developed for the Project, separate from the EIA, for approval.	n/a
A Tree Preservation Plan will be required prior to construction to help ensure the preservation of vegetation during the construction and landscaping work of this project.	No response required in EIA. A Tree Preservation Plan is being developed for the Project, separate from the EIA, for approval.	n/a
Comments from Parks and Roads Services (Resource Planning and Land Development):		
Upon approval of the plan, a site meeting with Natural Areas will be required to review construction plans and tree protection. This meeting will need to be scheduled a minimum of four weeks in advance of the construction start date. This is to review access points, placement of all permanent or temporary construction material required for this project, and to determine tree protection requirements for construction within 5 meters of any City tree. For any vegetation removal, please ensure the area has been clearly staked. Note the laydown area fencing must be installed outside the dripline of any adjacent trees.	No response required in EIA.	n/a

Review Comment	Response	EIA Report Section Reference
Please be advised that all costs associated with pruning, removal, tree damage, or replacement shall be covered by the Proponent as per the Corporate Tree Management Policy. Natural Areas will schedule and carry out all required tree work involved with this project. Please contact naturalareaoperations@edmonton.ca to arrange this meeting.	No response required in EIA.	n/a
Any soil damage or compaction compromising the tree's root system within the parkland space shall be corrected by and at a cost to the Proponent. Please be advised that all costs associated with soil remediation, watering, and tree protection shall be covered by the Proponent as per the Corporate Tree Management Policy.	No response required in EIA.	n/a
Please note that the removal of vegetation has the opportunity to impact birds and bird habitat. Protection of migratory and non-migratory birds is legislated federally and provincially and enforceable regardless of whether or not individual environmental reviews conducted in accordance with the River Valley Bylaw include discussions of these topics. The onus is on the individual or company conducting habitat disturbance or construction activities to ensure that due diligence has been exercised to avoid harm to migratory and non-migratory birds. Individuals or companies that do not avoid harm to most wildlife species risk prosecution under the Wildlife Act and, in some cases, the Species at Risk Act. In the case of migratory birds, prosecution under the Migratory Birds Convention Act is also possible.	No response required in EIA. Construction is planned to occur within winter months and will require an appropriate wildlife survey prior to construction during nesting season. .	n/a

Disclaimer

This document entitled “Mill Creek Ravine Pedestrian Bridge Replacements (B304-314)- Environmental Impact Assessment” has been prepared by ISL Engineering and Land Services Ltd. (ISL) for the use by the City of Edmonton. The information and data provided herein represent ISL’s professional judgment at the time of preparation. ISL denies any liability whatsoever to any other parties who may obtain this report and use it, or any of its contents, without prior written consent from ISL. Information provided by third parties is believed to be accurate but is not guaranteed.

Sincerely,

ISL Engineering and Land Services Ltd.

Authors:



Brent Piche, P. Biol.
Environmental Scientist



Robyn Gamber, P. Biol.
Environmental Scientist

Reviewer

Soren Poschmann, P. Geo.
Lead, Hydrogeology

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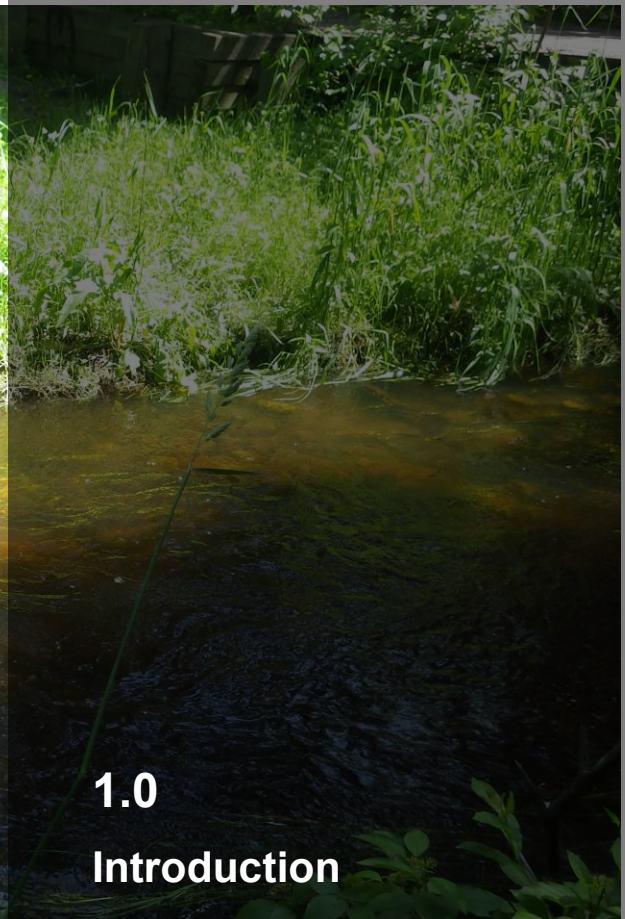
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1.0

Introduction



1.1 Background

The City of Edmonton's Integrated Infrastructure Services (the City) is proposing to replace the 11 existing pedestrian bridges at Mill Creek east of 50th Avenue and north of 34th Avenue in Edmonton, Alberta (the Project). The bridge locations are depicted in Figure 1.1. The existing pedestrian bridges have experienced progressive deterioration to the point where maintenance activities are unable to correct deficiencies and replacement is required.

1.2 Bylaw 7188 Environmental Review

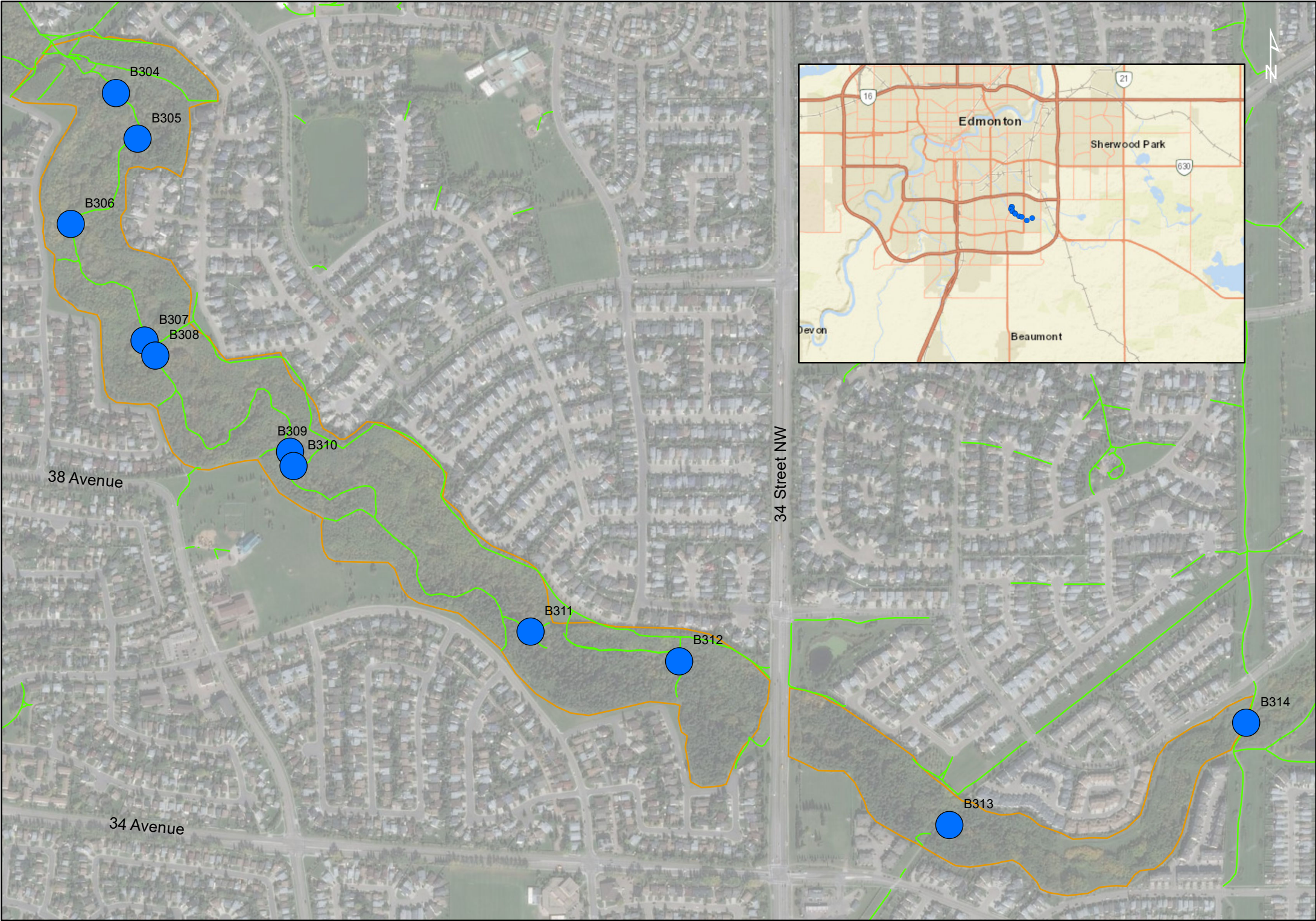
The Project is located within the North Saskatchewan River Valley area, managed under the City's *North Saskatchewan River Valley Development Plan, Bylaw 7188* and amendments (City of Edmonton 2018). The North Saskatchewan River Valley and Ravine system is considered the most unique natural feature in Edmonton and the largest urban open space in North America (City of Edmonton 2018). The major goals of the North Saskatchewan River Valley Area Redevelopment Plan are: environmental preservation, provide a public recreation area, the opportunity for cultural, recreational and aesthetic benefits, and to ensure the communities of Rosedale and Cloverdale are retained and enhanced within the River Valley.

An environmental review is required for most activities in the River Valley (City of Edmonton 2000). Large-scale capital works, excavation or new construction with a change of existing use would be defined as Major Work and requires an Environmental Impact Assessment (EIA).

On March 5, 2020, the City's Urban Form and Corporate Strategic Development department (Urban Form) indicated that replacement of the existing bridges would be considered Major Work and thus require an Environmental Impact Assessment (EIA) and Site Location Study (SLS) under Bylaw 7188, to be reviewed by internal City departments and ultimately by City Council. Urban Form deemed it to be acceptable to include all 11 bridges in one EIA report.

1.3 Objectives

An EIA and SLS were scoped with Urban Form and described in the EIA Terms of Reference (TOR) (ISL 2020a; Appendix A). This is a capital project that involves excavation works, as a result the appropriate level for the assessment was determined to be an EIA. This EIA provides a summary of existing environmental conditions in the Project area, an assessment of potential interactions of the Project's Valuable Ecosystem Components (VECs), and mitigation measures. This EIA also provides information on required regulatory approvals, permits and best practices required to remain in compliance with federal and provincial legislation in addition to municipal policies.



Legend

- Bridge
- LSA
- Parks Trail

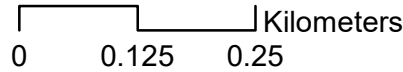


FIGURE 1.1
BRIDGE LOCATIONS





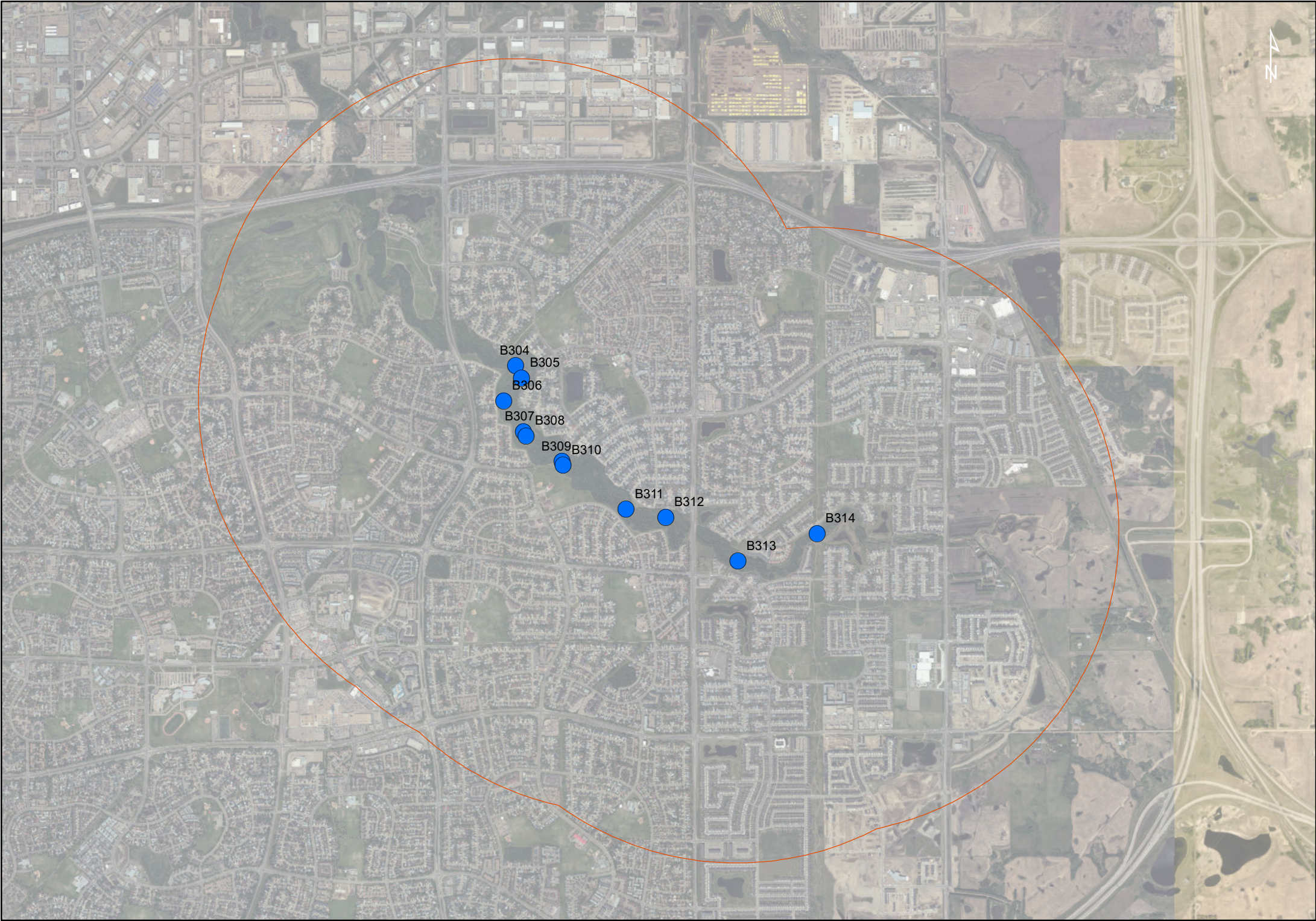
1.4 EIA Study Area

The Study Area for the desktop portion of this EIA is a 2km radius from the bridge location (Figure 1.2). The study areas for the fieldwork is defined by each VEC; the aquatics study focused on Mill Creek from 100m upstream of each bridge to 300m downstream of each bridge; the wildlife study area reviewed a 4 km radius around the bridge sites for potential species at risk and a 100 m radius during the field assessment; and the vegetation study reviewed a radius of approximately 20m around each bridge location.

The Local Study Area (LSA) used for this EIA is based on the ravine area potentially impacted by direct bridge construction, and indirect construction effects including; access and laydown, stockpile or other temporary use areas. The LSA also includes connected similar natural habitat types outside of the direct and indirect construction area and includes potential areas of recreational and visual impacts. The LSA therefore includes the natural portions of the ravine, bookended by pedestrian transportation infrastructure (i.e., trails) (Figure 1.1).

1.5 Report Organization

This EIA is organized as per the TOR (Appendix A). It includes an introduction, project description, methodology (desktop and field), existing conditions for each VEC, potential impacts and mitigation measures, a summary followed by references and closing with the appendices.



N

Legend

- Bridge
- 2km Buffer

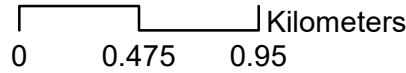
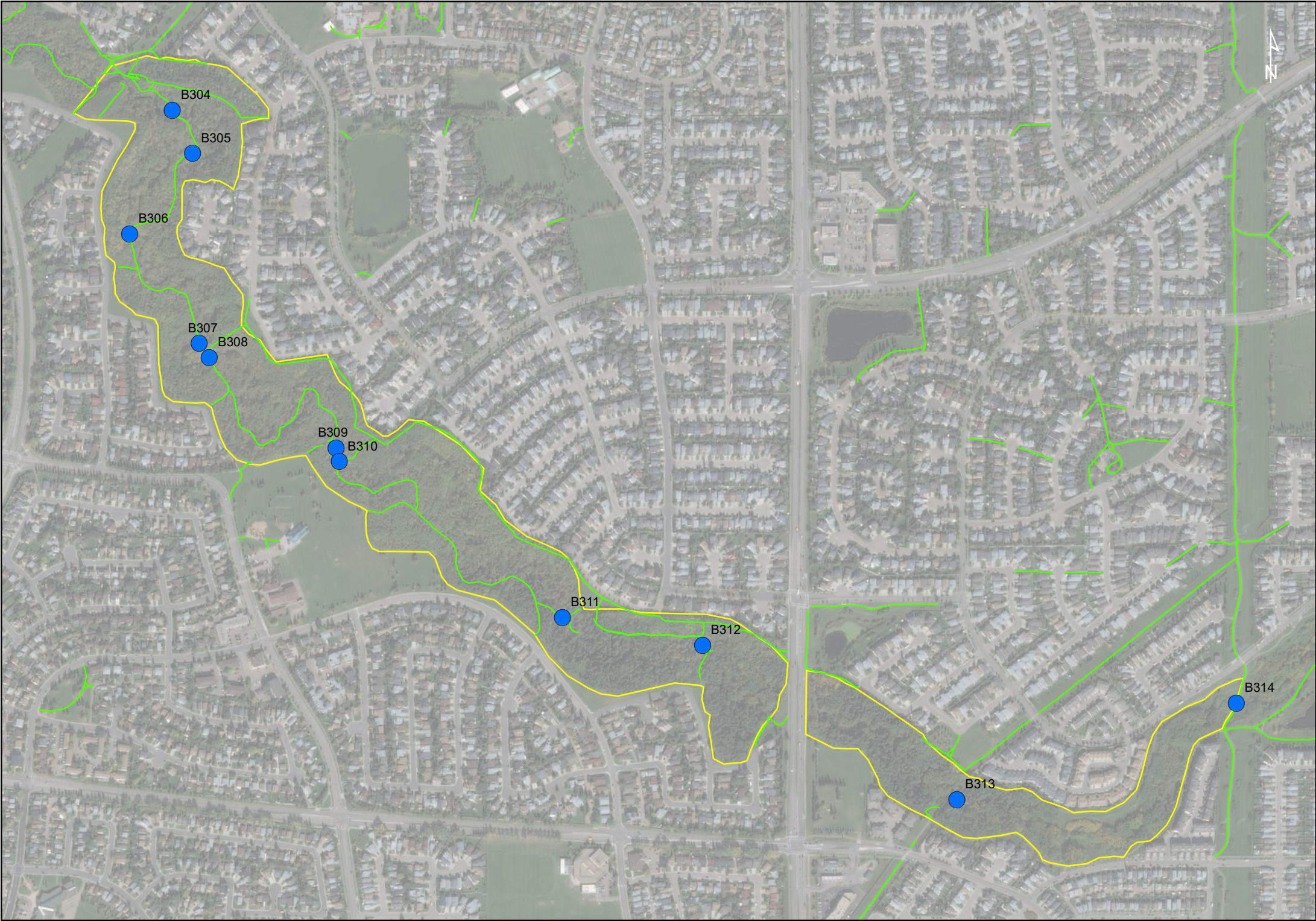


FIGURE 1.2
2KM STUDY AREA





Legend

- Bridge
- LSA
- Parks Trail

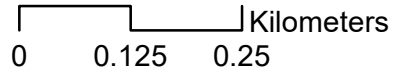


FIGURE 1.3
LOCAL STUDY AREA





2.0

Project Description

2.1 Project Need and Rationale

As previously discussed, replacement of the bridges was deemed to be required. The trail system, including the 11 bridges included in this Project, is well used by pedestrians and cyclists and is a widely considered a valuable resource to the community. Table 2.1 provides the current bridge condition, as evaluated by ISL in the Mill Creek Pedestrian Bridges Structural Alternatives Report (ISL 2020b).

Table 2.1: Bridge Current Condition

Bridge ID	Substructure	Superstructure	Handrail
B304	Rotten timber. Fill settlement and/or pile frost-jacking, wingwalls pulled apart, fill spilling out of backwalls	Minor surface corrosion on the steel beams on the rig mat, Portion of rig mat below grade.	Failing coating
B305	Rotten timber. Fill settlement and/or pile frost-jacking, wingwalls pulled apart, fill spilling out of backwalls	Minor surface corrosion on the steel beams on the rig mat, Portion of rig mat below grade.	Failing coating
B306	Rotten timber. Fill settlement and/or pile frost-jacking, wingwalls pulled apart, fill spilling out of backwalls	Minor surface corrosion on the steel beams on the rig mat	Partially painted
B307 (two span structure)	Rotten timber, wingwalls pulled apart, frost-jacking	Minor surface corrosion on the steel beams on the rig mat	Isolated patches of paint
B308	Rotten timber. Fill settlement and/or pile frost-jacking, wingwalls pulled apart, fill spilling out of backwalls	Minor surface corrosion on the steel beams on the rig mat, Portion of rig mat below grade.	Partially painted
B309	Rotten timber. Fill settlement and/or pile frost-jacking, wingwalls pulled apart, fill spilling out of backwalls	Minor surface corrosion on the steel beams on the rig mat, Portion of rig mat below grade.	Isolated patches of paint
B310	Frost-jacking/settlement, fill spilling out below backwalls and wingwalls	Minor surface corrosion on the steel beams on the rig mat	Partially painted
B311	Frost-jacking/settlement, fill spilling out below backwalls and wingwalls	Minor surface corrosion on the steel beams on the rig mat	Failing coating
B312	Frost-jacking/settlement, fill spilling out below backwalls and wingwalls	Minor surface corrosion on the steel beams on the rig mat	Rail extends beyond bridge
B313	Frost-jacking/settlement, fill spilling out below backwalls and wingwalls	Minor surface corrosion on the steel beams on the rig mat	Good
B314	Absence of rock on headslopes	Minor surface corrosion on the steel beams on the rig mat	Good

Source: Mill Creek Pedestrian Bridge Structural Alternatives Report (ISL 2020b)

The main driver of replacement of the bridges is due to structural deficiencies which have the potential to lead to public safety issues if left unaddressed. Repair of the existing bridges was considered as an option early in the design process, however the existing bridges do not have adequate load carrying capacity for S6-19 Maintenance Vehicles, and repair was no longer considered a viable option (ISL 2020b).

2.2 Project Details

2.2.1 Project Location and Setting

The Mill Creek Ravine east of 50th Street and north of 34th Avenue is a treed natural area with a gravel trail system that meanders through the ravine, passing over the creek several times. Land use surrounding the ravine on the upslope is primarily residential, including the communities of Minchau, Kiniski Gardens, Silverberry and

Wild Rose. The Minchau Elementary School is located on the south side of the Ravine, approximately between B311 and B310 (Figure 1.1). Table 2.2 provides the bridge locations, with their legal description, legal location, UTM location and photos included in Appendix B.

Table 2.2: Bridge Locations

Bridge ID	Address	Legal Description	Legal Location	UTM (12U)	Photo Plate (Appendix B)
B304	124 - KULAWY DRIVE NORTH NW	Lot 10ER, Block 40, Plan 9222564	NW 12-52-24 W4M	339963 E 5927944N	1
B305	3943 - 47 STREET NW	Lot 11ER, Block 40, Plan 9321873	SW 12-52-24 W4M	339998 E 5927854N	2
B306	3943 - 47 STREET NW	Lot 11ER, Block 40, Plan 9321873	SW 12-52-24 W4M	339879 E 5927709N	3
B307	190 - KULAWY DRIVE NW	Lot 27ER, Block 45, Plan 9825986	SW 12-52-24 W4M	340003 E 5927498N	4
B308	190 - KULAWY DRIVE NW	Lot 27ER, Block 45, Plan 9825986	SW 12-52-24 W4M	340019 E 5927469N	5
B309	190 - KULAWY DRIVE NW	Lot 27ER, Block 45, Plan 9825986	SW 12-52-24 W4M	340256 E 5927287N	6
B310	190 - KULAWY DRIVE NW	Lot 27ER, Block 45, Plan 9825986	SW 12-52-24 W4M	340261 E 5927259N	7
B311	2423 - KAASA ROAD WEST NW	Lot 16ER, Block 48, Plan 9825737	NE 1-52-24 W4M	340655 E 5927952N	8
B312	2423 - KAASA ROAD WEST NW	Lot 16ER, Block 48, Plan 9825737	NE 1-52-24 W4M	340918 E 5926890N	9
B313	2803 - 34 AVENUE NW	Lot 59ER, Block 45, Plan 0125039	NW 6-52-24 W4M	341375 E 5926590N	10
B314	2710 - 33 AVENUE NW	Plan 5766KS Blk RW Lot 52	NW 6-52-24 W4M	341897 E 5926753N	11

2.2.2 Land Use and Zoning

The City of Edmonton provided land title information for the bridge sites and holds title on all lands except B314, which is owned by AltaLink Management Ltd.

ISL engaged with Alberta Environment and Parks (AEP) following award of the project and determined that the province does not claim ownership of the bed and shore of Mill Creek under Section 3 of the Public Lands Act in the portion of Edmonton between 17th Street and 51st Avenue. Land Use Zoning within the ravine is entirely “A” for Metropolitan Recreational Zone (Figure 2.1 [City of Edmonton 2020a]).

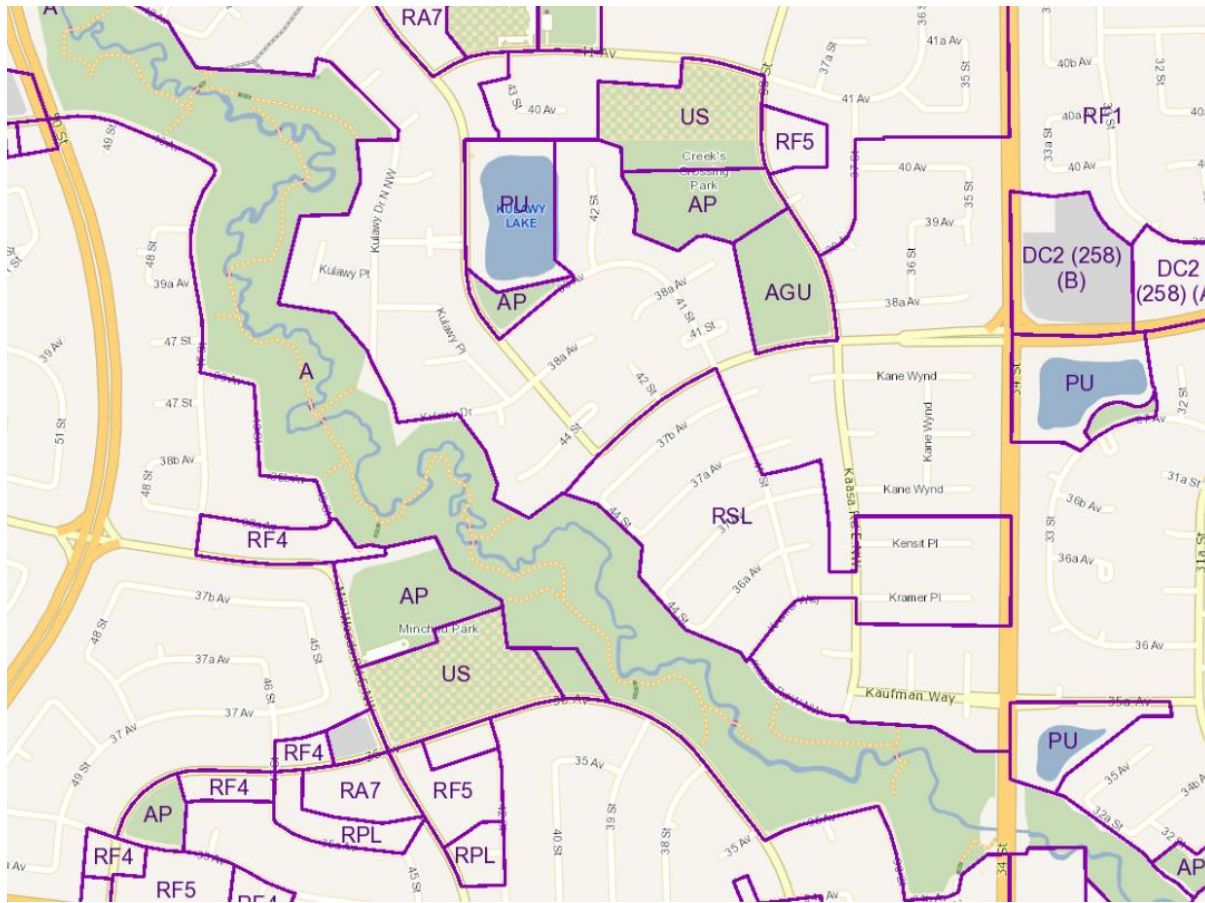


Figure 2.1: Land Use Zoning

2.3 Project Alternatives

2.3.1 Structural Alternatives

ISL completed a field review of the existing bridges as well as a desktop review of the limited available file information. The bridges vary from site to site but there were several deficiencies common to multiple sites. The timber substructures had deficiencies such as timber rot, frost jacked piles, fill spilling out under backwalls and wingwalls, and fill settlement. In some cases, the abutment had partially failed, and the superstructure end had settled into the abutment fill. The rig mat superstructures were in better condition than the substructures, but as part of the functional review, ISL evaluated the load carrying capacity of the existing superstructures and found that they are not able to support the design vehicle load.

The structural alternatives report presented the three structural alternatives for replacement of the bridges (Table 2.1 and ISL 2020b). Three scenarios were identified and evaluated to renew the structures:

- Option 1: replacement of the substructures;
- Option 2: complete replacement of the substructures and superstructures with build-in-place solutions; or
- Option 3: complete replacement of the substructures and superstructures with prefabricated bridges.



2.4 Construction Details

2.4.1 Construction Schedule

Construction is currently scheduled to occur in the spring of 2021, pending Council approval of the EIA, receipt of environmental approvals and tendering. If approvals are received in time, construction may occur earlier, in the winter of 2020/2021. Winter work provides some advantages, in that water levels within Mill Creek would be lower, and therefore provide less risk during the construction period. The specifics of construction work hours will be in compliance with the City's Community Standards Bylaw and will be presented in an Environmental Construction Operation (ECO) Plan.

2.4.2 Construction Methodology, Materials and Equipment

The Project will involve the following construction activities at each bridge site:

- Installation of temporary bridges for access (potentially utilizing the existing bridge decks where possible);
- Completing any required earthworks (grading, removal of existing abutments, etc.);
- Installation of foundation piles;
- Casting abutments and wing walls;
- Erecting trusses and bridgeworks;
- Installation of timber decking and bridge railing;
- Completing backfill and earthworks; and
- Removing the temporary bridge.

The Contractor shall also be responsible for the following during and following construction:

- Development and implementation of the ECO plan
- restoration and landscaping work,
- monitoring of all work including CCC/FAC, and
- installation and following the tree preservation plan.

2.4.3 Construction Staging and Access

It is expected that groups of bridges will be staged and sequenced together to limit pathway closures to the extent possible, as well as to utilize staging areas appropriately. A constructability report was commissioned by ISL (1449136 Alberta Ltd. 2020), and it was determined that the following bridge groups should be constructed together:

- Group 1: B304, B305, B306, B307, B308;
- Group 2: B309 and B310;
- Group 3: B311 and B313; and
- Group 4: B312 and B314.

It is expected that Groups 1 and 3 can be completed concurrently, followed by Groups 2 and 4. Work would occur concurrently at all sites within each group to limit impacts to residents, as well as to fully utilize the staging area access where possible. Staging areas would occur within the adjacent neighbourhoods and utilize existing clearings to the extent possible to limit tree removal.

To further limit tree clearing, the existing bridges will be utilized to the extent possible to access across the bridge either immediately upstream or downstream of the replacement location. This is expected at all sites, other than at bridges B307, B312 and B314. Where required, the crossing will be installed utilizing concrete lock blocks as

foundations, with the existing rig mat being lifted to the temporary location, and temporarily filled with native backfill materials.

2.4.4 Construction Mitigation Measures

The awarded contractor will prepare an ECO Plan prior to any construction activity starting. The ECO Plan will discuss spill prevention and cleanup, emergency procedures, erosion and sediment control (ESC), types of machinery and equipment used, and describe waste disposal. To reduce the potential effects of the construction activities on the VECs, the key mitigation measures listed in Section 5.0 of this report is recommended. The Contractor is expected to follow and meet the City's Envisio Program requirements (City of Edmonton 2020c).

2.5 Regulatory Framework

This section provides information on the expected regulatory requirements for the Project, including background on the regulatory process and the anticipated requirements for the Project.

2.5.1 Federal

Fisheries Act

The provisions of the new *Fisheries Act* came into force at the end of August 2019 (DFO 2019a). Important changes include the new prohibitions:

- 34.4 (1) No person shall carry on any work, undertaking or activity, other than fishing, that results in the death of fish
- 35 (1) No person shall carry on any work, undertaking or activity that results in the harmful alteration, disruption or destruction of fish habitat
- Harmful Alteration: any change to fish habitat that reduces its long-term capacity to support one or more life processes of fish but does not permanently eliminate the habitat.
- Disruption: any change to fish habitat occurring for a limited period of time that reduces its capacity to support one or more life processes of fish.
- Destruction: any permanent change of fish habitat, which completely eliminates its capacity to support one or more life processes of fish

As the new bridges require work within the wetted width of Mill Creek, it is expected that a Request-for-Review will be required for the Project. At this time, it is expected that the DFO review will return a Letter of Advice.

Migratory Birds Convention Act

The *Migratory Birds Convention Act (MBCA)* is administered by Environment and Climate Change Canada (ECCC) to ensure protection of migratory birds, their nests, and their eggs. Birds protected by the *MBCA* include waterfowl (such as ducks, geese, and swans), insectivorous birds (such as wrens, robins, shrikes, and woodpeckers), and some nongame birds (such as herons and gulls) (ECCC 2014).

To protect migratory birds, ECCC provides general nesting periods based on geographic location (ECCC 2018). The general nesting period covers the majority of species covered under the *MBCA*; however, it may not be accurate for species that can breed at any time during optimal conditions (e.g. crossbill species), or species that may nest earlier or later (ECCC 2018).

The general migratory bird-nesting period for the Project is mid-April to late August (ECCC 2018). **The LSA has good potential raptor (e.g., owls) habitat, and it is recommended that this Project have a general nesting period of March 1 to August 20, with potential extension for species that may nest outside this period, e.g., great-horned owl).** The best management practice should be to avoid work within the nesting period, or to



clear areas outside side of the nesting period to allow for work to continue through the bird restricted activity period (RAP). During the RAP, a nest sweep should be completed as a due-diligence measure to avoid incidental take. It's recommended that construction start within 7 days of the initial nest sweep and activities must not be stopped on site any longer than 4 days or another sweep must be conducted. In the event that nesting migratory birds are identified during the nest sweep, a setback may be identified through consultation with ECCC where feasible.

Canada Navigable Waters Act

The *Canada Navigable Waters Act*, administered by Transport Canada, provides protection of navigation on all public navigable waterways in Canada through the Navigation Protection Program (Transport Canada 2020). Regulatory approval is required in scheduled navigable waters, as well as waters that are considered Navigated, where the works risk a substantial interference with navigable.

Mill Creek is not considered a Scheduled Waterbody and is not considered 'Navigated'. No submission to the Navigation Protection Program is required for the Project.

Species at Risk Act

The *Species at Risk Act* (SARA) is federal legislation intended to protect sensitive species (Government of Canada 2002). In relation to wildlife species listed under Schedule 1 of SARA, it is prohibited to:

- kill, harm, harass, capture or take an individual of a wildlife species that is listed as an extirpated species, an endangered species or a threatened species;
- possess, collect, buy, sell or trade an individual of a wildlife species that is listed as an extirpated species, an endangered species or a threatened species, or any part or derivative of such an individual; and,
- damage or destroy the residence of one or more individuals of a wildlife species that is listed as an endangered species or a threatened species, or that is listed as an extirpated species if a recovery strategy has recommended the reintroduction of the species into the wild in Canada.

With the implementation of site specific and general mitigation measures, the Project is not anticipated to interact with any of the wildlife species listed under Schedule I of SARA. Therefore, additional regulatory notifications and permit applications under Section 73 of SARA are not required.

2.5.2 Provincial

Water Act

The *Water Act* contains the requirements for managing Alberta's water resources. Through AEP, the *Act* governs activities affecting waterbodies in Alberta, including construction, water diversions, and infilling of wetlands. *Water Act* approval is required to alter the flow or level of water; change the location of water; change the direction of water flow; cause the siltation of water; cause erosion of bed or shore of any waterbody; or if there is any anticipated effect on the aquatic environment.

A *Water Act* Code of Practice notification will be required for the Project as it will involve installation of a bridge structure over Mill Creek (Government of Alberta 2019). Mill Creek is a Mapped Class D waterbody under the Code, with no Restricted Activity Period (Alberta Environment and Sustainable Resource Development 2012).

Public Lands Act

The Public Lands Act requires surface disposition be issued for the use of all public lands in Alberta. The Public Lands Act is responsible for administering lands owned by the Crown. Under Section 3 of the Act, public lands include the bed and shore of all permanent and naturally occurring waterbodies, unless the title has been granted to a private landowner.

ISL contacted the Public Lands Officer for the region and determined that within the area between 17th Street and 51st Avenue, the Province does not claim ownership of the bed and shore of Mill Creek under Section 3 of the Public Lands Act. Therefore, no Public Lands Act requirements are required for the Project (Elise Neumann, Personal Comm. March 3 2020).

2.5.1 Wildlife Act

In addition to the federal MBCA, birds may be protected provincially under the *Wildlife Act* (Government of Alberta 2000a). AEP administers the *Wildlife Act*, which influences and controls human activities that may have adverse effects on wildlife or wildlife habitat on both Crown and privately owned land. Section 36(1) of the *Wildlife Act* states that a person shall not willfully molest, disturb, or destroy a house, nest, or den of prescribed wildlife or beaver dam in prescribed areas and prescribed times. This applies to nests and dens of endangered wildlife, migratory birds, snakes (except prairie rattlesnakes), bats and prairie rattlesnake hibernacula. Additionally, Section 36(1) also applies to beaver dens and houses on land that is not privately owned as well as houses, nests, and dens of all wildlife in a wildlife sanctuary and nests of game birds in game bird sanctuaries.

No formal submission under the Wildlife Act is required. Good potential raptor (e.g., owls) habitat is present in the Project area, therefore a general nesting period of March 1 to August 20 is recommended with potential extension for species that may nest outside this period (e.g., great-horned owl). Setback distances will be determined following nest sweeps, if required, and based on the construction activity at the time. Further information is provided in the wildlife report (Appendix C).

Historical Resources

The *Historical Resource Act* is administered by the Ministry of Culture, Multiculturalism and Status of Women (ACMSW) to preserve and study Alberta's historical resources (Province of Alberta 2000). *Historical Resource Act* clearance must be obtained by ACMSW before development. If historic resources may be impacted or if the proposed activity occurs within a high potential area, a Historical Resource Impact Assessment (HRIA) is required.

Turtle Island Historical Services has been retained to complete the Historical Resources component of this EIA. A HRIA will be required for the Project and is in progress at the time of writing.

Weed Control Act

The *Weed Control Act* protects stakeholders from economic and invasive losses caused by weeds. Some weed species exhibit extreme growth habits, which can have consequences for line of sight at intersections, wildlife control along roadways, culvert and outfall maintenance, agricultural production, livestock forage quality, and many others. The *Weed Control Act* prescribes activities that must be undertaken should a noxious or restricted weed be encountered. Each municipality is responsible for enforcing the *Weed Control Act* (Government of Alberta 2010).

Weed species listed by the Weed Control Act were identified during the vegetation studies assessment and measures to satisfy the Weed Control Act will be identified and implemented by the Contractor in their ECO Plan.

2.5.2 Municipal

North Saskatchewan River Valley Area Redevelopment Plan (Bylaw 7188)

The Project is located within the North Saskatchewan River Valley area, managed under the City's *North Saskatchewan River Valley Development Plan, Bylaw 7188* and amendments (City of Edmonton 2018). An environmental review is required for most activities in the River Valley (City of Edmonton 2000).



This EIA fulfills the Bylaw 7188 requirement for environmental review for work occurring within the River Valley.

Community Standards Bylaw 14600

The Community Standards Bylaw 14600 establishes construction activity periods (7AM to 9PM Monday to Saturday; Sunday and Holidays: 9AM to 7PM) and acceptable noise levels for non-residential areas (maximum 75 dBA). **It is a requirement that this Bylaw be adhered to during construction unless an exception is granted** (City of Edmonton 2019a).

Corporate Tree Management Policy C456A

Loss of city owned trees (Ornamental and Natural stands) will be protected and preserved and when they cannot be, must be equitably compensated for in accordance with the City of Edmonton Guidelines for Evaluation of Trees (City of Edmonton 2019b). No work is to begin unless a Tree Preservation or Tree Protection Plan has been approved by a City of Edmonton urban forester.

A Tree Preservation or Tree Protection Plan is required if work occurs within 10 metres of a Natural Stand (City of Edmonton 2020b). A Tree Protection Plan is being prepared for the Project by ISL, separately from this report.

City of Edmonton Wildlife Passage Guidelines

The City of Edmonton provides recommendations to incorporate the needs of wildlife into construction projects and while this guideline pertains to transportation projects, some construction and maintenance guidelines and best management practices are relevant (City of Edmonton 2010). This includes minimizing tree removal, avoiding work during ecologically sensitive periods, avoiding site pollution, control of erosion and sediment, and worker education.

The Project will improve potential wildlife passage by extending bridge lengths, providing a larger travel area under the bridges.

City of Edmonton Natural Area Systems Policy C531

Natural Area Systems Policy C531 (City of Edmonton 2007a) is intended, among other things, conserve, protect and restore biodiversity and natural area systems throughout Edmonton recognizing the urban context of the City.

This policy directs administration to require ecological information to support planning and development applications, for which this EIA provides.

City of Edmonton ENVISO Program

ENVISO is an environmental management system (EMS) that aims to manage and improve the City of Edmonton's environmental performance (EMS - ISO 14001).

An ENVISO checklist of environmental and regulatory requirements fulfills this ENVISO requirement (Appendix D, City of Edmonton 2020c), and it is expected that the Contractor will follow all ENVISO requirements through construction.

City of Edmonton Drainage Bylaw 16200

The release of materials into water including potentially contaminated runoff into watercourses is regulated locally by the City of Edmonton Drainage Bylaw. It is prohibited to release hazardous and other materials, including those that produce a colour value of 50 true colour units, into a watercourse or to the stormwater system.

If discharge is required, a permit through Drainage Regulatory Services is required, and will be coordinated by the Contractor.

Altalink Corridor Agreement

Bridge B314 occurs within an Altalink Corridor, and therefore an agreement must be in place between the City and Altalink prior to construction occurring. I

The City will engage with Altalink to obtain a permit for works occurring within their corridor



3.0

Assessment Methodology

General methods used in the preparation of this EIA were based on the guidelines presented in Bylaw 7188 and the preliminary list of key resources identified in A Guide to Environmental Review Requirements in the North Saskatchewan River Valley and Ravine System (City of Edmonton, 2000), as well as through the scoping exercise with Urban Form. Additional environmental resources with a potential to be impacted by the Project were identified during the desktop and field assessments.

The assessment focused on the existing conditions surrounding VECs, potential effects of the Project on the VECs, identification of mitigation measures to reduce or eliminate the impacts and evaluation of residual effects and analysis of these effects. The VECs were selected based on distribution and status of environmental elements in the vicinity of the Project, public and regulatory concern, as well as professional judgement. VECs selected include: geotechnical (geology/slope stability/soils), hydrology/surface drainage, fish and fish habitat, wildlife and wildlife habitat, vegetation, historical resources, recreational resources and visual resources. The VECs were assessed by means of desktop and field means in the spring and summer of 2020. The scope was determined through consultation with Urban Form on March 5, 2020.

3.1 Environmental Effects Methodology

The value of a VEC not only relates to its role in the ecosystem, but also to the value placed on it by humans. The potential Project VECs were identified based on those resources identified within the EIA TOR (Appendix A) and are identified in Table 3.2. Potential VECs were assessed to determine if they are present (or potentially present) within the Project and if they are subject to stakeholder or regulatory concern. Potential environmental impacts on VECs were evaluated to determine mitigation and best management practices that will reduce the environmental impacts of the Project and to determine the significance of any residual effects after mitigation has been applied. An impact or effect is defined in the Glossary of Environmental Assessment Terms and Acronyms Used in Alberta as “Any aspect of a project that may cause an effect; for example, land clearing during construction is an impact, while a possible effect is loss and fragmentation of wildlife habitat” (Alberta Environment 2010).

To understand and quantify potential impacts and effects, this EE uses an evaluation criteria adopted and modified from the previously mentioned Alberta Environment (2010) document, the Guide to Environmental Review Requirements in the North Saskatchewan River Valley and Ravine System (City of Edmonton, 2000) and the TOR for the Project (ISL 2020a).

If potential impacts are identified, mitigation measures are outlined that can be applied to reduce or eliminate the impact. If, after mitigation is implemented, an effect remains, it is referred to as a residual effect. The characteristics of this residual effect are assessed considering the criteria outlined in Table 3.1. Finally, the residual effect is characterized in terms of significance.

3.1.1 Potential Effects and Mitigation

The analysis of the Project includes consideration of relevant mitigation measures, as only the effects that remain after mitigation can be potentially of significance. Mitigation is considered to be the avoidance, reduction, or control of the Project’s adverse environmental effects. The following mitigation measures are applied in a tiered approach:

- **Avoidance:** measures taken to avoid creating potential effects from the outset, such as considering spatial or temporary factors in Project planning. These measures are taken to avoid potential effects on VECs.
- **Minimization:** measures taken to reduce the duration, intensity, and/or extent of potential effects that cannot be completely avoided, as far as feasible.
- **Restoration:** measures taken in response to potential residual effects where these effects cannot be completely avoided and/or minimized.

- **Offset/Engineered:** measures taken to offset for any residual significant, adverse impacts that cannot be avoided, minimized, and/or restored.

3.1.2 Significance of Effects

Residual effects of the Project were evaluated after mitigation was applied for nature of impact, magnitude, duration, extent and likelihood, which were used to determine the potential environmental consequences associated with the Project. Table 3.1 describes the residual effects rating criteria:

Table 3.1: Residual Effects Rating Criteria Definitions

Criteria	Definition	Rating	Definition
Nature of Effect	Is the effect directly caused by the Project	Direct	Project effect results in a direct change or loss of VEC.
		Indirect	Project effect results in an indirect change or loss of VEC, such as a downstream effect.
Magnitude	A measure of how adverse or beneficial an effect may be.	Low	Project effect could result in slight decline of the VEC. Example: project will alter common or provincially rare landscape, community, or species distributions, but will not reduce landscape community, or species diversity.
		Moderate	Project effect could result in decline of the VEC to lower than baseline. Example: project will reduce landscape, community, or species distributions, including local loss of provincially rare species or community, or alteration of nationally rare species or communities.
		High	Potential effect could threaten viability of the VEC and should be considered a management concern. Example: project will result in loss of nationally rare species or communities, or regional loss of provincially of provincially rare species or communities.
Duration	The period of time in which an effect on a VEC may exist or remain detectable (i.e., the recovery time for a resource, species or human use).	Short Term	Less than one year.
		Medium Term	More than one year, but less than 30 years.
		Long Term	More than 30 years.
		Permanent	Permanent effect
Extent	The spatial boundaries within which an effect of a defined magnitude occurs.	Restricted	Effect is limited to the Project footprint.
		Local	Effect extends beyond the project footprint, but not beyond the vicinity of the Project (i.e. LSA).
		Regional	Effect extends beyond the Project vicinity (i.e. 5 km).
Likelihood	The level of certainty of the effect occurring	Predictable	Likelihood of effects occurring are based on clear understanding of cause and effect relationships and data.
		Uncertain	Likelihood of effects occurring are based on incomplete understanding of cause and effect relationships and incomplete data.

The magnitude, duration, and extent of the negative effects are then considered to determine the significance of the residual effect as outlined below. The nature and likelihood of the effect is conservatively not considered in the significance determination as a direct or indirect rating results in an effect regardless, and the certainty of the likelihood of occurrence will be predictable to result in an effect. It should be emphasized that a residual effect can be minimal and not be considered significant, and therefore acceptable.

Low: Project effects are considered to result in minimal or negligible impacts to the environmental elements (**i.e., Non-Significant**).

Medium: Project effects will result in moderate impacts to environmental elements such as removal of a small portion of vegetation within a large area of environmentally significant land (**i.e., Non-Significant**).

Significant: Project effects result in severe alteration to the environmental elements such as re-contouring of an escarpment, open cut operation for deep utility installation through a ravine or wetland, or loss of critical habitat for species at risk wildlife.

The ranking of effects (*i.e.* significances) is summarized in Table 3.2.

Table 3.2: Summary of Significance Ranking Effects

Magnitude	Duration	Extent		
		Restricted	Local	Regional
Low	Short term	Low	Low	Medium
	Medium term	Medium	Medium	Medium
	Long term/Permanent	Medium	Medium	Significant
Moderate or High	Short term	Low	Medium	Medium
	Medium term	Medium	Medium	Medium
	Long term/Permanent	Medium	Significant	Significant

3.2 Literature and Database Review

A desktop review was completed for all VECs, where applicable. Technical reports and previous studies were reviewed and incorporated into the EIA, including:

- Thurber Engineering (Thurber)'s Geotechnical Investigation (Thurber 2020a)
- Thurber's Environmental Overview (Thurber 2020b)
- Thurber's Limited Phase II ESA (Thurber 2020c)
- Golder's Bridge Hydrotechnical Technical Memorandum (Golder 2020)
- Steppe Consulting's Statement of Paleontological Justification (Steppe Consulting 2020).
- Turtle Island's Statement of Justification (Turtle Island CRM 2020)
- SAGE Ecological's Wildlife Report (SAGE 2020)
- Natural Regions Committee (NRC 2006)
- City of Edmonton Biodiversity Report (Hobson, et. Al, 2008)
- ISL's Mill Creek TOR (ISL 2020a)
- ISL's Structural Alternatives Report (ISL 2020b)
- Environmentally Significant Areas in Alberta (Fiera 2014)

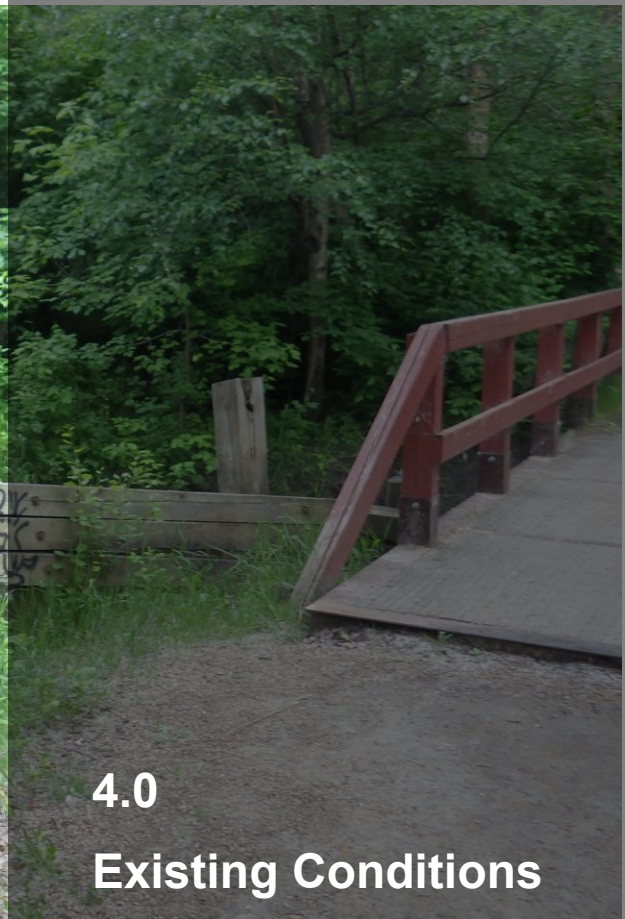
The following databases were queried for relevant information pertaining to the bridges and included within the EIA:

- The Agricultural Regions of Alberta Soil Inventory Database (AGRASID)
- Alberta Conservation Information Management System (ACIMS)
- Alberta Fish and Wildlife Management Information System (FWMIS)



3.2.1 Description of Existing Conditions

A description of existing conditions was completed for each VEC within the study areas, and specific methodology for each VEC varies. Specific methodology for obtaining field information is provided within the respective VEC subsection in Section 4.



4.0

Existing Conditions



4.1 Geotechnical (Geology/Slope Stability/Soils)

A geotechnical assessment, including an environmental site assessment (ESA), was completed by Thurber for the Project as part of their geotechnical program, and the results of their various reports are summarized below.

4.1.1 Geotechnical Program

Methods

A field assessment program was completed by Thurber between January 30th and February 9th, 2020, utilizing a track mounted auger drill rig. The test holes were drilled to depths ranging from about 10 m to 15 m below ground surface (bgs), and all test holes terminated in bedrock. Disturbed and undisturbed samples were obtained during drilling and SPTs were carried out at selected depths in the test holes. The undrained shear strengths of cohesive soil samples were estimated at select locations using a pocket penetrometer. Seepage and water levels in the test holes were recorded during and immediately after drilling. Piezometers were installed in the nine test holes to allow for future monitoring of the groundwater. The piezometers were installed flush to the ground surface and steel protector covers were installed to protect the piezometers. Laboratory testing consisted of visual classification and determination of the natural water content of all soil samples. Atterberg limits tests, grain size analyses, and soluble sulphate content tests were performed on selected soil samples (Thurber 2020a).

Results

Geology

The stratigraphic conditions at the bridge locations consist of the following main strata in descending order (Thurber 2020a Table 4.1.1).

Table 4.1.1: Geotechnical Strata Descriptions

Strata	Description
Fill materials	Surficial layers of clay, sand, and gravel fill were encountered in the test holes. Clay fill was located in four test holes and extended to depths between 0.5 m and 1.5 m bgs. Sand fill was located in two test holes and extended to depths between 1.2 m and 1.8 m bgs. The sand and gravel and fill was encountered in five test holes, extending to depths between 150 mm and 300 mm bgs.
Clay	Lacustrine silty clay was encountered below the sand in two test holes and extended to a maximum depth of about 2.6 m bgs
Clay till and / or sand	Clay till was encountered below the lacustrine clay in all test holes except three and extended to depths between 1.5 m and 9.5 m bgs. Sand was encountered overlying clay, thought to be alluvial in origin, in test holes TH20-01 and TH20-02. The layer was also encountered overlying clay till in test holes TH20-03, -04, -07, -08, and -09. In test holes TH20-08 and -09 sand was encountered underlaying the clay till. The sand layers ranged in thickness between 0.5 m and 6.1 m and extended to depths between 0.6 m and 11.4 m bgs.
Clay shale and Sandstone (Bedrock)	Clay shale and sandstone (bedrock) was encountered underlying the clay till or sand layers and extended to the bottom of all test holes. The depth to bedrock in the test holes ranged from 1.4 m to 11.4 m

Slope Stability

Active erosion was noted at most of the bridge head slope locations. It is recommended that a hydrotechnical study be completed for this project and that erosion protection measures be designed and implemented at each

of the crossing locations. A subdued slump was observed at the south bank of the creek at the B307 location. Based on limited observations made at the time of the site visit, the slump is about 3 m wide (perpendicular to the channel alignment) and 13 m wide (parallel to the channel alignment). The slump appears to be a result of the ongoing erosion along the outside bend of the creek.

Soils

The Project is located in the urban land classified as 'disturbed land' (Alberta Agriculture, Food and Rural Development 2020). The Project traverses 1 soil polygon listed in Table 4.1.2 below (Alberta Agriculture, Food and Rural Development 2020). Output from the AGRASID database is provided in Appendix E.

Table 4.1.2: Soil Polygon

Polygon ID	Map Unit Name	Polygon Information
14284	ZDL1/DL	DL- Disturbed Land Miscellaneous undifferentiated mineral soils

Source: Alberta Soil Information Viewer (Alberta Agriculture, Food and Rural Development 2020)

4.1.2 Environmental Site Assessment

Methods

Thurber completed a desktop level Environmental Overview (EO) to determine the potential for contaminated soils present. This included a records review of the Alberta Environment Environmental Site Assessment Repository, Abacus Datagraphics Ltd Database, Coal Mine Maps and available geotechnical information (Thurber 2020b).

As part of the Environmental Overview results, two areas of potential concern were noted, and a Limited Phase II ESA was conducted, which included the analysis of five soil samples, collected during the geotechnical drilling investigation (TH20-01, TH20-03, TH20-07, TH20-08 and TH20-09), for polycyclic aromatic hydrocarbons (PAHs) associated with treated timber, metals and grain size. Further soil sampling was completed on June 17, 2020 at three selected bridge locations (B311 to B313). During this environmental investigation, Thurber advanced two hand-augured test holes around the bridge timber pier or abutment and one hand-augured control test hole at each of the three bridge locations. Selected soil samples were submitted to a laboratory for PAHs including naphthalene (Thurber 2020c).

Results

Based on the information reviewed and presented in the EO, the following Areas of Potential Concern were identified:

- Six crude oil pipelines present approximately 70 m northwest of bridge B304
- Two pipelines, containing high vapour or low vapour products, present approximately 30 m northwest of bridge B313
- Imported fill material, of unknown origin, identified at three geotechnical test hole locations.
- Pressure treated timber supports for bridges

The five soil samples originally submitted for laboratory testing returned a naphthalene concentration of 0.021 mg/kg from test hole TH20-07 (B312) at 0.30 m bgs. This does not meet the applied fine-grained residential/parkland soil guideline (0.017 mg/kg). All other metals and PAHs analyzed parameters met applied guidelines (Thurber 2020c).

Following the laboratory results, Thurber advanced an additional two hand-augured test holes around the bridge timber pier or abutment and one hand-augured control test hole at each of the three bridge locations (B311, B312 and B313), following coordination with the City's contaminated site experts. Selected soil samples were



submitted for PAHs testing including naphthalene. Confirmatory soil PAH concentrations from bridges B311 to B313 met Tier 1 residential/parkland guidelines. These include soil samples from test hole TH20-14 advanced near TH20-07 and around bridge B312 abutment where the naphthalene exceedance was previously identified. Based on soil results from these three bridges, soil removed during bridge timber pier or abutment excavation should be considered as meeting AEP Tier 1 residential/parkland guidelines.

4.2 Hydrology and Surface Drainage

A hydrologic assessment was completed by Golder for the Project, and the results of their hydrotechnical report is summarized below. An initial site visit was completed in ice-covered conditions on February 12, 2020. A second site visit was conducted on April 22, 2020 to survey water levels at each bridge and complete a discharge measurement and water level survey for calibration of the hydraulic model (Golder 2020).

Historical air photos were assessed to determine the historical and future potential for lateral channel migration for each bridge. Air photos were obtained from AEP (2020) for 1950, 1972 and 1987. Due to the scale of the aerial photos, size of the stream and vegetation present, only the imagery for 1950 was used for analysis, though the creek has maintained its general shape throughout the years (Golder 2020). Overall, there has been minimal movement of Mill Creek throughout the assessed period with the lateral migration rates varying between 0.021 m/year to 0.084 m/year. It is likely that replacement of the existing bridges with more robust bridges will further reduce the lateral channel migration within the vicinity of each bridge. A review of runoff modeling results as well as available mapping, shows that between 17th Street and 34th Street, Mill Creek receives inflow from one storm pond (Pond 612 in the Wild Rose/Silverberry reach) between Bridge B314 and 34th Street, and from two storm ponds (Pond 604 and Pond 611 in the Minchau/Kiniski Gardens reach) between 34th Street and 50th Street (Golder 2020).

A 1D HEC-RAS model was created from survey and LiDAR data provided by ISL for each bridge. A channel Manning roughness of 0.060 and an overbank Manning roughness of 0.09 were used. The channel roughness values were determined by calibrating the hydraulic model to the water surface elevation and discharge measurements collected during Golder's spring field program (conducted on April 22, 2020). These values fall into the typical ranges expected for this type of channel and overbank, topography, and vegetation (Golder 2020). A design criteria was developed for each bridge, and it was recommended that Class I rip rap is used at each bridge to manage erosion. The rock rip rap should armour the channel bank along face of the bridge abutment, extend up to one channel width upstream and downstream and be tied into the bank to prevent outflanking and unravelling (Golder 2020).

4.3 Fish and Fish Habitat

4.3.1 Desktop Assessment

Fish Inventory

A search of the FWMIS database reported 7 fish species occurrences historically found within the Study Area, provided in Table 4.3.1. The FWMIS report is provided in Appendix C. It should be noted that the rainbow trout and yellow perch noted in Table 4.3.1. are stocked fisheries in an adjacent recreational pond and are not present within Mill Creek.

Table 4.3.1: Wildlife Species with Historical Occurrences in the 2km Study Area

Common Name	Scientific Name	Provincial Status ¹	COSEWIC Status ²
Brook Stickleback	<i>Culaea inconstans</i>	Secure	Not listed
Fathead Minnow	<i>Pimephales promelas</i>	Secure	Not listed
Goldeye	<i>Hiodon alosoides</i>	Secure	Not listed
Goldfish	<i>Carassius gibelio</i>	Exotic/Invasive	Not listed / Invasive
Northern crayfish	<i>Orconectes virilis</i>	Exotic to NSR	Not listed
Rainbow Trout	<i>Oncorhynchus mykiss</i>	At Risk (Native Stock) Secure (Introduced Stock)	Endangered; Schedule 1 (Athabasca River Population)
Yellow Perch	<i>Perca flavescens</i>	Secure	Not listed

Notes:

Source: FWMIS (AEP 2020a)

1. Listing on Alberta General Status (AEP 2015).
2. SARA Species Status Search (Government of Canada 2002)

Watershed

Mill Creek is a minor tributary to the North Saskatchewan River, and is an important feature within Edmonton's River Valley and Ravine System. Between the 1960s and 1970s, the most downstream reach of Mill Creek was diverted into a tunnel, and now discharges from an outfall approximately 5 m above the North Saskatchewan River, precluding any fish migration from the North Saskatchewan River (City of Edmonton, 2016a). While the City has identified the restoration of the connectivity between Mill Creek and the North Saskatchewan River as a key priority, restoration has not occurred to date. Based on the lack of connectivity, Mill Creek does not provide any sportfish habitat. Another major culvert, approximately 1.5 km in length between 75 Street NW and Argyll Road NW, occurs downstream of the Project site and would further exclude the Project area from any fisheries importance. This matches the AEPs classification of Mill Creek as a Class D waterbody, considered of Low fisheries values (AESRD 2012).

4.3.2 Field Assessment

Methods

An open water aquatic assessment was completed by a Fisheries Biologist with a Professional Biologist designation (P. Biol.) on May 13, 2020 at each of the 11 crossings over Mill Creek.

The objectives for the aquatic assessments included:

- Documenting fish use, aquatic habitat condition and habitat potential in the area of each proposed crossing;
- Identify any fisheries constraints in regard to the potential crossing location;
- Describing the potential effects of the Project on fish and fish habitat; and

- Providing mitigation measures from a P.Biol. to be considered in future phases of the Project to minimize the effects on the aquatic environment.

Habitat assessment data was collected approximately 100 m upstream to 300 m downstream of each watercourse crossing site (i.e., the potential Zone-of-Influence due to Project construction). The final length of the study reach was determined by the P.Biol, who took into account any constraints, stream gradient, channel width, channel depth and morphology, flow velocity and potential Project disturbances. Four transects were completed, one at 100 m upstream of the existing crossing, one located at the existing crossing, one at 100 m downstream and one at 300 m downstream. At each transect, substrate types were visually assessed based on substrate size, substrate type (i.e., boulder [>256 mm diameter]; large cobble [128-256 mm]; small cobble [64-128 mm]; large gravel [16-64 mm]; small gravel [2-16 mm] and fines [<2 mm] (Alberta Transportation 2009); and recorded. Channel (i.e., bankfull) width, wetted width, bank height and water depth were recorded utilizing a survey-staff to the nearest 0.1 m. Time, dates, locations and transects were recorded at each assessment location utilizing a handheld GPS.

Morphological and riparian vegetation were described for each transect, as well as channel pattern and characteristics. Macro habitat units (e.g., riffle, run, pool, flat) were identified at each transect (Alberta Transportation 2009), and fish habitat was rated according to the potential to support spawning, rearing, overwintering and migration for the representative species most likely to be present at the assessed site (Table 4.3.2). Habitat ratings were limited to non-sportfish only, as sportfish are not present within Mill Creek.

Table 4.3.2: Habitat Suitability Ratings

Habitat Suitability Rating	Description
Excellent	All habitat present is considered to be of the highest quality for all life stages of species under consideration.
Good	Habitat present may be slightly limiting for most life stages. Moderate limitations may be present for a particular life stage.
Moderate	Life stages may use habitat occasionally, however is not considered the most desirable. Severe limitations may be present for certain life stages or species present.
Poor	All life stages of species under consideration are unlikely to utilize due to moderate to severe limitations to fish health and/or productivity.
Nil	Habitat is unsuitable for all stages of fish life history.

Water quality parameters were measured at each of the transects, including dissolved oxygen, conductivity, pH and water temperature utilizing an ExTech Exstik II and Oakton PCSTestr 35. Turbidity was visually assessed.

Habitat mapping was completed for the entire assessed area to provide information on the macro-habitat types within the area. Habitat mapping was completed following the Alberta Transportation Fish and Fish Habitat Inventory Procedures, following the Small River Stream Habitat Classification System (Alberta Transportation 2009). Habitat types, locations and extents were identified by the P. Biol during the field assessment and recorded utilizing a mapping tablet. Habitat mapping was transferred to desktop ArcGIS, and the amount of instream area of each discrete habitat type was calculated. It should be noted that the transcription process to ArcGIS provides some potential overlap of areas, such that these area values may be slightly overestimated.

Results

Field results for each bridge site are provided within the attached site cards, in Appendix F, and the general reach information is provided below.

During the assessment, water levels were considered at a seasonally high level, following spring melt. Bankfull channel widths ranged from 6 m to 12 m, with an average width of 8 m. Water levels were deeper than expected

due to a wet spring, with depths ranging from 0.2 m in riffles, to greater than 2.0 meters in areas that had been backflooded with woody debris. The reach is vegetated with grasses and forbs, willows species and aspen providing moderate overhead cover. The reach is also defined by a large amount of woody debris, with nearly every bridge having a log jam in the vicinity. Substrates throughout the reach varied depending on the habitat type. The slower areas (pools and flats) consisted mostly of fines and organics, with intermittent sections of gravels and cobbles in riffle and run areas. Under most of the existing bridges, existing large rock rip-rap has been previously placed,

The Environmental Quality Guidelines for Alberta Surface Waters (Government of Alberta 2014) guideline for the protection of aquatic life for pH ranges from 6.5 to 9.0, while dissolved oxygen ranges from 6.5 mg/L to 9.5 mg/L. The water temperature at the time of the assessment was 5 °C, the pH was 8.5, with 11.1 mg/L of dissolved oxygen and 1054 µS/cm of electrical conductivity, and therefore met all guidelines. The creek was considered stained during the assessment, following spring melt.

Habitat ratings for the study area were considered “Good” for spawning, rearing, feeding for non-sportfish, and ‘Moderate to Good’ for migration due to the presence of significant logjams within the channel that may limit migrations during low flow events. No sportfish habitat ratings are given, as they are not present within Mill Creek, and are precluded by a perched outfall at the North Saskatchewan River and a 1.5 km culvert approximately 3 km downstream from the Project. The migration potential does not include the lack of migration from the North Saskatchewan River or through this culvert, which is likely lacking.

Habitat Mapping

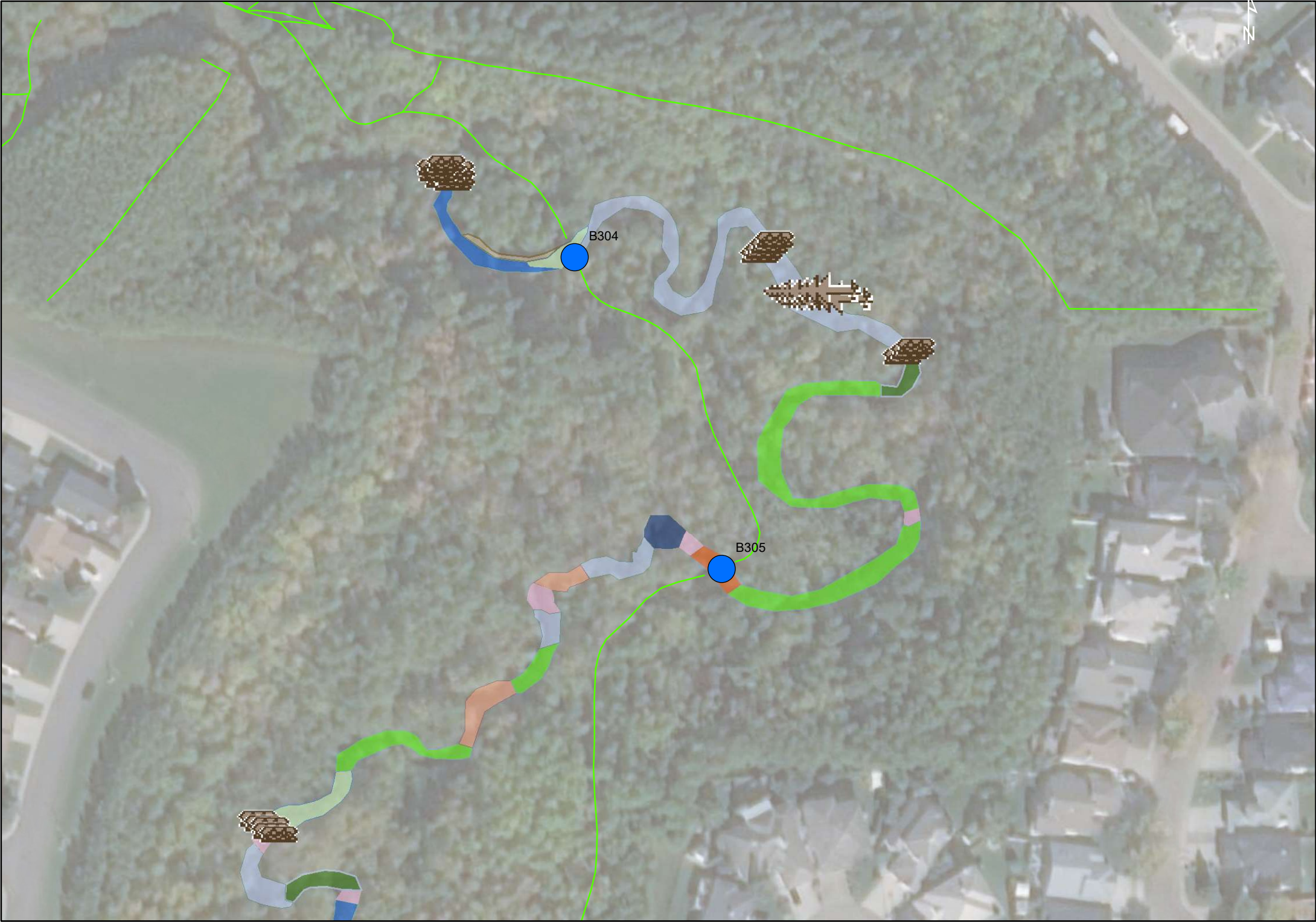
Habitat mapping was completed as part of the field assessment for the studied reach of Mill Creek to determine the variety and extent of habitat units available in the creek for fish and fish habitat.

A distribution of habitat type, calculated by surface area (m²), for the study reach is presented in Table 4.3.3 and Figure 4.3.1. The majority of habitat within the reach are flats, with Class 2 flat (0.5 to 1 m in depth) and Class 3 flat (<0.5 m in depth) accounting for approximately 46.6% of the habitat that was mapped. It is also worth noting that most of the Class 2 sections would likely decrease in depth to become Class 3 (less than 0.5 m in depth) in typical water levels. Extensive woody debris is present within the Project area, which typically backs up water flows, indicative of the flats and pools that are present, indicating slower flows. These areas would provide good variety of habitat for the various non-sportfish that are present within Mill Creek.



Table 4.3.3: Fish Habitat Inventory

Section Type	Details	Area (m ²)	% of total
C1	Cascade	26	0.2
P1	Class 1 Pool (>1.0 m depth)	1725	1.9
P2	Class 2 Pool (0.5 – 1m depth)	436	14.0
P3	Class 3 Pool (<0.5 m depth)	2913	6.3
R1	Class 1 Run (>1.0 m depth)	779	7.9
R2	Class 2 Run (0.5 – 1m depth)	236	3.5
R3	Class 3 Run (<0.5 m depth)	2822	1.9
F1	Class 1 Flat (>1.0 m depth)	242	5.0
F2	Class 2 Flat (0.5 to 1.0 m depth)	974	23.7
F3	Class 3 Flat (<0.5 m depth)	626	22.9
RF	Riffle (<0.5 m depth)	1504	12.
<i>Total</i>		1746	100.0



Legend

- Bridge
- Parks Trail
- Beaver Dam
- Large Woody Debris
- Overhanging Vegetation
- Deposition Bar
- Embankment

Sections

- Cascade
- Class 1 Flat (>1.0 m depth)
- Class 1 Pool (>1.0 m depth)
- Class 1 Run (>1.0 m depth)
- Class 2 Flat (0.5 to 1.0 m depth)
- Class 2 Pool (0.5-1.0 m depth)
- Class 2 Run (0.5-1.0 m depth)
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- Class 3 Pool (<0.5 m depth)
- Class 3 Run (<0.5 m depth)
- Riffle (<0.5 m depth)

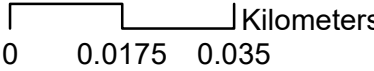


FIGURE 4.3.1
FISHERIES HABITAT MAPPING



Credits: Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS,

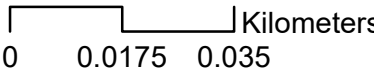


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- Riffle (<0.5 m depth)



**FIGURE 4.3.1
FISHERIES HABITAT MAPPING**



Credits: Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS,

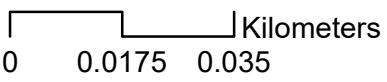


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**FIGURE 4.3.1
FISHERIES HABITAT MAPPING**





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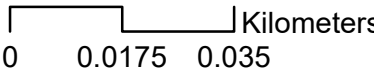


FIGURE 4.3.1
FISHERIES HABITAT MAPPING



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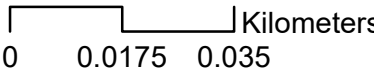


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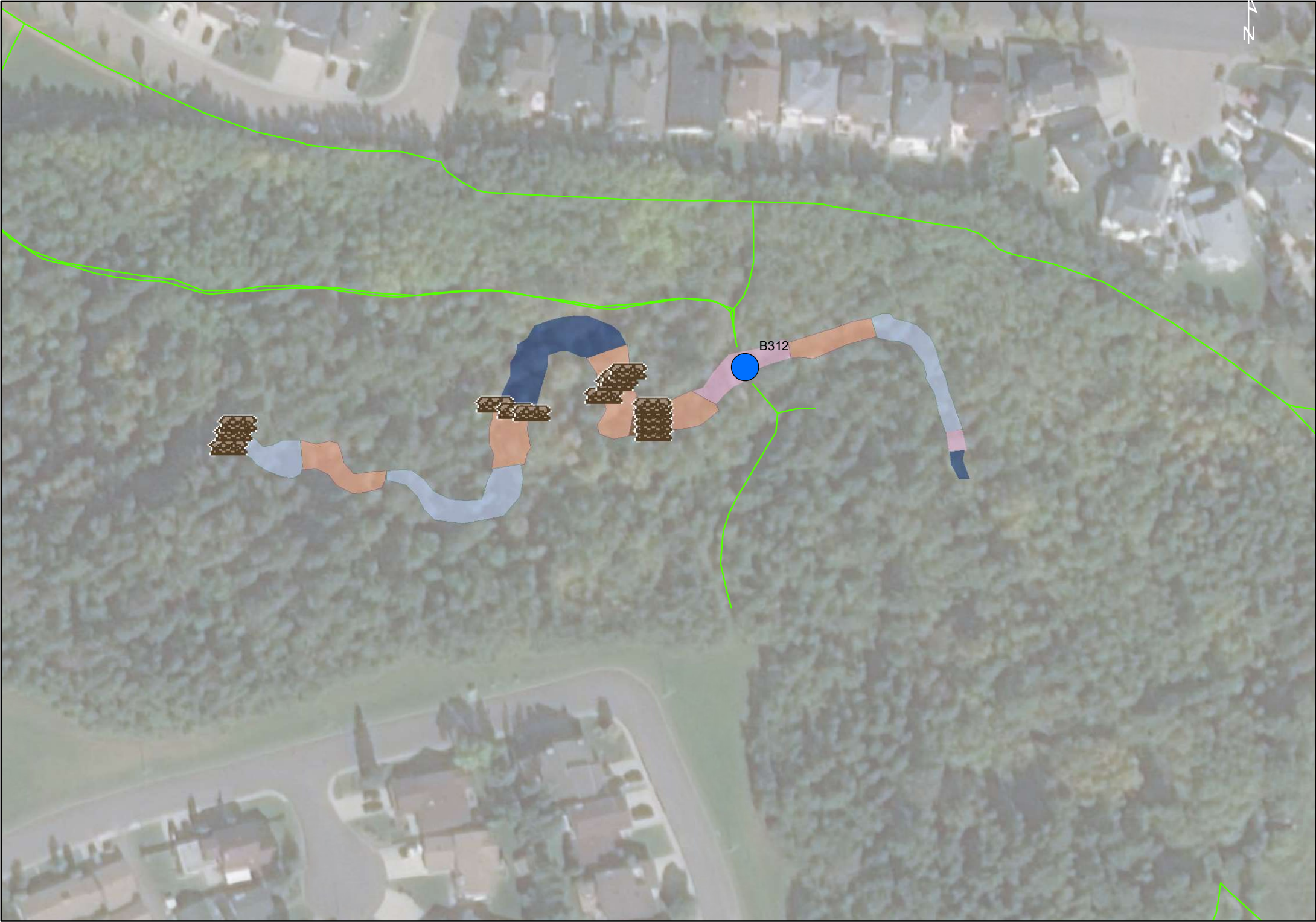
Sections

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- Riffle (<0.5 m depth)



**FIGURE 4.3.1
FISHERIES HABITAT MAPPING**





Legend

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- Parks Trail
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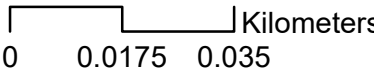


FIGURE 4.3.1
FISHERIES HABITAT MAPPING



Credits: Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS,

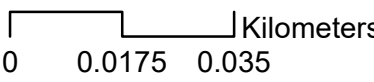


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**FIGURE 4.3.1
FISHERIES HABITAT MAPPING**



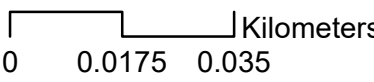


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**FIGURE 4.3.1
FISHERIES HABITAT MAPPING**



Credits: Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS,

4.4 Wildlife and Wildlife Habitat

The wildlife and wildlife habitat assessment was completed by SAGE Ecological Services for the Project, and the results of their various reports are summarized into the EIA below. The full wildlife report is provided in Appendix C.

4.4.1 Desktop Assessment

Searches of the FWMIS database for the purposes of the wildlife report were completed on October 22, 2019. A four-kilometre radius centred on the bridges was queried, which equals an area of approximately 50.3 km². Results of the FWMIS search confirmed observations of 10 wildlife species of conservation concern within the search area. Based on desktop and field data, combined with known habitat requirements and distributional ranges, a list of 24 vertebrate wildlife species of conservation concern was compiled. These species have the potential to occur within the Project area and spend some portion of their life cycle as resident, breeding, or overwintering within the Project area. These species are listed in Table 4.4.1 and include two amphibian, two reptile, 18 bird, and two mammal species. It should be noted that, although identified in the FWMIS search for the Project area, several species have been excluded from this list due to a lack of required habitat attributes within or near the Project area (e.g., sharp-tailed grouse, bald eagle). These species are not expected to occur, nor do they have potential to be impacted by the project (SAGE 2020).

Table 4.4.1: Vertebrate Species-of Conservation Concern with Potential to Occur within or Near the Project Work Area

Common Name	Scientific Name	Potential to Occur in Study Area	Status			
			AEP ¹	COSEWIC ²	Schedule ²	SARA ²
Reptiles and Amphibians						
Western Tiger Salamander	<i>Ambystoma mavortium</i>	Potential	Secure	Special Concern	No schedule	No Status
Wandering Garter Snake	<i>Thamnophis elegans</i>	Potential	Sensitive	--	--	--
Red-Sided Garter Snake	<i>Thamnophis sirtalis</i>	Potential	Sensitive	--	--	--
Western Toad	<i>Anaxyrus boreas</i>	Potential	Sensitive	--	--	--
Birds						
Great Blue Heron	<i>Ardea herodias</i>	Confirmed ³	Sensitive	Special Concern	Schedule 1	Special Concern
Northern Goshawk	<i>Accipiter gentilis</i>	Potential	Sensitive	Not At Risk	--	--
Broad-winged Hawk	<i>Buteo platypterus</i>	Potential	Sensitive	--	--	--
Swainson's Hawk	<i>Buteo swainsoni</i>	Potential	Sensitive	--	--	--
Sora	<i>Porzana carolina</i>	Confirmed ³	Sensitive	--	--	--
Common yellowthroat	<i>Geothlypis trichas</i>	Potential	Sensitive	--	--	--
Black-crowned Night-heron	<i>Nycticorax nycticorax</i>	Potential	Sensitive	--	--	--
Great Gray Owl	<i>Strix nebulosa</i>	Potential	Sensitive	--	--	--
Common Nighthawk	<i>Chordeiles minor</i>	Potential	Sensitive	Special Concern	Schedule 1	Threatened
Black-backed Woodpecker	<i>Picoides arcticus</i>	Potential	Sensitive	--	--	--

Pileated Woodpecker	<i>Dryocopus pileatus</i>	Potential	Sensitive	--	--	--
Western Wood-Pewee	<i>Contopus sordidulus</i>	Potential	Sensitive	--	--	--
Alder flycatcher	<i>Empidonax alnorum</i>	Potential	Sensitive	--	--	--
Least flycatcher	<i>Empidonax minimus</i>	Confirmed ³	Sensitive	--	--	--
Eastern Phoebe	<i>Sayornis phoebe</i>	Potential	Sensitive	--	--	--
Western Wood-Pewee	<i>Contopus sordidulus</i>	Confirmed ³	May Be At Risk	--	--	--
Bank swallow	<i>Riparia riparia</i>	Potential	Sensitive	Threatened	Schedule 1	Threatened
Western Tanager	<i>Piranga ludoviciana</i>	Potential	Sensitive	--	--	--
Mammals						
Long-tailed Weasel	<i>Mustela frenata</i>	Potential	May Be At Risk	--	--	--
Silver-haired Bat	<i>Myotis lucifugus</i>	Potential	Sensitive	--	--	--

Notes:

1. Government of Alberta 2017
 2. COSEWIC 2020
 3. Confirmed by FWMIS data to occur within a 4-km radius.
- "--" = Not Listed

4.4.2 Field Assessment

Methods

Potential for Nesting or Denning Sites

A reconnaissance-level field survey was conducted on April 22, 2020 to assess habitat quality and the occurrence of, or potential for, nesting or denning sites (e.g., cliff swallow nesting colonies, raptor nests, burrowing mammal dens, and snake hibernacula, etc.).

Potential for Wildlife Movement

A desktop review of available imagery (and other materials) combined with field searches for sign of wildlife movement were used to assess the potential for established wildlife corridors within and across the LSA. Focus was placed on regional rarity of habitats or unique ecological features on the property, existing habitat fragmentation, and the potential for the property to sustain or enhance regional wildlife movement.

Sensitive Raptor Winter Nest Survey

A survey for sensitive raptor stick nests was conducted during the reconnaissance-level field visit. In accordance with the Sensitive Species Inventory Guidelines (Government of Alberta 2013), potential raptor nesting sites, including treed, tall shrub, and cliff sites were investigated for stick nests, nesting behaviour, raptor sign, or important habitat features. Nesting behaviour included nest building, territorial displays, or nest defense (e.g., swooping calling, or aggressive behaviour). Raptor sign includes pellets, plucking posts, and associated remains. Important habitat features, in addition to existing stick nests, included large cavities, mature (dead or living) balsam poplar adjacent to spruce stands, and large standalone conifer trees within deciduous stands.



Results

Potential for Nesting or Denning Sites

Habitats within the study area with the highest potential for nesting or denning wildlife include treed riparian areas adjacent to Mill Creek. This is the most abundant habitat type near all work areas and is characterized by riparian balsam poplar forest with understory shrub including willow, alder, red osier dogwood, prickly rose, and wild red raspberry. Other adjacent habitats include coniferous and aspen forest patches on upper valley slopes, manicured grasslands (i.e., mowed fields & lawns), and anthropogenic areas/features (e.g., buildings, roads, parking areas, residences). Shoreline areas and riparian treed and shrub habitat types were assessed to provide suitable nesting habitat for a variety of bird species including migratory songbird, waterfowl, and shorebird and it is anticipated that the area holds high potential for use by nesting individuals or groups during the migratory bird breeding period (i.e., April to August).

Treed areas (especially spruce trees or groves) were assessed to have moderate potential for nesting by raptor and owls. Treed areas also hold moderate potential for use as roosting sites for bat species during breeding. Standing dead trees hold high potential for cavity nesting songbird species. There are multiple steep streambanks in the study area(s) which hold potential for nesting colonies of bank swallows or burrowing mammal den sites. Rock/debris piles and excavations also hold potential for snake hibernacula sites. The underside of each bridge structure was searched for evidence of cliff or barn swallow nesting and/or burrows or dens of fossorial mammals or snake hibernacula. No evidence of nesting or denning was observed at the bridge structures.

The LSA was investigated for other wildlife signs including established dens or multi-year nests, burrows, game trails, tracks, and scat. Incidental sighting or evidence of the 18 species were observed during the reconnaissance-level site visit including:

- American crow;
- American robin;
- Black-billed magpie;
- Black-capped chickadee;
- Bohemian waxwing;
- Common raven;
- Coyote;
- Dark-eyed junco;
- Downy woodpecker;
- Deer;
- Herring gull;
- House sparrow;
- Mallard;
- Merlin;
- Red squirrel;
- Ring-billed gull;
- Sharp-shinned hawk;
- Snowshoe hare;
- Small mammals/mice/voles.

The high amount of human recreational use on the Mill Creek trail system, and adjacent roads, residential, and commercial/industrial areas reduces the potential for nesting or denning within the LSA.

Sensitive Raptor Winter Nest Survey

The LSA is assessed to hold several important habitat features in the form of standalone conifer trees and coniferous stands which hold potential for nesting raptors and owls. An individual sharp-shinned hawk was observed near B311. No nest was discovered but it is likely that the species may nest nearby. An active merlin nest was observed at 12 U 340157E 5927298N approximately 90 m W-NW of B309 and 110 m NE of B301. It occurs near busy recreational trails and is not expected to be disturbed by the proposed construction

Wildlife Corridors and Connections

The Mill Creek ravine within the project area is assessed to be locally important for wildlife movement. Regionally, extensive fragmentation caused by urban residential and industrial development has, in effect, blocked regional movement; especially with respect to connectivity with the North Saskatchewan River Valley. Wildlife movement is evidenced by a network of game trails on valley slopes and within the valley bottom crisscrossing Mill Creek. Track evidence shows that wildlife species also use the recreational pathway system when human use is low (e.g., at night). Human use on game trails was also observed during the field

investigation in the form of tracks in snow, ice, and mud. It is likely that medium to large mammals common to the City (e.g., deer, coyote) utilize the Mill Creek corridor to access adjacent residual habitats or anthropogenic natural areas (e.g., golf courses) as available.

The existing bridge structures were assessed for wildlife passage. The bridge structures do not have sufficient height to allow for wildlife passage under the bridges for most large mammals that might occur. Medium-bodied species such as coyote might cross under the bridge when water levels are low or frozen, and larger mammals may cross over the bridge structures themselves.



4.5 Vegetation

4.5.1 Desktop Assessment

Central Parkland Natural Subregion

The Parkland Natural Region has been strongly influenced by agriculture for greater than 100 years and is densely populated. The remaining native vegetation is a mosaic of aspen and grasslands. Grassland vegetation communities dominate the southern areas of the region with small aspen dominated communities occurring in moister habitats. The northern parts of the Region are composed of aspen or aspen and balsam poplar forest with grasslands being restricted to the driest areas (NRC 2006).

The Central Parkland Natural Subregion occupies over 50,000 km² of land and most of these lands are under cultivation. Undulating till plains and hummocky uplands dominate the landscape. Lacustrine and fluvial deposits are common with some substantial eolian deposits in the northern and eastern parts of the subregion. Plains rough fescue dominates the vegetation communities in the southern and eastern areas of the subregion with trembling aspen dominated communities occurring in moister habitats. The northern and western parts of the subregion are composed of aspen forest with grasslands restricted to the driest areas. Black Chernozem soils normally occur under grasslands while Dark Grey Chernozems and Luvisols generally occur in aspen forests (NRC 2006).

ACIMS Element Data

ACIMS element occurrence data was reviewed to identify known rare plant and rare ecological community occurrences in the 2km Study Area of the Project. No historical ACIMS occurrences are within this 2km Study Area. Rare vascular plant species and rare ecological communities known to occur within the Central Parkland Natural Subregion are provided in Appendix G.

Environmentally Significant Areas

The probability for Environmentally Significant Areas was assessed by examining the Environmentally Significant Areas in Alberta: 2014 Update report (Fiera 2014) as well as the corresponding spatial data.

To qualify as a provincial Environmentally Significant Area, areas must exceed the criteria sum of 0.189 (Fiera 2014). No provincial environmentally significant areas are located in the LSA (Appendix H).

Regionally Significant Habitat

The Project is not located within or in close proximity (*i.e.* 5.0 km) to any:

- Ramsar Wetlands of International Importance (Bureau of the Convention on Wetlands 2014)
- Migratory Bird Sanctuaries (ECCC 2019)
- World Biosphere Reserves (United Nations Educational, Scientific and Cultural Organization 2018)
- Western Hemisphere Shorebird Reserves (Western Hemisphere Shorebird Reserve Network 2019)
- Important Bird Areas (Bird Studies Canada and Nature Canada 2015)
- National Wildlife Areas (ECCC 2020)
- Ducks Unlimited Canada Projects (DUC 2020);
- Alberta Provincial Parks and Protected Areas (Alberta Parks 2016)

4.5.2 Field Assessment

Methods

Vegetation in the Project was assessed using a wandering meander technique (Alberta Native Plant Council [ANPC] 2012) focused on the immediate area surrounding each bridge (20m radius). Plants were identified to species level where possible and vegetation communities were described using the Urban Ecological Field Guide (City of Edmonton 2015). Lichens and bryophytes were not assessed in the field.

Results

Observed Species

A map of bridge locations on the Project is depicted in Figure 4.5.1 and each community type is described below.

Native Plants

Native plant species observed during the 2020 field assessments are provided in Appendix G.

Weeds

There were 20 weed species including five Noxious (white cockle, common tansy, Canada thistle, perennial sow-thistle, and common burdock) and one Prohibited Noxious weed species (common buckthorn) observed during the 2020 field assessments; see Appendix G for a list of all weed species at each bridge and Appendix B (Photo Plates 12-18) for photographs.

Rare Plants

No previous occurrences of rare vascular species or rare ecological communities have been recorded in the 2km Study Area. The output from ACIMS is provided in Appendix G. A table of rare vascular plant species known to be in the Central Parkland Natural Subregion is provided in Appendix G.

No rare plants or rare ecological communities were observed during the 2020 field surveys, though the rare plant potential of the Project Area is considered moderate.

Vegetation Communities

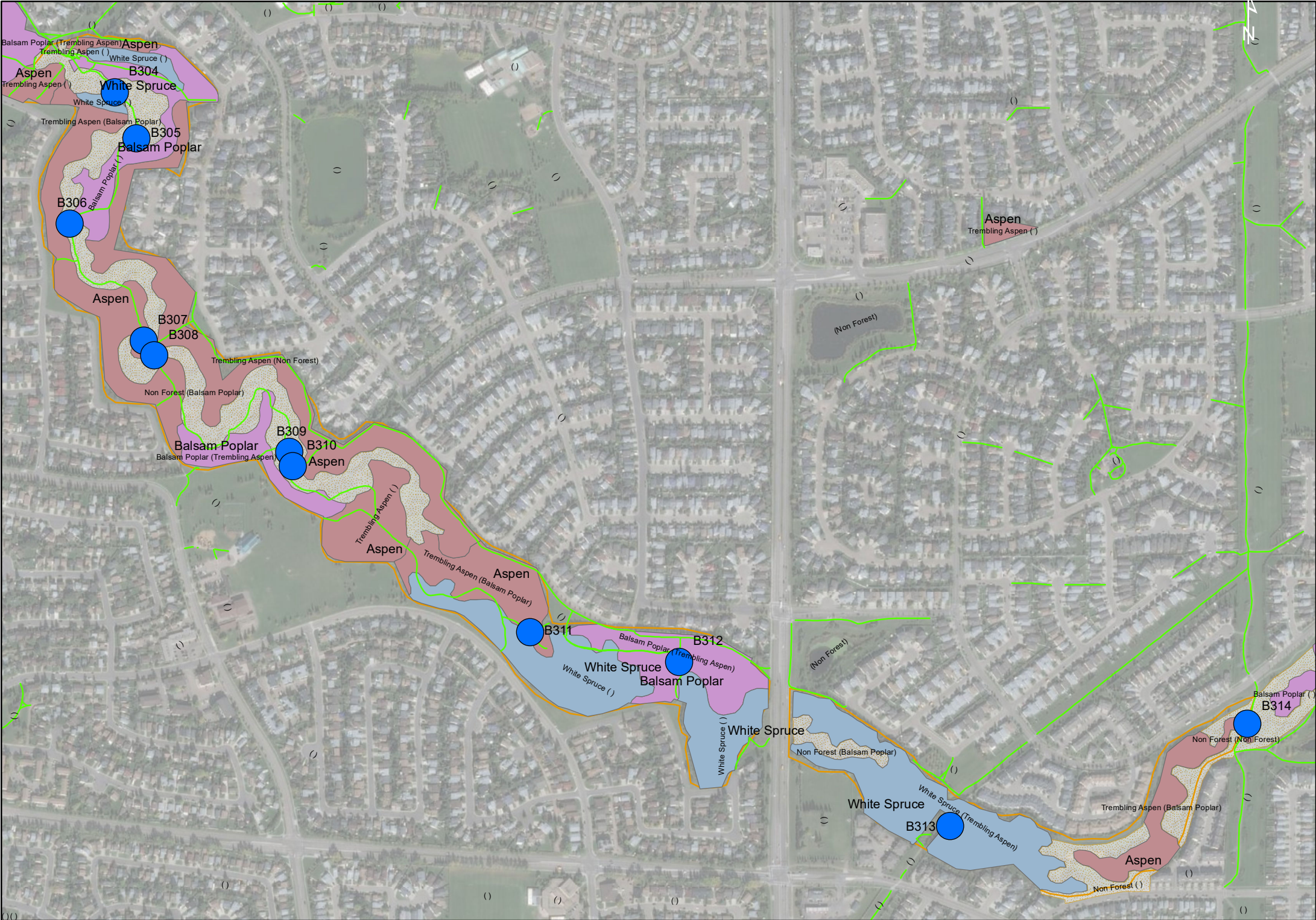
Vegetation communities at each bridge was keyed as per the Urban Ecological Field Guide (City of Edmonton 2015), described in Table 4.5.1 below. The Primary Land and Vegetation Inventory (uPLVI) dataset, shows the primary canopy species polygons in the Mill Creek Ravine (City of Edmonton 2016b).

Table 4.5.1: Vegetation Communities

Vegetation Community Code	Bridge	Typical Tree Species	Typical Shrub Species	Typical Understory Species (Forbs, Grasses)
NF13 Non-Forest/ Reed canary grass	B314 (east side of)	n/a	Yellow willow, high bush-cranberry, red-osier dogwood, beaked willow, beaked hazelnut, wild red raspberry	Reed canary-grass, Canada thistle, ostrich fern, common dandelion, purple stemmed aster, large leaved avens
AW5 Aspen/ Red osier-dogwood	B308	Trembling aspen, balsam poplar	Red osier-dogwood, beaked hazelnut, high bush-cranberry, saskatoon, western snowberry, prickly rose, choke cherry, common snowberry, bracted honeysuckle, low bush-cranberry, wild red raspberry	Wild sarsaparilla, bunchberry, wild lily-of-the-valley, Kentucky bluegrass, marsh reed-grass
AW7 Aspen/ Smooth brome	B314 (west side of)	Trembling aspen, balsam poplar, White spruce	choke cherry, western snowberry, red osier-dogwood, beaked hazelnut, prickly rose, wild red raspberry, saskatoon	Smooth brome, common horsetail
DLM4 Deciduous mixedwood/ European mountain-ash	B313	White spruce, balsam poplar, white birch, European mountain-ash, trembling aspen	Common buckthorn, hedge cotoneaster, low bush-cranberry, choke cherry, beaked hazelnut, wild red currant, northern black currant	wild sarsaparilla, palmate-leaved coltsfoot
MD5 Mixed Deciduous/ Beaked hazelnut	B312	Balsam poplar, trembling aspen, white spruce, white birch	Beaked hazelnut, high bush-cranberry, saskatoon, red osier-dogwood, caragana, wild red raspberry, common snowberry, twinning honeysuckle, bracted honeysuckle	Canada thistle, wild sarsaparilla, palmate-leaved coltsfoot, bunchberry, smooth brome
CLM9 Coniferous mixedwood/ Red osier-dogwood – level slopes	B311	White spruce, balsam poplar	Red osier-dogwood, western snowberry, common snowberry, choke cherry, high bush-cranberry, wild red raspberry, prickly rose	Wild sarsaparilla
PB2 Balsam Poplar/ Beaked Hazelnut	B307, B306, B305, B310, B309	Balsam Poplar	Beaked hazelnut, red-osier dogwood, high bush-cranberry, common buckthorn, prickly rose, choke cherry	Showy aster, wild sarsaparilla, dewberry
PB3 Balsam Poplar/ Red-osier dogwood	B304	Balsam Poplar, Manitoba maple	Red-osier dogwood, river alder, wild red raspberry, western snowberry, prickly rose, choke cherry, low bush-cranberry	Canada thistle, wild sarsaparilla, stinging nettle, marsh reed grass, smooth brome

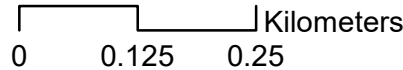
Notes:

1. Common name is as per Urban Ecological Field Guide (City of Edmonton 2015).
2. Species with typical percent cover of 1% or less are excluded from this table for brevity.
3. Species assemblages listed are as described in the Urban Ecological Field Guide (City of Edmonton 2015).



Legend

-  Bridge
 -  LSA
 -  Parks Trail
- uPLVI**
- Dominant Canopy Species**
-  Aspen
 -  Balsam Poplar
 -  White Spruce
 -  Naturally Non-wooded



**FIGURE 4.5.1
PRIMARY LAND AND VEGETATION
INVENTORY (UPLVI) MAP FOR
MILL CREEK RAVINE**





4.6 Historical Resources

Historical Resources and their associated regulatory requirements have been completed by Turtle Island Cultural Resource Management (Turtle Island) and their subconsultants for the Project. The Statements of Justification (SOJs) for both archaeology and paleontology for the Project are summarized below, and have been provided in Appendix I.

4.6.1 Desktop Assessment

Archaeology

As part of the historical desktop assessment, a review of the land use of the area, records of previously identified historical sites within 1 km of the Project area, and historical aerial photos were reviewed to determine the potential for historical sites. The review also included the depth and extent of sedimentation and the history of disturbance in the area, to determine the likelihood of disturbance of potential subsurface deposits.

Thirteen previously recorded archaeological sites are located within and adjacent to the Project area and are presented in Table 4.6.1. Proximities given are approximates, to protect the historical nature of the sites. The majority of these sites have been recorded in association with a residential development.

Table 4.6.1: Previously Identified Historical Sites

Site Number	Proximity to Bridge(s)	HRV	Type
FiPi-20	>500 m	0A	Isolated Find
FiPi-5	<100 m	0A	Scatter, Campsite
FjPi-6	<200m	0A	Scatter, Campsite
FiPi-42	<100 m	4A	Campsite
FiPi-7	>100 m	0A	Scatter, Campsite
FiPi-8	>200m	0A	Scatter, Campsite
FiPi-12	>200m	0A	Scatter, Campsite
FiPi-109	>200m	4A	Scatter <10
FiPi-9	>100 m	0A	Scatter
FiPi-11	>200m	0A	Isolated Find
FiPi-10	>200m	0A	Scatter, Campsite
FiPi-48	>200m	0A	Isolated Find
FiPi-50	>200m	0A	Scatter
FiPi-51	>200m	0A	Campsite

Source: Turtle Island Cultural Resource Management 2020

Paleontology

No paleontological HRV values have been assigned for the LSDs that Project will affect. However, a review of the geology indicates that there is the potential to impact Quaternary fossils in glacial outwash, and in the underlying Cretaceous Horseshoe Canyon Formation. The Edmonton area has produced a wealth of Quaternary macro-fossils. These fossils have primarily been found in gravel deposits and river terrace exposures along the edge of the North Saskatchewan River (Steppe Consulting 2020).

4.6.2 Field Assessment

Methods

No formal field assessment was completed for historical resources, rather, Turtle Island and Steppe Consulting completed a review of Thurber's geotechnical boreholes. Specimens from these boreholes were examined on February 14 and March 9, 2020. Thirty-seven samples collected from the nine boreholes were inspected by an archaeologist for sediments within the upper two meters of the bore. Two main areas of paleontological potential were targeted in the investigation: identifying whether glacial outwash sediments were present and significant, and the depth and potential of the Horseshoe Canyon Formation.

Results

Archaeological

Sediments at the bridge locations generally consisted of course grained sand overlaying high plastic clay mixed with unsorted gravel. Surface deposits were not identified at bridges B305, B313 and B314, and were not investigated further. A preserved stable surface within 30 cm of the surface was identified at bridges B307, B308 and B312, with additional sediments being located at bridges B304, B306, B309, B310 and B311 (Turtle Island Cultural Resource Management 2020).

It was recommended as part of the SOJ that a formal archaeological HRIA be completed at bridges B304, B307, B308, B309, 310 and 312 prior to construction. This recommendation was approved by the Province, and the HRIA work is currently being completed.

Paleontology

The investigation revealed that the surficial sediments (where not removed through previous construction) were thin, predominantly fluvial, and of recent origin. Silty sand layers were present, however these were generally thin (<0.5m) and fine to medium grained. These sand deposits were interbedded with silt and clay layers, interpreted as overbank flood deposits from Mill Creek. These sediments have little potential palaeontological potential (Steppe Consulting 2020).

The Horseshoe Canyon formation consisted of interbedded sandstone and shale beds. The sandstone was weakly to moderately consolidated, massive to well bedded (Appendix I, Figure 5) and commonly contained fragmentary carbonaceous material. These sediments have moderate to high potential to produce significant palaeontological material (Steppe Consulting 2020). It was recommended as part of the SOJ that no paleontological HRIA be completed prior to construction and that no further paleontological work is required if screw-piles or similar non-disturbing construction methods are used. In the case where excavation exceeds the depth of bedrock, paleontological monitoring should occur (Table 4.6.2). ACMSW agreed with this approach in their historical approval.

Table 4.6.2: Recommended Depths for Paleontological Monitoring

Bridge ID	Bedrock Depth (m)
B304	9.0
B305	2.0
B306	3.0
B307 and B308	2.0
B309 & B310	5.0
B311	4.0
B312	6.5
B313	4.0
B314	10.5

Source: Steppe Consulting 2020



4.7 Recreational Resources

4.7.1 Methodology

Recreational use of the upper Mill Creek valley is well understood by the City, as it is an important resource for dog walkers, runners and mountain bikers. A review of the River Valley Trail Maps was completed by ISL and impacts to recreational access are focused on trail closures and detours. Additional observations of recreational use were observed by ISL's biologists during their respective field assessments

4.7.2 Results

The Mill Creek Ravine South pathway is a granular pathway that connects to nearby neighborhoods by numerous pathways and stairways, including the nearby Minchau School Playground (City of Edmonton 2020a). Both the utility right-of-way and the granular pathway through Mill Creek Ravine from 50th Street NW to 34 Street are off-leash dog areas, allowing for ample off-leash dog walking opportunities in southeast Edmonton (Figure 4.7.1). Multiple linkages exist between the Mill Creek Ravine trail and the neighborhoods of Minchau and Greenview to the west and Larkspur, Wild Rose and Silver Berry to the east.

Less formal singletrack trails favoured by mountain bikers are also present in the Mill Creek Ravine, in areas adjacent to the Creek. Adjacent to the natural ravine is open manicured park space that support various informal recreational uses. Overall, the area is heavily used by pedestrians, joggers, cyclists, dog-walkers, birders, cross-country skiers in winter, and other recreational users.

ISL biologists frequently observed cyclists, dog-walkers, joggers and walking groups using the trail system in the Mill Creek Ravine.



Figure 4.7.1: Off Leash Dog Park in Mill Creek Ravine South

4.8 Visual Resources

4.8.1 Methodology

Assessment of the visual resources in the area of the Mill Creek Ravine bridges (B304 to B314) accounted for the aesthetics of the bridges, their context in the Mill Creek Ravine South area and anthropogenic use. Existing views and sightlines were documented by the ISL field biologists through a qualitative description of views observed on and surrounding the bridges.

4.8.2 Results

The Mill Creek Ravine is a deep, un-manicured natural ravine in the middle of numerous residential neighborhoods. The thick canopy of the forest provides a seclusion and noise buffering from the City. Sightlines are limited due to the dense vegetation present, tree canopy and the winding and topographically varying nature of the trail system. These aspects are appreciated by the public as relayed to the biologists during their field assessments. ISL biologists received informal comments from the public including remarks on the ‘peacefulness’ of the area and how it feels like one is “out of the City”.

The current bridges appear to have been meant for foot and cycling traffic only and to match the granular trail system. Some bridges naturally blend in with the surrounding natural environment in an understated manner, while others are painted brightly and provide contrast to the environment (Figure 4.8.1). The bridges generally provide excellent viewpoints of Mill Creek, which meanders slowly under the bridges, providing a visual focal point and, for some, a destination within the Ravine.



Figure 4.8.1: Bridge B314, showing contrast to the natural environment that surrounds it (June 26, 2020).

The bridges are visually showing their age, with most chipping paint and many with visible decay and hazardous tripping gaps, which detract from the visual resource value (Figure 4.8.2).



Figure 4.8.2: Bridge B309, Showing Visual Signs of Age and Deterioration (June 26, 2020).



5.0

Potential Effects, Mitigation Measures and Residual Analysis

5.1 Effects and Mitigation

Potential environmental effects on VECs of the Project were evaluated to determine mitigation and best management practices that will reduce the impacts of the Project and any residual effects after mitigation has been applied. Typical effects for each VEC and standard mitigation key mitigation measures to reduce the impact on the environment are provided below, and a summary mitigation table is provided in Table 5.1. Within this table, standard mitigation measures are provided with site-specific mitigation provided for each specific effect, and any potential residual effect. The effects table includes potential effects during demolition of the existing bridge, construction of the replacement bridges and post-construction requirements. An assessment of significance of residual effects follows in Section 5.2.

5.1.1 Geotechnical

Geotechnical effects and mitigation measures relating to the pile types, depths and compression are not considered in the EIA as they are covered in Thurber's Geotechnical report. Environmental effects and key mitigation are provided below.

Effects

Potential effects on the Geotechnical VEC associated with the Project that may impact the environment include:

- Alteration of banks as a result of earthworks to achieve engineering requirements
- Admixing of soils
- Chance finds of contaminated soils

Mitigation

Application of appropriate mitigation measures will reduce the potential effects of the Project on the Geotechnical VEC. Key mitigation measures include:

- Restoring and armoring bank slopes
- Monitoring and maintenance of slopes should be carried out on a regular basis.
- Use appropriate fill material to promote slope stability. Remove any existing organic soil before placing embankment materials.
- Developing a Contaminated Soils Discovery Contingency Plan

5.1.2 Hydrology and Surface Drainage

Effects

Potential effects on the Hydrology and Surface Drainage VEC associated with the Project include:

- Alteration of surface hydrology of Mill Creek
- Alteration of drainage patterns
- Erosion into Mill Creek

Mitigation

Numerous potential effects on hydrology and surface drainage can be avoided through design, such as through hydrotechnical design of the bridge elevations and extension of the bridge length compared to the existing bridges. A positive impact is expected in regards to improvement of hydraulic capacity of the crossings, as the crossings provide a greater cross-sectional area for Mill Creek to travel through.

Application of appropriate mitigation measures will reduce the potential effects of the Project on Hydrology and Surface Drainage. Key mitigation measures include:



- Armoring bank slopes with appropriate size rip rap
- Installing effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody.
- Restore topography to return drainage patterns as close to original as possible

5.1.3 Fish and Fish Habitat

Effects

Potential effects on Fish and Fish Habitat associated with the Project are focused mostly on instream work, such as the implementation of rip rap along bridge edges, the removal of the existing piers/abutments and include:

- Direct mortality of fish
- Alteration of instream fish habitat
- Alteration of riparian habitat
- Sedimentation of the watercourse during construction

Mitigation

Numerous potential effects on fish and fish habitat can be minimized through design, and by extending the bridge lengths the fish habitat availability is greater. The design has reduced the total footprint below the bridge by including a key into riprap design to avoid cross-stream impacts. Furthermore, application of appropriate mitigation measures will reduce the potential effects of the Project on fish and fish habitat. Key mitigation measures include:

- Work within the watercourse should be conducted in low-water season as much as possible, and any instream work should be completed in isolated conditions. This includes the demolition and removal of the existing abutments and piers.
- Prohibit fuel storage, refueling, or servicing of equipment within 30 m of waterbodies (i.e., Mill Creek), except where secondary containment and/or tertiary containment is provided.
- Direct the grading away from Mill Creek to the extent possible, to reduce the risk of sedimentation.
- Use dams made of non-earthen material such as water-inflated portable dams, concrete blocks, sandbags, clean rock, or other appropriate designs to separate the work site from flowing water
- Remove fish from isolated areas, prior to completing work
- Monitor to assess sediment release (i.e., turbidity and Total Suspended Solids [TSS]) during construction

5.1.4 Wildlife and Wildlife Habitat

Effects

Potential effects on Wildlife and Wildlife Habitat associated with the Project are focused mostly on disturbance of wildlife species during construction and include:

- Disturbance to breeding or overwintering groups or individuals
- Disturbance during the general nesting period
- Disturbance of nesting or denning wildlife.

Mitigation

Numerous potential effects on wildlife and wildlife can be minimized by construction timing. Furthermore, application of appropriate mitigation measures will reduce the potential effects of the Project on wildlife and wildlife habitat. Key mitigation measures include:

- Avoid disturbance of natural habitats by minimizing work footprint.

- Conduct vegetation clearing after late August and/or before March 1 to avoid incidental take of migratory birds, nests, or eggs and to maintain compliance with the Migratory Birds Convention Act, the Species at Risk Act, and the Alberta Wildlife Act.
- If clearing is required within known breeding periods, migratory bird breeding surveys should be completed by a qualified avian specialist. If breeding bird activity is observed, appropriate disturbance buffers should be implemented until young have fledged and left the nesting area.

5.1.5 Vegetation

Effects

The potential effects on Vegetation include tree removal for the new bridges, tree removal where required for temporary access across the creek as well as grading impacts, and are anticipated to be the following:

- Loss of native plant species and communities
- Introduction of new weed or invasive species
- Further establishment of existing weed or invasive species

Tree removal will be limited at each bridge site where the replacement bridges are being installed, approximately 5 m on each side of the bridge width, to provide adequate clearance for the bridges. A separate Tree Protection Plan is being developed by ISL in consultation with the City to provide a clearer understanding of the tree removals required.

Mitigation

Numerous potential effects on vegetation have been minimized through design, including utilizing the existing bridge footprint to the extent feasible, as well as limiting the clearing of trees to the extent required for the new bridges. Furthermore, application of appropriate mitigation measures will reduce the potential effects of the Project on vegetation. Key mitigation measures include:

- Design and implementation of a Tree Protection Plan for the Project
- Plan for laydowns outside of the Mill Creek Ravine to avoid significant tree removal.
- Weed control prior, during, and following construction, as well as equipment cleaning and soil handling procedures to minimize weed spread, is recommended
- Implement a post-construction monitoring program to monitor weeds at least twice during the growing season post-construction for two years

5.1.6 Historical Resources

Effects

The potential effects on Historical Resources are focused on chance-find encounters that may impact historical resources, as pre-construction historical assessment is being completed to limit any direct impact on resources.

Mitigation

Application of appropriate mitigation measures will reduce the potential effects of the Project on recreational resources. Key mitigation measures include:

- The Contractor will develop a Chance-Find procedure for the incidental find of historical resources during construction.
- Paleontology monitoring will occur if excavations that reach bedrock occur (see below).
- An archaeological HRIA will occur prior to construction.



It was recommended as part of the SOJ that no HRIA be completed prior to construction and that no further paleontological work is required if screw-piles or similar non-disturbing construction methods are used. In the case where excavation exceeds the depth of bedrock, paleontological monitoring should occur (Table 5.2). ACMSW agreed with this approach for their historical approval.

Table 5.2: Recommended Depths for Paleontological Monitoring

Bridge ID	Bedrock Depth (m)
B304	9.0
B305	2.0
B306	3.0
B307 and B308	2.0
B309 & B310	5.0
B311	4.0
B312	6.5
B313	4.0
B314	10.5

Source: Steppe Consulting 2020

5.1.7 Recreational Resources

Effects

The potential effects on Recreational Resources is limited to trail closures and detours during construction.

Mitigation

Application of appropriate mitigation measures will reduce the potential effects of the Project on recreational resources. Key mitigation measures include:

- Minimizing construction time to extent possible
- Preferentially choosing bridge construction options that result in shorter construction times to minimize disruption
- Providing signage at all trail entries at the top of the ravine, notifying the public of closures and providing detour options well in advance.

5.1.8 Visual Resources

Effects

The potential effects on Visual Resources are anticipated to be the following:

- Loss of aesthetic value (bridge aesthetic and vegetation changes) by visitors/recreational users

Mitigation

Design of the bridges has been completed to complement the natural environment and be similar to the existing structures. Additional application of appropriate mitigation measures will reduce the potential effects of the Project on recreational resources. Key mitigation measures include

- Narrow construction limits to the minimum required for construction.
- Plant and seed with native species known to be present in the Mill Creek Ravine

Table 5.1: Standard and Site-Specific Mitigation for Potential Effects of the Proposed Project

Environmental Component	Potential Effect	Location	Standard Mitigation	Site Specific Mitigation	Potential Residual Effect
Geotechnical	Alteration of banks as a result of earthworks to achieve engineering requirements	Project Footprint	- Work will be suspended during weather that could increase the potential for erosion and sedimentation. - Monitor revegetation of side-slopes and banks to ensure that adequate vegetation is in place to deter sedimentation of any waterbody - Postpone grading until spring breakup if the spoil piles have frozen to an extent that would impair natural water drainage on site. - Restore topography to return drainage patterns as close to original as possible. - Conduct vegetation restoration with fast growing native species immediately after earthworks on banks are complete, to help limit erosion and dust. Consider planting plugs instead of seeding. - Monitor areas of potential terrain instability following construction. Conduct remedial erosion control work, as needed	- Limit impacts to landscape by limiting footprint of project to extent feasible. - Follow recommendations in the Geotechnical report for armoring and bank geotechnical requirements	No residual effect identified
	Admixing of Soils	Project Footprint		Limit impacts to landscape by limiting footprint of project to extent feasible.	No residual effect identified
	Chance finds of contaminated soils	Project Footprint		- Limit impacts to landscape by limiting footprint of project to extent feasible. - Soil removed during bridge timber pier or abutment excavation should be treated as meeting AEP Tier 1 residential/parkland guidelines. - The Contractor will develop a Contaminated Soil Chance Find Procedure and will notify the consultant if during construction within the project area visual and/or olfactory signs of soil hydrocarbon and/or creosote impacts are encountered in order to test the soil for PAHs.	No residual effect identified
Hydrology and Surface Drainage	Alteration of surface hydrology of Mill Creek	Project Footprint, Local	- Work will be suspended during weather that could increase the potential for erosion and sedimentation. - Install effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody. - During soil disturbance activities identify locations where gaps in snow, topsoil, and spoil, if needed, are to be created. Gaps are typically associated with terrain features (e.g., slope changes), and crossings (e.g. roads).	- Design has been complete to raise and extend bridges, therefore not impacting surface hydrology - Armor bank slopes with appropriate size rip rap (Class 1M or larger)	Alteration of surface hydrology of Mill Creek
	Alteration of drainage patterns	Project Footprint		Maintain drainage patterns through the site through design and attempt to design to retain entire seasonal and semi-permanent stream lengths.	No residual effect identified
	Erosion into Mill Creek	Project Footprint, Local		- Develop a site-specific ESC plan for the Project area to be incorporated by the Contractor and ensure the ESC measures are inspected by a qualified professional (e.g., CPESC) on a frequent basis - Monitor revegetation of side-slopes to ensure that adequate vegetation is in place to deter sedimentation of Mill Creek - Ensure that design of the bridge and approach structures transport precipitation away from the creek, towards well vegetated areas to allow for sediment to settle out before entering any waterbody - Do not remove root systems of vegetation wherever feasible, to limit erosion and dust.	No residual effect identified
Fish and Fish Habitat	Direct Mortality of Fish	Project Footprint	- Restrict construction activities to designated workspace, access routes and approved temporary workspace. - Maintain equipment in good working conditions and ensure that equipment and vehicles are free of leaks. - Do not wash equipment or machinery in Mill Creek. Control wastewater from construction activities to ensure it does not enter Mill Creek. - Prohibit fuel storage, refueling, or servicing of equipment within 30 m of any waterbodies (i.e., Mill Creek), except where secondary containment and/or tertiary containment is provided. - Ensure no fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides, or other chemicals are release on the ground or into any waterbody (i.e., Mill Creek). - Where practical, delay grading until immediately before construction of the crossing. If required, appropriate temporary erosion and sediment control structures should be installed. - Direct the grading away from Mill Creek to the extent possible, to reduce the risk of sedimentation. - Store spoil in a manner that does not interfere with natural drainage patterns. - Install erosion and sediment control measures where warranted, prior to commencing grading and existing bridge removal, in the vicinity of watercourse crossings.	- Consider implementing fish scare tactics (e.g., scare pass with electrofisher) prior to installation of isolation to reduce the number of fish within isolated area. - Conduct a fish rescue in all isolated areas prior to any in-water works taking place. - Block fish from entering in-water work areas before the fish rescue and in-water works occur.	No residual effect identified
	Alteration of instream fish habitat	Project Footprint		- Limit impacts to the riparian area by limiting vegetation removal to the extent required. - Avoid work within the normally wetted area of the waterbody. - Minimize in-water work requirements to the extent required.	Alteration of instream fish habitat
	Alteration of riparian habitat	Project Footprint		Limit impacts to the riparian area by limiting vegetation removal to the minimum extent required.	No residual effect identified
	Sedimentation of the watercourse during construction	Project Footprint, Local		- Implement adequate erosion control on upslope areas to prevent release of suspended sediment. - Inspect temporary sediment control structure on a regular basis, and following precipitation events and snowmelt. Undertake repairs where required. - Use dams made of non-earthen material such as water-inflated portable dams, concrete blocks, sandbags, sheet piling, clean rock, or other appropriate designs to separate the work site from flowing water	Increase of suspended sediment during in-water construction

Environmental Component	Potential Effect	Location	Standard Mitigation	Site Specific Mitigation	Potential Residual Effect
			- Reduce clearing of extra temporary workspace to the extent practical. Ensure staging areas for crossing construction and grade/borrow areas for spoil storage are located outside the riparian area. - Vegetative buffers should be maintained where feasible.	- If pumping occurs, pump sediment laden dewatering discharge into an approved upland vegetated area or settling basin to prevent sediment and other deleterious substances from directly re-entering Creek. - Follow guidance on screen design found in DFO's Freshwater Intake End-of- Pipe Fish Screen Guideline (DFO 1995). - Clean isolated area before removing any isolation - Monitor to assess sediment release (i.e., turbidity and Total Suspended Solids [TSS]) during construction.	
Wildlife and Wildlife Habitat	Disturbance to breeding or overwintering groups or individuals	Project Footprint	- Work only within designated areas within the Project work area - If an active nest or den is suspected within or near the work area during construction, establish a work buffer and contact a qualified wildlife biologist immediately. - Avoid disturbance of natural habitats by minimizing work footprint to established rights-of-way, trails, pads, etc.	- Implement construction outside the general nesting period for raptors and migratory birds for this region (i.e., March 1 to August 20) - If clearing is required within known breeding periods, an inclusive preconstruction wildlife survey should be completed by a qualified specialist. If breeding activity is observed, appropriate disturbance buffers should be implemented.	No residual effect identified
	Disturbance during the general nesting period	Project Footprint, Local		If clearing is required within known breeding periods, migratory bird breeding surveys should be completed by a qualified avian specialist. If breeding bird activity is observed, appropriate disturbance buffers should be implemented until young have fledged and left the nesting area.	No residual effect identified
	Disturbance of nesting or denning wildlife.	Project Footprint, Local		- Implement construction outside the general nesting period for raptors and migratory birds for this region (i.e., March 1 to August 20) - If clearing is required within known breeding periods, an inclusive preconstruction wildlife survey should be completed by a qualified specialist. If breeding activity is observed, appropriate disturbance buffers should be implemented.	No residual effect identified
Vegetation	Loss of native plant species and communities	Project Footprint	- Narrow construction limits to the minimum required for construction. - Do not plan for placement of temporary workspace where significant tree removal is required to accommodate it. - Prior to construction, manage weeds located on the construction footprint during previous growing season. This is to additionally include locations of temporary workspace, staging and stockpile areas. - Do not park or store vehicles, equipment, materials or machinery on invasive plant infestations. If a weed infested area must be used for material or equipment storage, treat or remove invasive plants prior to use of the area. - Construction equipment must be clean and free of soil or vegetative debris before its arrival on the Project site to reduce the risk of weed introduction. Any equipment that arrives dirty, will not be permitted on the construction footprint. - The contractor is to review site-specific locations to be avoided during topsoil movement and any grading activities. - Install signage on the fences of avoidance areas to alert workers of the presence of sites to be avoided or where special measures are necessary (e.g. weed infestations, Mill Creek) - Clear vegetation only to the extent warranted to reduce the loss of native vegetation and reduce the potential for terrain instability and erosion. - Monitor weed growth monthly in the growing season during the course of construction and conduct corrective measures. - Use equipment that will avoid or reduce disturbance and deposition of debris off the construction footprint. - If warranted, lay geotextile material such as matting over sensitive erosional areas to reduce soil and surface vegetation effects. - Conduct native vegetation restoration at earliest possible date. On erosional slopes use a fast growing, certified weed free native seed mix not more than 2 years old. Certification must be provided and approval by the Engineer is required prior to	Fence boundaries to avoid disturbance of Mill Creek. Do not allow clearing or grading beyond the fencing unless mitigation plans and approvals for that area have been made/obtained from the Engineer. Re-fence the boundaries where warranted following disturbance.	Loss of existing native plants
	Introduction of new weed or invasive species	Project Footprint		- Weeds: The Project area has moderate densities of weed species. Weed control prior, during, and following construction, as well as equipment cleaning and soil handling procedures to minimize weed spread, is recommended, including: - Clean all construction equipment prior to its arrival on site and following exit of the site to prevent the introduction of new weed species to the site or of weed species on site to other locations. - Conduct weed control (if prior to seed set) before construction commences. - Monitor weed growth during construction occurring in the growing season and conduct weed control on soil storage piles and elsewhere, if necessary. Do not utilize the soil in weed infested areas on other projects to avoid transferring weed to other locations. - Conduct post-construction monitoring of weed growth and conduct weed control if necessary. Implement a multi-year weed control and monitoring program. - Utilize a certified and licensed pesticide applicator company to conduct any chemical control of weeds. - If Noxious or Prohibited Noxious weeds (as listed by the Government of Alberta) are mechanically controlled (cutting, mowing, pulling), remains should be collected, double bagged and disposed of in deep burial at a landfill. - Seeding with a certified weed free mix of native grasses, or plugs, following construction activities (or in the spring of the following growing season) is recommended.	Introduction or further establishment of weed or invasive species.
	Further establishment of existing weed or invasive species	Project Footprint			



Environmental Component	Potential Effect	Location	Standard Mitigation	Site Specific Mitigation	Potential Residual Effect
			planting/seeding. Plant replacement native trees and shrubs where removed for construction. • After seeding or planting, reduce foot traffic until establishment has occurred. • Vehicle traffic should be prohibited on newly vegetated areas until establishment. • Implement a post-construction monitoring program to monitor weeds at least twice during the growing season post construction for 2 years. • If weed species on the Weed Act are observed, they are to be immediately controlled or eradicated as per the Weed Act.		
Historic, Archaeological and Paleontological Resources	Impacts to historical resources	Project footprint	• The Contractor shall develop a Chance Find Procedure for Historical resources. Any discovery of additional archaeological resources, palaeontological resources, Aboriginal traditional use sites and/or historic sites are required to be reported to the Engineer and to the Ministry of Culture, Multiculturalism and Status of Women.	• Paleontology monitoring will occur if excavations that reach bedrock occur (see Table 5.2) • Complete and follow any requirements under the HRIA.	Incidental impacts on previously unknown historical resources.
Recreation Resources	Trail closures and detours	Local Study Area	• Preferentially choose bridge construction options that result in shorter construction times to minimize disruption to recreational users (e.g. prefabricated structures or components). • Provide and install ample signage at trail intersections, describing closures and alternate routes well ahead of construction. • Preferentially conduct bridge construction at known low recreational use times of the year.	• Preferentially choose bridge construction options that result in shorter construction times to minimize disruption (e.g. prefabricated structures or components). • Provide signage at all trail entries at the top of the ravine, notifying the public of closures and providing detour options.	Loss of recreational access during construction
Visual Resources	Loss of aesthetic value (tree loss or bridge aesthetic) by visitors/recreational users	Project footprint and temporary workspace	• Narrow construction limits to the minimum required for construction. • Conduct native vegetation restoration at earliest possible date. On erosional slopes use a fast growing, certified weed free native seed mix not more than 2 years old. Certification must be provided and approval by the Engineer is required prior to planting/seeding. Plant replacement native trees and shrubs where removed for construction.	• Choose a bridge design that complements the natural environment of the Mill Creek Ravine. • Plant and seed with native species known to be present in the Mill Creek Ravine.	No residual effect identified

5.2 Residual Effect Analysis

Residual effects are those environmental effects that may exist following the implementation of mitigation measures. This section provides an assessment and characterization of the potential residual effects in order to determine the likelihood and significance of the effects. Table 5.3 provides a summary of the significance evaluation for the potential residual effects of the Project on the VECs and the following sections describe the rationale behind the evaluation.

Table 5.3: Evaluation of the Residual Effects of the Project

VEC	Potential Effect	Nature	Magnitude	Duration	Extent	Likelihood of Effect	Significance
Geotechnical	No residual effect identified	n/a					
Hydrology and Surface Drainage	Alteration of surface hydrology of Mill Creek	Direct	Low	Long Term	Restricted	Predictable	Non-significant
Fish and Fish Habitat	Alteration of instream fish habitat	Direct	Low	Long Term	Restricted	Predictable	Non-significant
	Increase of suspended sediment during in-water construction	Indirect	Low	Short Term	Local	Uncertain	Non-significant
Wildlife and Wildlife Habitat	No residual effect identified	n/a					
Vegetation	Loss of existing native plants and communities.	Direct	Low	Medium Term	Restricted	Predictable	Non-significant
	Introduction or further establishment of weed or invasive species.	Indirect	Moderate	Medium Term	Restricted	Uncertain	Non-significant
Historical and Archaeologic Resources	Incidental impacts on previously unknown historical resources.	Direct	Low	Permanent	Restricted	Predictable	Non-significant
Recreation Resources	Loss of recreational access during construction	Indirect	Low	Short Term	Local	Predictable	Non-significant
Visual Resources	No residual effect identified	n/a					

5.2.1 Residual Effect Evaluation

Each residual effect, and how its significant rating was evaluated is analyzed in detail in the below sections:

Alteration of Surface Hydrology of Mill Creek

A summary of the rationale for the significance criteria evaluation is provided below:

- Nature: Direct – Alterations of Mill Creek flows are directly attributed to the Project.
- Magnitude: Low – The Project will slightly affect the hydraulics of Mill Creek, however will not significantly change the flows.
- Duration: Long-Term – The Project will slightly affect the hydraulics of Mill Creek, for the lifespan of the Bridges.
- Extent: Restricted - The Project will affect the hydraulics of Mill Creek at the bridge locations
- Likelihood: Predictable – the hydraulics of Mill Creek are well modelled, and therefore understood.

Significance Evaluation

As the impacts to hydraulics are modelled by hydraulic engineers and deemed to not be significant, the magnitude is conserved low, the duration long-term and extent restricted the residual effect is considered not significant. Furthermore, the new bridges provide a greater freeboard for the creek.

Alteration of Instream Fish Habitat

A summary of the rationale for the significance criteria evaluation is provided below:

- Nature: Direct – Alteration of fish habitat due to rip rap placement is a direct effect.
- Magnitude: Low – The Project will slightly increase rip rap in the bridge locations, however most of the crossings already have rip rap placed across the channel and will not significantly change the habitat values of the Project.
- Duration: Long-term - The Project will affect the instream habitat for the lifespan of the bridges.
- Extent: Restricted -The Project will affect habitat at Mill Creek, only at the bridge locations
- Likelihood: Predictable – Instream works will occur, as they are part of the design for the Project.

Significance Evaluation

Fish habitat is considered of low value within Mill Creek due to the lack of connectivity to the North Saskatchewan River, and the habitat change is incremental considering rip rap is currently in place. As the magnitude of the effect is low, and with implementation of appropriate mitigation measures the residual effect is considered not significant.

Increase of Suspended Sediment During In-Water Construction

A summary of the rationale for the significance criteria evaluation is provided below:

- Nature: Indirect – Sedimentation of Mill Creek would occur as an indirect cause of construction, such as a sediment release during demolition or rip rap installation.
- Magnitude: Low – Sedimentation is likely to occur in small amounts during the installation and removal of isolation measures
- Duration: Short Term – Sedimentation would only occur during the demolition or construction during in-water.
- Extent: Local - Sedimentation would only occur at the construction site, and to the Zone of Influence of the Project, approximately 100 m downstream of the site.
- Likelihood: Uncertain – the likelihood of sedimentation is unknown and will be dependent on the Contractor's skill and approach to construction (e.g., type of isolation).



Significance Evaluation

Residual sediment effects are considered to result in low magnitude impacts to fish and fish habitat, over a short-term duration and restricted to a local area and can typically be well managed during construction and therefore the residual effect is considered not significant.

Loss of Existing Native Plants and Communities.

A summary of the rationale for the significance criteria evaluation is provided below:

- Nature: Direct – vegetation located in areas of temporary use or where new hardscaping will be placed, will be disturbed (cut/removed) to facilitate construction
- Magnitude: Low – Vegetation removal will be limited to commonly available species, is limited in the amounts removed around the bridge and where access is deemed absolutely necessary
- Duration: Medium Term – Vegetation removed for access will naturally revegetate in one to three years.
- Extent: Restricted – Vegetation removed will be limited to the footprint of the Project.
- Likelihood: Predictable – Vegetation removal is well understood and will be included within the Tree Protection Plan being developed for the Project.

Significance Evaluation

As the magnitude of effects to vegetation is considered low, the duration medium-term and extent restricted the residual effect is considered not significant. Any effects to trees are relatively small and will equitably compensated for in accordance with the City of Edmonton Guidelines for Evaluation of Trees (City of Edmonton. 2020b).

Introduction or Further Establishment of Weed or Invasive Species.

A summary of the rationale for the significance criteria evaluation is provided below:

- Nature: Indirect – Introduction of weeds would be an indirect effect of the Project, as it would occur as an indirect effect of construction.
- Magnitude: Moderate – Introduction of weeds could result in an increase of invasive species and cause an alteration of the native plant community.
- Duration: Medium-Term – Weeds that are introduced by the Project would require control by the Contractor during construction and through the warranty period.
- Extent: Restricted – introduction of weeds would be limited to workspace that the Contractor utilizes, i.e., the footprint of the Project.
- Likelihood: Uncertain – The likelihood of weed introduction is unknown and will be dependent on the Contractor's skill and approach to construction (e.g., diligence on following cleaning mitigation).

Significance Evaluation

Residual weed and invasive species effects are considered to result in moderate magnitude impacts to vegetation, over a moderate term duration and restricted to a local area, and can typically be well managed during construction by a diligent Contractor and therefore the residual effect is considered not significant.

Incidental Impacts on Previously Unknown Historical Resources.

A summary of the rationale for the significance criteria evaluation is provided below:

- Nature: Direct – Impacts to previously unknown historical resources would be caused directly by Construction.
- Magnitude: Low – Unknown historical resources are relatively unlikely to occur at the Site, and important features would have been captured by the HRIA process.
- Duration: Permanent – Impacts to historical resources during construction would be permanent.
- Extent: Restricted – Impacts are restricted to the footprint of the Project.

- **Likelihood: Predictable** – The likelihood of finding unknown historical resources is considered predictable and unlikely, as extensive historical work has been completed for the Project to proactively locate historical features.

Significance Evaluation

Impacts to previously unknown historical resources is a highly unlikely event that would result in low magnitude impacts and can typically be well managed during construction by a diligent Contractor. Therefore, the residual effect is considered not significant.

Loss of Recreational Access During Construction

A summary of the rationale for the significance criteria evaluation is provided below:

- **Nature: Indirect** – Impacts to recreational users will be indirect, as it will force users through detours.
- **Magnitude: Low** – the detours will be well marked, and construction staging can limit the total length and number of detours.
- **Duration: Short Term** – detours and access limitations will only occur during construction.
- **Extent: Local** – detours will occur at and around the Project site.
- **Likelihood: Predictable** – The detours are required for construction to occur safely.

Significance Evaluation

Impacts to recreational access is of a limited timespan that will only occur during construction, the Project will expand the lifespan of recreational access through the Ravine, so therefore is considered not significant.

5.2.2 Cumulative Effects

Cumulative effects are defined as changes caused by actions of the past, present and future (CEAA 2016). Since thresholds for impacts to VECs are not defined by the City, assessing cumulative impacts is limited to a qualitative assessment of potential cumulative effects on environmental resources (Hegmann et. al 1999).

There are both positive and negative effects of the Project, including providing greater habitat under the existing bridge for fish, a larger cross-sectional width for hydraulic connectivity, as well as updating the trail system to extend the lifespan of the Project. Negative effects include some loss of vegetation where access for construction is required, as well as around the bridge replacement. Cumulatively, the environmental nature of Mill Creek has been relatively retained while the growth of Edmonton has occurred around it, with limited access and previous disturbance. This Project limits cumulative impacts on the environment by capitalizing on the existing trail network, providing an increased lifespan in the ravine while limiting direct new impacts (i.e., adding additional trail networks) that could add to the disturbance within the ravine. Furthermore, where impacts do occur on vegetation, alternative and equivalent habitat is very present elsewhere in the region, including immediately adjacent to all bridge sites. As no residual effects are considered significant, it is not expected that cumulative impacts will be deemed significant. Cumulative effects are further be reduced by constructing all 11 bridges as part of the Project, and by not undertaking construction works in an incremental process within the area for a number of years following the Project to allow for regrowth.



6.0

Public Engagement

To inform the public of impending replacement of bridges B304 to B314, a public information session will be held prior to construction (approximately November 2020) and will be organized and facilitated by ISL. The purpose of this event will be to share information on the impending project, construction, schedule and proposed detours. The public information will be advertised by free-standing road signage placed at strategic locations and held in a yet to be determined local space where public gathering restrictions due to the COVID-19 pandemic can be adhered to. The information presented at the public information session will also be available online at the City of Edmonton's website.

Previous public engagement on similar bridge replacement projects within Mill Creek Ravine are deemed sufficiently representative for additional bridge replacements in the same ravine. In these sessions, topics of concerns included:

- Cost
- Safety
- Accessibility and functionality
- Environmental Impacts
- Material
- Historical Signage
- Aesthetics
- Historical Integrity
- Construction impacts on users
- Design
- Shared-use
- Volume/Use
- Additional Infrastructure Required

All of these items of concern were taken into account in the design, staging and construction timing and scheduling for this project.



7.0 Summary Assessment

7.1 Summary of Impacts

As the bridges are existing within the Mill Creek Ravine, with no significant change in land-use, there are limited effects to the environment expected for the Project, and therefore Council Approval to proceed is recommended.

Impacts with Positive Nature

Surface Hydrology: The widths and heights of all bridges will be extended and raised, providing additional freeboard and providing a greater cross-sectional area compared to what is currently present. This should provide less potential backwater effects and flooding concerns in the valley.

Fish and Fish Habitat: The widths of nearly all bridges will be extended, resulting in additional in-stream habitat compared to what is currently present. DFO looks upon these types of projects favorably as they provide net benefit to fish. For this reason, it is expected to receive a Letter of Advice as opposed to requiring a Fisheries Act authorization.

Recreation: Although impacted in the short term through trail detours during construction, new bridges will reduce tripping hazards and extend the lifespan of the crossings leading to a more positive recreational experience for users.

Visual Resources: Structural and surficial deterioration of the bridges is evident to users. Replacement of the bridges will eliminate this until the lifecycle of the new bridges is reached.

Impacts with Negative Nature

Recreation: Impacted in the short term through trail detours during construction.

Vegetation: Some earthworks, tree, shrub and vegetation removal for construction and temporary workspace will occur. Vegetation is expected to be re-planted or re-seeded and, in time, return to previous conditions where hardscaping is absent.

Wildlife: Some wildlife habitat (tree and shrub) removal for construction and temporary workspace will occur. Vegetation is expected to be re-planted or re-seeded and, in time, return to previous conditions where hardscaping is absent.

7.2 Monitoring Measures

ESC measures, weed control, and construction turbidity monitoring will be required and conducted as per the contractors ECO Plan.

7.3 Regulatory

Fisheries Act: As the new bridges require work within the wetted width of Mill Creek, it is expected that a Request-for-Review will be required for the Project. At this time, it is expected that the DFO review will return a Letter of Advice.

Migratory Birds Convention Act and Alberta Wildlife Act: With the potential for raptor (e.g., owls) presence in the Project area, it is recommended that this Project has a general nesting period of March 1 to August 20 with consideration for species that may nest outside this period, e.g., great-horned owl). Nest sweeps will be required 4-7 days prior to construction, if construction occurs within the general nesting period. No formal submission or permit is required.



Water Act: A *Water Act* Code of Practice notification will be required for the Project as it will involve installation of a bridge structure over Mill Creek. Mill Creek is a Mapped Class D waterbody under the Code, with no Restricted Activity Period.

Historical Resources Act: A HRIA is required for the Project and the work required to complete the HRIA is proceeding at the time of writing.

Alberta Weed Act: Weed species listed by the Weed Control Act were identified during the vegetation studies assessment and measures to satisfy the Weed Control Act will be identified and implemented by the Contractor in their ECO Plan.

Corporate Tree Management Policy: A Tree Protection Plan is being prepared for the Project by ISL, separately from this report, and will be completed as part of the Contract.

7.4 Closing

Implementing mitigation measures pre-construction, during construction and implementing a post-construction monitoring program are expected to reduce the impact to an acceptable level such that no significant residual effects are anticipated due to the Project.



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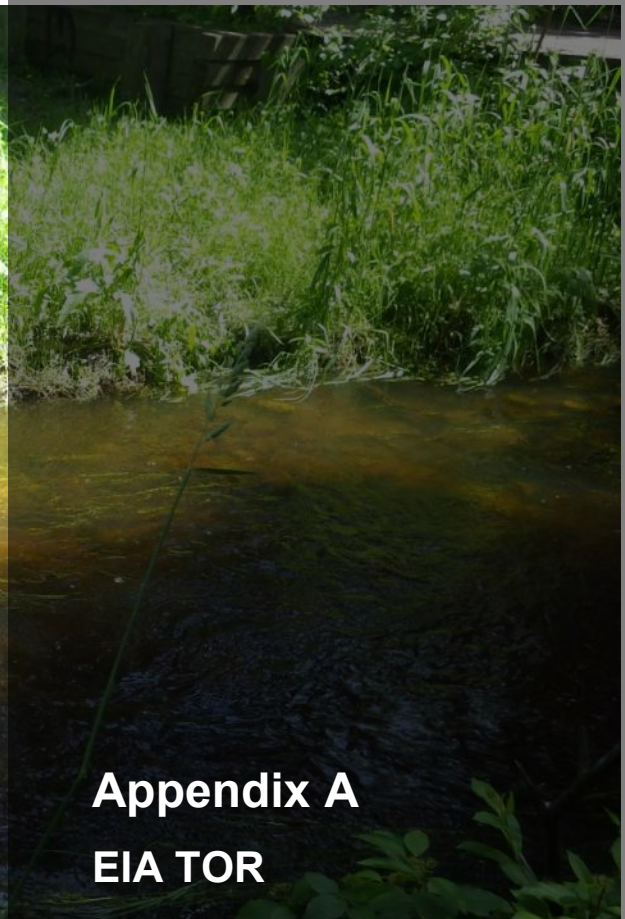
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Appendix A

EIA TOR



7909 51 Avenue NW, Edmonton AB T6E 5L9, T: 780.438.9000 F: 780.438.3700

March 17, 2020

Our Reference: 15616

The City of Edmonton
Urban Form

Attention: Achyut Adhikari

Dear Mr. Adhikari:

Reference: Mill Creek Pedestrian Bridges – Environmental Impact Assessment Terms of Reference

As per the North Saskatchewan River Valley Area Redevelopment Plan (Bylaw 7188), and the meeting held between ISL Engineering and Land Services Ltd. (ISL) and The City of Edmonton (The City) on March 5th, 2020, a draft Terms of Reference (TOR) is required to be prepared and reviewed by Urban Form prior to initiation of an Environmental Impact Assessment (EIA).

This letter provides the draft TOR for review and acceptance from The City and Urban Form. Upon agreement of the following Terms of Reference, the EIA will be prepared by ISL and submitted to The City of Edmonton, Urban Form upon which it will be reviewed by City Administration as required by Bylaw 7188. It is also understood that the EIA, as well as the related Site Location Study, will require approval by City Council.

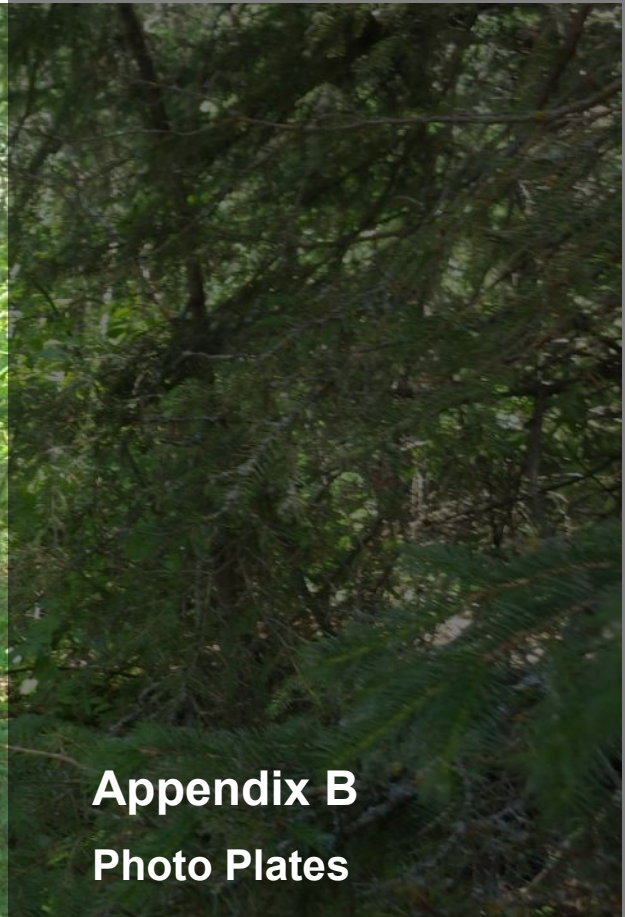
1. **Introduction** - Includes background, objectives, study area, and report organization.
2. **Project Description**
 - 2.1. **Declaration**
 - 2.2. **Project Need/Rational** – Will include reference to the City's RFP# 934231, the structural alternative report, and preliminary design report. Using these resources, the EIA will provide extensive justification in support of the project.
 - 2.3. **Project Alternatives Considered**
 - 2.4. **Project Details** - A detailed description of the project including: project location/setting; project construction details; land use and zoning; scope of work; and key project activities
 - 2.5. **Environmental permitting requirements.**
3. **Methodology** - Descriptions of the main methods and steps employed in the preparation of the EIA, including: literature review, assessment scoping, valued environmental components (VECs) description of existing conditions, impact analysis, and public consultation.
4. **Existing Conditions** - Includes descriptions for each of the following VECs:
 - 4.1. Geology/Slope Stability/ Soils: Utilizing information from Thurber's Geotechnical report and Environmental Site Assessment
 - 4.2. Hydrology/Surface Drainage
 - 4.3. Fish and Fish Habitat
 - 4.4. Wildlife and Wildlife Habitat
 - 4.5. Vegetation
 - 4.6. Historical Resources
 - 4.7. Recreational Resources
 - 4.8. Visual Resources.



5. **Potential Impacts and Mitigation Measures** - Interactions of specific project activities (demolition, construction, operations) with VECs and socioeconomic factors and recommended mitigation measures.
6. **Summary Assessment** - Includes: a summary of impacts; monitoring and follow-up requirements; environmental protection planning; and summary assessment and conclusions.
7. **References**
8. **Appendices**

We trust this TOR meets your expectations, and if you have any additions or changes or accept this TOR as proposed, please advise the undersigned.

Brent Piche, B.Sc., P.Biol. R.P.Bio
Environmental Scientist
ISL Engineering and Land Services Ltd.
403.254.0544
bpiche@islengineering.com



Appendix B

Photo Plates



Plate 1 Bridge B304 (June 24, 2020)



Plate 2 Bridge B305 (June 24, 2020)



Plate 3 Bridge B306 (June 24, 2020)



Plate 4 Bridge B307 (June 24, 2020)



Plate 5 Bridge B308 (June 24, 2020).



Plate 6 Bridge B309 (June 24, 2020).



Plate 7 Bridge B310 (June 24, 2020).



Plate 8 Bridge B311 (June 24, 2020).



Plate 9 Bridge B312 (June 24, 2020).



Plate 10 Bridge B313 (June 24, 2020).



Plate 11 Bridge B314 (June 24, 2020).



Plate 12 View of white cockle at B311 (June 24, 2020)



Plate 13 View of Canada thistle at B306 (June 24, 2020)



Plate 14 View of perennial sow-thistle B313 (May 20, 2020)



Plate 15 View of common burdock at B311 (June 24, 2020)



Plate 16 View of common tansy at B307, previous years flowering heads (May 20, 2020)



Plate 17 View of common tansy leaves at B307 (May 20, 2020)



Plate 18 View of common buckthorn at B311 (June 24, 2020)



Plate 19 View of NF13 community (June 24, 2020)



Plate 20 View of AW5 community (June 24, 2020)



Plate 21 View of AW7 Community (May 20, 2020)



Plate 22 View of DLM4 community (June 24, 2020)



Plate 23 View of MD5 community (June 24, 2020)



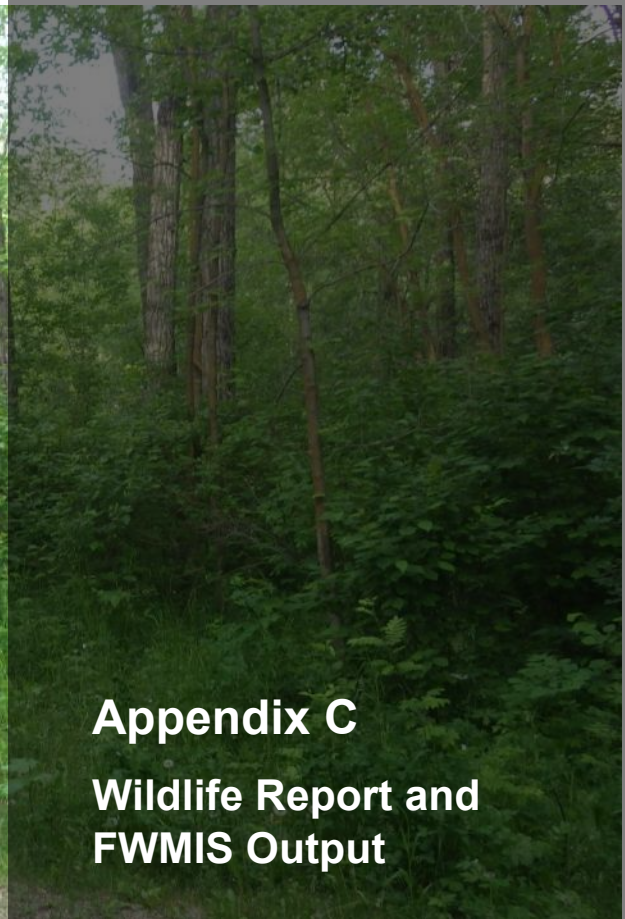
Plate 24 View of CLM9 community (June 24, 2020)



Plate 25 View of PB2 community (June 24, 2020)



Plate 26 View of PB3 community (June 24, 2020)



Appendix C
Wildlife Report and
FWMIS Output



Date: July 07, 2020
To: Brent Piche, ISL Engineering and Land Services Ltd.
CC: Troy Letwin, ISL Engineering and Land Services Ltd.
From: Nathan L. Erik, P. Biol, SAGE Ecological Solutions Inc.
File: City of Edmonton – Mill Creek Pedestrian Bridges Program
Subject: Memorandum – Wildlife Assessment

1.0 Introduction

SAGE Ecological Solutions Inc. (SAGE) was retained in January 2020 by ISL Engineering and Land Services Ltd. (ISL) to complete wildlife components of environmental assessments to support regulatory permitting for proposed replacements of 11 pedestrian bridges (B304, B305, B306, B307, B308, B309, B310, B311, B312, B313, B314) on Mill Creek within the City of Edmonton. This memo report has been prepared to present methods and results of desktop and field investigations and to provide recommendations for mitigation to avoid impacts to wildlife during construction.

1.1 Project Description

The Project includes the planned replacement of 11 pedestrian bridge structures along the Mill Creek Ravine between 34 Street and 50 Street within in NW, SW, & SE-12-52-24 W4M and NE-1-52-24 W4M (Figure 1). The existing pedestrian bridges are assessed to have progressive deterioration to the point where maintenance activities are unable to correct the deficiencies and replacement is required. The bridges are one to two span bridges made up of “Rig-mat” style super structures and timber handrails. They cross Mill Creek along the lower level gravel trail system which consists of shared-use paths and typically provide a 2.5m clear width.

MEMORANDUM

Date: July 07, 2020
File: City of Edmonton – Mill Creek Pedestrian Bridges Program
Subject: Memorandum – Wildlife Assessment
Page: 2 of 19



Figure 1 – Project Area (SE Edmonton)

1.2 Study Objectives

Specific objectives of this assessment are:

- To provide an overview of regulatory requirements for the Project with respect to wildlife;
- To describe the existing conditions within the project work with respect to wildlife and wildlife habitat including a list of provincial or federal wildlife species of conservation concern known or expected to occur within the project work area. This includes the following components:
 - i. A desktop review of historical records of wildlife occurrence for the project work area;
 - ii. A reconnaissance-level field visit to investigate the project work area for occurrence of vertebrate species at risk, sign of potential vertebrate species at risk, and sign of nesting or denning wildlife. Due to project timing, formal surveys for most species of conservation concern conducted during seasonally appropriate time periods were not possible but can be provided as supplemental studies if required. Winter raptor stick nest surveys were completed as part of the field assessment.
 - iii. Evaluation of the presence or potential for occurrence of nesting migratory birds within or near the existing bridge structures.
- Identify potential effects to wildlife; and

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- Provide recommendations for mitigation measures to be implemented to avoid or minimize effects caused by the project.

2.0 Regulatory Information

The following are potentially applicable legislation to be considered with respect to wildlife:

2.1 Federal

Species at Risk Act

The *Species at Risk Act* (SARA) provides legislation to prevent wildlife species in Canada from becoming endangered, threatened, extinct, or extirpated and to provide for the recovery of wildlife species that are extirpated, endangered, or threatened by human activities. Project conflicts with SARA might include the occurrence of critical habitat or active breeding, nesting, or denning of federally listed wildlife species within or near the project work area.

Migratory Birds Convention Act

The *Migratory Birds Convention Act* (MBCA) provides legislation for the protection of migratory birds and their eggs and nests. Project conflicts with MBCA might include the occurrence of active nesting migratory birds (listed under the Act) within or near the project work area.

2.2 Provincial

Wildlife Act

Alberta's provincial *Wildlife Act* states that "a person shall not willfully molest, disturb or destroy a house, nest, or den of prescribed wildlife or a beaver dam in prescribed areas or at prescribed times." Implementation of the *Wildlife Act* includes, but is not limited to:

- Protection of Species-at-Risk populations from decline;
- Protection of wildlife dens, nests, and burrows;
- Mitigation of potential impacts to wildlife by measures such as the observation of timing restrictions.

2.0 Methods

Methods of investigation included desktop review of the Project Area as well as publicly available materials and field investigation by resource specialists. A review of publicly available digital aerial imagery was conducted to assess habitat occurring within or near the project work area and Alberta Environment and Parks' (AEP) Fish and Wildlife Management Information System (FWMIS) was queried to determine known species occurrences within a 4-km radius from the centre of the Project Area. A reconnaissance-level field

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visit was conducted on April 22, 2020 to investigate the Project Area for occurrence of vertebrate species at risk, sign of potential vertebrate species at risk, and sign of nesting or denning wildlife. Due to project timing, seasonally appropriate surveys targeted to species of conservation concern were not possible but can be provided as supplemental studies if required. Sensitive raptor winter stick nest surveys were completed as part of the field assessment.

The study area included riparian and upland habitat types within and immediately adjacent to the Mill Creek Ravine pathway system extending out to the nearest existing major human disturbance (e.g., roads, residences, other anthropogenic disturbance). The study area is shown on Figure 2.

Specific methods are listed by resource component in the following sections.

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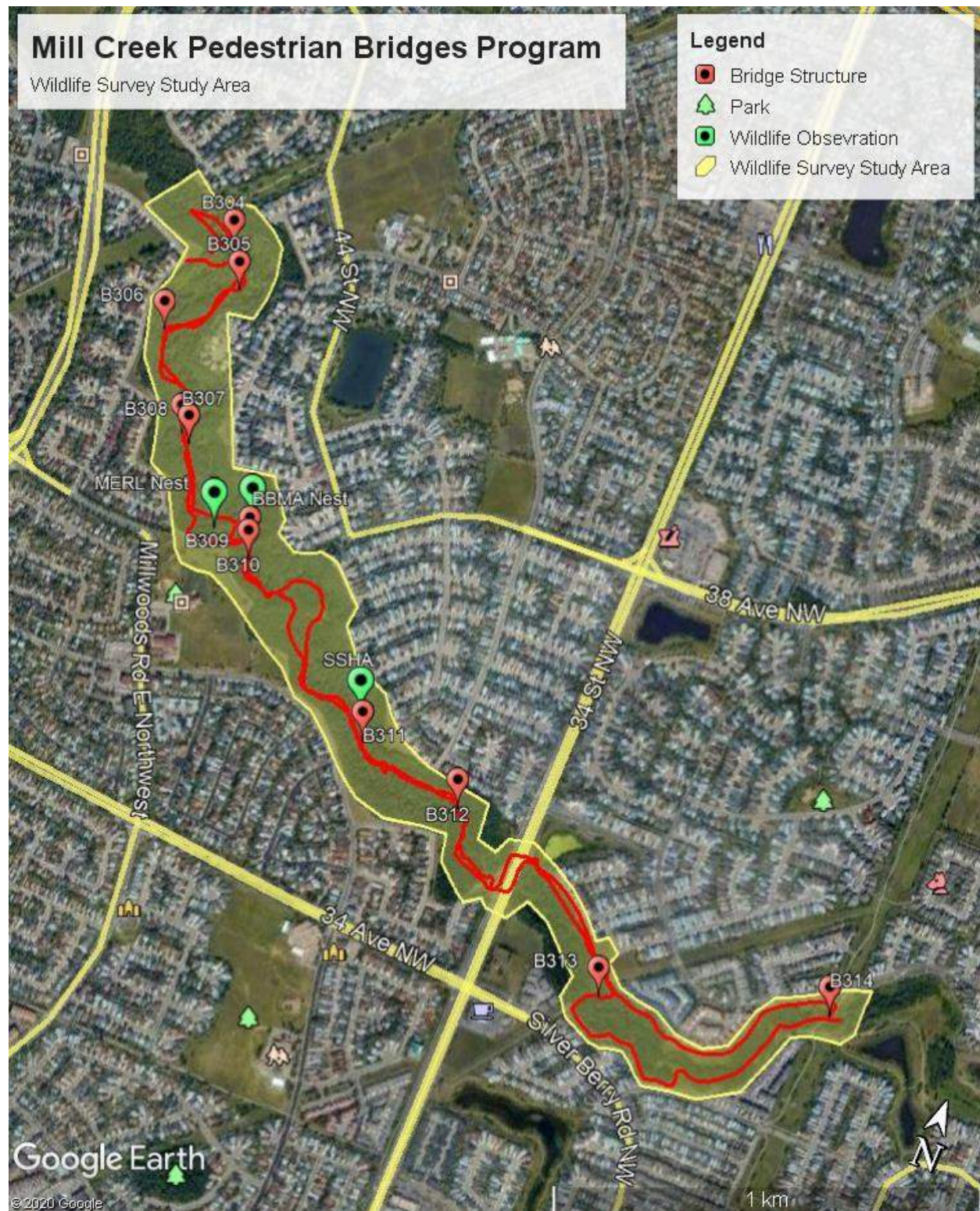


Figure 2 – Wildlife Survey Study Area

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**2.1 Potential for Vertebrate Species of Conservation Concern**

A desktop review of available imagery and the Fisheries and Wildlife Management Information System (FWMIS) was conducted to determine the potential for vertebrate species of conservation concern (e.g., At-Risk species). A list of species of conservation concern with potential to reside, breed, or overwinter within the assessment area was produced using range and habitat requirements and FWMIS records.

2.2 Potential for Nesting or Denning Sites

A review of habitat quality, native integrity, and potential for nesting or denning was conducted using aerial imagery. A reconnaissance-level field survey was conducted to assess habitat quality and the occurrence of, or potential for, nesting or denning sites (e.g., cliff swallow nesting colonies, raptor nests, burrowing mammal dens, and snake hibernacula, etc.).

2.3 Potential for Wildlife Movement

A desktop review of available imagery (and other materials) combined with field searches for sign of wildlife movement were used to assess the potential for established wildlife corridors within and across the assessment area. Focus was placed on regional rarity of habitats or unique ecological features on the property, existing habitat fragmentation, and the potential for the property to sustain or enhance regional wildlife movement.

2.3 Sensitive Raptor Winter Nest Survey

A survey for sensitive raptor stick nests was conducted during the reconnaissance-level field visit. In accordance with the SSIG, potential raptor nesting sites, including treed, tall shrub, and cliff sites were investigated for stick nests, nesting behaviour, raptor sign, or important habitat features. Nesting behaviour included nest building, territorial displays, or nest defense (e.g., swooping calling, or aggressive behaviour). Raptor sign includes pellets, plucking posts, and associated remains. Important habitat features, in addition to existing stick nests, included large cavities, mature (dead or living) balsam poplar adjacent to spruce stands, and large standalone conifer trees within deciduous stands.

3.0 Results

Results of desktop and field investigations are organized by resource component. The Wildlife Survey Study Area and relevant results are shown on Figure 2.

3.1.1 Potential for Vertebrate Species of Conservation Concern

Searches of the FWMIS database were completed on October 22, 2019. A four-kilometre radius centred on the Project Area was queried using the Fisheries and Wildlife Internet Mapping Tool; which equals an area of approximately 50.3 square kilometres.

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FWMIS search results are presented in Appendix A and identified that the Project Area occurs within the following wildlife sensitivity layers:

- i) Sharp-tailed Grouse Survey Area
- ii) Sensitive Raptor Range – Bald Eagle

Results of the FWMIS search confirmed observations of 10 wildlife species of conservation concern within the search area (AEP 2020; Appendix A). Based on desktop and field data, combined with known habitat requirements and distributional ranges, a list of 24 vertebrate wildlife species of conservation concern was compiled (GoA 2015; COSEWIC 2017). These species have the potential to occur within the Project Area and spend some portion of their life cycle as resident, breeding, or overwintering. These species are listed in Table 1 and include two amphibian, two reptile, 18 bird, and two mammal species.

It should be noted that, although identified in the FWMIS search for the project area, several species have been excluded from this list due to a lack of required habitat attributes within or near the project area (e.g., sharp-tailed grouse, bald eagle). These species are not expected to occur, nor do they have potential to be impacted by the project.

Table 1 Vertebrate Species-of Conservation Concern with Potential to Occur within or Near the Project Work Area

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COMMON NAME	SCIENTIFIC NAME	Potential to Occur in Study Area	STATUS			
			AEP	COSEWIC	SCHEDULE	SARA
Reptiles and Amphibians						
Western Tiger Salamander	<i>Ambystoma mavortium</i>	Potential	Secure	Special Concern	No schedule	No Status
Western Terrestrial (Wandering) Garter Snake	<i>Thamnophis elegans</i>	Potential	Sensitive			
Red-sided Garter Snake	<i>Thamnophis sirtalis</i>	Potential	Sensitive			
Western (Boreal) Toad	<i>Anaxyrus boreas</i>	Potential	Sensitive			
Birds						
Great Blue Heron	<i>Ardea herodias</i>	Confirmed ¹	Sensitive	Special Concern	Schedule 1	Special Concern
Northern Goshawk	<i>Accipiter gentilis</i>	Potential	Sensitive	Not At Risk		
Broad-winged Hawk	<i>Buteo platypterus</i>	Potential	Sensitive			
Swainson's Hawk	<i>Buteo swainsoni</i>	Potential	Sensitive			
Sora	<i>Porzana carolina</i>	Confirmed ¹	Sensitive			
Common Yellowthroat	<i>Geothlypis trichas</i>	Potential	Sensitive			
Black-crowned Night-heron	<i>Nycticorax nycticorax</i>	Potential	Sensitive			
Great Gray Owl	<i>Strix nebulosa</i>	Potential	Sensitive			
Common Nighthawk	<i>Chordeiles minor</i>	Potential	Sensitive	Special Concern	Schedule 1	Threatened
Black-backed Woodpecker	<i>Picoides arcticus</i>	Potential	Sensitive			
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Potential	Sensitive			
Western Wood-Pewee	<i>Contopus sordidulus</i>	Potential	Sensitive			
Alder Flycatcher	<i>Empidonax alnorum</i>	Potential	Sensitive			
Least Flycatcher	<i>Empidonax minimus</i>	Confirmed ¹	Sensitive			
Eastern Phoebe	<i>Sayornis phoebe</i>	Potential	Sensitive			
Western Wood-Pewee	<i>Contopus sordidulus</i>	Confirmed ¹	May Be At Risk			
Bank Swallow	<i>Riparia riparia</i>	Potential	Sensitive	Threatened	Schedule 1	Threatened
Western Tanager	<i>Piranga ludoviciana</i>	Potential	Sensitive			
Mammals						
Long-tailed Weasel	<i>Mustela frenata</i>	Potential	May Be At Risk			
Silver-haired Bat	<i>Myotis lucifucus</i>	Potential	Sensitive			

¹ - Confirmed by FWMS data to occur within a 4-km radius.

3.1.2 Potential for Nesting or Denning Sites

The study area was surveyed using aerial imagery and on foot for suitable habitat for nesting or denning of wildlife. Habitats within the study area with the highest potential for nesting or denning wildlife include treed riparian areas adjacent to the Mill Creek. This is the most abundant habitat type near all work areas and is characterized by riparian balsam poplar forest with understory shrub including willow, alder, red osier dogwood, prickly rose, and wild red raspberry. Other adjacent habitats include coniferous and aspen forest patches on upper valley slopes, manicured grasslands (i.e., mowed fields & lawns), and anthropogenic areas/features (e.g., buildings, roads, parking areas, residences).

The timing of the reconnaissance-level field visit was not appropriate to survey for breeding bird activity. However, shoreline areas and riparian treed and shrub habitat types were assessed to provide suitable nesting habitat for a variety of bird species including migratory songbird, waterfowl, and shorebird and it is anticipated that the area holds high potential for use by nesting individuals or groups during the migratory bird breeding period (i.e., April to August). Treed areas (especially spruce trees or groves) were assessed

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to have moderate potential for nesting by raptor and owls. Treed areas also hold moderate potential for use as roosting sites for bat species during breeding. Standing dead trees hold high potential for cavity nesting songbird species. There are multiple steep streambanks in the study area(s) which hold potential for nesting colonies of bank swallows or burrowing mammal den sites. Rock/debris piles and excavations also hold potential for snake hibernacula sites.

The underside of each bridge structure was searched for evidence of cliff or barn swallow nesting and/or burrows or dens of fossorial mammals or snake hibernacula. No evidence of nesting or denning was observed at the bridge structures.

The project work area was investigated for other wildlife sign including established dens or multi-year nests, burrows, game trails, tracks, and scat. Incidental sighting or evidence of the following species were observed during the reconnaissance-level site visit:

- American crow;
- American robin;
- Black-billed magpie;
- Black-capped chickadee;
- Bohemian waxwing,
- Common raven;
- Coyote;
- Dark-eyed junco;
- Downy woodpecker;
- Deer;
- Herring gull;
- House sparrow;
- Mallard;
- Merlin;
- Red squirrel;
- Ring-billed gull;
- Sharp-shinned hawk;
- Snowshoe hare;
- Small mammals/mice/voles.

The high amount of human recreational use on the Mill Creek trail system, and adjacent roads, residential, and commercial/industrial areas reduces the potential for nesting or denning within the study area.

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Representative photos of habitat within the study area and observed sign are provided in Appendix B.

3.1.3 Sensitive Raptor Stick Nest Surveys

The area is assessed to hold several important habitat features in the form of standalone conifer trees and coniferous stands which hold potential for nesting raptors and owls. An individual sharp-shinned hawk was observed near B311. No nest was discovered but it is likely that the species might nest nearby. An active merlin nest was observed at 12 U 340157E 5927298N (NAD 83; Figure 3) approximately 90 m WNW of B309 and 110 m NE of B301. It occurs near busy recreational trails and is not expected to be disturbed by the proposed construction. Preconstruction surveys and subsequent monitoring should be conducted prior to and during construction, respectively, if within the breeding and fledgling period for raptors. These mitigation are provided in Section 4.0.

3.1.4 Potential for Wildlife Movement

The Mill Creek ravine within the project area is assessed to be locally important for wildlife movement. Regionally, extensive fragmentation caused by urban residential and industrial development has, in effect, blocked regionally movement; especially with respect to connectivity with the North Saskatchewan River Valley. Approximately 3 km downstream of the site at 75 St Northwest, significant industrial development has created a barrier almost 500 m across. In other words, wildlife would need to travel through 500 m of industrial area to connect with lower (downstream) portions of the Mill Creek ravine. Human development also impedes wildlife movement at the upper end of the ravine. A major impedance to movement to natural lands to the east includes Anthony Henday Drive SE. Several other roadways create more minor impedances in the portion of Mill Creek ravine in between Anthony Henday Drive and 75 St NW.

Locally, wildlife movement is evidenced by a network of game trails on valley slopes and within the valley bottom crisscrossing Mill Creek. Track evidence shows that wildlife species also use the recreational pathway system when human use is low (e.g., at night). Human use on game trails was also observed during the field investigation in the form of tracks in snow, ice, and mud. It is likely that medium to large mammals common to the City (e.g., deer, coyote) utilize the Mill Creek corridor to access adjacent residual habitats or anthropogenic natural areas (e.g., golf courses) as available.

The existing bridge structures were assessed for wildlife passage. The bridge structures do not have sufficient height to allow for wildlife passage for most large mammals that might occur (see typical photos in Appendix B). Medium-bodied species such as coyote might cross under the bridge when water levels are low or frozen. Impacts to wildlife movement or passage are not expected as a result of the replacements of the existing bridge structures. Potential impacts during construction are addressed and mitigation provided in Section 4.0.

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**4.0 Potential Impacts and Recommendations**

Table 2 describes the potential impacts by resource associated with the proposed activities. Mitigation recommendations are provided to avoid or minimize impacts.

Table 2 Potential Impacts and Mitigation Recommendations

RESOURCE	PROJECT PHASE	POTENTIAL IMPACTS	MITIGATION RECOMMENDATIONS
Wildlife			
Species of Conservation Concern	Construction; Restoration	Disturbance to breeding or overwintering groups or individuals.	- Implement construction outside the general nesting period for raptors and migratory birds for this region (i.e., March 1 to August 20); - An inclusive wildlife sweep should be conducted by a qualified environmental specialist prior to construction to minimize risk of disturbance to breeding or overwintering wildlife. - Avoid disturbance of natural habitats by minimizing work footprint to established right-of-ways, trails, pads, etc.; - Work only within designated areas within the project work area; - If an active nest or den is suspected within or near the work area during construction, establish a work buffer and contact the undersigned immediately.
Migratory Birds	Construction; Restoration	Disturbance during the general nesting period (i.e., Mid-April to Mid-August).	- Implement construction outside the general nesting period for raptors and migratory birds for this region (i.e., March 1 to August 20); - Conduct vegetation clearing after late August and/or before March 1 to avoid incidental take of migratory birds, nests, or eggs and to maintain compliance with the Migratory Birds Convention Act, the Species at Risk Act, and the Alberta Wildlife Act. - If clearing is required within known breeding periods, migratory bird breeding surveys should be completed by a qualified avian specialist. If breeding bird activity is observed, appropriate disturbance buffers should be implemented until young have fledged and left the nesting area.
Nesting or Denning Wildlife	Construction; Restoration	Disturbance of nesting or denning wildlife and their young.	- Implement construction outside the general nesting period for raptors and migratory birds for this region (i.e., March 1 to August 20); - An inclusive wildlife sweep should be conducted by a qualified environmental specialist prior to construction to minimize risk of disturbance to breeding or overwintering wildlife. - Avoid disturbance of natural habitats by minimizing work footprint to established right-of-ways, trails, pads, etc.; - Work only within designated areas within the project work area; - If an active nest or den is suspected within or near the work area during construction, establish a work buffer and contact the undersigned immediately.

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We trust this meets your requirements at this time. Please do not hesitate to contact the undersigned at (403) 921-7057 or nathanerik@sage-eco.com with any questions or concerns.

Sincerely,

A handwritten signature in blue ink, appearing to read "N. Erik", with a long horizontal flourish extending to the right.

Nathan Erik, P. Biol.

President | Professional Biologist | Environmental Planner

SAGE Ecological Solutions, Inc.



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5.0 Literature Cited

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Government of Alberta. 2013. Sensitive Species Inventory Guidelines. Alberta Environment & Sustainable Resource Development, Fish and Wildlife Division. Edmonton, Alberta. Available at:
<https://open.alberta.ca/dataset/93d8a251-4a9a-428f-ad99-7484c6ebabe0/resource/f4024e81-b835-4a50-8fb1-5b31d9726b84/download/2013-sensitivespeciesinventoryguidelines-apr18.pdf>

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APPENDIX A
FWMIS Species Summary Report

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Fish and Wildlife Internet Mapping Tool (FWIMT)

(source database: Fish and Wildlife Management Information System (FWMIS))

Species Summary Report

Report Created: 22-Oct-2019 15:57

Species present within the current extent :

Fish Inventory

BROOK STICKLEBACK
FATHEAD MINNOW
GOLDEYE
GOLDFISH
NORTHERN CRAYFISH
RAINBOW TROUT
YELLOW PERCH

Wildlife Inventory

AMERICAN KESTREL
BARN SWALLOW
EASTERN KINGBIRD
EASTERN PHOEBE
GREAT BLUE HERON
LEAST FLYCATCHER
PURPLE MARTIN
RUSTY BLACKBIRD
SORA
WESTERN WOOP-PEWEE

Stocked Inventory

No Species Found in Search Extent

Buffer Extent

Centroid (X,Y):	Projection	Centroid: (Qtr Sec Twp Rng Mer)	Radius or Dimensions
606586, 5922927	10-TM AEP Forest	NW 6 S2 23 4	4 kilometers

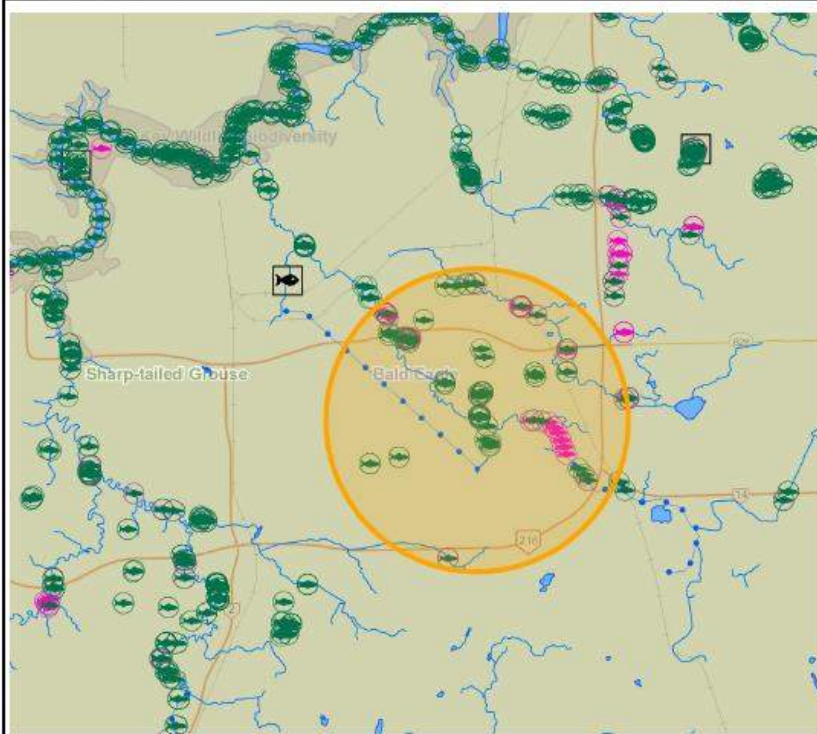
Contact Information

For contact information, please visit:

<http://aep.alberta.ca/about-us/contact-us/fisheries-wildlife-management-area-contacts.aspx>

22-Oct-2019 15:57

Map Results



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**APPENDIX B****Photographs – Habitat and Wildlife Sign**

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Photo B-1 (File No. P1000891) – Representative photograph of typical bridge structure and adjacent riparian habitat.



Photo B-2 (File No. P1000911) – Representative photograph of typical bridge underside. No evidence of cliff or barn swallow nesting was observed.

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Photo B-3 (File No. P1000934) – Representative photo of aspen parkland forest at upper slope. Standalone conifers are seen in right of pane (important nesting habitat features for raptors).



Photo B-4 (File No. P1000896) – Representative photo showing spruce forest patch at upper valley slope. Standing dead trees are shown on the left of the pane which provide nesting habitat for cavity-nesting songbird species.

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Photo B-5 (File No. P1000893) – Merlin nest in standalone spruce tree.



Photo B-6 (File No. P1000928) – Sharp-shinned hawk observed near B311.

Fish and Wildlife Internet Mapping Tool (FWIMT)

(source database: Fish and Wildlife Management Information System (FWMIS))

Species Summary Report

Report Date: 02-Apr-2020 15:14

Species present within the current extent

Fish Inventory

BROOK STICKLEBACK
FATHEAD MINNOW
GOLDEYE
NORTHERN CRAYFISH
RAINBOW TROUT
YELLOW PERCH

Wildlife Inventory

No Species Found in Search Extent

Stocked Inventory

No Species Found in Search Extent

Buffer Extent

Centroid (X,Y)

605668, 5923455

Projection

10-TM AEP Forest

Centroid (Qtr Sec Twp Rng Mer)

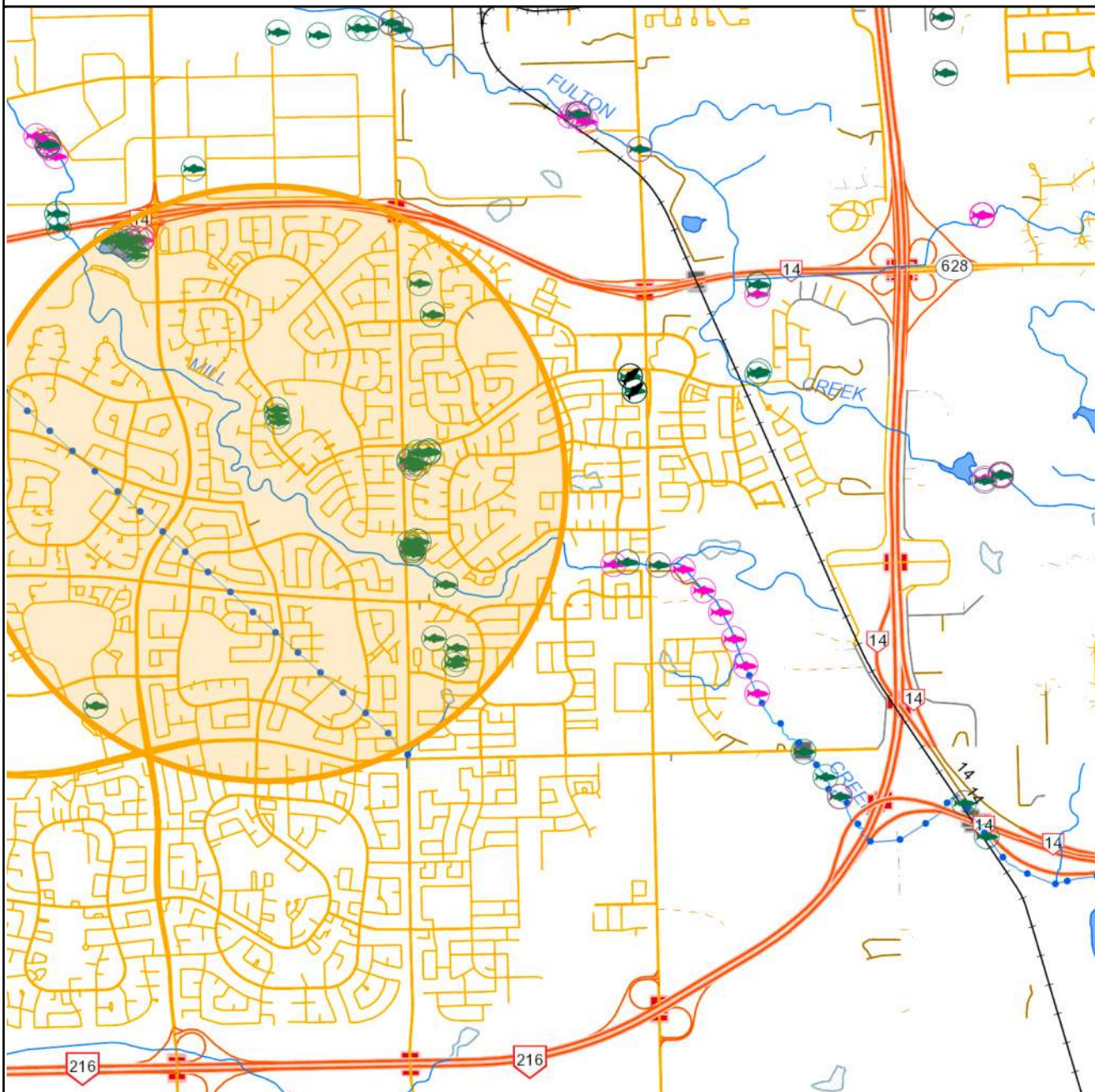
SW 12 52 24 4

Radius or Dimensions

2 kilometers

Contact Information

For contact information, please visit:
<https://www.alberta.ca/fisheries-and-wildlife-management-contacts.aspx>



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Fish and Wildlife Internet Mapping Tool (FWIMT)

(source database: Fish and Wildlife Management Information System (FWMIS))

Species Summary Report

Report Date: 02-Apr-2020 15:15

Species present within the current extent

Fish Inventory

BROOK STICKLEBACK
FATHEAD MINNOW
GOLDFISH
NORTHERN CRAYFISH

Wildlife Inventory

AMERICAN KESTREL
SORA

Stocked Inventory

No Species Found in Search Extent

Buffer Extent

Centroid (X,Y)

607064, 5922734

Projection

10-TM AEP Forest

Centroid (Qtr Sec Twp Rng Mer)

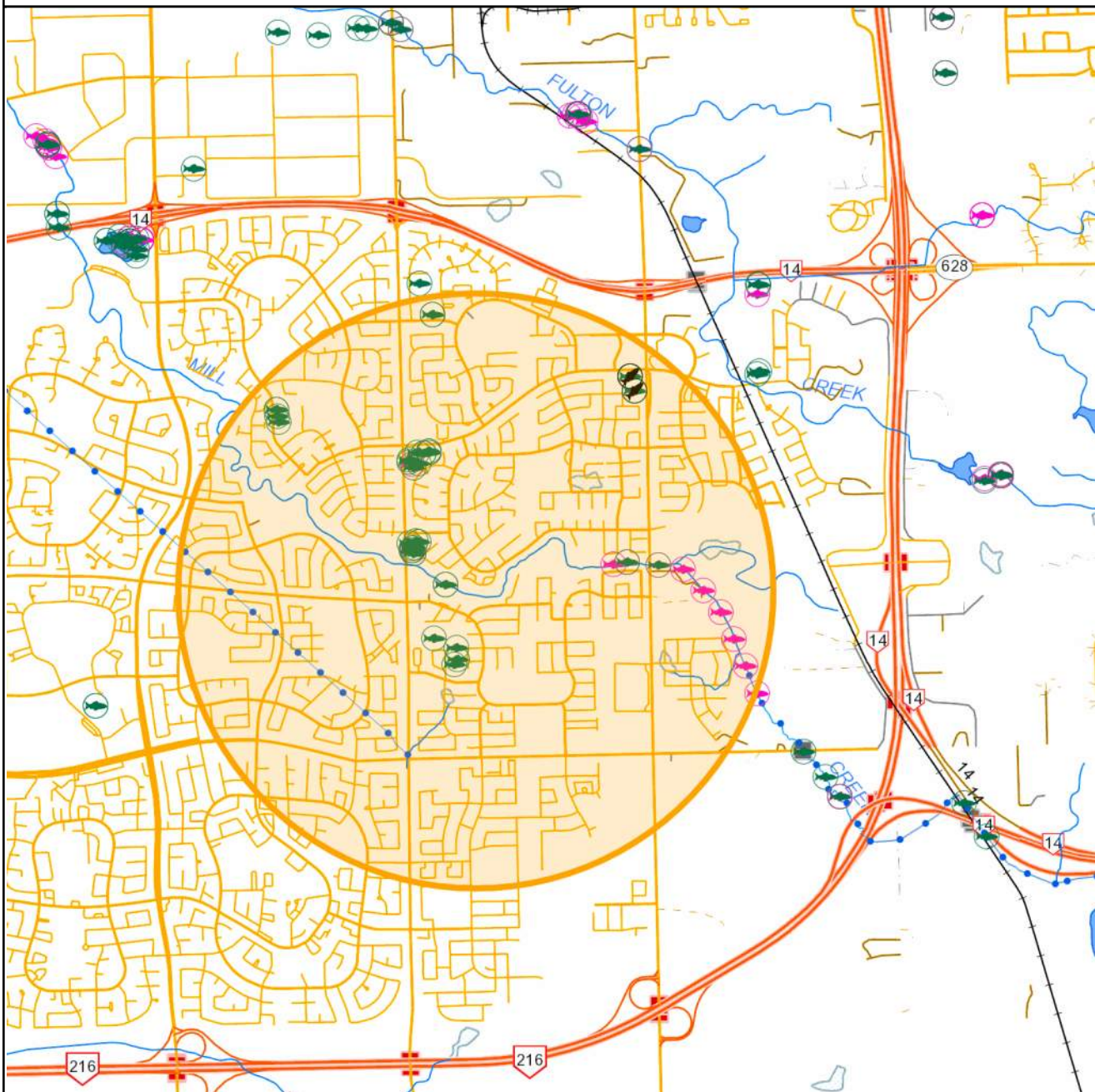
NW 6 52 23 4

Radius or Dimensions

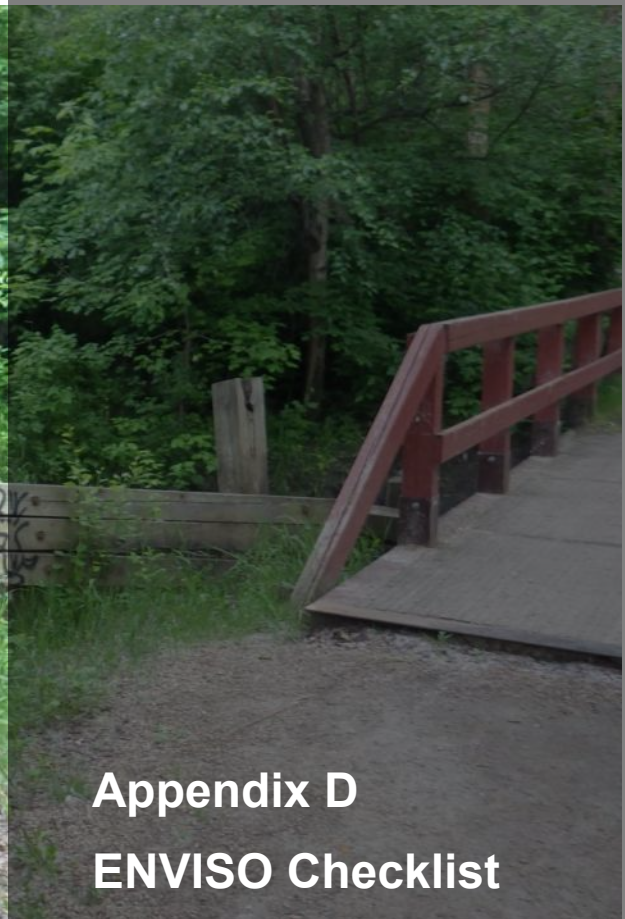
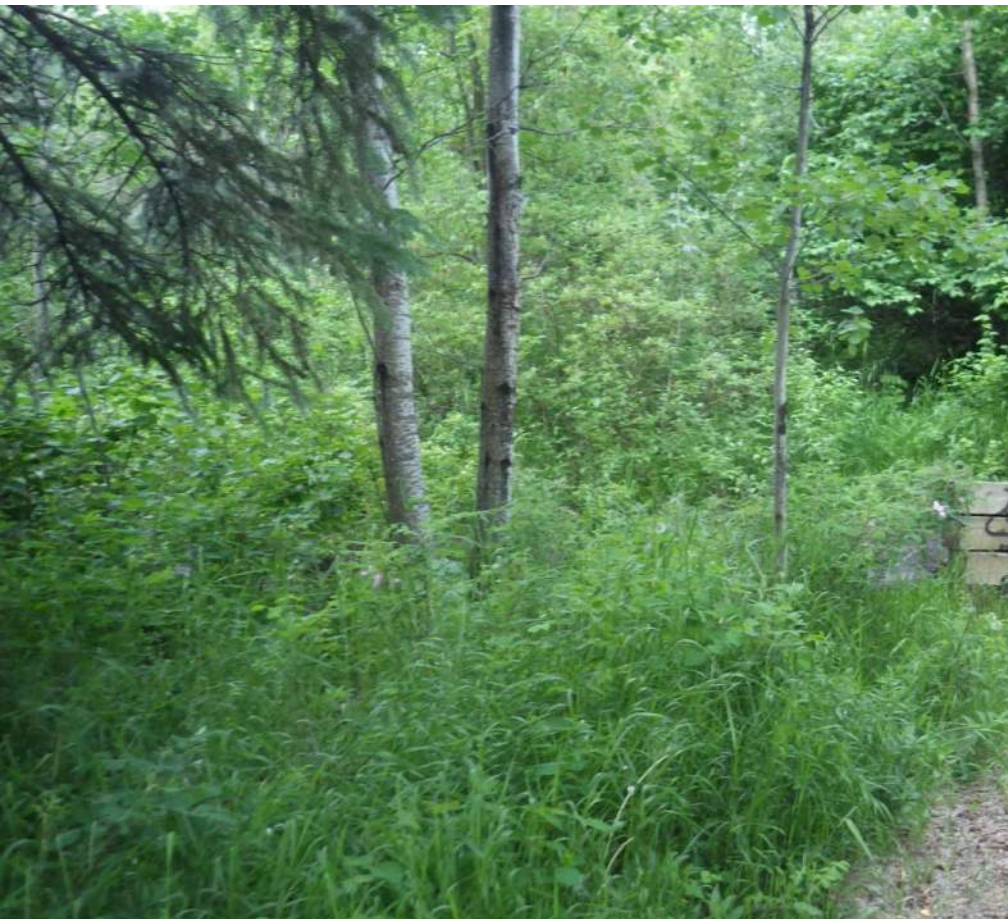
2 kilometers

Contact Information

For contact information, please visit:
<https://www.alberta.ca/fisheries-and-wildlife-management-contacts.aspx>



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Appendix D

ENVISO Checklist

Environmental Permit / Approval Checklist					
Project: Mill Creek Pedestrian Bridges Rehab (B304 to B314)			IIS Project Manager: John Phong		
Project Description: Rehabilitation of pedestrian bridges in the Mill Creek Ravine					
Federal Agency	Federal Regulation	Requirement	Applicable Y/N/U	Completed or Received Date	Comments and Restrictions / Conditions to be Followed
Fisheries and Ocean Canada (previously DFO) (Federal)	Fisheries Act	Complete "Self Assessment"	n/a	n/a	Self-assessment is not longer valid under Fisheries Act 2019. RFR to be completed
		Fisheries "Request for Review" Form required if criteria not met	Y		To be completed following fisheries assessment and 60% design
		"Application Form for Authorization" if required	U		TBD by DFO. Unlikely
		Authorization or Letter of Advice obtained	U		TBD by DFO. Unlikely
		Fish Habitat Compensation Plan required	U		TBD by DFO. Unlikely
Transport Canada (Federal)	Canadian Navigation Waters Act	Review schedule to NPA and Minor Works and Waters Order (MWWO)	N	n/a	Unscheduled, and unlikely to be navigated based on AT Navigation Map. Therefore not navigated under the CNWA
		Request required from TC in order to determine if navigable if unsure	n/a	n/a	n/a
		"Application for Approval" required	n/a	n/a	n/a
		Approval/Work Assessment obtained	n/a	n/a	n/a
Canadian Environmental	Canadian Environment	Environment Assessment (EA) required	N	n/a	n/a
Environment Canada (Federal)	Migratory Birds Convention Act (MBCA)	Restrictions on Work Activities (varies, May 1-August 10 general rule of thumb)	Y		Wildlife assessment occurring for EIA
		Field Assessment (Nest Sweep) required before or during construction	Y		Pending construction schedule
	Species at Risk Act (SARA)	Search of ACIMIS, FWMIS and COSEWIC	Y	02-Apr-20	No SARA listed on ACIMS/FWMIS/COSEWIC Present
		Field Assessment required	Y		Wildlife assessment occurring for EIA. Fish and vegetation assessment to occur in May/June
		Permit or Agreement required	N	n/a	n/a
		Restrictions on Work Activities	N	n/a	n/a
Provincial Agency	Provincial Regulation	Requirement	Applicable Y/N	Completed or Received Date	Comments and Restrictions / Conditions to be Followed
Alberta Environment (Provincial)	Water Act	Codes of Practice (CP) review	Y		COP to be submittedd following detailed design
		Notification sent if CP applicable			COP to be submittedd following detailed design

		Approval/License Required if CP is not applicable i.e. cannot meet requirements in CP	U		Expecting bridges to meet Schedule 1 of Code
		Wetland Assessment required by a QAES	N	n/a	no wetlands impacted
		Compensation Plan required	n/a	n/a	n/a
		Restricted Activity Periods (RAPs) applicable	N	n/a	Mapped class d, no RAP
	Environmental Protection and Enhancement Act (EPEA)	Consultation with Regulators	N	n/a	n/a
		Screening Report or Environment Impact Assessment (EIA) required	n/a	n/a	n/a
		Public consultation required	n/a	n/a	n/a
Alberta Culture and Community Spirit (ACCS) (Provincial)	Historical Resources Act (HRA)	HRA approval	Y		
		Consultation with First Nations required	N	n/a	
		Consultation with accredited archaeologist	Y	2020-01-20	SOJ required, HRA clearance to be applied for
		Statement of Justification (SOJ) notification required	Y	2020-03-22; April 22 2020	Province has asked for more information, updated information provided April 22, 2020
		Historical Resource Impact Assessment (HRIA) required	U		Waiting for HRA Requirements
		Clearance Letter received from ACCS			
Sustainable Resource Development (Provincial)	Public Lands Act	Department Licence of Occupation (DLO) or Temporary Deposition required	N	n/a	Confirmed no DLO through PLA
	Wildlife Act	Wildlife Assessment required	Y		Wildlife assessment occurring for EIA
		Restriction on activities	N		Construction timing and sweeps
Municipal	Municipal Regulation	Requirement	Applicable Y/N	Completed or Received Date	List All Restrictions or Conditions to be Followed
Municipal (City of Edmonton)	COE Tree Management Policy	Notification to COE if trees affected	Y		Tree Protection Plan to be developed for the Project
	Community Standards Bylaw	Noise Exemption Permit required	N	n/a	All work occurring within daytime hours
	River Valley Bylaw 7188	North Saskatchewan River valley ARP Project review form completed and submitted	Y	05-Apr-20	Scoped directly with Urban Form in person. No form required.
		Environmental Report required	Y	09-Apr-20	EIA ongoing
	Contaminated Sites	COE - Engineering Services consultation to check their database and ESAR (Alberta Environment's Environmental Site Repository)	Y	26-Mar-20	Paul Fuellbrandt requested representative samples at bridges
		Further assessment recommended	Y		Thurber completing a modified Phase 2 ESA
	Drainage Bylaw	Permit required to discharge site effluent into Storm / Combined / Sewer	N	n/a	n/a

	Erosion & Sedimentation Control	Permanent ESC Design required	Y		Permanent erosion/bank protection under bridge will be included in design
	Wildlife Passage Engineering Design Guidelines (WPEDG)	Wildlife Passage Design required & Complete Appendix D Checklist of WPEDG	U		Wildlife assessment ongoing. Replacement of existing bridges so no additional impacts
	Natural Area Systems Policy	Natural Area may be impacted by project	Y		EIA ongoing for impacts to natural area
<u>Completion Verification</u>					
Completed By:				Date:	
Comments:					
					Version 1.15



Appendix E

AGRASID Output

Report on Soil Polygon: 14284

Variable	Value
POLY_ID	14284
Map Unit Name	ZDL1/DL
Landform	DL - disturbed land
LSRS Rating (Spring Grains)	NR(10)

Landscape Model Descriptions:

Miscellaneous undifferentiated mineral soils (ZUN).

The polygon may include soils that are not strongly contrasting from the dominant or co-dominant soils (1).
Disturbed land (urban, open pit mines, gravel pits) (DL).

Image:

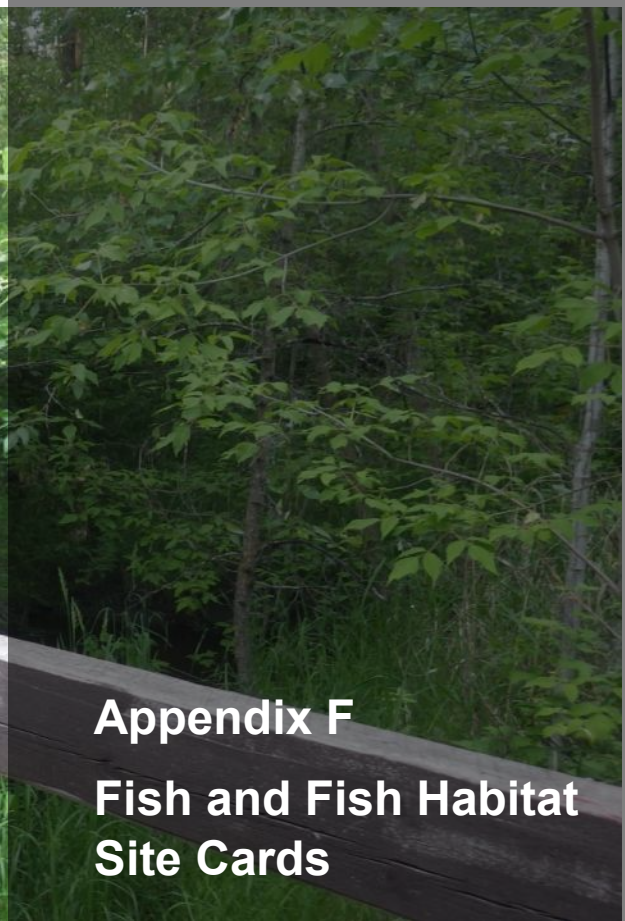
No image.

Landform Model:

No landform model.

Landform Profile:

No landform profile.



Appendix F
Fish and Fish Habitat
Site Cards



ID: Bridge B304; May 13, 2020
UTM: 12U 339963E 5927944N
Legal Location: NW-12-52-24-W4M
Waterbody and Class (RAP): Mill Creek – Class D (No RAP)

Existing Physical Conditions

Hydrologic Characteristics:

Bridge 304 occurs over a deep flat, approximately 1.5 m in depth, with limited flow velocities. Upstream and downstream are deep slow pools with a large woody debris pile approximately 300 m downstream of the site

Substrate Characteristics:

- 40% boulders (>250 mm)
- 10% small gravel (2-25 mm)
- 40% fines (<2 mm)

Riparian Characteristics

Bank: Left bank – near vertical, vegetated. Right bank sloping outside bend

Dominant Species: Mixed forest of cottonwood, willows with intermittent spruce

Woody Vegetation: Willow species (*Salix* spp.) and cottonwood species (*Populus* spp.).

Fish Habitat

No barriers to fish passage were observed past significant large woody debris, such that migration is considered moderate to good. Rearing and feeding habitat potential was considered Good for non-sport and sportfish due to the depths present. Under the bridge has previously placed riprap, with mostly boulders and fine present

Habitat Quality:

No fish were observed at the time of the assessment.

Sportfish/Non-sportfish	Spawning	Rearing	Feeding	Migration
Non-sportfish	Good	Good	Good	Moderate to Good

Potential Instream Fish Habitat Features:

Significant LWD noted within channel.

Potential Riparian Fish Habitat Features:

Limited riparian vegetation at site. Downstream and upstream has significantly more vegetation as cover (willows).

Previously Documented Fish Occurrences (AEP 2015):

Brook Stickleback, Fathead Minnow, Goldeye, Northern Crayfish



Plate 1: View upstream from bridge B304



Plate 2: View upstream from bridge B304 showing silt and riprap



Plate 3: View downstream from B304, showing highly sedimented area



Plate 4: View downstream approximately 100 m downstream from the site, showing flat habitat and large woody debris



Plate 5: View downstream toward bridge B304



Plate 6: View showing extensive flat habitat and large woody debris approximately 300 m downstream of site



ID: Bridge B305; May 13, 2020
UTM: 12U 339998E 5927854N
Legal Location: SW-12-52-24-W4M
Waterbody and Class (RAP): Mill Creek – Class D (no RAP)

Existing Physical Conditions

Hydrologic Characteristics:

Bridge B305 occurs over a class 2 run, approximately 0.75 m in depth with a riffle located immediately upstream of the site and an extended class 2 flat occurring downstream. The run at the bridge is caused by riprap that is present within the channel

Substrate Characteristics:

- 60% boulders (>250 mm)
- 10% small gravel (2-25 mm)
- 30% fines (<2 mm)

Riparian Characteristics

Bank: Left bank – sloping, vegetated. Right bank sloping vegetated

Dominant Species: Mixed forest of cottonwood, willows with intermittent spruce

Woody Vegetation: Willow species (*Salix* spp.) and cottonwood species (*Populus* spp.).

Fish Habitat

No barriers to fish passage were observed past significant large woody debris, such that migration is considered moderate to good. Rearing and feeding habitat potential was considered Good for non-sport and sportfish due to the depths present. Under the bridge has previously placed riprap, with mostly boulders and fine present

Habitat Quality:

No fish were observed at the time of the assessment.

Sportfish/Non-sportfish	Spawning	Rearing	Feeding	Migration
Sportfish	Good	Good	Good	Moderate to Good

Potential Instream Fish Habitat Features:

Significant LWD noted within channel.

Potential Riparian Fish Habitat Features:

Limited riparian vegetation at site. Downstream and upstream has significantly more vegetation as cover (willows).

Previously Documented Fish Occurrences (AEP 2015):

Brook Stickleback, Fathead Minnow, Goldeye, Northern Crayfish



Plate 1: View downstream from bridge B305, showing flat in the distance, and run underneath bridge



Plate 2: View upstream and under bridge B305, showing riprap present, and riffle upstream of site



Plate 3: View showing woody debris presence, approximately 300 m downstream of bridge B305



Plate 4: View downstream towards bridge B305, showing riffle habitat



Plate 5: View upstream towards bridge B305, showing run habitat



Plate 6: View upstream showing extensive woody debris, approximately 300 m upstream of bridge B305.



ID: Bridge B306; May 13, 2020
UTM: 12U 339879E 5927709N
Legal Location: SW-12-52-24-W4M
Waterbody and Class (RAP): Mill Creek – Class D (no RAP)

Existing Physical Conditions

Hydrologic Characteristics:

Bridge B306 occurs over a class 2 pool, approximately 0.75 m in depth with a class 3 pool located immediately upstream. Riprap is present at the bridge location.

Substrate Characteristics:

- 60% boulders (>250 mm)
- 10% small gravel (2-25 mm)
- 30% fines (<2 mm)

Riparian Characteristics

Bank: Left bank – sloping, vegetated. Right bank sloping vegetated

Dominant Species: Mixed forest of cottonwood, willows with intermittent spruce

Woody Vegetation: Willow species (*Salix* spp.) and cottonwood species (*Populus* spp.).

Fish Habitat

No barriers to fish passage were observed past significant large woody debris, such that migration is considered moderate to good. Rearing and feeding habitat potential was considered Good for non-sport and sportfish due to the depths present. Under the bridge has previously placed riprap, with mostly boulders and fine present

Habitat Quality:

No fish were observed at the time of the assessment.

Sportfish/Non-sportfish	Spawning	Rearing	Feeding	Migration
Sportfish	Good	Good	Good	Moderate to Good

Potential Instream Fish Habitat Features:

Significant LWD noted within channel.

Potential Riparian Fish Habitat Features:

Limited riparian vegetation at site. Downstream and upstream has significantly more vegetation as cover (willows).

Previously Documented Fish Occurrences (AEP 2015):

Brook Stickleback, Fathead Minnow, Goldeye, Northern Crayfish



Plate 1: View upstream from bridge B306, showing riprap presence and shallow pool habitat



Plate 2: View showing large woody debris within channel, located approximately 50 m downstream of bridge B306



Plate 3: View upstream of bridge B306 showing pool habitat and flat habitat



Plate 4: View downstream towards bridge B306, showing riparian habitat



Plate 5: View upstream towards bridge B306, showing riprap already present on site.



Plate 6: View showing backwater effect caused by large woody debris, upstream of site



ID: Bridge B307; May 13, 2020
UTM: 12U 340003E 5927498N
Legal Location: SW-12-52-24-W4M
Waterbody and Class (RAP): Mill Creek – Class D (no RAP)

Existing Physical Conditions

Hydrologic Characteristics:

Bridge B307 occurs over a class 2 pool and riffle, approximately 0.75 m in depth. Riprap is present at the bridge location.

Substrate Characteristics:

- 60% boulders (>250 mm)
- 10% small gravel (2-25 mm)
- 30% fines (<2 mm)

Riparian Characteristics

Bank: Left bank – sloping, vegetated. Right bank sloping vegetated

Dominant Species: Mixed forest of cottonwood, willows with intermittent spruce

Woody Vegetation: Willow species (*Salix* spp.) and cottonwood species (*Populus* spp.).

Fish Habitat

No barriers to fish passage were observed past significant large woody debris, such that migration is considered moderate to good. Rearing and feeding habitat potential was considered Good for non-sport and sportfish due to the depths present. Under the bridge has previously placed riprap, with mostly boulders and fine present

Habitat Quality:

No fish were observed at the time of the assessment.

Sportfish/Non-sportfish	Spawning	Rearing	Feeding	Migration
Sportfish	Good	Good	Good	Moderate to Good

Potential Instream Fish Habitat Features:

Significant LWD noted within channel.

Potential Riparian Fish Habitat Features:

Limited riparian vegetation at site. Downstream and upstream has significantly more vegetation as cover (willows).

Previously Documented Fish Occurrences (AEP 2015):

Brook Stickleback, Fathead Minnow, Goldeye, Northern Crayfish



Plate 1: View upstream from bridge B307, showing shallow pool towards log jam



Plate 2: View downstream towards bridge B307, showing riffle that leads to jog jam



Plate 3: View downstream from bridge B307, showing riffle that leads to run habitat



Plate 4: View approximately 100 m downstream of bridge B307, showing run habitat leading to riffle



Plate 5: View upstream towards bridge B307 showing riffle downstream of bridge, and riprap present



Plate 6: View downstream towards bridge B307 showing riffle downstream of bridge, and riprap present



ID: Bridge B308; May 13, 2020
UTM: 12U 340019E 5927469N
Legal Location: SW-12-52-24-W4M
Waterbody and Class (RAP): Mill Creek – Class D (no RAP0)

Existing Physical Conditions

Hydrologic Characteristics:

Bridge B307 occurs over a class 2 pool and riffle, approximately 0.75 m in depth. Riprap is present at the bridge location.

Substrate Characteristics:

- 40% boulders (>250 mm)
- 30% small gravel (2-25 mm)
- 30% fines (<2 mm)

Riparian Characteristics

Bank: Left bank – sloping, vegetated. Right bank sloping vegetated

Dominant Species: Mixed forest of cottonwood, willows with intermittent spruce

Woody Vegetation: Willow species (*Salix* spp.) and cottonwood species (*Populus* spp.).

Fish Habitat

No barriers to fish passage were observed past significant large woody debris, such that migration is considered moderate to good. Rearing and feeding habitat potential was considered Good for non-sport and sportfish due to the depths present. Under the bridge has previously placed riprap, with mostly boulders and fine present

Habitat Quality:

No fish were observed at the time of the assessment.

Sportfish/Non-sportfish	Spawning	Rearing	Feeding	Migration
Sportfish	Good	Good	Good	Moderate to Good

Potential Instream Fish Habitat Features:

Significant LWD noted within channel.

Potential Riparian Fish Habitat Features:

Limited riparian vegetation at site. Downstream and upstream has significantly more vegetation as cover (willows).

Previously Documented Fish Occurrences (AEP 2015):

Brook Stickleback, Fathead Minnow, Goldeye, Northern Crayfish



Plate 1: View downstream from bridge B308, showing large woody debris and riffle/pool habitat



Plate 2: View



Plate 3: View upstream towards bridge B308, showing riffle and riparian habitat



Plate 4: View upstream from bridge B308 showing large woody debris and pool habitat and rap presence on left-downstream bank



Plate 5: View downstream towards bridge B308, approximately 100 m upstream.



Plate 6: View downstream from bridge B308, approximately 100 m downstream.



ID: Bridge B309; May 13, 2020
UTM: 12U 340256E 5927287 N
Legal Location: SW-12-52-24-W4M
Waterbody and Class (RAP): Mill Creek – Class D (no RAP)

Existing Physical Conditions

Hydrologic Characteristics:

Bridge B309 occurs over a class 1 run, approximately 1.0 m in depth. Riprap is present at the bridge location. Upstream of the site is a class 1 pool.

Substrate Characteristics:

- 40% boulders (>250 mm)
- 30% small gravel (2-25 mm)
- 30% fines (<2 mm)

Riparian Characteristics

Bank: Left bank – sloping, vegetated. Right bank sloping vegetated

Dominant Species: Mixed forest of cottonwood, willows with intermittent spruce

Woody Vegetation: Willow species (*Salix* spp.) and cottonwood species (*Populus* spp.).

Fish Habitat

No barriers to fish passage were observed past significant large woody debris, such that migration is considered moderate to good. Rearing and feeding habitat potential was considered Good for non-sportfish due to the depths present. Under the bridge has previously placed riprap, with mostly boulders and fine present

Habitat Quality:

No fish were observed at the time of the assessment.

Sportfish/Non-sportfish	Spawning	Rearing	Feeding	Migration
Sportfish	Good	Good	Good	Moderate to Good

Potential Instream Fish Habitat Features:

Significant LWD noted within channel.

Potential Riparian Fish Habitat Features:

Limited riparian vegetation at site. Downstream and upstream has significantly more vegetation as cover (willows).

Previously Documented Fish Occurrences (AEP 2015):

Brook Stickleback, Fathead Minnow, Goldeye, Northern Crayfish



Plate 1: View upstream from bridge B309, showing run habitat under bridge, riprap presence and pool upstream.



Plate 2: View downstream from bridge B309, showing large woody debris and eroded banks



Plate 3: View downstream, approximately 100 m downstream of bridge B309, showing depositional area



Plate 4: View downstream towards bridge B309



Plate 5: View upstream towards bridge B309



Plate 6: View showing large woody debris/dam approximately 100 m upstream of bridge B309



ID: Bridge 310; May 13, 2020
UTM: 12U 340261E 5927260N
Legal Location: SW-12-52-24-W4M
Waterbody and Class (RAP): Mill Creek – Class D (no RAP)

Existing Physical Conditions

Hydrologic Characteristics:

Bridge B310 occurs over a class 2 pool that has been backed up due to extensive large woody debris located immediately downstream of the Project. Riprap is present at the bridge location. Upstream of the site is a class 1 pool.

Substrate Characteristics:

- 40% boulders (>250 mm)
- 30% small gravel (2-25 mm)
- 30% fines (<2 mm)

Riparian Characteristics

Bank: Left bank – sloping, vegetated. Right bank sloping vegetated

Dominant Species: Mixed forest of cottonwood, willows with intermittent spruce

Woody Vegetation: Willow species (*Salix* spp.) and cottonwood species (*Populus* spp.).

Fish Habitat

Significant large woody debris may limit migration such that it is considered poor to moderate. Rearing and feeding habitat potential was considered Good for non-sportfish due to the depths present. Under the bridge has previously placed riprap, with mostly boulders and fine present, as well as extensive large woody debris located directly at the bridge site.

Habitat Quality:

No fish were observed at the time of the assessment.

Sportfish/Non-sportfish	Spawning	Rearing	Feeding	Migration
Sportfish	Good	Good	Good	Poor to Moderate

Potential Instream Fish Habitat Features:

Significant LWD noted within channel.

Potential Riparian Fish Habitat Features:

Limited riparian vegetation at site. Downstream and upstream has significantly more vegetation as cover (willows).

Previously Documented Fish Occurrences (AEP 2015):

Brook Stickleback, Fathead Minnow, Goldeye, Northern Crayfish



Plate 1: View downstream from bridge 310, showing extensive large woody debris within the channel



Plate 2: View downstream from bridge B310, showing extensive large woody debris and riprap presence



Plate 3: View upstream from bridge B310, showing backed up flows



Plate 4: View upstream from bridge B310, showing rip rap presence



Plate 5: View downstream showing bridge B310



Plate 6: View upstream, showing large log jam at bridge B310



ID: Bridge B311; May 13, 2020
UTM: 12U 340655E 5926952N
Legal Location: NE-1-52-24-W4M
Waterbody and Class (RAP): Mill Creek – Class D (no RAP)

Existing Physical Conditions

Hydrologic Characteristics:

Bridge B311 occurs over a riffle and class 2 run that has been backed up due to extensive large woody debris located immediately downstream of the Project. Riprap is present at the bridge location. Upstream of the site is a riffle followed by a run.

Substrate Characteristics:

- 40% boulders (>250 mm)
- 30% small gravel (2-25 mm)
- 30% fines (<2 mm)

Riparian Characteristics

Bank: Left bank – sloping, vegetated. Right bank sloping vegetated

Dominant Species: Mixed forest of cottonwood, willows with intermittent spruce

Woody Vegetation: Willow species (*Salix* spp.) and cottonwood species (*Populus* spp.).

Fish Habitat

Significant large woody debris, is located immediately down such that migration is considered poor to moderate. Rearing and feeding habitat potential was considered Good for non-sportfish due to the depths present. Under the bridge has previously placed riprap, with mostly boulders and fine present, as well as extensive large woody debris located directly at the bridge site.

Habitat Quality:

No fish were observed at the time of the assessment.

Sportfish/Non-sportfish	Spawning	Rearing	Feeding	Migration
Sportfish	Moderate	Good	Good	Poor to Moderate

Potential Instream Fish Habitat Features:

Significant LWD noted within channel.

Potential Riparian Fish Habitat Features:

Limited riparian vegetation at site. Downstream and upstream has significantly more vegetation as cover (willows).

Previously Documented Fish Occurrences (AEP 2015):

Brook Stickleback, Fathead Minnow, Goldeye, Northern Crayfish



Plate 1: View downstream from bridge B311, showing significant large woody debris pile immediately downstream of bridge



Plate 2: View upstream from bridge B311 showing run habitat, and rip rap present



Plate 3: View across from bridge B311, showing erosion present



Plate 4: View upstream, approximately 100 m upstream of bridge B311 showing significant instream debris



Plate 5: View upstream towards bridge B311, showing extensive instream debris



Plate 6: View downstream approximately 100 m downstream of bridge B311



ID: Bridge B312; May 13, 2020
UTM: 12U 340918E 5926890N
Legal Location: NE-1-52-24-W4M
Waterbody and Class (RAP): Mill Creek – Class D (no RAP)

Existing Physical Conditions

Hydrologic Characteristics:

Bridge B312 occurs over a riffle and class 2 located immediately downstream of the Project. Extensive riprap is present at the bridge location. Upstream of the site is a riffle followed by a run.

Substrate Characteristics:

- 40% boulders (>250 mm)
- 30% small gravel (2-25 mm)
- 30% fines (<2 mm)

Riparian Characteristics

Bank: Left bank – sloping, vegetated. Right bank sloping vegetated

Dominant Species: Mixed forest of cottonwood, willows with intermittent spruce

Woody Vegetation: Willow species (*Salix* spp.) and cottonwood species (*Populus* spp.).

Fish Habitat

No barriers to fish passage were observed past significant large woody debris, such that migration is considered moderate to good. Rearing and feeding habitat potential was considered Good for non-sportfish due to the depths present. Under the bridge has previously placed riprap, with mostly boulders and fine present, as well as extensive large woody debris located directly at the bridge site.

Habitat Quality:

No fish were observed at the time of the assessment.

Sportfish/Non-sportfish	Spawning	Rearing	Feeding	Migration
Sportfish	Good	Good	Good	Moderate to Good

Potential Instream Fish Habitat Features:

Significant LWD noted within channel.

Potential Riparian Fish Habitat Features:

Limited riparian vegetation at site. Downstream and upstream has significantly more vegetation as cover (willows).

Previously Documented Fish Occurrences (AEP 2015):

Brook Stickleback, Fathead Minnow, Goldeye, Northern Crayfish



Plate 1: View downstream from bridge B312, showing riprap presence and riffle



Plate 2: View upstream from bridge B312, showing riprap, riffle and run



Plate 3: View showing the substrate at bridge B312



Plate 4: View across of bridge B312



Plate 5: View upstream showing riprap present at bridge B12



Plate 6: View upstream, approximately 100 m downstream of bridge 312



ID: Bridge B313; May 13, 2020
UTM: 12U 341375E 5926591N
Legal Location: NW-6-52-23-W4M
Waterbody and Class (RAP): Mill Creek – Class D (no RAP)

Existing Physical Conditions

Hydrologic Characteristics:

Bridge B313 occurs over a flat followed by a riffle/run complex riffle and is limited in depth, with riprap present
Upstream of the bridge is a large pool.

Substrate Characteristics:

- 50% boulders (>250 mm)
- 30% small gravel (2-25 mm)
- 20% fines (<2 mm)

Riparian Characteristics

Bank: Left bank – sloping, vegetated. Right bank sloping vegetated

Dominant Species: Mixed forest of cottonwood, willows with intermittent spruce

Woody Vegetation: Willow species (*Salix* spp.) and cottonwood species (*Populus* spp.).

Fish Habitat

No barriers to fish passage were observed past significant large woody debris, such that migration is considered moderate to good. Rearing and feeding habitat potential was considered Good for non-sportfish due to the depths present. Under the bridge has previously placed riprap, with mostly boulders and fine present

Habitat Quality:

No fish were observed at the time of the assessment.

Sportfish/Non-sportfish	Spawning	Rearing	Feeding	Migration
Sportfish	Good	Good	Good	Moderate to Good

Potential Instream Fish Habitat Features:

Significant LWD noted within channel.

Potential Riparian Fish Habitat Features:

Limited riparian vegetation at site. Downstream and upstream has significantly more vegetation as cover (willows).

Previously Documented Fish Occurrences (AEP 2015):

Brook Stickleback, Fathead Minnow, Goldeye, Northern Crayfish



Plate 1: View looking downstream towards flat and riffle/run from bridge B313.



Plate 2: View upstream from bridge B313 showing pool habitat



Plate 3: View downstream, approximately 100 m downstream of bridge B313, showing riffle



Plate 4: View downstream towards bridge B313, showing flat and riffle habitat,



Plate 5: View upstream towards bridge B313, showing flat habitat



Plate 6: View downstream, approximately 200 m downstream from bridge B313



ID: Bridge 314; May 13, 2020
UTM: 12U 341897E 5926753N
Legal Location: NW-6-52-23-W4M
Waterbody and Class (RAP): Mill Creek – Class D (no RAP)

Existing Physical Conditions

Hydrologic Characteristics:

Bridge B314 occurs over run riffle complex, immediately downstream of a vegetation-inundated channel.

Substrate Characteristics:

- 50% boulders (>250 mm)
- 30% small gravel (2-25 mm)
- 20% fines (<2 mm)

Riparian Characteristics

Bank: Left bank – sloping, vegetated. Right bank sloping vegetated

Dominant Species: Mixed forest of cottonwood, willows with intermittent spruce

Woody Vegetation: Willow species (*Salix* spp.) and cottonwood species (*Populus* spp.).

Fish Habitat

No barriers to fish passage were observed past significant large woody debris, such that migration is considered moderate to good. Rearing and feeding habitat potential was considered Good for non-sportfish due to the depths present. Under the bridge has previously placed riprap, with mostly boulders and fine present.

Habitat Quality:

No fish were observed at the time of the assessment.

Sportfish/Non-sportfish	Spawning	Rearing	Feeding	Migration
Sportfish	Good	Good	Good	Moderate to Good

Potential Instream Fish Habitat Features:

Significant LWD noted within channel.

Potential Riparian Fish Habitat Features:

Limited riparian vegetation at site. Downstream and upstream has significantly more vegetation as cover (willows).

Previously Documented Fish Occurrences (AEP 2015):

Brook Stickleback, Fathead Minnow, Goldeye, Northern Crayfish



Plate 1: View upstream from bridge B314 showing riffle run complex, downstream of inundated vegetation



Plate 2: View upstream from bridge B314, showing inundated vegetation within channel



Plate 3: View upstream towards bridge B314, showing riffle and run habitat



Plate 4: View downstream, approximately 100 m downstream of bridge B314 showing flat habitat



Plate 5: View downstream showing bridge B314, showing the riparian habitat



Plate 6: View showing backed up flows with large class 1 pool, approximately 50 m upstream of bridge B314.



Appendix G
Vegetation
Information
(Observed Species,
ACIMS Species
Tables, Maps,
Database Output)

Table G-1: Vegetation Species Observed During the 2020 Field Assessments

Scientific Name	Common Name	Provincial Rank	Plot										
			B304	B305	B306	B307	B308	B309	B310	B311	B312	B313	B314
Trees and Shrubs													
<i>Betula neoalaskana</i>	Alaska birch	S5	x		x	x		x					
<i>Alnus incana</i>	alder	S5	x		x						x		
<i>Populus tremuloides</i>	aspen	S5	x		x	x	x	x	x	x	x	x	
<i>Populus balsamifera</i>	balsam poplar	S5		x		x	x	x	x	x	x	x	x
<i>Salix petiolaris</i>	basket willow	S5							x				
<i>Corylus cornuta</i>	beaked hazelnut	S5	x	x		x		x	x	x	x	x	
<i>Lonicera involucrata</i>	bracted honeysuckle	S5		x		x	x	x	x	x	x		
<i>Ribes lacustre</i>	bristly black currant	S5		x	x		x						
<i>Symphoricarpos occidentalis</i>	buckbrush	S5						x	x	x	x		
<i>Prunus virginiana</i>	choke cherry	S5	x	x			x	x		x	x		x
<i>Rosa woodsii</i>	common wild rose	S5	x		x	x	x	x		x	x	x	x
<i>Acer negundo</i>	Manitoba maple	SU	x	x	x	x		x	x		x		x
<i>Salix myrtillifolia</i>	myrtle-leaved willow	S5									x		
<i>Ribes hudsonianum</i>	northern black currant	S5	x	x	x	x		x	x	x	x		
<i>Ribes oxycanthoides</i>	northern gooseberry	S5	x								x		
<i>Prunus pensylvanica</i>	pin cherry	S5						x	x				
<i>Actaea rubra</i>	red and white baneberry	S5								x	x		
<i>Sambucus racemosa</i>	red elderberry	S4								x			
<i>Cornus stolonifera</i>	red-osier dogwood	S5	x	x	x	x	x	x	x	x	x	x	x
<i>Amelanchier alnifolia</i>	saskatoon	S5	x			x					x		
<i>Salix scouleriana</i>	Scouler's willow	S5											
<i>Salix lasiandra</i>	shinning willow	S5									x	x	

<i>Sorbus sitchensis</i>	Sitka mountain ash	S3			x	x				x			x
<i>Ribes glandulosum</i>	skunk currant	S5						x	x	x	x	x	
<i>Symphoricarpos albus</i>	snowberry	S5	x	x	x	x	x	x		x		x	x
<i>Betula occidentalis</i>	water birch	S4									x		
<i>Sorbus scopulina</i>	western mountain-ash	S5		x						x			
<i>Picea glauca</i>	white spruce	S5			x					x	x	x	
<i>Rubus idaeus</i>	wild red raspberry	S5	x	x	x	x	x	x	x	x		x	x
<i>Salix</i> sp	willow species	-					x	x				x	x
<i>Sambucus racemosa</i>	red elderberry	S5										x	
Forbs													
<i>Agrimonia striata</i>	agrimony	S4	x	x	x	x	x			x	x		x
<i>Geranium bicknellii</i>	Bicknell's geranium	S5	x										
<i>Mitella nuda</i>	bishop's-cap	S5	x	x					x				
<i>Cornus canadensis</i>	bunchberry	S5	x							x		x	
<i>Ranunculus</i> sp	buttercup species	-			x							x	
<i>Anemone canadensis</i>	Canada anemone	S5	x	x		x	x	x	x		x	x	x
<i>Chamerion angustifolium</i>	common fireweed	S5		x	x		x	x				x	
<i>Urtica dioica</i>	common nettle	S5	x		x	x	x	x	x	x	x	x	x
<i>Pyrola asarifolia</i>	common pink wintergreen	S5	x		x	x	x		x		x	x	
<i>Heracleum maximum</i>	cow parsnip	S5		x	x	x	x	x	x		x		
<i>Lathyrus ochroleucus</i>	cream-colored vetchling	S5				x	x				x	x	
<i>Rubus pubescens</i>	dewberry	S5		x	x	x	x						
<i>Lepidium densiflorum</i>	dense-flower pepper-grass	S5											x
<i>Prosartes trachycarpa</i>	fairybells	S5	x			x				x			
<i>Solidago</i> sp.	Goldenrod species	-											x
<i>Geum macrophyllum</i>	large-leaved yellow avens	S5		x	x		x	x		x	x		
<i>Stellaria longipes</i>	long-stalked chickweed	S5							x				
<i>Achillea alpina</i>	many-flowered yarrow	S5			x	x							

<i>Scutellaria galericulata</i>	marsh skullcap	S5			x							x	
<i>Equisetum pratense</i>	meadow horsetail	S5	x	x	x	x	x	x	x	x	x		x
<i>Adoxa moschatellina</i>	moschatel	S4	x	x				x	x		x		
<i>Rumex triangulivalvis</i>	narrow-leaved dock	S5	x		x							x	x
<i>Galium boreale</i>	northern bedstraw	S5						x			x		x
<i>Gymnocarpium dryopteris</i>	oak fern	S5								x			
<i>Cardamine pensylvanica</i>	Pennsylvania bittercress	S5										x	
<i>Lathyrus venosus</i>	purple peavine	S4		x	x		x	x	x			x	x
<i>Erigeron strigosus</i>	rough fleabane	S3	x										
<i>Eurybia conspicua</i>	showy aster	S5	x										
<i>Circaea alpina</i>	small enchanter's nightshade	S4				x		x		x			x
<i>Sanicula marilandica</i>	snakeroot	S4S5		x			x						
<i>Corallorhiza maculata</i>	spotted coralroot	S4	x								x		
<i>Maianthemum stellatum</i>	star-flowered Solomon's-seal	S5		x						x			x
<i>Galium triflorum</i>	sweet-scented bedstraw	S5	x	x		x	x	x	x			x	
<i>Mertensia paniculata</i>	tall lungwort	S5	x	x			x	x	x	x	x		
<i>Thalictrum dasycarpum</i>	tall meadow rue	S3	x										
<i>Maianthemum trifolium</i>	three-leaved Solomon's-seal	S5	x			x					x		
<i>Lonicera dioica</i>	twining honeysuckle	S5							x				
<i>Thalictrum venulosum</i>	veiny meadow rue	S5	x	x		x	x					x	
<i>Sium suave</i>	water parsnip	S5	x									x	
<i>Cicuta maculata</i>	water-hemlock	S5										x	
<i>Viola canadensis</i>	western Canada violet	S5	x	x	x		x	x		x			
<i>Maianthemum canadense</i>	wild lily-of-the-valley	S5	x		x		x		x	x	x	x	
<i>Mentha arvensis</i>	wild mint	S5			x							x	x
<i>Aralia nudicaulis</i>	wild sarsaparilla	S5			x	x		x	x	x			
<i>Fragaria vesca</i>	woodland strawberry	S4				x						x	
<i>Geum aleppicum</i>	yellow avens	S5				x					x	x	

<i>Nuphar variegata</i>	yellow pond-lily	S5	x	x								x	
Grasses													
<i>Calamagrostis canadensis</i>	bluejoint	S5					x	x		x	x	x	x
<i>Carex sp</i>	sedge species	-	x	x	x	x	x	x			x	x	
<i>Carex chordorrhiza</i>	prostrate sedge	S5	x										
<i>Carex concinna</i>	beautiful sedge	S5	x	x		x	x	x	x	x		x	
<i>Carex dewyana</i>	Dewey's sedge	S4		x	x					x		x	
<i>Phalaris arundinacea</i>	reed canary grass	S5	x	x	x	x	x	x	x	x	x	x	x
<i>Poa pratensis</i>	Kentucky bluegrass	S5	x	x	x	x		x	x	x	x	x	x
<i>Sparganium sp</i>	bur-reed species	-	x									x	x
<i>Typha latifolia</i>	common cattail	S5									x		x
<i>Poa palustris</i>	fowl bluegrass	S5	x								x		
<i>Scirpus microcarpus</i>	small-fruited bulrush	S5	x		x	x		x				x	x
<i>Schoenoplectus acutus</i>	great bulrush	S5?											x
<i>Carex rostrata</i>	beaked sedge	S4											x
<i>Scolochloa festuacea</i>	spangletop	S4	x		x	x	x		x		x	x	x
<i>Carex utriculata</i>	small bottle sedge	S5	x	x	x		x						x
<i>Festuca ovina</i>	sheep fescue	S5											x
Weeds													
<i>Artemisia absinthium</i>	absinthe wormwood	SNA											x
<i>Trifolium hybridum</i>	Alsike clover	SNA			x	x			x	x	x	x	x
<i>Silene latifolia</i>	white cockle, bladder campion	SNA			x						x		x
<i>Carum carvi</i>	caraway	SNA								x		x	x
<i>Rhamnus catharticus</i>	common buckthorn	SNA								x			
<i>Arctium minus</i>	common burdock	SNA								x			
<i>Taraxacum officinale</i>	common dandelion	SNA	x	x	x	x	x	x	x	x	x	x	x
<i>Tanacetum vulgare</i>	common tansy	SNA			x	x	x				x	x	x
<i>Cirsium arvense</i>	creeping thistle	SNA	x	x	x	x	x	x		x	x	x	x

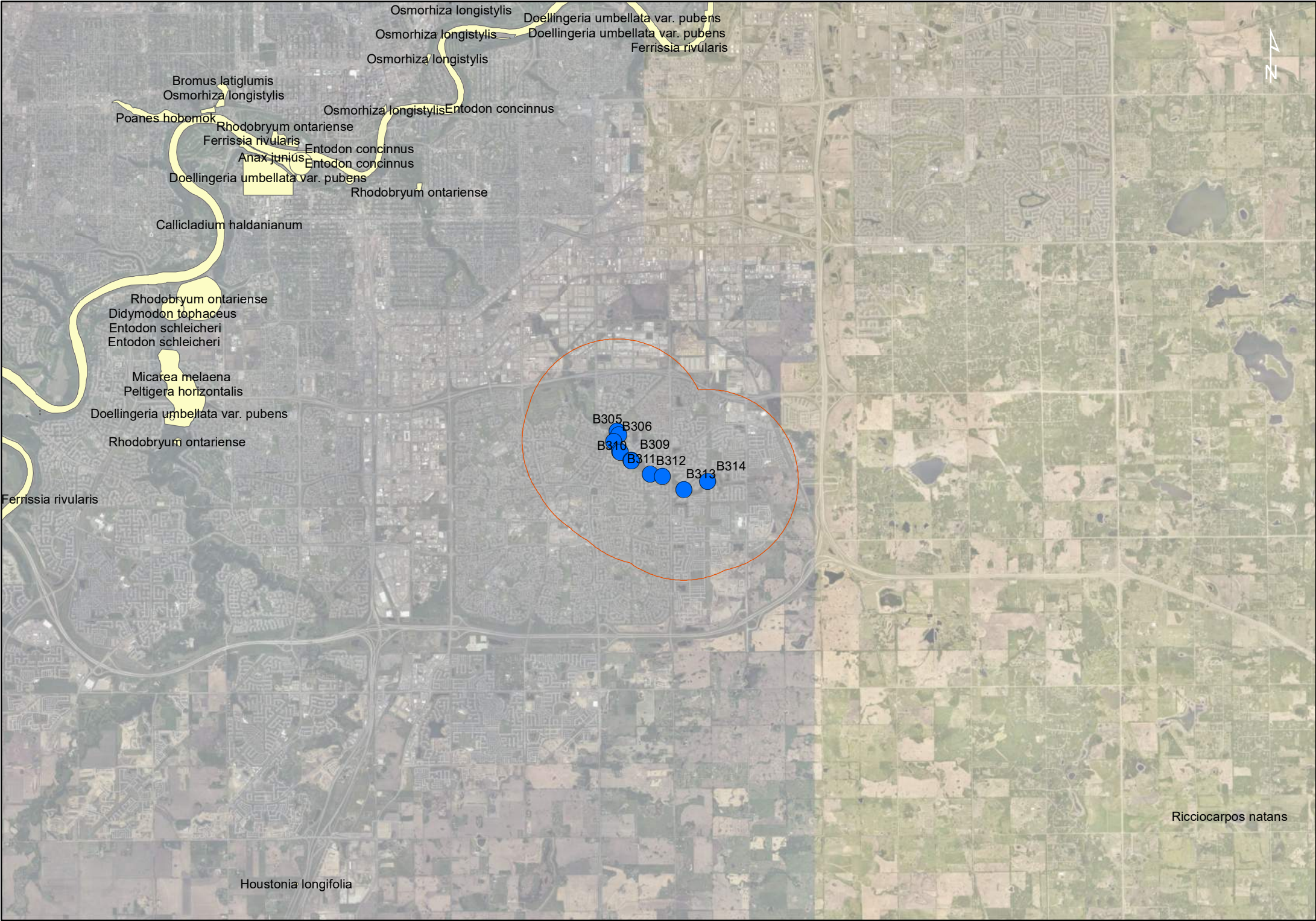
<i>Sorbus aucuparia</i>	European mountain-ash	SNA	X	X		X	X	X	X	X	X	X	
<i>Thlaspi arvense</i>	field pennycress	SNA							X				
<i>Sonchus arvensis</i>	perennial sow-thistle	SNA			X	X							X
<i>Plantago major</i>	nipple-seed plantain	SNA			X			X		X	X		X
<i>Dactylis glomerata</i>	orchard grass	SNA		X							X		
<i>Cotoneaster acutifolius</i>	Peking cotoneaster	SNA		X			X					X	
<i>Elymus repens</i>	quackgrass	SNA		X		X	X	X	X	X	X	X	X
<i>Trifolium pratense</i>	red clover	SNA		X			X		X			X	
<i>Bromus inermis</i>	smooth brome	SNA					X	X			X	X	X
<i>Melilotus sp</i>	sweet-clover	-											X
<i>Trifolium repens</i>	white clover	SNA		X			X		X			X	

Sources: ACIMS 2017a,b,c,d, 2018

- Notes: 1 Bold denotes a Noxious species in the Alberta Weed Act (Government of Alberta 2010)
 2 Grey Highlight denotes a Prohibited Noxious species in the Alberta Weed Act (Government of Alberta 2010)
 3 Nomenclature is per ACIMS 2017.

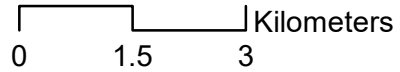
Table G-2: Rare Vascular Plant Species within the Central Parkland Natural Subregion

Common Name	Scientific Name	Rank (Provincial) ¹	Rank (Global) ²
American bugseed	<i>Corispermum americanum</i> var. <i>americanum</i>	S2	G5?T5?
annual skeletonweed	<i>Shinnersoseris rostrata</i>	S3	G5?
ascending grape fern	<i>Botrychium ascendens</i>	S3	G3
big-fruit dodder	<i>Cuscuta megalocarpa</i>	S1	G5
blunt-leaved watercress	<i>Rorippa curvipes</i>	S3	G5
bog adder's-mouth	<i>Malaxis paludosa</i>	S2S3	G3G4
Canada brome	<i>Bromus latiglumis</i>	S1	G5
Canada rice grass	<i>Piptatherum canadense</i>	S2	G4G5
clammy hedge-hyssop	<i>Gratiola neglecta</i>	S3	G5
Columbia watermeal	<i>Wolffia columbiana</i>	S2	G5
Crawe's sedge	<i>Carex crawei</i>	S3	G5



Legend

- Bridge
- 2km Buffer



Common Name	Scientific Name	Rank (Provincial) ¹	Rank (Global) ²
crowfoot violet	<i>Viola pedatifida</i>	S3	G5
dark-green goosefoot	<i>Chenopodium atrovirens</i>	S1	G5
dwarf grape fern	<i>Botrychium simplex</i>	S2	G5
false buffalo grass	<i>Munroa squarrosa</i>	S3	G5
few-flowered aster	<i>Almutaster pauciflorus</i>	S3	G4
field grape fern	<i>Botrychium campestre</i>	S3	G3G4
flat-topped white aster	<i>Doellingeria umbellata</i> var. <i>pubens</i>	S3	G5T5
fox sedge	<i>Carex vulpinoidea</i>	S3	G5
Fremont's goosefoot	<i>Chenopodium fremontii</i>	S2	G5
hairy pepperwort	<i>Marsilea vestita</i>	S3	G5
Hooker's bugseed	<i>Corispermum hookeri</i> var. <i>hookeri</i>	S2	G4G5T4T5
Kelsey's cat's eye	<i>Cryptantha kelseyana</i>	S3	G4
lance-leaved loosestrife	<i>Lysimachia hybrida</i>	S3	G5
Leiberg's millet	<i>Dichantherium leibergii</i>	S1	G4
long-leaved bluets	<i>Houstonia longifolia</i>	S3	G5
low cinquefoil	<i>Potentilla plattensis</i>	S2	G4
marsh gentian	<i>Gentiana fremontii</i>	S3	G3G4
narrow-winged water-starwort	<i>Callitriche stenoptera</i>	SU	GNR
Nevada rush	<i>Juncus nevadensis</i>	S1	G5
ovate spikerush	<i>Eleocharis ovata</i>	S1	G5
pale bulrush	<i>Scirpus pallidus</i>	S1	G5
pale moonwort	<i>Botrychium pallidum</i>	S2	G3
Pallas' bugseed	<i>Corispermum pallasii</i>	S2	G4?
river bulrush	<i>Bolboschoenus fluviatilis</i>	S1	G5
rough barnyard grass	<i>Echinochloa muricata</i> var. <i>microstachya</i>	S1	G5T5
sandhills cinquefoil	<i>Potentilla lasiodonta</i>	S3	G3
shrubby evening-primrose	<i>Oenothera serrulata</i>	S3	G5
slender beak-rush	<i>Rhynchospora capillacea</i>	S2	G4G5
slender naiad	<i>Najas flexilis</i>	S3	G5
smooth cliff brake	<i>Pellaea glabella</i> ssp. <i>simplex</i>	S2	G5T4?
smooth monkeyflower	<i>Mimulus glabratus</i>	S1	G5
smooth sweet cicely	<i>Osmorhiza longistylis</i>	S3	G5
spatulate grape fern	<i>Botrychium spathulatum</i>	S3	G3
spiked lobelia	<i>Lobelia spicata</i>	S1	G5
straight-leaf moonwort	<i>Botrychium lineare</i>	S1	G3
tall blue lettuce	<i>Lactuca biennis</i>	S3	G5
western grape fern	<i>Botrychium hesperium</i>	S3	G4



Common Name	Scientific Name	Rank (Provincial) ¹	Rank (Global) ²
widgeon-grass	<i>Ruppia cirrhosa</i>	S3	G5
Wilcox's panicgrass	<i>Dichanthelium wilcoxianum</i>	S2	G5
wild comfrey	<i>Cynoglossum virginianum</i> var. <i>boreale</i>	S1	G5T4T5
yellow water-crowfoot	<i>Ranunculus flabellaris</i>	S1	G5

Source: ACIMS 2017 (a-f)

Table G-3: Rare Lichens and Mosses within the Central Parkland Natural Subregion

Common Name	Scientific Name	Rank (Provincial) ¹	Rank (Global) ²
alkaline wing-nerved moss	<i>Pterygoneurum kozlovii</i>	S2	G2G3
bean-spored rim-lichen	<i>Lecania dubitans</i>	S2S4	G4?
beautiful branch moss	<i>Callicladium haldanianum</i>	S2	G5
black woodscript lichen	<i>Xylographa parallela</i>	S2S4	G5
bladder-cap moss	<i>Physcomitrium hookeri</i>	S2	G2G4
blunt-leaved hair moss	<i>Didymodon tophaceus</i>	S2S3	G5
bright cobblestone lichen	<i>Acarospora socialis</i>	SU	GNR
broken-leaf moss	<i>Dicranum tauricum</i>	S1S3	G4G5
brown-eyed scale	<i>Psora tuckermanii</i>	S2S3	G5
bumpy rim-lichen	<i>Lecanora hybocarpa</i>	S2	G5
campylium moss	<i>Pseudocampylium radicale</i>	S3	G3G5
cat-tongue liverwort	<i>Conocephalum salebrosum</i>	S2S4	G5
chiseled sunken disc lichen	<i>Aspicilia contorta</i>	S1	G5
cobblestone lichen	<i>Acarospora veronensis</i>	S2	G5
crescent frost lichen	<i>Physconia perisidiosa</i>	S3	G4G5
cryptic rosette lichen	<i>Physciella chloantha</i>	SU	G5?
cushion moss	<i>Dicranum ontariense</i>	S1S2	G5
dark shadow lichen	<i>Phaeophyscia sciastra</i>	S3	G5
disk lichen	<i>Lecidella latypiza</i>	SU	GNR
Donian grimmia moss	<i>Grimmia donniana</i>	S1S2	G4G5
dot lichen	<i>Micarea melaena</i>	S1	G5
dot lichen	<i>Myxobilimbia sabuletorum</i>	S2	G5
dotted ramalina	<i>Ramalina farinacea</i>	S3	G5
fallacious screw moss	<i>Didymodon fallax</i>	S2S3	G5
firedot lichen	<i>Caloplaca ahtii</i>	SU	GNR
firedot lichen	<i>Caloplaca lactea</i>	SU	GNR
firedot lichen	<i>Caloplaca pyracea</i>	SU	GNR
firedot lichen	<i>Caloplaca subsoluta</i>	SU	GNR
flat fruited pelt lichen	<i>Peltigera horizontalis</i>	S2S4	G5
Flowers' rim lichen	<i>Lecanora flowersiana</i>	SU	GNR
frost lichen	<i>Physconia enteroxantha</i>	S3	G4G5
frost lichen	<i>Physconia isidiigera</i>	S2	G3G4
frosted rim-lichen	<i>Lecanora caesiorubella ssp. saximontana</i>	S1	G4G5TNR

Common Name	Scientific Name	Rank (Provincial) ¹	Rank (Global) ²
glaucous-headed liverwort	<i>Scapania glaucocephala</i>	S2S4	G4G5
goldspeck lichen	<i>Candelariella rosulans</i>	SU	G3G5
hoary rosette lichen	<i>Physcia alnophila</i>	SU	G5T5
lichen	<i>Pseudevernia consocians</i>	S2	G3G5
liverwort	<i>Calypogeia muelleriana</i>	S2S4	G5
liverwort	<i>Mannia fragrans</i>	SU	G5
liverwort	<i>Mannia pilosa</i>	SU	G4?
liverwort	<i>Riccardia chamedryfolia</i>	SU	G5
liverwort	<i>Riccardia multifida</i>	SU	G5
liverwort	<i>Riccia cavernosa</i>	S2S4	G5
liverwort	<i>Riccia fluitans</i>	SU	G5
liverwort	<i>Ricciocarpos natans</i>	SU	G5
long-stalked beardless moss	<i>Hennediella heimii</i>	S2S3	G5
mortar rim-lichen	<i>Lecanora dispersa</i>	S2	G5
moss	<i>Sciuro-hypnum hylotapetum</i>	S1S3	GU
moss	<i>Ptychostomum turbinatum</i>	S2S3	G5
moss	<i>Ptychostomum cernuum</i>	S1S2	G3G5
moss	<i>Desmatodon randii</i>	SU	G3?Q
moss	<i>Didymodon vinealis</i>	S2S3	G5
moss	<i>Entodon concinnus</i>	S1S2	G4G5
moss	<i>Hygroamblystegium tenax</i>	S1S2	G5
moss	<i>Leskea gracilescens</i>	S2	G5
moss	<i>Leskea obscura</i>	S1	G5
moss	<i>Leskea polycarpa</i>	S1	G5
moss	<i>Pohlia atropurpurea</i>	S2	G4G5
moss	<i>Thuidium philibertii</i>	S1S2	G5
moss	<i>Limprichtia cossonii</i>	SU	G5
moss	<i>Haplocladium virginianum</i>	S1S2	G5
mottled-disk lichen	<i>Trapeliopsis flexuosa</i>	S1S3	G5
narrow-leafed chain-teeth moss	<i>Tortula cernua</i>	S1	G3G5Q
Ontario Rhodobryum moss	<i>Rhodobryum ontariense</i>	S1S2	G5
orange firedot lichen	<i>Caloplaca decipiens</i>	SU	G4G5
orange foliose lichen	<i>Xanthomendoza mendozae</i>	SU	GNR
pepper-spore lichen	<i>Rinodina castanomelodes</i>	SU	GNR
rim-lichen	<i>Lecanora crenulata</i>	S1	G3G5
rock licorice	<i>Lichinella nigritella</i>	SU	G4G5

Common Name	Scientific Name	Rank (Provincial) ¹	Rank (Global) ²
rosette lichen	<i>Physcia dimidiata</i>	S2	G5?
sand-loving Iceland lichen	<i>Cetraria arenaria</i>	S1S2	G4
Schleicher's silk moss	<i>Entodon schleicheri</i>	S2S3	G3G5
shadow lichen	<i>Phaeophyscia cernohorskyi</i>	S2	G4G5
shadow lichen	<i>Phaeophyscia hirsuta</i>	S2	G3
shadow lichen	<i>Phaeophyscia nigricans</i>	S2S3	G4
short-tooth hump moss	<i>Amblyodon dealbatus</i>	S3	G3G5
soot lichen	<i>Cyphelium notarisii</i>	S2	GNR
speck lichen	<i>Verrucaria muralis</i>	S2	G5?
sunburst lichen	<i>Xanthomendoza montana</i>	S3	GNR
variable orange lichen	<i>Caloplaca variabilis</i>	SU	G3G5
Un-named	<i>Porpidia zeoroides</i>	SU	G3G5

Source: ACIMS 2017 (a-f)

Table G-4: Rare Ecological Communities in the Central Parkland Natural Subregion

Common Name	Scientific Name	Rank (Provincial) ¹	Rank (Global) ²
Alaska birch - white spruce / pussy willow / common horsetail swamp forest	<i>Betula neoalaskana</i> - <i>Picea glauca</i> / <i>Salix discolor</i> / <i>Equisetum arvense</i> swamp forest	S1S2	GNR
alkali cord grass - (western wheat grass) saline meadow	<i>Spartina gracilis</i> - (<i>Pascopyrum smithii</i>) saline meadow	S2S3	GNR
aspen / creeping juniper / hay sedge woodland	<i>Populus tremuloides</i> / <i>Juniperus horizontalis</i> / <i>Carex siccata</i> woodland	S2S3	GNR
balsam poplar / high-bush cranberry / ostrich fern forest	<i>Populus balsamifera</i> / <i>Viburnum opulus</i> / <i>Matteuccia struthiopteris</i> forest	S1S2	GNR
black spruce / red-osier dogwood / feathermoss rich fen	<i>Picea mariana</i> / <i>Cornus stolonifera</i> / feathermoss rich fen	S1S2	GNR
creeping juniper / (June grass) / green reindeer lichen stabilized dune community	<i>Juniperus horizontalis</i> / (<i>Koeleria macrantha</i>) / <i>Cladonia arbuscula</i> ssp. <i>mitis</i> stabilized dune community	S1S2	GNR
little bluestem - sand grass grassland	<i>Schizachyrium scoparium</i> - <i>Calamovilfa longifolia</i> grassland	S2	GNR
Nevada bulrush - (seaside arrow-grass) emergent marsh	<i>Amphiscirpus nevadensis</i> - (<i>Triglochin maritima</i>) emergent marsh	S2S3	GNR
Nuttall's salt-meadow grass community	<i>Puccinellia nuttalliana</i> community	S3?	G3?
plains rough fescue - June grass / juniper / forb grassland	<i>Festuca hallii</i> - <i>Koeleria macrantha</i> / <i>Juniperus horizontalis</i> / forb grassland	S2	GNR
plains rough fescue - sand grass grassland	<i>Festuca hallii</i> - <i>Calamovilfa longifolia</i> grassland	S1	GNR
plains rough fescue - western porcupine grass grassland	<i>Festuca hallii</i> - <i>Hesperostipa curtipetala</i> grassland	S2S3	GNR
plains rough fescue grassland	<i>Festuca hallii</i> grassland	S1	GNR
salt grass - western wheat grass meadow	<i>Distichlis stricta</i> - <i>Pascopyrum smithii</i> meadow	S2	GNR
samphire emergent marsh	<i>Salicornia rubra</i> emergent marsh	S2	G2G3
sand dropseed semi-active dune	<i>Sporobolus cryptandrus</i> semi-active dune	S2	GNR
sand grass - needle-and-thread grassland	<i>Calamovilfa longifolia</i> - <i>Hesperostipa comata</i> Grassland	S3	G3
sand grass - sand dropseed dune community	<i>Calamovilfa longifolia</i> - <i>Sporobolus cryptandrus</i> dune community	S2S3	GNR
seaside arrow-grass emergent marsh	<i>Triglochin maritima</i> emergent marsh	S2?	GNR
tamarack - black spruce / red-osier dogwood - wild red raspberry rich fen	<i>Larix laricina</i> - <i>Picea mariana</i> / <i>Cornus stolonifera</i> - <i>Rubus idaeus</i> rich fen	S1S2	GNR

Source: ACIMS 2017 (a-f)

Table G-5: Tracked Wildlife Species in the Central Parkland Natural Subregion

Common Name	Scientific Name	Rank (Provincial) ¹	Rank (Global) ²
Lake Sturgeon	<i>Acipenser fulvescens</i>	S1S2	G3G4
Canadian Toad	<i>Anaxyrus hemiophrys</i>	S3	G4G5
Burrowing Owl	<i>Athene cunicularia</i>	S2B	G4
Ferruginous Hawk	<i>Buteo regalis</i>	S2S3B	G4
Piping Plover	<i>Charadrius melodus circumcinctus</i>	S2B	G3T3
Trumpeter Swan	<i>Cygnus buccinator</i>	S2S3B	G4
Peregrine Falcon	<i>Falco peregrinus</i>	S2S3B	G4
Whooping Crane	<i>Grus americana</i>	S1B	G1
Northern Leopard Frog	<i>Lithobates pipiens</i>	S2S3	G5
American White Pelican	<i>Pelecanus erythrorhynchos</i>	S2S3B	G4
White-faced Ibis	<i>Plegadis chihi</i>	S1S2B	G5

Source: ACIMS 2017 (a-f)

Table G-6: Rare Invertebrate Species in the Central Parkland Natural Subregion

Common Name	Scientific Name	Rank (Provincial) ¹	Rank (Global) ²
Bellmouth Rams-horn	<i>Planorbella campanulata</i>	SU	G5
Bronze Copper	<i>Lycaena hyllus</i>	S2	G5
Common Green Darner	<i>Anax junius</i>	S3	G5
Creeping Ancyld	<i>Ferrissia rivularis</i>	SU	G5
Crimson-ringed Whiteface	<i>Leucorrhinia glacialis</i>	S3S4	G5
Dod's Old World Swallowtail	<i>Papilio machaon dodi</i>	S3	G5T4T5
Dun Skipper	<i>Euphyes vestris</i>	SU	G5
Fragile Ancyld	<i>Ferrissia fragilis</i>	SU	G5Q
Hobomok Skipper	<i>Poanes hobomok</i>	S2	G5
Lorquin's Admiral	<i>Limenitis lorquini</i>	S2	G5
Nevada Buck Moth	<i>Hemileuca nevadensis</i>	S1	G5
Northern Pearly-eye	<i>Lethe anhedon</i>	S2S3	G5
Pale Yellow Dune Moth	<i>Copablepharon grandis</i>	S1S2	G4G5
Shasta Blue	<i>Plebejus shasta</i>	S3	G5
Umbilicate Sprite	<i>Promenetus umbilicatellus</i>	SU	G4
Verna Flower Moth	<i>Schinia verna</i>	S2S3	GU
Western Red Damsel	<i>Amphiagrion abbreviatum</i>	S3	G5

Source: ACIMS 2017 (a-f)

Notes:

- S1 (Critically Imperiled): Five or fewer occurrences, or especially vulnerable to extirpation due to other factor(s).

S2 (Imperiled): Twenty or fewer occurrences, or vulnerable to extirpation due to other factor(s).

S3 (Vulnerable): One hundred or fewer occurrences, or somewhat vulnerable due to other factors, such as restricted range, relatively small population sizes, or other factor(s).

S4 (Apparently Secure): Fairly low risk of extinction in the jurisdiction due to extensive range and/or many populations or occurrences, but with possible concern as a result of recent declines, threats or other factors.

S_ S_: Denotes the range of uncertainty about the status rank of the element.

SNA: Not Applicable because the species or ecosystems is not a suitable target for conservation activities (e.g., introduced species).

SU (Unrankable): Due to lack of information or substantially conflicting information.

B (Breeding Qualifier): Refers to the breeding population of the species.

N (Non-breeding): Refers to the non-breeding population of the species.

H (Possibly extirpated): known only from historical records but still some hope of rediscovery.

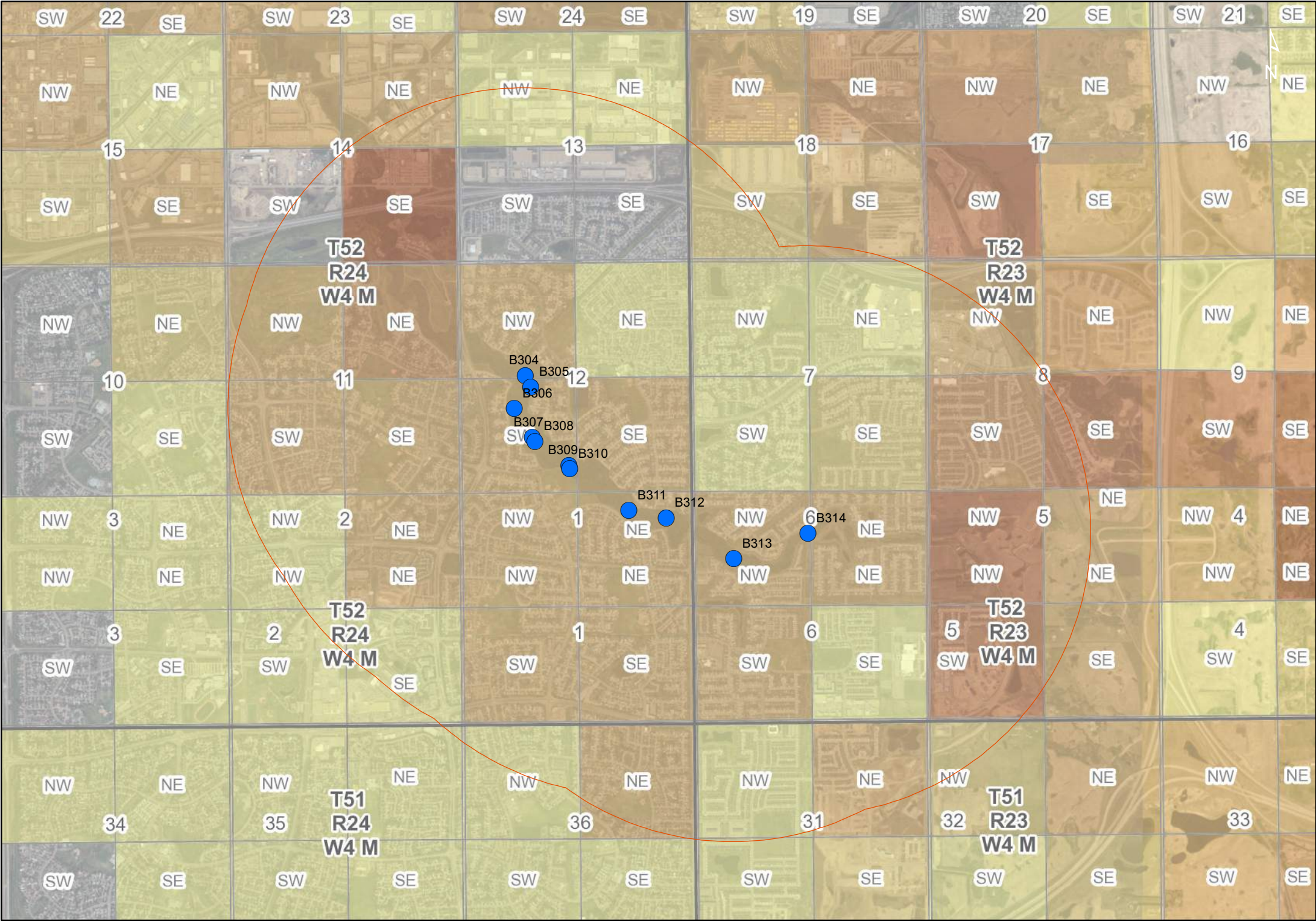
T (Intraspecific Taxon): The status of subspecies or varieties are indicated by the T-Rank following the global rank.

Q (questionable Taxonomy): Distinctiveness of this entity as a taxon at the current level is questionable.

NR (not ranked): Rank not yet assessed
- G ranks are similar to S ranks, on a Global scale.

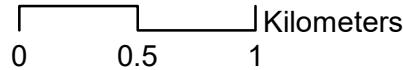


**Appendix H
Environmentally
Significant Areas Map
(Provincial)**



Legend

- Bridge
- 2km Buffer
- ESA Score Greater Than 0.189 Equals Provincial ESA
- 0.152 - 0.189
- 0.115 - 0.151
- 0.077 - 0.114
- 0.040 - 0.076
- 0.001 - 0.039



PROVINCIAL ENVIRONMENTALLY SIGNIFICANT AREAS





Appendix I

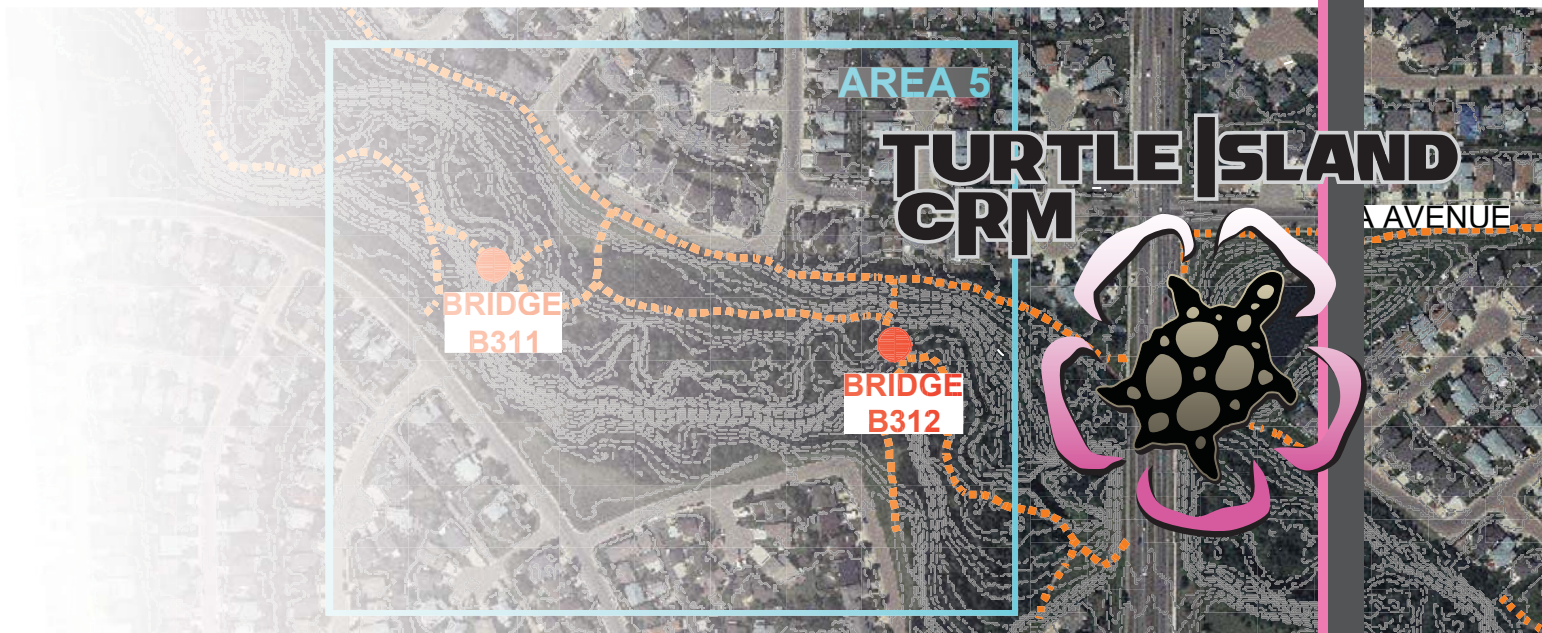
Historical Resources

Mill Creek Pedestrian Bridges

Edmonton, Alberta, Canada

Statement of Justification (SoJ) - DRAFT

ISL Engineering and Land Services Ltd.
7909 51 Avenue NW
Edmonton, AB
T5J 1K3



Prepared by:

Turtle Island Cultural Resource Management Inc.
5 Creston Crescent NW. Calgary, Alberta T2M 4J9
February 29, 2020



TURTLE ISLAND CULTURAL RESOURCE MANAGEMENT INC.

Statement of Justification for Historical Resources Act Requirements

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Project Name or Project Identifier:

Mill Creek Bridges (B304-B314)

Disposition Type & Number:

N/A

Name of proponent contact:

John Phong P.Eng, PMP

Corporate name of proponent:

City of Edmonton - Integrated Infrastructure Services

Address:

12 Floor, Edmonton Tower
10111 - 104 Avenue NW
Edmonton, AB
T5J 0J4

Office number:

780-496-1974

Mobile number:

N/A

E-mail address:

john.phong@edmonton.ca

Name:

Gareth Spicer

Corporate name of consulting company:

Turtle Island Cultural Resource Management Inc.

Phone number:

403-620-9032

Fax number:

403-450-9267

E-mail address:

gareth@turtleislandcrm.com

Lands Affected:

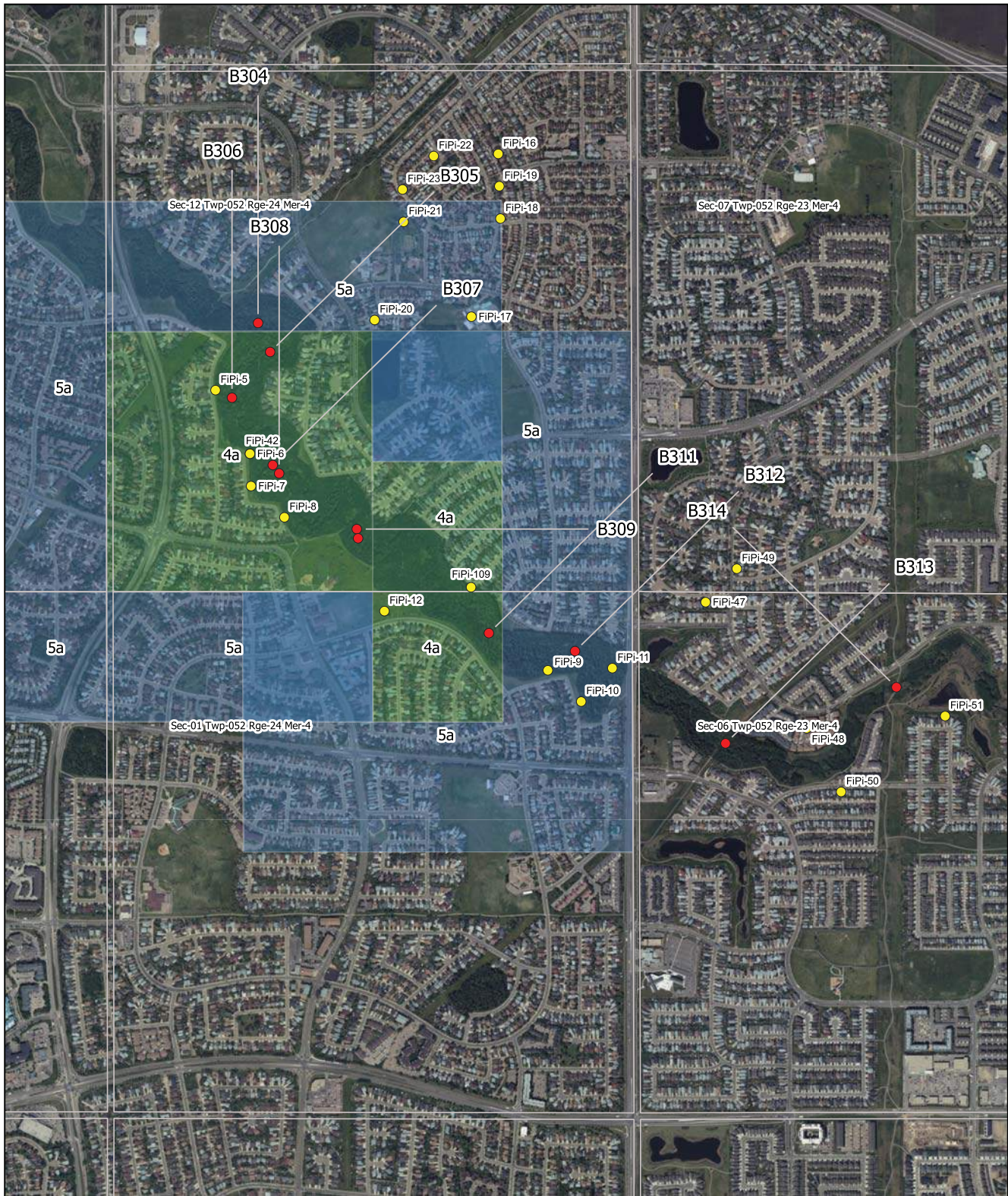
Land Ownership Type: City of Edmonton

Activity type and Anticipated Ground Disturbance:

This Statement of Justification relates to the construction of replacement bridges (n=11) within an upper reach of the Mill Creek Valley in Edmonton, Alberta. As currently planned this project will extend from 50th Street NW to east of 34 Street NW; a distance of approximately 1.85 km. These bridges will upgrade existing structures which span sections of the Mill Creek channel in association with a multi-use recreational trail. The current trail and associated bridges were constructed in the early 1990's overlaying an existing trail system.

The replacement bridges will include concrete foundation piles and/or footings installed within the flood plain of the Mill Creek Ravine adjacent to the current channel of Mill Creek. In addition, construction will include clearing and surface disturbance associated with temporary work and access areas to facilitate construction. The location of the proposed bridge developments are depicted in Figure 1.

It is anticipated work related to this Project will include:



0 250 500 750 1000 m

Legend

Cultural Resource Site
Bridge Locations
NTS 83H Section

HRV Listing (Oct.2019)
4 archaeology
5 archaeology



Figure 1: Project area

Mill Creek Bridges - SoJ - DRAFT

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Bridge Abutments - May include screw piles on CIP concrete abutments and/or cast in place concrete reinforced piles on CIP concrete abutments.

Work Areas - May include areas on the pathway next to the bridge abutments or near the top of banks out of the valley near the bridges.

Project size:

The proposed development is approximately 2 km in length.

Existing Disturbance:

Multi-use recreational trail, bridge construction, utility RoW, and fluvial erosion.

Landscape and Environmental Information:

The proposed development is located within the City of Edmonton within an upper reach of the Mill Creek ravine. The surrounding area has been impacted originally by cultivation, and subsequently, residential housing development. Utility and road RoWs cross the Mill Creek ravine at four locations. Within the ravine, an existing gravel covered multiuse traverses the flood plain of the valley and crossed the active of the creek at eleven locations. With the exception of the trail, associated bridges, and road and utility RoWs, the ravine is remarkably intact characterized by a mature white spruce, cottonwood, and aspen forest. Large caliber white spruce, in excess of 75 cm in diameter, are common throughout the ravine. No evidence of significant 20th century clearing, apart from those outlined above, or fire events are present in the project area. It is likely that many of these mature trees represent a generation growing at this location in excess of 100 years and perhaps longer. Intact Holocene sediments, including two preserved cultural deposits (FiPi-42 and FiPi-109), have been identified at the margin of the project area.

Thirteen previously recorded archaeological sites are located within and adjacent to of the project area. These sites are listed below:

FiPi-20

Site Class: Prehistoric

Site Type: Isolated find

HRV: 0A

Impacts: None

Relationship to proposed development:

The site is located 550 m east of the proposed development.

Permit Number(s):

ASA 80-069

FiPi-5

Site Class: Prehistoric

Site Type: Campsite, Scatter

HRV: 0A

Impacts: Yes

Relationship to proposed development:

The site is located 90 m west of the proposed development.

Permit Number(s):

ASA 78-092

FjPi-6

Site Class: Prehistoric

Site Type: Campsite, Scatter

HRV: 0A

Impacts: None

Relationship to proposed development:

The site is located 130 m northwest of the proposed development.



Permit Number(s):

ASA 78-092

FiPi-42**Site Class:** Fur Trade, Historic**Site Type:** Campsite**HRV:** 4A**Impacts:** None**Relationship to proposed development:**

The site is located 75 m north of the proposed development.

Permit Number(s):

ASA 93-047

FiPi-7**Site Class:** Prehistoric**Site Type:** Campsite, Scatter**HRV:** 0A**Impacts:** None**Relationship to proposed development:**

The site is located 150 m northwest of the proposed development.

Permit Number(s):

ASA 78-092

FiPi-8**Site Class:** Prehistoric**Site Type:** Scatter, Campsite**HRV:** 0A**Impacts:** None**Relationship to proposed development:**

The site is located 225 m south of the proposed development.

Permit Number(s):

ASA 78-092

FiPi-12**Site Class:** Prehistoric**Site Type:** Scatter, Campsite**HRV:** 0A**Impacts:** None**Relationship to proposed development:**

The site is located 375 m south of the proposed development.

Permit Number(s):

ASA 78-092

FiPi-109**Site Class:** Prehistoric**Site Type:** Scatter <10**HRV:** 4A**Impacts:** No**Relationship to proposed development:**

The site is located 230 m south of the proposed development

Permit Number(s):

ASA 06-001

FiPi-9**Site Class:** Prehistoric**Site Type:** Scatter

HRV: 0A

Impacts: No

Relationship to proposed development:

The site is located 150 m west of the proposed development

Permit Number(s):

ASA 78-092

FiPi-11

Site Class: Prehistoric

Site Type: Isolated find

HRV: 0A

Impacts: None

Relationship to proposed development:

The site is located 200 m east of the proposed development.

Permit Number(s):

ASA 78-092; 93-047

FiPi-10

Site Class: Prehistoric

Site Type: Scatter, Campsite

HRV: 0A

Impacts: None

Relationship to proposed development:

The site is located 225 m south of the proposed development.

Permit Number(s):

ASA 78-092

FiPi-48

Site Class: Prehistoric

Site Type: Isolated find

HRV: 0A

Impacts: None

Relationship to proposed development:

The site is located 500 m west of the proposed development.

Permit Number(s):

ASA 01-070

FiPi-50

Site Class: Prehistoric

Site Type: Scatter >10

HRV: 0A

Impacts: No

Relationship to proposed development:

The site is located 250 m south of the proposed development

Permit Number(s):

ASA 01-237

FiPi-51

Site Class: Prehistoric

Site Type: Campsite

HRV: 0A

Impacts: No

Relationship to proposed development:

The site is located 275 m southwest of the proposed development

Permit Number(s):



Evaluation

Known Sites

The Mill Creek Pedestrian Bridges Project impact the flood plain of the Mill Creek Ravine at eleven locations. Thirteen cultural resource sites are located along the margin of the ravine in proximity to these areas. The majority of these sites have been recorded in association with cultural resource assessment related residential housing development (Fedirchuk 1978). Two of these, FiPi-42 (Damkjar 1993) and FiPi-109 (Somer and Saxberg 2006), are subject to management requirements; both sites are recorded as Prehistoric period lithic scatters and campsites. As the proposed project is currently understood, neither of these sites will be impacted. However, FiPi-42, as described in the HRIA report describing the site (Damkjar 1993), is located within the ravine and bisected by the existing multiuse trail. This location is in close proximity to the proposed bridges B307 and B308.

Depositional History

Although the project area includes previously recorded cultural resource sites and the potential that additional sites for archaeology are present in the area is high, the project area includes a mixture of risk due to its depositional history. As reported by Damkjar (1993), the flood plain of Mill Creek ravine at this location is dominated by sandy coarse grained fluvial deposits. These sediments are likely to result of high energy flood events not typically associated with the preservation of cultural deposits. No buried land surfaces were reported as a result of the 1993 HRIA.

To complement the above review, geotechnical samples collected by Thurber Engineering (February, 2020) were inspected by Turtle Island CRM on February 14, 2020. Thirty-seven samples collected from nine bore locations were inspected as part of this analysis. Only sediment samples collected from the uppermost two metres of these bores were inspected. These samples are presented in Table 1 and their locations are shown in Figure 2.

Consistent with the description of the project area made by Damkjar, sediments at the locations of the bridge replacements generally consist of coarse grained sand overlaying high plastic glacial clay mixed with unsorted gravel. Surface fluvial deposits were not identified in proximity to three bridge locations (B305, B313, and B314). Organic rich silty deposits (yellow), typical of a preserved stable surface within 30 cm BS was identified at three bridge locations (B307, B308, and B312). Four additional locations (orange) included red/brown sand typical iron rich B-horizon sediments underlying the silt rich organic deposits described at bridges B307, B308, and B312. These include bridges B304, B306, B309, B310, and B311.

The silt observed in sediments observed at bridges B307, B308, and B312 is likely the result of loess derived from the adjacent margins of the Mill Creek Ravine and accumulated over time. This location is also within the depositional zone (inside) of a curve of the active channel of Mill Creek where the oldest sediments within the flood plain will occur.

In combination, the analysis of geotechnical samples (B307/B308 and B311), known cultural resource site data, the sinuosity of the Mill Creek channel, and the climax forest currently present within the ravine (B304 and B309/310) suggest potentially stable soil deposits are present where these factors intersect. These locations are considered to be high potential for cultural resource sites; these locations, adjacent to the proposed bridge replacements, are depicted in Figure 3.

Recommendations



Bridge ID	Thurber ID	Sample type	Sample ID	Depth (MBS)	Observed sediment	Sediment type	Preserved surface
B304	TH20-01	geotechnical	P2	0.76-1.22	sorted sand (brown)	fluvial	potential
B304	TH20-01	geotechnical	C3	1.52	sorted sand (brown)	fluvial	no
B304	TH20-01	geotechnical	P4	2.29-2.74	plastic clay	glacial	no
B305	TH20-02	geotechnical	G1	0.30	sand/clay/unsorted gravel	fill	no
B305	TH20-02	geotechnical	P2	0.76-1.22	mottled clay/sand	fluvial/glacial	no
B305	TH20-02	geotechnical	C3	1.52	tan clay/sand	glacial	no
B305	TH20-02	geotechnical	C3b	1.98	layered silt (grey) clay (weathered bedrock?)	bedrock	no
B305	TH20-02	geotechnical	P4	2.29-2.74	grey clay (weathered bedrock?)	bedrock	no
B306	TH20-03	geotechnical	G1	0.30	red brown sand (Thurber test)	fluvial	potential
B306	TH20-03	geotechnical	P2	0.76-1.22	brown sand with clay	fluvial/glacial	no
B306	TH20-03	geotechnical	C3a	1.52	coarse sand (with pea gravel)	fluvial/glacial	no
B306	TH20-03	geotechnical	C3b	1.98	clay/sand (with charcoal)	fluvial/glacial	no
B307/B308	TH20-04	geotechnical	G1	0.30	silty sand with roots (dark brown)	fluvial	yes
B307/B308	TH20-04	geotechnical	P2	0.76-1.22	red/brown sand with roots	fluvial	no
B307/B308	TH20-04	geotechnical	G3	1.52	mottled clay (red, brown, grey)	glacial	no
B307/B308	TH20-04	geotechnical	T4	2.29-2.74	Thurber test (missing)	N/A	no
B307/B308	TH20-04	geotechnical	P5	2.74-3.20	grey sand with clay (weathered bedrock?)	bedrock	no
B309/B310	TH20-05	geotechnical	G1	0.30	brown coarse sand	fluvial	potential
B309/B310	TH20-05	geotechnical	P2	0.76-1.22	brown sand with clay	fluvial	no
B309/B310	TH20-05	geotechnical	G3	1.52	brown sand	fluvial	no
B309/B310	TH20-05	geotechnical	P4	2.29-2.74	grey silt/clay (rounded gravel)	glacial	no
B311	TH20-06	geotechnical	G1	0.30	red/brown sand (with roots)	fluvial	potential
B311	TH20-06	geotechnical	P2	0.76-1.22	red/brown sand (with clay)	fluvial	no
B311	TH20-06	geotechnical	G3	1.52	sand/clay (gleyed)	fluvial/glacial	no
B311	TH20-06	geotechnical	P4	2.29-2.74	grey clay (weathered bedrock?)	glacial	no
B312	TH20-07	geotechnical	G1	0.30	silty sand with roots (dark brown)	fluvial	yes
B312	TH20-07	geotechnical	P2	0.76-1.22	grey/brown sand (with clay)	fluvial	no
B312	TH20-07	geotechnical	G3	1.52	coarse sand (brown)	fluvial	no
B312	TH20-07	geotechnical	P4	2.29-2.74	plastic clay with charcoal	glacial	no
B313	TH20-08	geotechnical	SPT2	0.76-1.22	grey sand/clay (pea gravel)	fluvial	no
B313	TH20-08	geotechnical	B3	1.52	dark grey palstic clay	glacial	no
B313	TH20-08	geotechnical	SPT5	2.29-2.74	grey coarse sand (pea gravel)	glacial	no
B313	TH20-08	geotechnical	SPT6	2.74-3.20	grey coarse sand	glacial	no
B314	TH20-09	geotechnical	C1	0.46	light brown clay/sand (some gravel)	glacial	no
B314	TH20-09	geotechnical	P2	0.76-1.22	brown/grey clay (some gravel)	glacial	no
B314	TH20-09	geotechnical	G3	1.52	orange/grey clay (layerd sand)	glacial	no
B314	TH20-09	geotechnical	G3b	1.98	orange/grey sand	glacial	no

Table 1: Geotechnical sediment samples

(Recommendations regarding archaeological resources must be made by a professional archaeologist)

Archaeology

A Historical Resources Impact Assessment (HRIA) is recommended for this project. It is recommended that archaeological assessment be carried out at four locations related to the proposed bridge replacements. These will include B304, B307 and B308, B309 and B310, and B312.

Recommendations made by:

Gareth Spicer, MA.
Principle Archaeologist
Turtle Island CRM



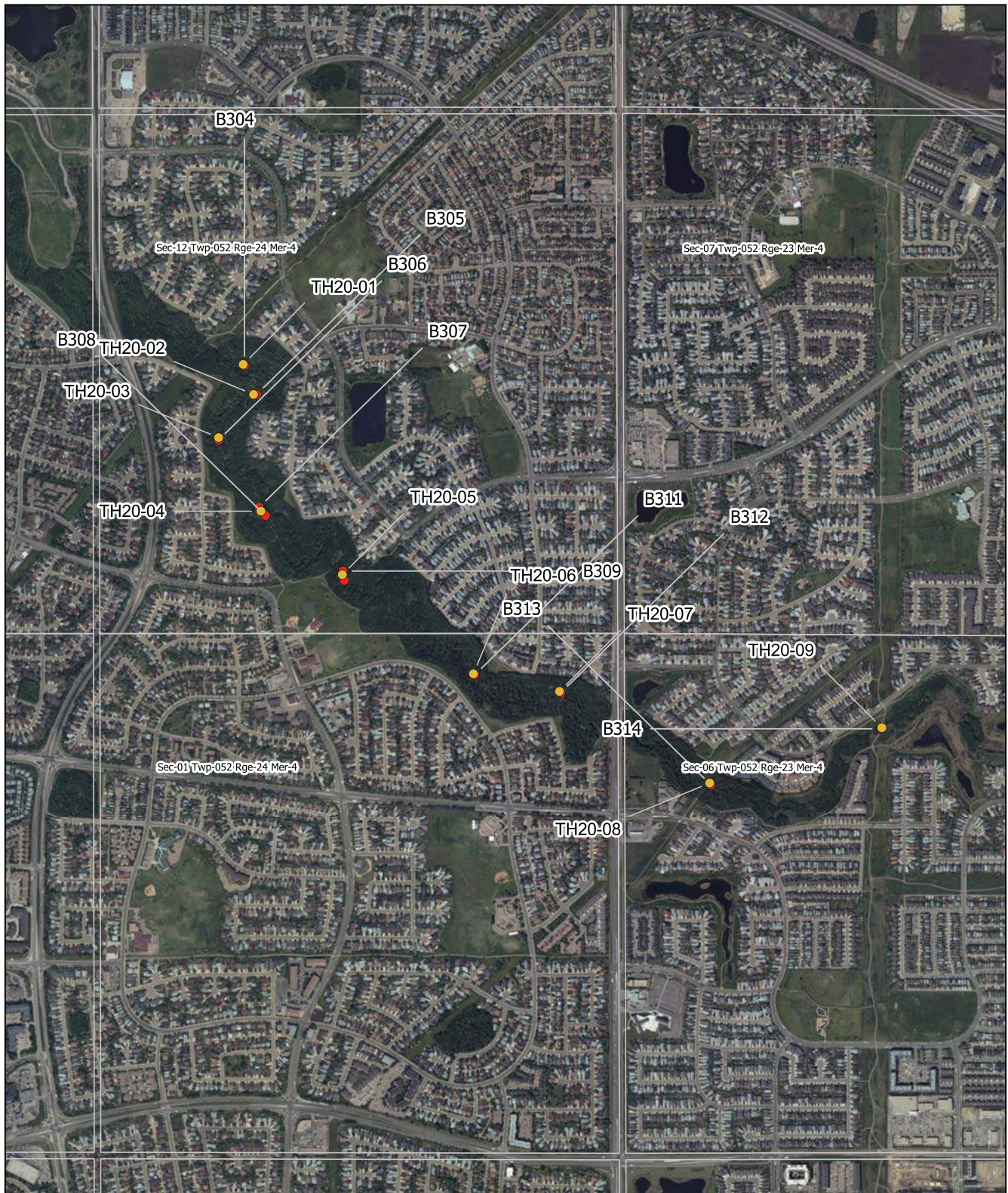



Figure 2: Locations of geotechnical bores

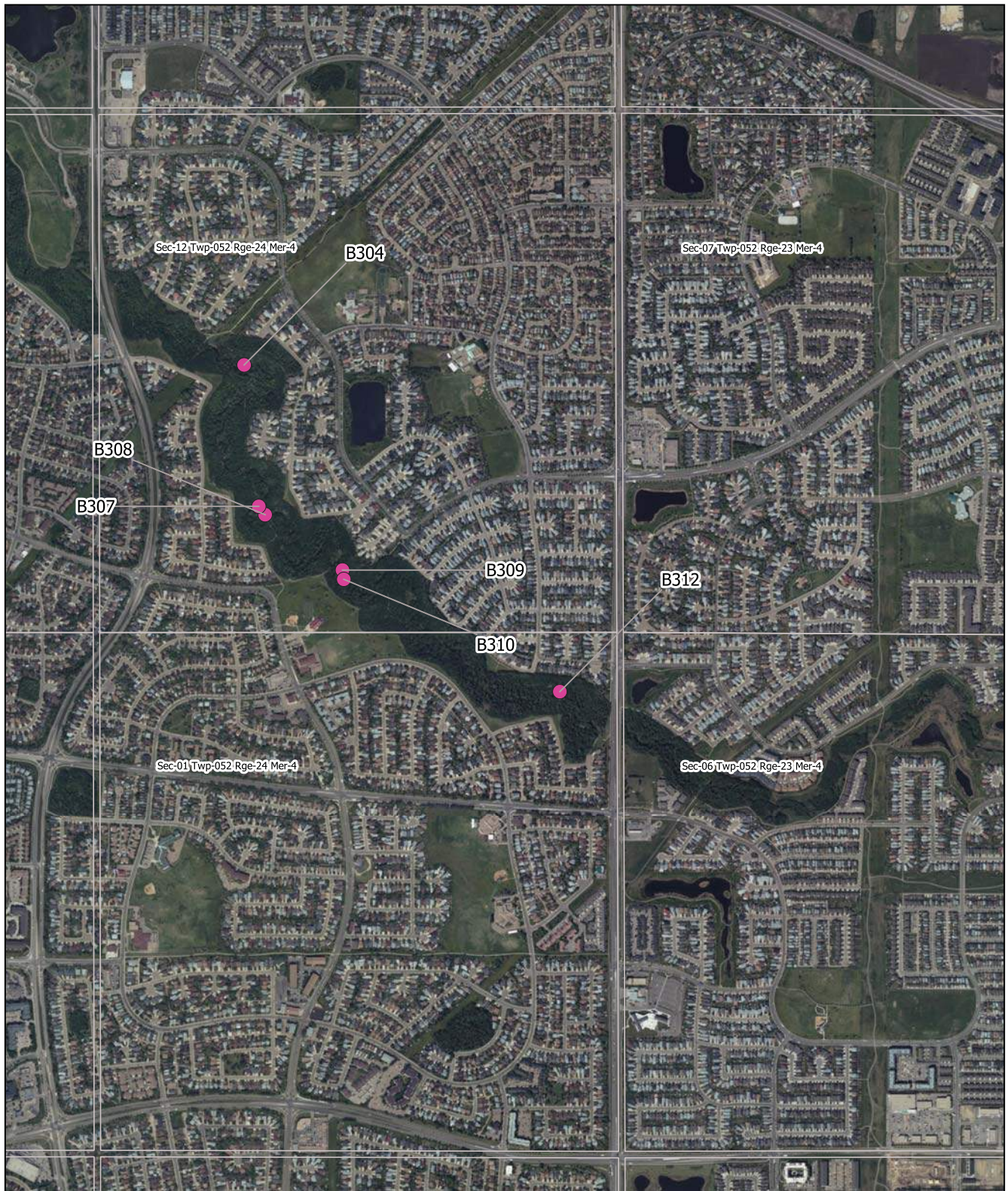


Figure 3: Recommended assessment locations

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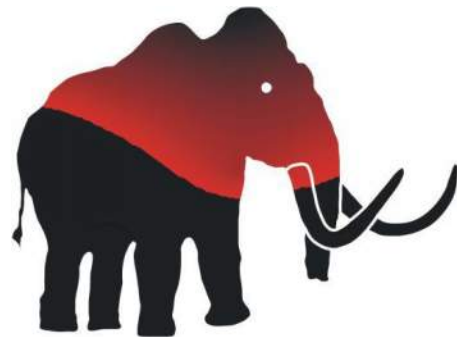


SoJ - Palaeontological Statement of Justification

City of Edmonton – City of Edmonton – Mill Creek Pedestrian Bridges

Prepared for Turtle Island CRM and ISL Engineering and Land Services

March 17th, 2020



Paul E. McNeil, Ph.D.

Steppe Consulting Inc.

554 19 Ave SW, Calgary, AB T3A 5T7

Phone: Cell (403) 615-6325

Email: pemcneil@gmail.com

Statement of Justification for Historical Resources Act Requirements City of Edmonton – Mill Creek Bridges (B304-B314)

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Project Name or Project Identifier:

Mill Creek Bridges (B304-B314)

Disposition Type and Number:

N/A

Developer/Proponent Contact:

John Phong, P.Eng, PMP

City of Edmonton – Integrated Infrastructure Services

12 Floor Edmonton Tower, 10111-104 Avenue NW, Calgary, AB, T5J 0J4

Phone: 780-496-1974

Email: john.phong@edmonton.ca

Agent Contact:

Paul McNeil

Steppe Consulting Inc.

554 19 Ave SW, Calgary, AB, T2S 0E2

Phone: 403-615-6325

Email: pemcneil@gmail.com

Lands Affected:

Land Ownership Type: City of Edmonton

Legal Descriptions / HRV: See Table 1 below.

Table 1: Affected Lands

HRV	Category	Meridian	Range	Township	Section	LSD
n/a	p	4	24	52	01	15, 16
n/a	p	4	24	52	12	3,5,6,11
n/a	p	4	23	52	06	11,13,14

Project Type and Anticipated Ground Disturbance:

The City of Edmonton is proposing to construct eleven replacement bridges within the Mill Creek Ravine, part of the River Valley parks and trail system. Located in southeast Edmonton, surrounded by the neighbourhoods of Kiniski Gardens, Wild Rose, Silver Berry, and Minchau, the Project stretches from 50th Street NW to east of 34th Street NW between 40th Ave NW and 34th Ave NW, a distance of approximately 2km (Figure 1). The bridges are part of a recreational multi use trail system within the Mill Creek Ravine and will be used to cross Mill Creek. Legal subdivisions affected by this Project are provided in Table 1.

Disturbance for the Project is expected to include the construction of pilings and footings for the bridges, potentially excavated deeply into the ground, plus the construction of temporary access roads and workspaces which will likely require shallow disturbance such as clearing brush and stripping topsoil. Designs for the replacement bridges have not been finalized at the time of writing, but screw piles were the footings of choice. However, they could potentially include augered concrete pilings and excavated foundations depending on design and geotechnical requirements.

Geology:

The surficial geology at the proposed Mill Creek Bridges Project area is comprised primarily of hummocky glacial till with small pockets of glacial outwash sand following the course of the Mill Creek Ravine, an old glacial outwash channel (Figure 2; Bayrock, 1972). Bedrock within the Ravine consists of the Horseshoe Canyon Formation, which represents the lower part of the Edmonton Group in central Alberta and is composed primarily of sandstone interbedded with siltstone and mudstone (Prior *et al.*, 2013).

The proposed Project is located within the Mill Creek Ravine, an old glacial outwash channel associated with draining the late stage remnants of Glacial Lake Edmonton into the North Saskatchewan River. Bayrock (1972) maps glacial outwash sediments within the channel, and potentially within the Project area, however Kathol and McPherson (1975, Figure 23) do not map any outwash sediments within the Project area. These sediments overlie hummocky glacial till of variable thickness.

The Horseshoe Canyon depositional environments are brackish to fresh water in origin and include marginal marine, to estuarine to lacustrine settings (Shepherd and Hills, 1970; Rahmani, 1988). The lower half of the Formation is represented by several minor marine transgressive cycles which led to the formation of coal seams, the upper half is predominantly represented by fluvial to lacustrine conditions and thus devoid of coal with the exception of the Carbon-Thompson zone at the top. The Horseshoe Canyon formation forms an eastward thinning wedge, ranging from 750m in thickness in the foothills, to less than 30m in southern Saskatchewan (Dawson *et al.*, 2012).

Palaeontology:

No palaeontological HRV values have been assigned for the LSDs that Project will affect. However, a review of the geology indicates that there is the potential to impact Quaternary fossils in glacial outwash, and in the underlying Cretaceous Horseshoe Canyon Formation. The Edmonton area has produced a wealth of Quaternary macro-fossils. These fossils have primarily been found in gravel deposits and river terrace exposures along the edge of the North Saskatchewan River including: mammoth (Hay, 1924), horse (Hay, 1927; Weinstock *et al.*, 2005), muskoxen (Harington, 1975; Wilson *et al.*, 2008; Jass *et al.*, 2011), the predators *Canis lupus*, *Arctodus simus*, *Panthera leo atrox* (Burns and Young, 1994). In addition, micro-fossils of lemmings have been identified (Burns, 2004).

There is good potential for fossil remains from the Horseshoe Canyon in the Edmonton area as indicated by recent finds such as the Danek bonebed (Burns, *et al.* 2014; discovered 1988, located within the city of Edmonton, containing bones of *Edmontosaurus* and *Saurolophus*, as well as the teeth of *Albertosaurus*, *Daspletosaurus*, and *Troodon formosus*), and *Edmontosaurus* and *Albertosaurus* found at Quesnell Crescent in northwest Edmonton (e.g. Landry, 2010) while constructing a sewer tunnel. In addition, the plant macrofossils *Metasequoia* and *Cercidiphyllum* (Provincial Museum of Alberta, 1980) have been identified from the North Saskatchewan River Valley.

Evaluation:

The proposed Project is in the upper reaches of the Mill Creek Ravine, where incision into the surrounding glacial peneplain is moderate, on the order of 5 to 10m at the west end decreasing to 5m to the east. Satellite imagery shows that the ravine walls are gently sloped, and the ravine itself is well forested with no indications of significant exposures of the underlying stratigraphy.

A geotechnical investigation was carried out by Thurber Engineering Ltd. In late January and early February 2020, which drilled nine geoprobe/solid stem boreholes associated with 11 bridge replacements (Figure 1, Table 2). Specimens from these boreholes were examined March 9th, 2020. Two main areas of paleontological potential were targeted in the investigation: identifying whether glacial outwash sediments were present and significant, and the depth and potential of the Horseshoe Canyon Formation (bedrock).

The investigation revealed that the surficial sediments (where not removed through previous construction) were thin, predominantly fluvial, and of recent origin. Silty sand layers were present, however these were generally thin (<0.5m) and fine to medium grained. These sand deposits were interbedded with silt and clay layers, interpreted as overbank flood deposits from Mill Creek. Occasional chaotic unsorted sediment including intra-clasts and pebbles, likely colluvium or a thin remnant of outwash sediments, were observed at the contact between the overlying surficial fluvial sediments and the underlying glacial till (Figure 3). The glacial till consisted of a hard blocky to plastic blue grey clay with occasional pebbles (Figure 4). These sediments have little potential palaeontological potential.

The Horseshoe Canyon formation consisted of interbedded sandstone and shale beds. The sandstone was weakly to moderately consolidated, massive to well bedded (Figure 5) and commonly contained fragmentary carbonaceous material. The clay was silty, hard and blocky, with occasional lenses of siltstone and sandstone. Carbonaceous material was abundant, and occasional poorly developed coal layers with more well-preserved plant remains were present (Figure 6). These sediments have moderate to high potential to produce significant palaeontological material.

Table 2: Analysis of Geotechnical Samples

Bridge ID	Thurber Borehole ID	Notes	Bedrock Depth (m)
B304	TH20-01	Thin recent fluvial sediment dominantly silt and clay with sand lenses, potential palaeosol surfaces developed. Glacial till, grey blue to massive, plastic. Bedrock, sandstone, weakly consolidated, fine medium grained silty sand, greenish grey.	9.0
B305	TH20-02	Recent stream sediment dominantly silt and clay with bedded sand at base. Bedrock clay, hard, blocky, bedded with silt and sand lenses, common plant fragments and carbonaceous material. Coaly bed present at 8.5m with abundant well-preserved plant material.	2.0
B306	TH20-03	Surficial, fill/recent fluvial sand bedded with thin silt and clay lenses. Thin glacial till, clay, plastic to hard. Bedrock, bedded sandstone, weakly consolidated, interbedded with, clay, hard, blocky, bedded with silt and sand lenses, common plant fragments and carbonaceous material.	3.0
B307 & B308	TH20-04	Surficial, thin rooted fluvial sand, thin glacial clay, plastic to hard. Bedrock, bedded sandstone, weakly consolidated, interbedded with, clay, hard, blocky, bedded with silt and sand lenses, common plant fragments and carbonaceous material.	2.0
B309 & B310	TH20-05	Thin surficial, recent fluvial sand bedded with thin silt and clay lenses, colluvium at the base. Glacial till, clay, plastic to hard. Bedrock, bedded sandstone, weakly consolidated, interbedded with, clay, hard, blocky, bedded with silt and sand lenses, common plant fragments and carbonaceous material.	5.0
B311	TH20-06	Recent fluvial sand bedded with thin silt and clay lenses, colluvium at the base. Glacial till, clay, hard/blocky. Bedrock, bedded sandstone, weakly consolidated, interbedded with, clay, hard, blocky, bedded with silt and sand lenses, common plant fragments and carbonaceous material.	4.0
B312	TH20-07	Recent fluvial sediment dominantly silt and clay with sand lenses, potential palaeosol surfaces developed. Glacial till, grey blue to massive, plastic. Bedrock, sandstone, weakly consolidated, fine medium grained silty sand, greenish grey, common carbonaceous material.	6.5
B313	TH20-08	Thin recent fluvial sand bedded with thin silt and clay lenses, colluvium at the base. Glacial till, clay, hard/blocky. Bedrock, bedded sandstone, weakly consolidated, interbedded with, clay, hard, blocky, bedded with silt and sand lenses, common plant fragments and carbonaceous material.	4.0
B314	TH20-09	Asphalt and fill on thick glacial till, clay, plastic to hard. Glacial till, clay, hard/blocky. Bedrock, bedded sandstone, weakly consolidated, interbedded with, clay, hard, blocky, bedded with silt and sand lenses, common carbonaceous material.	10.5

Recommendations:

Given: the moderate depth and grade of incision of Mill Creek Ravine at the Project location, that satellite imagery does not reveal any likely exposures of stratigraphy, and that geotechnical specimens have been examined, a pre-construction HRIA would likely not provide significant additional information as to the palaeontological potential of the Project. It is therefore recommended that:

1. No palaeontological HRIA be required prior to construction.

Geotechnical specimens indicate that little to none of the mapped Quaternary glacial outwash sands are present, however, the potentially fossiliferous Horseshoe Canyon Formation is present at various depths throughout the Project. Current plans are to use screw piles as foundations for the bridges, which do not disturb the ground extensively and bring no tailings to surface. If screw pilings or other similar non-disturbing methods are used, it is recommended that:

2. No further palaeontological work be required for the Project if screw pilings or similar non-disturbing construction methods are used.

If construction plans change, and extensive excavation is required (e.g. through large diameter augered concrete pilings, poured concrete foundations, or similar construction methods) it is recommended that:

3. Palaeontological monitoring be required if extensive excavation exceeds the depth of bedrock (Table 3).

Table 3: Recommended Depth of Palaeontological Monitoring.

Bridge ID	Bedrock Depth (m)
B304	9.0
B305	2.0
B306	3.0
B307 & B308	2.0
B309 & B310	5.0
B311	4.0
B312	6.5
B313	4.0
B314	10.5

Recommendations made by:

A handwritten signature in black ink, appearing to read 'P. McNeil', is written over a light blue rectangular background.

Paul McNeil, Ph.D.
President and Senior Palaeontologist
Steppe Consulting Inc.

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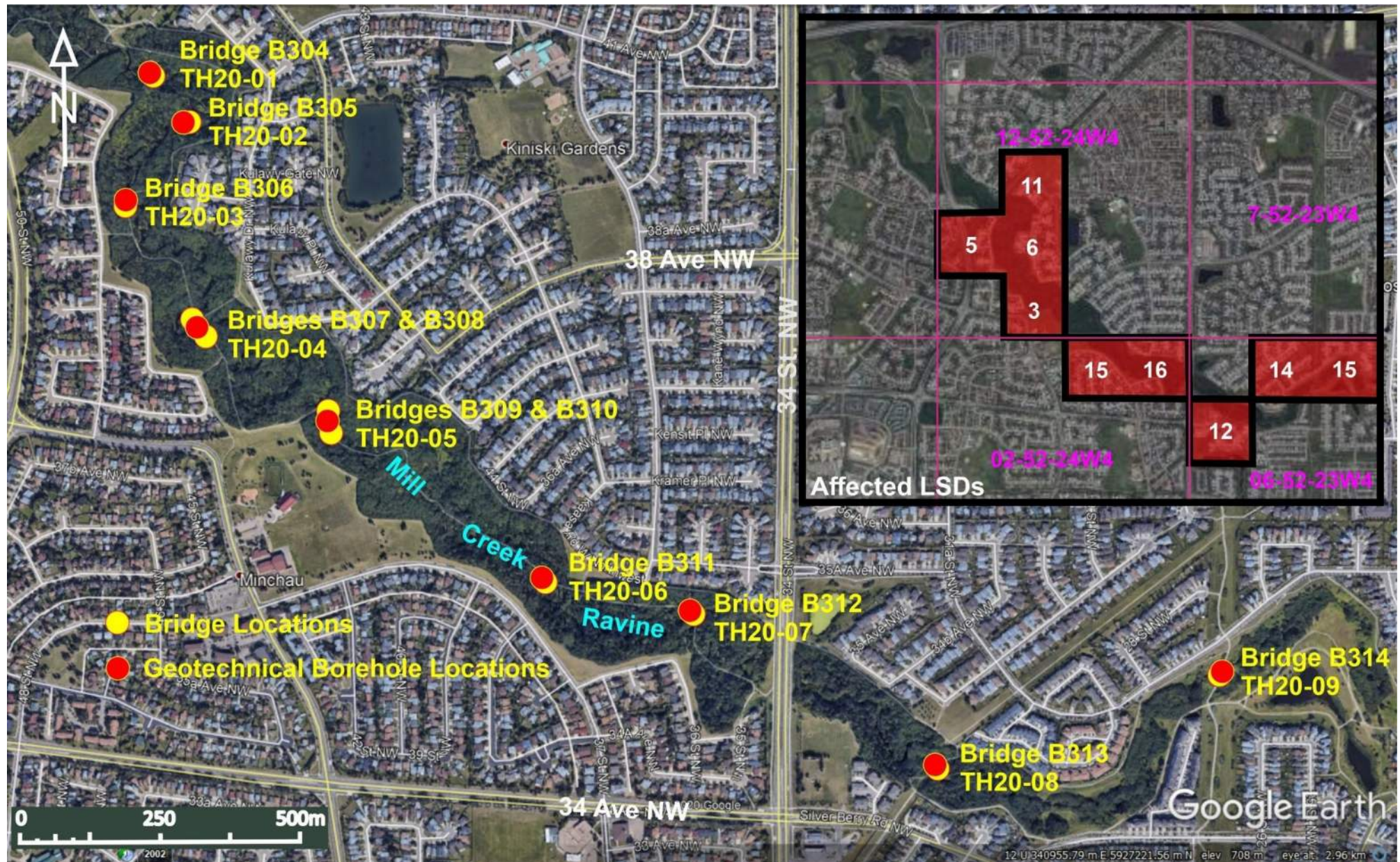


Figure 1: Proposed City of Edmonton Mill Creek Pedestrian Bridges Project.

Image modified from Google Earth (2020).

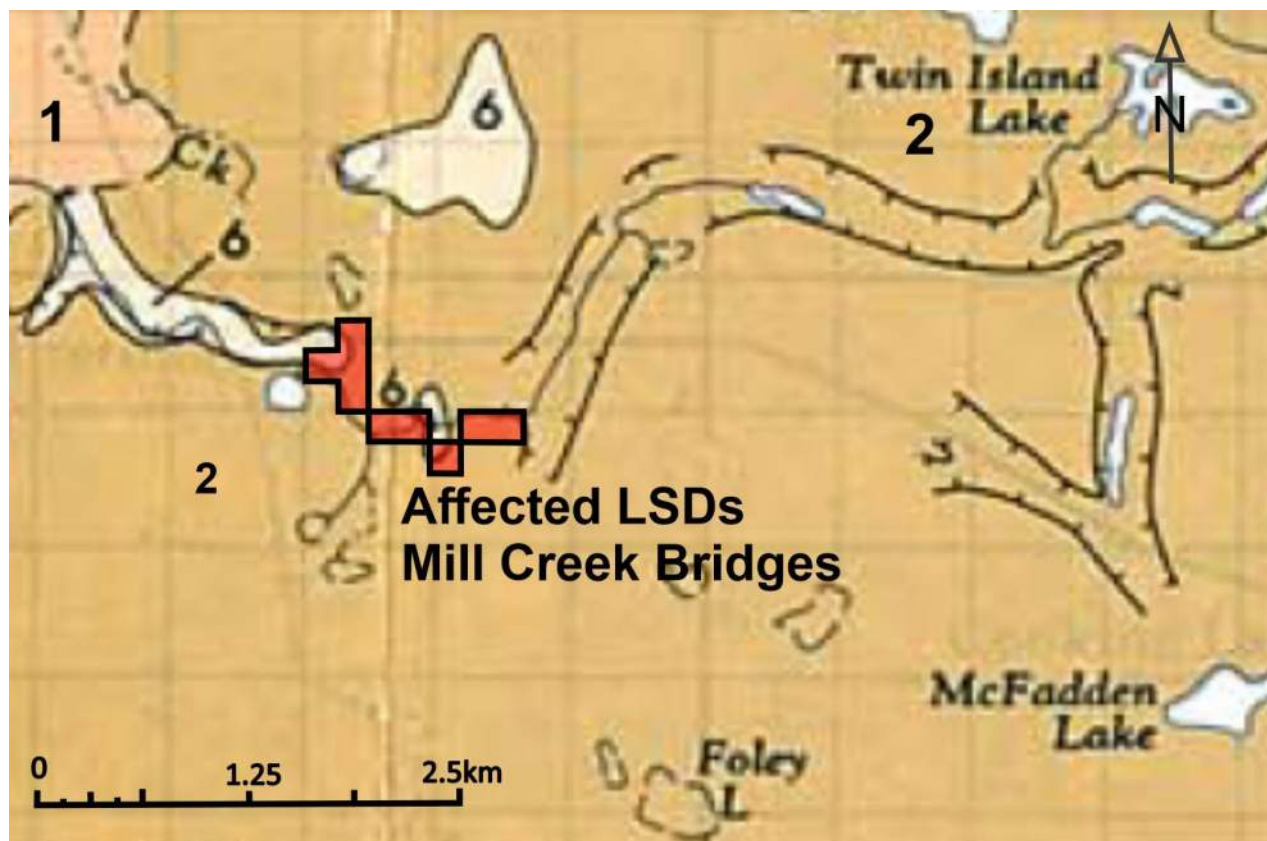


Figure 2: Surficial Geology of the Mill Creek Pedestrian Bridges Project.

Abbreviations: 1 – ground moraine, till composed of clay, silt, and sand with pebbles and boulders, generally less than 13m thick, level to undulating; 2- hummocky moraine, till composed of clay, silt, and sand with pebbles and boulders, generally greater than 13m thick, undulating to gently rolling; 6 - outwash sand, coarse to medium grained sand with pebbles and small gravel lenses, thickness 1-6m. Modified from Bayrock (1972).



Figure 3: Basal lag in sand above glacial till.

Sand with abundant pebbles, either colluvium from the ravine walls or a remnant of glacial outwash. From TH20-05 at 2.5m depth.



Figure 4: Glacial till.

Black, plastic with rare pebbles. From TH20-09 at 8.0m depth.



Figure 5: Bedded sandstone of the Horseshoe Canyon Formation.

From TH20-03 at 3.0m depth.



Figure 6: Plant layer in blocky clay in the Horseshoe Canyon Formation.
From TH20-02 at 8.0m depth.



Appendix J Satellite Imagery

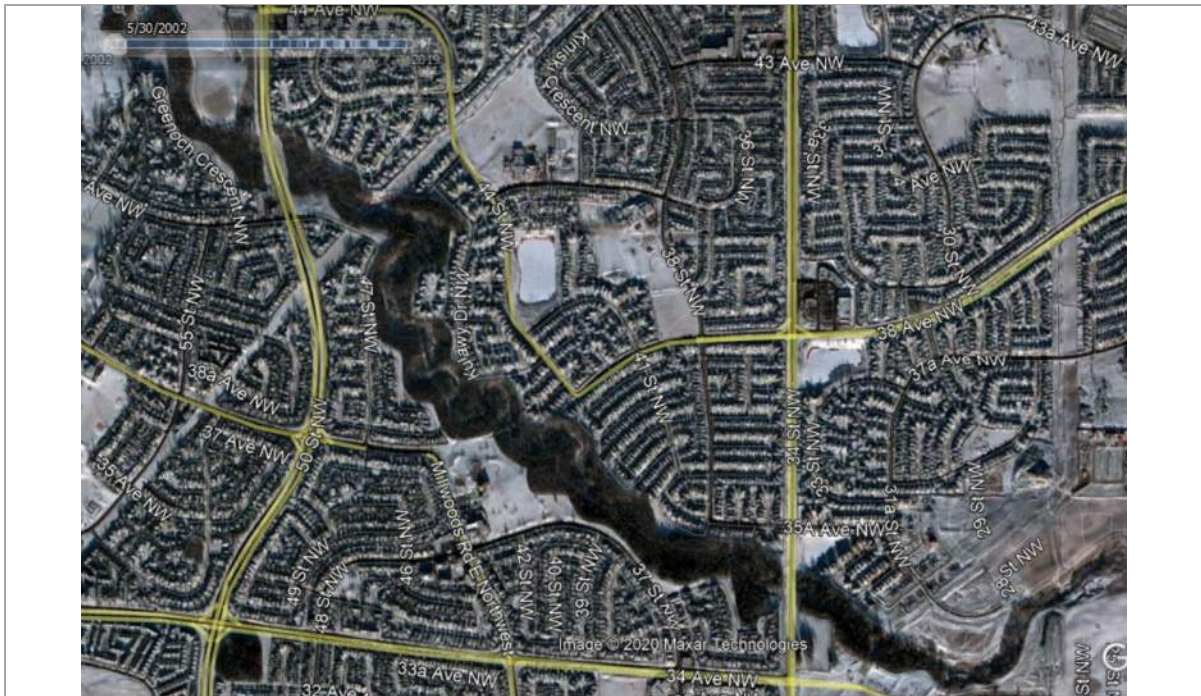


Plate 1 Google Earth Imagery (5/30/2002).

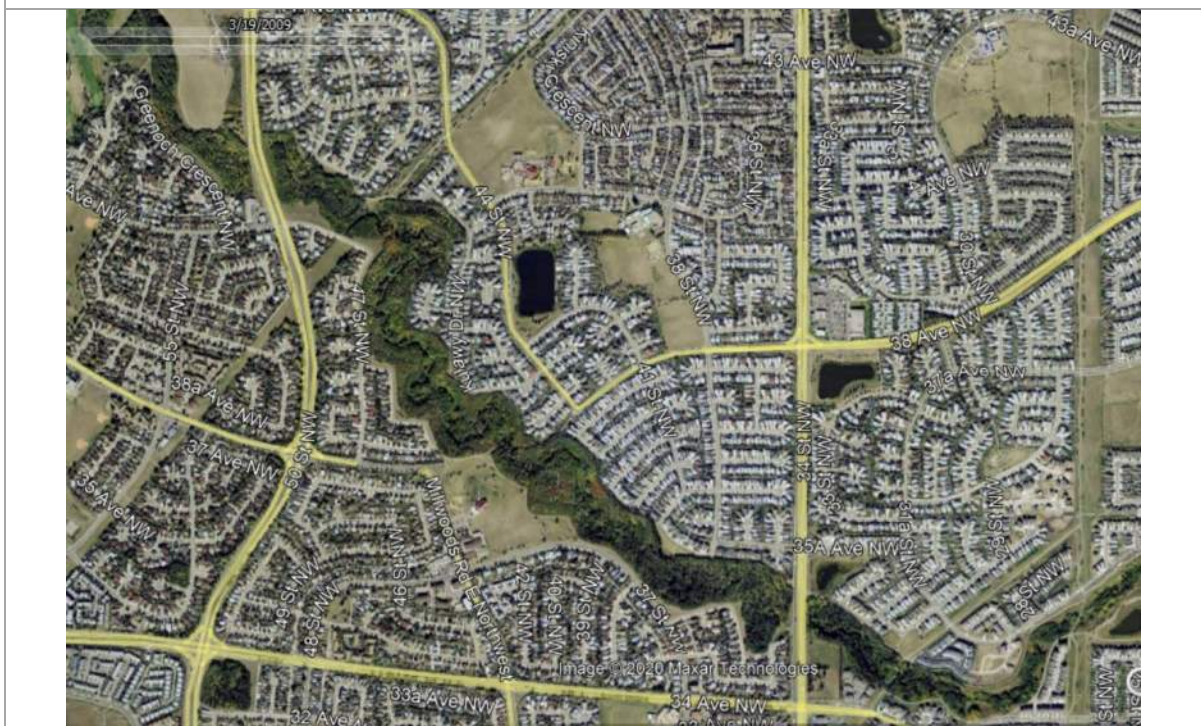
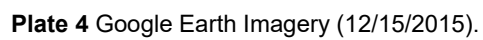
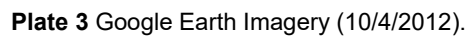


Plate 2 Google Earth Imagery (3/19/2009).



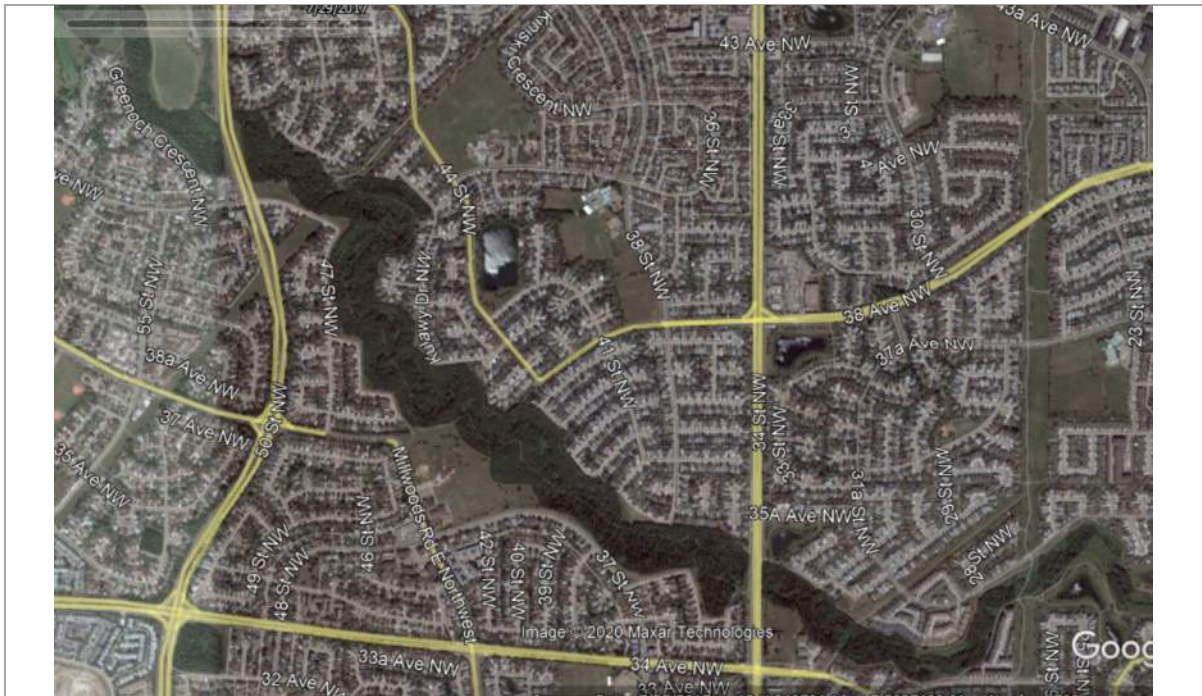


Plate 5 Google Earth Imagery (7/29/2017).

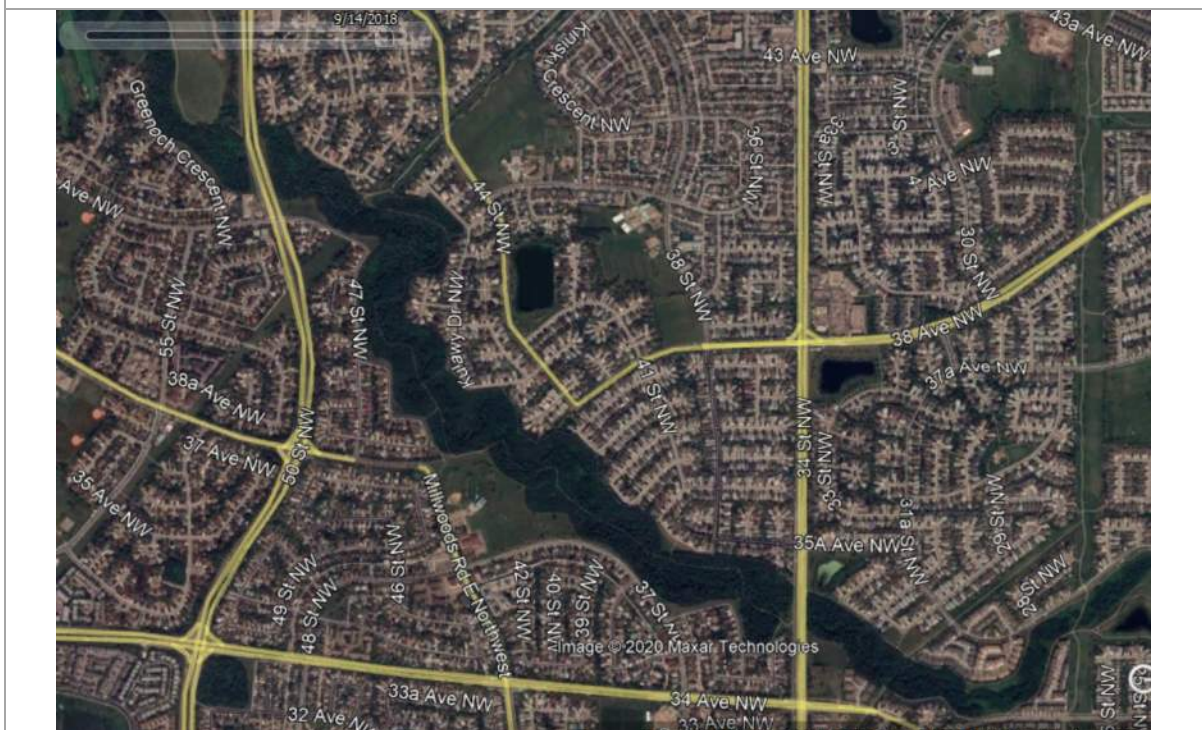


Plate 6 Google Earth Imagery (9/14/2018).