Environmental Impact Assessment
Pursuant to Bylaw 7188
for
Valley Line West Light Rail Transit (LRT)
Crossing at Groat Ravine

Final Report

Prepared for:

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1.0 INTRODUCTION

The City of Edmonton is currently developing the Valley Line Light Rail Transit (LRT), an urban style LRT that will connect Mill Woods Town Center to the Lewis Farms Area. The project has been divided into two stages, Valley Line-Southeast (VL-SE) extending from Mill Woods to downtown (102 Street) and Valley Line -West (VL-W) extending from downtown to Lewis Farms Transit Centre. VL-SE, is now under construction. In 2017, City of Edmonton LRT Delivery retained a consortium of firms known as ConnectEd Transit Partnership (CTP) to update preliminary design (which had been taken to 30% in 2011) and facilitate procurement. Spencer Environmental was retained by CTP to act as environmental lead. With the VL-W preliminary design nearing completion, the project is now in the procurement preparation phase. The preliminary design will serve as a Reference Design that will be advanced and provided to the successful bidder (Proponent) for the next design phase. The intent is to have the VL-W procurement-ready by autumn 2018 in anticipation of availability of higher order government funding that could potentially facilitate construction initiation in 2019/2020.

The VL-W alignment is wholly situated in highly urbanized areas of Edmonton (Figure 1, Appendix A); however, in three locations the alignment also runs adjacent to or through more natural environments: Groat Ravine, MacKinnon Ravine and Muskakosi Natural Area. Much of the VL-W alignment follows Stony Plain Road (SPR), including where that road crosses Groat Ravine, as a bridge. In this segment of SPR, the addition of LRT to SPR requires widening of the east bridge approach and a wider bridge. Groat Ravine is included in the North Saskatchewan River Valley Area Redevelopment Plan (NSRVARP) (Bylaw 7188) and the proposed bridge triggers the need for an environmental review pursuant to that Bylaw. Discussions with Edmonton City Planning ecological planners determined that the appropriate level of review is an Environmental Impact Assessment (EIA) to be subject to approval by Council. Further west on SPR, the alignment passes adjacent to MacKinnon Ravine, which is also within the NSRV ARP, and requires some minor work at the top of the ravine slope. That work also requires an EIA that must be approved by Council. A separate EIA has been prepared for that segment of the project. The two project intersections with Bylaw 7188 lands must also be addressed in a Site Location Study (SLS). One SLS will be prepared covering both sites. Finally, the west terminus of VL-W, in Lewis Farms Area, will be situated adjacent to the Muskakosi Natural Area and within an Neighbourhood Structure Plan (NSP) special study area. The potential for the VL-W terminus infrastructure to affect the adjacent Natural Area required an assessment pursuant to Bylaw C531. That assessment was also prepared as separate document and was also used to support an application for a Potter Greens NSP amendment.

This report comprises the Bylaw 7188 EIA prepared for the VL-W crossing of Groat Ravine. The EIA format and content follows a project-specific Terms of Reference developed through scoping discussions held between the environmental consultant, LRT Delivery and a City ecological planner, informed by a brief description of project activities, preliminary engineering drawings, the project location and anticipated project activities. Discussions determined that of the natural resources typically covered, groundwater and fish were not relevant to this assessment. This EIA addresses all components of the VL-W project having potential to affect lands within the Groat Ravine NSRV ARP. Project components outside of the bylaw boundaries are referred to as needed for context.

2.0 THE PROPERTY

2.1 Project Area Location, Disposition, Zoning

The project assessed by this EIA is located on SPR where it crosses over Groat Ravine by way of a bridge. Figure 2 (Appendix A) illustrates the proposed LRT ravine crossing location in relation to Bylaw 7188 lands, and the adjacent legal land and residential lot context. In this location, the bylaw boundaries generally respect City-owned lands, with local exceptions at the SE corner of the existing SPR bridge, where the boundary intersects with three residential lots that until recently were private lands. Figure 3 (Appendix A) shows that these lots and several adjacent to them are now City-owned. Therefore, at this point, all project lands for the Groat Ravine crossing are owned by the City of Edmonton. Figure 4 (Appendix A) illustrates land use zones in and near the proposed VL-W crossing. Most of the bylaw lands are zoned for recreational land use. The recently acquired adjacent lands are zoned for residential. The remainder of the tablelands adjacent to the project area are zoned for residential or parkland. In this location, Groat Ravine forms the west boundary of Westmount Neighbourhood and the east boundary of Glenora Neighbourhood.

2.2 Historic Conditions

Developer interest in residential lots west and adjacent to Groat Ravine dates back to the 1860s (CoE Interactive Neighbourhood Map). Tablelands adjacent to the ravine have been built out for many decades. Development within Groat Ravine is much more recent. Historical aerial photograph review was limited to the photograph series included in AECOM (2017) that spans the period 1920 to 2014 (Appendix B). That series shows the following sequence of development. In 1920 the ravine remained naturally forested from the river valley to beyond 104 Ave, there was evidence of a natural ravine watercourse, 102 Ave already crossed the ravine, SPR had not yet been constructed, some housing was present on the west ravine margin and the east margin but to a lesser degree. In 1949 the ravine remained predominantly naturally forested, more clearing was present at the confluence with the river valley, a natural watercourse was still evident, 102 Ave and Stony Plain Road crossed the ravine, full build out was evident on the adjacent tablelands. In 1952, few new coarse scale changes were visible. Groat Road development began in 1958. By 1962, Groat Road occupied the ravine bottom, the watercourse was no longer evident, vegetation had been reduced to discontinuous remnant patches of trees/shrubs on ravine walls, west ravine slopes near SPR were fully cleared, and the lower ravine and valley confluence were cleared of trees. In 1967, ravine wall trees/shrubs were filling in, but little regrowth was evident near SPR. By 1975, trees were filling in around SPR. The aerial photograph record shows only minor scale ravine changes since 1975.

2.3 Summary of Environmental Regulatory Approvals

All typical potential environmental approvals issued at the federal, provincial and municipal level for this type of project were reviewed with respect to their application to this project (Appendix C). Because of the absence of watercourses and wetlands in the project area, construction of this project will not require any federal or provincial approvals. As always, several provincial and federal environmental statutes prohibiting harm to select resources are also relevant to construction. Bylaw 7188 is the only trigger for an environmental assessment. Table 2.1 lists the environmental legislation and bylaws identified as particularly applicable to this project.

Additional detail is provided in Appendix C. This EIA does not address other municipal approvals that may be required during construction depending on Proponent activity, such as OSCAM permits.

Table 2.1. Summary of applicable legislation and bylaws (details in Appendix C)

Legislation or Policy	Regulatory Agency	Authorization/ Approval/ Permit Required	Approval Timeline or Potential Schedule Impact
Bylaws Requiring Approvals - Municipal			
***North Saskatchewan River Valley Area Redevelopment Plan* (Bylaw 7188)**	City Planning	EIA and SLS required. City Council must approve both.	Committee/Council date for approval of the EIA planned for October/ November 2018.
***Corporate Tree Management Policy* (C456)**	City Forestry	VL-W approach developed by City.	Compliance built into Project Agreement.
***City of Edmonton Drainage* (Bylaw 18100)**	EPCOR	Application for a permit and payment of fees.	Proponent responsibility.
City of Edmonton Parkland Bylaw 2202	City of Edmonton	Approval required to stage construction equipment or other use in park-space.	Proponent responsibility.
Acts Influencing Construction Methods - Provincial			
Wildlife Act	Alberta Environment and Parks	No permit required; however, the act prohibits disturbing prescribed breeding wildlife such as flying squirrels or owls.	Proponent responsibility. Vegetation clearing between 15 February and 20 August may result in nest sweep findings that delay clearing.
Acts Influencing Construction Methods - Federal			
Fisheries Act	Fisheries and Oceans Canada (DFO)	No approval required; however, the act prohibits release of deleterious substances to fish habitat.	Not applicable.
Migratory Birds Convention Act	Environment and Climate Change Canada	No permit required; however, violation of the *MBCA* may result in penalties.	Proponent responsibility. Vegetation clearing between 15 February and 20 August may result in nest sweep findings that delay clearing.
Species at Risk Act	Environment and Climate Change Canada	No permits required; however, violation of the *SARA* may result in penalties.	Proponent responsibility. Schedule potentially impacted if *SARA* species are found in the area.

2.4 Environmental Site Assessments

As part of preliminary design, CTP undertook a Limited Phase I Environmental Site Assessment (ESA) of the entire alignment (AECOM 2017) to identify potential environmental liabilities, from the perspective of both construction and land acquisition. As the Limited Phase 1 ESA covers the entire project and is of significant size, it is not appended here. The report is available upon request, under separate cover. The ESA included a search area along the alignment/roadway that spanned one city block on either side to account for on and off-site impacts. The resulting report did not flag any concerns for lands at or adjacent to Groat Ravine. The VL-W Phase 2 ESA that is now underway did not pursue any areas of concern in or adjacent to the project assessed in this EIA. The Phase 2 ESA is, however, shallow testing surficial soils for contamination, at regular intervals along the entire alignment.

3.0 ENVIRONMENTAL CONTEXT

3.1 Overview

The VL-W crossing of Groat Ravine (the project) is situated on SPR, approximately 870 m (straight line distance) upstream from the confluence of Groat Ravine with the NSRV. At this location, Groat Ravine is a steep-walled, deeply incised tributary ravine. The entire ravine is relatively short - approximately 1350 m long -and has been highly modified by transportation development. The dominant development in the ravine is Groat Road. That notwithstanding, the ravine remains a part of the NSRV system, is mapped as recognized natural areas, comprising a natural and semi-natural linkage in Edmonton's ecological network, and, is structurally connected to the NSRV. However, the ravine's ecological function has been compromised by the replacement of the natural watercourse with a storm sewer system, the presence of a road occupying the entire ravine bottom, the presence of many exotic and weedy species and the fully urban character of the surrounding tablelands. The slopes are mainly well-vegetated with dense trees and shrubs (a mix of native and exotic) that have established passively and through reclamation efforts since the 1950s. In addition, two significant roads currently cross the ravine - the recently replaced 102 Avenue bridge, which is a clear span bridge that has steep, organic, semi-vegetated abutment slopes (Plate 1); and the SPR (104 Ave) bridge which is shorter, and presents more of a barrier, as it is supported by piers and has very steep, barren abutment slopes (Plate 2). Further north, the 107 Avenue crossing is situated just beyond the north terminus of the ravine.

Plate 1. Existing single span steel-haunched girder bridge at 102 Ave over Groat Road.

Plate 2. Existing Groat Road Bridge at SPR (Photo 31 July 2018).

The EIA study area was defined at two scales, core and expanded. The core study area comprises the lands within and adjacent to the bylaw boundaries that have potential to be directly affected by the proposed development, permanently and temporarily. The core study area is the same as the project area shown on Figure 1. The expanded study area includes adjacent north and south ravine reaches that are structurally connected bylaw lands that may be indirectly affected and some vegetated lands near/at the top of ravine slopes (Figure 5, Appendix A). The expanded study area was relevant to some resources such as environmental sensitivities, vegetation and wildlife movement.

3.2 Environmental Sensitivities

3.2.1 Original (2016) Mapping

Figure 5 shows the results of the City of Edmonton environmental sensitivities analysis and classification mapping (Solstice Canada 2016b) in the project vicinity, overlaid with our expanded study area. For the expanded study area, the original sensitivity mapping classifies the majority of the east ravine slopes south of the SPR bridge as having extremely high value to the City and the majority of east slopes north of the bridge as having very high value. The majority of the west ravine slopes north and south of the bridge were classified as having high value. That study considers extremely high, very high and high values lands as suitable for protection or conservation.

3.2.2 Refined (2018) Mapping

Methods

As requested by the ToR, using the 2017 site-specific vegetation data and mapping, we re-analyzed City of Edmonton's Environmental Sensitivities (2016) GIS layer for the expanded study area. In particular, we updated the input Ecological Asset scores for the Natural Vegetation ('AVegNat2' attribute), and for the Non-Native Vegetation

('AVegNoNat1' attribute). We reviewed wildlife data and found it to be similar to that used in the 2016 analysis. No other new data were available. Contours are from City of Edmonton open data. Overlay analysis (union function) was used to intersect the 2017 vegetation polygons with the 2016 Environmental Sensitivities polygons. This not only allowed us to update the relevant scores, it also allowed us to break up the larger 2016 mapped polygons to reflect our finer scale 2017 mapped polygons. Scores were updated as shown in Table 3.1.

Table 3.1. Sensitivity Analysis Refinement

Where 2017 Vegetation were observed to be...	…the respective Environmental Sensitivities attribute was updated to:
Deciduous-Leading Mixedwood – Mixed Shrub (DLM.1)	Natural Vegetation ('AVegNat2' attribute) = 2 score
Non-Forested – Caragana, Steep Slopes (NF.1)	Non-Native Vegetation ('AVegNoNat1' attribute) = 1 score
Manicured (M)	Non-Native Vegetation ('AVegNoNat1' attribute) = 1 score

With the scores updated, the Environmental Sensitivities analysis – whereby Assets, Threats and Constraints were summed – was re-run using the model formula as per originally prescribed by Solstice Canada (2016) to produce the new cumulative Environmental Sensitivities layer for the study site. The original final score categorical classes were used to bin the new scores.

GIS data will be provided to the City's ecological planners as part of the EIA review submission.

Results

The revised environmental sensitivities map (Figure 6) includes some changes to polygon classifications in all four vegetated study area quadrants. Northwest of the bridge there is a minor decrease in the area of land rated as high value, downgraded to moderate value. Northeast of the bridge some of the lands rated as very high value are downgraded to high value. Southwest of the bridge, the tablelands adjacent to the ravine are downgraded from high value to moderate value. Southeast of the bridge some of the extremely high value lands are downgraded to very high value. Additionally, southeast of the bridge and outside of the bylaw lands, a small parcel is upgraded from moderate value to high value. All of these changes are the result of finer mapping of vegetation as dominated by exotic species. In general, the updated map illustrates that most of the area to be cleared is not ranked as the highest quality forest in the ravine.

Portions of the area to be used for laydown are rated as moderate and therefore candidates for restoration/stewardship. As a final stage of construction some of these lands will in fact be reclaimed to a new natural area.

3.3 Surface Water

There is no natural watercourse in the core or expanded study area. All SPR surface runoff and all adjacent ravine surface runoff in the expanded study area is ultimately directed to Groat Road catch basins and storm sewers and then to the North Saskatchewan River (NSR). During small rainfall events, up to about the 1:5 year rainfall, runoff from the bridge is captured by four catch basins (CBs), two located at the southwest end of the bridge (Plate 3) and two at the southeast, that connect to a 200mm storm sewer along the west ravine slope to a storm trunk on Groat Road. That storm trunk ultimately outlets to the NSR via an outfall near Government House Park located west of Groat Bridge. Some core study area drainage is also picked up by CBs that connect to a combined sewer system that drains north. Within the core study area, there are four CB leads in Groat Road just upslope of the SPR bridge and two downslope of the bridge.

Under larger rainfall events, the bridge sewer system does not have capacity for the larger runoff flows. In those instances, runoff that does not enter the CBs and sewer system may overtop the roadway curb and flow into a culvert chute and down the ravine slope to Groat Road (Plates 3-4) and into the storm system. No obvious surface erosion issues were noticed in the study area during our site inspections.

The core study area is located outside of the NSR 100 year floodplain (AEP 2017).

Plate 3. View east showing drainage CBs adjacent to southwest sidewalk on SPR.

Plate 4. View west showing overflow drainage infrastructure adjacent to southwest corner of SPR bridge abutment.

3.4 Geology/Geomorphology and Soils

3.4.1 Methods

Site-specific geological, geomorphological and soils information was gleaned from investigations undertaken by CTP geotechnical engineers, which included, a high-level geotechnical assessment of the entire VL-W alignment (Thurber 2017). This report is not appended here as the Groat Ravine crossing is only one short segment of the 14 km covered. The report is available upon request. The geotechnical assessment was based on the findings of a review of available information and a site reconnaissance of the proposed alignment. Site reconnaissance involved visual examination of surface conditions along the proposed route, including the natural slopes at Groat Ravine. The reconnaissance assisted with the identification of potential geotechnical risks and challenges that should be considered during the preliminary design. No test holes were advanced as part of this study.

3.4.2 Description

The following description was compiled by referring to Thurber (2017). The ravine slopes at the VL-W Groat Ravine crossing are approximately 10-12 m high, inclined at 2H:1V to 3H:1V and have been incised into high plastic lacustrine clay with pre-existing slickensides, overlying clay till. The slopes of the Groat Ravine are generally covered with a veneer of colluvium material. Colluvium is deposited by gravity as a result of slumping and erosion of overburden units at higher stratigraphic positions. It is composed of a random mixture of clay, silt, sand and possibly blocks of bedrock. Colluvium material tends to be loose and can be prone to sliding.

At the crossing, the ravine slopes are heavily vegetated with mature trees and shrubs. A review of aerial photographs did not indicate signs of active slope movement/instability in the area and in general, the reviewed images did not show any significant ground disturbances such as mines, borrow pits, landfills, or similar. However, a review of City of Edmonton records (A.D. Williams, 1997) indicated that a failure of the cut slope of the northbound Groat Road ramp to 107 Avenue occurred in 1996. The inclination of the cut slope was approximately 2.5H:1V. The investigation into the failure concluded that it was confined to the upper, glacio-lacustrine clay and that it was triggered by the infiltration of runoff water due to poor surface drainage. This failure instance highlights the sensitivity of ravine slopes to construction related disturbances, including changes in drainage patterns

Although there is no evidence of active slope movement in the EIA core study area at this time, the presence of slickensides within the structure of the lacustrine clay warrants careful review and consideration in design and awareness of a sensitivity to construction-related disturbances (grading, stripping of vegetation, alteration of surface drainage patterns, etc.).

Site reconnaissance by Spencer Environmental in June and July 2018 documented the slopes under the existing SPR bridge as steep and surfaced with exposed soils, strewn with concrete rubble, rocks and other litter (Plate 5) and completely absent of vegetative cover (Plate 6).

Plate 5. View of exposed soils on steep east-facing slope, strewn with concrete rubble and rocks (31 July 2018).

Plate 6. View of exposed soils on steep west-facing slope strewn with concrete rubble, rocks and litter (31 July 2018).

3.5 Vegetation

3.5.1 Methods

Vegetation in the expanded study area was characterized by undertaking the following tasks:

- Desktop preliminary plant community delineations using high resolution remote imagery.
- A rare plant and plant community survey by a professional plant ecologist, on 29 August 2017. All vegetated lands in the study area were surveyed to ground truth plant community delineations, characterize community composition, and search for rare or underrepresented plant species occurrences. Each community was surveyed via meandering transects. All species were documented, and their relative abundances ranked as dominant, abundant, frequent, occasional, or rare (locally uncommon). All plant communities were surveyed at an intensity that was deemed sufficient to capture the diversity of plants within the site and to encounter any rare species present.
- A reconnaissance level survey on 31 July 2018 to verify condition within the recently defined core study area.
- Representative sites of each community were photographed.
- A noxious weed survey conducted concurrent with the plant community survey, covering all plant communities within the project area. In each community, any noxious or prohibited noxious species observed were recorded and their relative abundance ranked as dominant, abundant, frequent, occasional or rare (locally uncommon).

- Plant species that could not be identified in the field were collected and identified with the aid of a dissecting microscope and botanical manuals. Species scientific and common names follow the most recent data from ACIMS (AEP 2018). Common names are used throughout the text; however, complete plant community data, including species scientific names, are provided in Appendix D.
- Mapped plant communities were classified following the *Urban Ecological Field Guide for the City of Edmonton, Alberta, Canada* (City of Edmonton 2015). Manicured lands present were classified as such.
- A search of the Alberta Conservation Information Management System (ACIMS) (Alberta Environment and Parks 2018) for all records of special status plant species within project area. Site accessed on 17 January 2018. The area searched consisted of legal section 01-53-25-W4M.

3.5.2 Description

In general, most of the ravine slopes and top-of-slopes in the study area were well-vegetated. The following individual plant communities were mapped in the study area (Figure 7):

- Deciduous-Leading Mixedwood – Mixed Shrub (DLM.1)
- Non-Forested – Caragana, Steep Slopes (NF.1)
- Manicured (M)

Deciduous-Leading Mixedwood – Mixed Shrub (DLM.1)

In general, this Edmonton community type is characterized by City of Edmonton (2015) as having considerable tree cover comprising predominantly balsam poplar and white spruce, moderate but diverse shrub cover and relatively low forb and grass cover. It tends to occur on rich sites.

Within the study area, the deciduous-leading mixedwood – mixed shrub community (Plate 7) was present on the lower west ravine slopes and the upper east ravine slopes. In the study area, this community generally conformed to the description provided above, comprising dominant balsam poplar and trembling aspen and abundant white spruce; and frequent Manitoba maple. Abundant or frequent shrubs included red-osier dogwood, saskatoon, prickly rose, snowberry and species of currant. The forb and graminoid layer were variable, with abundant or frequent occurrences of wild sarsaparilla, tall lungwort, showy aster and smooth brome with occasional northern bedstraw and cut-leaved ragwort. The community is narrow, ranging from 12 to 32 m wide (with a mean width of about 23 m).

Plate 7. Typical deciduous mixedwood – mixed shrub forest at Groat Ravine (29 August 2017).

Overall, 49 species were observed in the deciduous-leading mixedwood – mixed shrub community. Of these, 29 (59%) were native, while the remaining 20 (41%) were exotic, noxious, or prohibited noxious. Four species of noxious weeds were observed in this community: creeping bellflower (frequent), creeping thistle (frequent), perennial sow-thistle (occasional) and common tansy (occasional). One prohibited noxious weed, common buckthorn, was observed but occurred only rarely.

Non-Forested Community – Caragana, Steep Slopes (NF.1)

This Edmonton community type is characterized in City of Edmonton (2015) as having dense thickets of common caragana (Plate 8), an exotic species, situated on steep, mid- to upper slopes in the North Saskatchewan River Valley (City of Edmonton 2015). These communities are noted as generally extremely species-poor. Relatively few species can grow beneath the dense cover of common caragana.

In the study area, the non-forested caragana community was documented on the upper west ravine slopes and on lower east ravine slopes and was more abundant on the east slopes. Common caragana dominated with frequent Manitoba maple. The understorey comprised grasses including abundant smooth brome and abundant quack grass (both exotic) and frequent Kentucky bluegrass (introduced here). The community is narrow, ranging from 4 to 32 m in width, with a mean width of about 16 m.

Plate 8. Non-forested caragana community upslope on the west side of Groat Ravine (29 August 2017).

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Overall, 24 species were observed in the non-forested caragana community. Of these, seven (29%) were native and 17 (71%) were exotic, noxious or prohibited noxious. Four noxious weed species were observed: creeping bellflower (frequent), creeping thistle (occasional), common mullein (rare) and perennial sow-thistle (occasional). A particularly large patch of creeping thistle and sow thistle was observed on 31 July 2018 approximately 15-25 m north of Stony Plain Road on the east side of Groat Road (Plate 9). One prohibited noxious weed, common buckthorn, was observed to occur occasionally.

Plate 9. Creeping thistle and sow thistle infestation east of Groat Road and north of Stony Plain Road bridge (31 July 2018).

Manicured (M)

Manicured areas are those subject to regular mowing or maintenance and or supporting landscaping trees. They are characterized by grassy areas and planted beds, as well as areas where the original cover has been maintained but severely thinned. Manicured areas were present upslope of Groat Ravine, along the east side of Connaught Drive (Plate 10). This area was dominated by maintained Kentucky bluegrass, smooth brome and crested wheatgrass. A comprehensive inventory was not undertaken.

Plate 10. Typical manicured area adjacent to Connaught Drive, looking northeast (31 July 2018).

Special Status Species

For this EIA, special status plant species were defined as species having an ACIMS conservation rank of S1, S2 or S3. S1 species are known from five or fewer locations in the province, S2 species are those with 6-20 recorded occurrences and S3 species have 21-100 recorded occurrences. The Province and the City consider S1 and S2 species to be rare. City of Edmonton also carefully considers the fate of S3 species as these species may be ecologically under-represented in the City.

The ACIMS search of legal section 01-53-25-W4M returned records of two special status vascular plant species: smooth sweet cicely (S3) and Canada brome (S1), reported to ACIMS in 2013 and 1944, respectively. Note that the SPR bridge over Groat Road occupies only the southeast quarter-section of 01-53-25-W4M. Smooth sweet cicely is typically found in moist woods and has recently been downgraded from an S2 species to an S3 species (21-100 confirmed occurrences in the province). It was not detected in the study area during our surveys, although the balsam poplar-white spruce community may represent suitable conditions for smooth sweet cicely. Canada brome is typically found in open woods and meadows and is currently reported at less than five confirmed locations. It was not detected during our surveys and the dense overstorey in the balsam poplar-white spruce forest likely precludes the presence of Canada brome suitable understorey habitat.

Considering the historical nature of the report (1944), and the changes that have occurred since that time, it is unlikely that this species continues to occur in this area. These conclusions are confirmed by Millenium EMS (2012) who undertook a rare plant survey in this same area in support of the 2013 bridge rehabilitation . Their ACIMS search reported the same two species but also noted specific historical recorded locations, which were well outside the project area. Millenium (2012) also recorded no observations of rare plant species in the project area.

One species of recent interest to the City, high-bush cranberry, was observed during the rare plant survey. High-bush cranberry is a tall shrub from the honeysuckle family (Caprifoliaceae). Until recently that species was ranked as S3 and was therefore of conservation interest to the City. The species was downgraded from S3 to S3S4 in October 2015, as part of a comprehensive 2015 AEP review of all vascular plant species (AEP 2018). While S3 species are considered uncommon, S4 species are considered uncommon but apparently secure and are known from >100 occurrences (AEP 2018). A blended rank of S3S4 suggests there is some uncertainty about this species' abundance in Alberta, and/or this species is vulnerable to extirpation due to various internal or external factors (AEP 2018). The species is found in moist woods and river valleys and although it has a wide range in Alberta, from the southern limit of the Central Parkland in the south to the lower Peace and Athabasca valleys in the north (Moss 1983) it occurs in low abundances over much of its range. An exception is in Edmonton, where vegetation surveys in the last decade have shown that this species is locally abundant in Edmonton's North Saskatchewan River Valley (Spencer Environmental in-house database). In addition, species abundance in Edmonton may be stable or increasing as the City has recently installed many of these shrubs as part of their Root for Trees program (Maslen, *pers. comm.*). Within the study area, high-bush cranberry was found in the deciduous mixedwood – mixed shrub community and abundance was rare.

Weeds

The Alberta *Weed Control Act* defines two categories of weeds: noxious and prohibited noxious. Noxious weeds are generally those that are currently widespread in the province and are considered difficult to eradicate. Provincial legislation requires that these species be *controlled*. Prohibited noxious weeds are those that are currently uncommon or absent in the province but have been identified as noxious due to their potential to invade and damage natural and cultivated systems. Alberta law requires that prohibited noxious weeds *be destroyed* where they are found.

Prohibited Noxious Species

Common buckthorn was the only prohibited noxious species observed in the study area. It occurred as scattered seedlings and mature shrubs in both the non-forested caragana and deciduous mixedwood – mixed shrub communities on both sides of Groat Ravine. Seeds of common buckthorn germinate readily in disturbed soils. Common buckthorn can be controlled using herbicides, burning, hand-pulling or flooding (Alberta Invasive Species Council 2014); however, as with many invasive species, control is difficult and may require a multi-year effort.

Noxious Species

Noxious weeds found in the study area included creeping bellflower, creeping thistle, common mullein, perennial sow-thistle and common tansy. All these species are common on disturbed lands in the Edmonton area. Most of these noxious weed species were widespread in the study area but occurred in relatively low abundances (i.e., rare to occasional observations). An exception was a weed infestation situated approximately 15-25 m north of the bridge on the east ravine slope.

Exposed Soils

Both slopes under the bridge are unvegetated exposed soils with a scattered veneer of loose rocks and concrete rubble.

3.6 Wildlife

3.6.1 Methods

Wildlife resources in the study area were characterized by undertaking the following tasks:

- Surveys were limited to one breeding bird survey in the core study area, conducted on 29 June 2017, at 0530 hours, by a professional biologist with appropriate skills. The survey consisted of one point-count that encompassed all vegetation communities present in a 100 m radius centred on the west ravine margin, just south of the bridge. With the exception of residential areas to the west, the survey recorded all birds seen or heard within an 8-minute period. Estimated bird locations within the survey area were mapped.
- All incidental wildlife and wildlife sign observations during site visits were recorded.
- Available habitat type, condition and quality was assessed through field observations and examination of study area vegetation data and maps.
- A search of FWMIS for all wildlife records for lands within a one km radius of the study area centre. FWMIS was accessed on 30 July 2018.
- The core study area was visually surveyed on 31 July 2018, looking for the presence of wildlife trees.
- A list of potential wildlife species present, including special status species, was generated by considering all of the above and our knowledge of Edmonton wildlife communities and occurrences.
- Common species names are used throughout the text; scientific names are provided in Appendix E.

3.6.2 Description

Available Habitat/Connectivity

Natural habitat types available in the study area are limited to narrow, elongated patches of deciduous-leading mixedwood forest and narrow elongated patches of tall shrubs, dominated by common caragana. The mixedwood forest represents a less common and higher quality habitat type and offers mature, vertically complex avian habitat. However,

in this case, both habitat types are bounded either by a busy urban freeway or residential areas and/or recreational trails and all of the natural habitat is situated within 45 m of Groat Road. Therefore, both habitat types are regularly permeated by loud urban noise, particularly high-volume traffic noise. There is no interior habitat. All of the above conditions reduce the habitat quality in the study area, even the quality of the mature mixedwood forest. For this reason, the study area is not considered to comprise significant wildlife habitat. That said, mature mixedwood forest is a valuable habitat type. But in this case, exotic species and few mature trees reduce its value, and, proximity to Groat Road likely means this habitat type is underused.

There is some potential for the shrubby and forested ravine slopes to function as wildlife corridors as they represent continuous habitat patches in a natural linear feature, offer good security cover and are directly connected to the river valley and to other nearby areas of urban tree canopy. The steep slope is sub-optimal terrain but not impassable. The ravine may be used as a movement corridor to varying degrees by numerous avian species, including birds of prey, and by some larger mammals such as coyote, deer and moose. The steep incline and dense shrub understorey along the ravine slopes may discourage movement of larger mammals and/or cause them to preferentially travel along the outer edge of the ravine corridor. Less frequently, transient carnivores such as cougar and lynx may move through the area. Both species have occasionally been observed in surrounding neighbourhoods in the last decade as reported in media and directly to the author by individuals. The Groat corridor is pinched at two locations: the existing SPR bridge and the 102 Avenue bridge. All species would hesitate to move under these bridges owing to one or more of the following conditions: lack of cover, concrete substrate, steep slopes, a nearby sidewalk and traffic noise. Most species would also be reluctant to move upslope and cross over these major roads. However, AECOM (2013) reported a winter track survey conducted in Groat Ravine under the 102 Avenue bridge as documenting snowshoe hare and deer tracks passing under that bridge (this was prior to bridge replacement). They found that both species preferred to pass under the 102 Avenue bridge on the east side due to the presence of less steep terrain and that snowshoe hare preferred to cross under the bridge either close to the underside of the bridge/top of the ravine or mid-slope under the bridge and deer preferred to cross mid-slope (AECOM 2013). The SPR bridge subjectively appears to be a less permeable pinchpoint owing to the presence of unvegetated abutment slopes and piers that obstruct sight lines. However, the west abutment slope does have a very narrow, slightly flatter bench near the top that offers about 4.0 m clearance under the bridge girders. In addition, there is very visible dense vegetation immediately adjacent to both abutment slope edges, which may entice animals to cross under the bridge (Plate 11-12).

Plate 11. View northwest of west abutment slope and narrow upper bench that perhaps facilitates wildlife passage (31 July 2018).

Plate 12. View south of unvegetated west abutment slope, and adjacent, visible security cover (31 July 2018).

Documented and Potential Wildlife

The EIA's breeding bird survey provides a snapshot of passerine use of the area. The survey recorded 7 species, all commonly-occurring in Edmonton (Table 3.2). Most of these species were singing territorially and may have been nesting in the study area. Species abundance within the surveyed area ranged from 1 to 3 individuals. Individual birds were widespread throughout the point count area, four species were observed on each side of Groat Road. Consistent with previous breeding bird survey findings at this bridge (Millennium 2012), species recorded near the SPR bridge are mainly habitat generalists,

most prefer forest or forest edges, none are mixedwood forest specialists, although dark-eyed juncos and chipping sparrows can prefer that habitat type. Yellow warblers and cedar waxwings were well represented with 3 and 2 individuals observed respectively, suggesting that the abundance of tall shrubs in the surveyed area is a valuable component of the available habitat. While no evidence of nesting under the bridge was observed in 2017, Millenium (2012) did observe a songbird nest under the southeast corner of the bridge. Red squirrel was also observed in the study area. Specific wildlife trees (i.e., trees with visible nests or large trees or snags with cavities) were not observed in the study area. FWMIS records, of unknown dates for the 1 km search area, included three additional species (Table 3.2) all having special status (see next section).

Table 3.2. Results of 29 June 2017 Breeding Bird Survey, Incidental Mammal Observations[1], and FWMIS Search Results[2]

Species[2]	Abundance	Observed In 2018	Reported
Black-capped chickadee	2	✓	
Black-billed magpie	1	✓	
American robin	1	✓	
Yellow warbler	3	✓	
Cedar waxwing	2	✓	
Chipping sparrow	1	✓	
Dark-eyed junco	1	✓	
Bay-breasted warbler*			✓
Cape may warbler*			✓
Little brown myotis*			✓

[1]Incidental observations of red squirrel were also recorded

[2]Dates of FWMIS record unknown, record is for unspecified lands within 1 km of bridge, so may not be from the study area.

Other undocumented species may use the area as breeding, foraging or year-round habitat. Expected additional species are limited to commonly occurring urban-tolerant species, such as American crow, deer mice and white-tailed jack-rabbit. A list of all wildlife species potentially occurring in the study area is provided in Appendix E.

Special Status Species

Based on species habitat requirements, an understanding of the available habitat, provincial species distributions, species records in the FWMIS database and field data from this and previous nearby studies, several special status species were identified as having at least some potential to occur in the project area (Appendix E). The following section discusses the potential occurrence of species that are ranked by the Province as *At Risk* or *May Be At Risk*, or, have been federally assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as either *Endangered*, *Threatened*, or *Special Concern*, and were rated by this study as having at least a moderate likelihood of occurrence within the local study area (Table 3.3). In addition, all species on Schedule 1 of the Species at Risk Act (SARA) with ranges that include Edmonton and for which suitable habitat is

available in the project area are included for discussion. Species having a provincial status of *Sensitive*, but no federal status, hold no potential to trigger project considerations beyond those applicable to wildlife in general, and, thus, are not discussed, even if their potential for occurrence was considered moderate or high.

The FWMIS search returned records of three special status species observed within 1 km of the project area: bay breasted warbler, cape may warbler and little brown myotis. Both warbler species are provincially ranked as *Sensitive* with no federal ranking and will not be discussed further here. The third species, little brown myotis, is discussed further below.

Table 3.3. Special Status Wildlife Species with Moderate or High Potential to Occur in the Study Area

Common Name	Provincial Status (General Status of AB Wild Species 2015)	Wildlife Act Designation*	COSEWIC Designation	SARA Designation	Observed/ Previous Record	Likeli-hood of Occur-rence	Potential Habitat Use
Little Brown Myotis	May Be At Risk	None given	Endangered	Endangered (Sched 1)	AECOM (2013); FWMIS (2018)	High	Roosting, foraging
Northern Myotis	May Be At Risk	Data Deficient	Endangered	Endangered (Sched 1)		Low	Roosting, foraging

* Under the Wildlife Act, select species carry a designation of Threatened or Endangered; additional species assessed by the Endangered Species Conservation Committee (ESCC) also have these designations

Little brown myotis and northern myotis are two of three bat species in Canada that were emergency listed as *Endangered* in Schedule 1 of the *Species at Risk Act* (SARA) in 2014 because of sudden population declines due to high rates of mortality in the eastern portions of their range from white-nose syndrome (WNS) (Environment Canada 2015). The third species is the tri-colored bat, which does not occur in Alberta. WNS is present in eastern North America and has spread as far west as Washington state in 2015-2016 in the United States and to central Manitoba in 2017-2018 in Canada, putting these two bat species at risk of extinction (White Nose Syndrome Response Team 2018). Bats are being exposed to WNS during hibernation in infected hibernacula (e.g., caves used by bats for winter hibernation). WNS has not yet been detected in Alberta.

Schedule 1 of SARA prohibits destruction of individual bats on federal lands but not on other lands. The SARA Recovery Strategy for Little Brown Myotis, Northern Myotis and Tri-colored Bat in Canada – Proposed (2015) declares hibernacula to be critical habitat but not maternity roosts [used for giving birth and rearing young (pups)]. The exclusion of maternity roosts has been questioned. The federal recovery strategy has not yet been finalized and no Critical Habitat Orders have been issued pursuant to SARA to legally protect critical habitat for these bat species. Bat conservation is an emerging issue and it

may be that in the near future maternity roosts become critical habitat or are afforded protection by SARA and/or by provincial governments.

In response to the federal government's emergency listing of these bat species, Alberta ranked little brown myotis as *May Be At Risk* in 2015. Northern myotis remained provincially ranked as *May Be At Risk*. The Alberta *Wildlife Act* prohibits the disturbance or destruction of a nest or den of bats from September 1 through April 30, and, dens of bats, excluding those constructed by humans, used as hibernacula throughout the year. Individual bats are not explicitly protected and neither are summer roosts of any kind. Nevertheless, apart from hibernacula, the primary provincial bat conservation concern is maternity roosting colonies and avoidance of disturbance to maternity roosts is a recommended practice. It should be noted that Alberta Environment and Parks (AEP) is currently undertaking a review of the provincial status of little brown myotis (L. Wilkinson, *pers. comm.*). If they determine that this bat species should be ranked as *Threatened* or *Endangered*, development of a recovery strategy will follow with associated protection and conservation management requirements.

During the breeding season, little brown myotis utilizes tree crevices (especially in old, dead (e.g., snags) and dying trees and mature aspen/deciduous trees), buildings and bridges for roosting, including maternity roost colonies. Northern myotis is a more tree-dependent species, utilizing a wide variety of tree species in primarily intact forest patches for summer roosting, including maternity roost colonies, and often using deciduous trees such as aspen or balsam poplar (AESRD 2009 and Alberta Community Bat Program 2018). The relative importance of human-made structures in Alberta to northern myotis, such as buildings and bridges, is unknown (AESRD 2009). Both species could make use of the few sizeable balsam poplar or aspen snags in the proposed project area for roosts, while little brown myotis could also be expected to potentially use the existing SPR bridge over Groat Ravine for roosting, including colonial maternity roosting. Little brown myotis and northern myotis do not hibernate in trees and are not known to overwinter in the Edmonton area.

Suitable summer bat roosting and foraging habitat is present in Groat Ravine as documented by AECOM (2013). They detected a total of three (3) identified bat species, including 22 little brown myotis near the 102 Avenue bridge during their bat survey. They did not detect northern myotis. More recently, AEP confirmed that, in fact, a bat maternity roost colony was found at one end of that bridge during the bridge demolition project (M. Pybus, *pers. comm.*). Similar habitat, including presence of some tree canopy, a few large snags and relative proximity to the NSR, a suitable foraging area and water source, is present in the project area. On that basis, and the fact that little brown myotis was detected in Groat Ravine south of the project area, the likelihood of little brown myotis occurring in the local study area is rated as high. There is also moderate to high probability for a little brown myotis maternity colony to be present under the existing SPR bridge crossing at Groat Ravine if there are crevices with suitable microclimate conditions available. Conversely, northern myotis prefers more intact forested habitat. That species was not detected by AECOM (2013) in targeted bat surveys in Groat Ravine to the south of the project area. For those reasons, the likelihood of northern myotis occurring in the project area is rated as low.

3.7 Historical Resources

A Statement of Justification (SOJ) was completed for the VL-W LRT, downtown to Lewis Farms, in 2010. Alberta Culture and Tourism (ACT) granted the project, as outlined in the SOJ, Clearance in December 2010. The Clearance Letter include one requirement: when the final alignment has been established, should it be determined that any pre-1960 structures will be affected by the project, staff of the HRMB are to be notified immediately, additional studies may be required prior to development proceeding.

Historical Resources will not be further considered in this EIA.

4.0 THE PROJECT

4.1 Project Delivery

Preliminary design (to approximately 30% of final design) is complete for the entire VL-W alignment. The design, referred to as the Reference Design, will be carried forward into the procurement phase and will be provided to the successful bidder (Proponent) who will advance design and construct the project. The City is currently developing the Project Agreement (PA) that will govern the Proponent's design and practices. Among other things, the PA will specify required design outcomes, required environmental plan submissions, lands temporarily available for construction, construction prohibitions and practices, reclamation requirements, environmental management and planning requirements, methodological standards and specifications, etc., both site-specific and for the entire alignment. The procurement phase is expected to occur within the next 12 months.

The project assessed in this EIA is limited to the components associated with the VL-W crossing of Groat Ravine. The fact that the Proponent will be responsible for advancing design and determining all construction methods is relevant to this EIA in several ways:

- This EIA assesses the Reference Design and is based on 100% preliminary engineering drawings and reports produced in spring 2018. For some project elements, design information is less detailed than is typically provided for Bylaw 7188 EIAs.
- The PA will allow for some innovation during detailed design according to specified variation tolerances. Thus, for example, the final design for the SPR bridge may vary from the Reference Design, although it is certain that the bridge will span the ravine without piers. All final designs must still be accepted by the City and for added control with respect to design changes, any proposed innovation (design or method) beyond those specified variances will be subject to review and acceptance by City business partners following current standard City approval processes.
- There are no details known about construction methods, equipment, access and schedule for the Groat Ravine crossing. The PA will not tightly govern construction methods or project component schedule. Therefore, this EIA cannot describe construction methods or construction scheduling.
- To control for the uncertainty around final design and construction methods, this EIA sets out proactive mitigation measures in the form of constraints, specifications and requirements for submission of environmental plans for review and acceptance by the City. Mitigation measures in this EIA represent City commitments that will be carried forward into PA requirements.
- To enable assessment of direct impacts, using the professional judgment of the project team, the City has delineated a project area or construction limit for the Groat Ravine crossing project segment. This EIA is based on that area and assumes that the full project area (core study area) will be used during construction.
- To protect against the future need for a larger working area within bylaw lands, any proposed innovations or activities that would require modification of lands or facilities situated *outside of the project area delineated here and within bylaw*

lands, will be subject to the Bylaw 7188 environmental review process, to be undertaken by the Proponent.

4.2 Need for a Replacement Bridge

The VL-W alignment follows SPR from 121 Street to 139 Street (and beyond) and, therefore, crosses over Groat Ravine. Both east and west approaches to the SPR/Groat bridge are curved and the addition of LRT at this curved segment requires a widening of the road (Figure 2). Similarly, the existing two-lane SPR bridge over Groat Ravine is not wide enough to tie into the widened road or to accommodate the additional infrastructure. Thus, this project includes replacement of the existing bridge.

4.3 Replacement Bridge Description

The proposed replacement bridge will be wider than the existing bridge (25.4 m wide vs the existing 18.4 m wide) (Figure 8). The vertical profile of the bridge remains the same and the horizontal alignment slightly curved with the east abutment slightly shifted to the south. The replacement bridge is designed to accommodate two centre LRT tracks, two outside vehicle lanes and two 4.2 m sidewalks (Figure 9). The Reference Design shows the bridge type as a single span steel haunched girder bridge (Figure 10). Supporting infrastructure within the ravine will consist of concrete abutments on piles with concrete slope protection in front of the abutment seat that will have a slope equal to or less than the existing exposed slopes (Figure 11). The existing Shared Use Path (SUP) along the west side of Groat Road, including the retaining wall forming the west boundary of that path, will be maintained.

While the vertical clearance under the replacement bridge will remain the same, because of the change to the abutment style, the replacement bridge will be slightly shorter than the existing bridge (by about 8 m) (Figure 11). The replacement bridge will not include supporting piers.

At the southeast bridge end, some fill is required on the upper ravine slope to support the widened roadway and new sidewalk. The fill will be held in place by an estimated 28 m long MSE wall (Figure 10). Approximately half of the MSE wall and associated fill will be situated within the bylaw boundary, the remainder extends back into some sloped, treed parcels that have been acquired by the City.

SPR will be closed to traffic at Groat Bridge for the duration of construction and Groat Road under the bridge will be periodically closed to accommodate bridge demolition and construction.

The delineated project area (which also represents the construction limits) is shown on Figure 8.

4.4 Bridge Drainage

The replacement SPR bridge will drain in a fashion similar to the existing bridge. The bridge will have a cross fall sloping towards the curb. Roadway curb and gutters will convey both roadway and LRT runoff to the west end of the bridge. New catch basins will be installed on the west end of the bridge to capture runoff from small events. Excess runoff from larger rainfall events may overtop the curb and run down the ravine slope via a new chute. The PA will require a concrete or armoured chute that controls high velocity flows to the Groat Road storm system. Associated slope surface erosion will not be acceptable.

4.5 Activities on Adjacent Lands

At the east approach to the replacement bridge, south of SPR, between Woodbend Place and the east ravine bylaw boundary, the widening of SPR will encroach on six privately held lots, three of which support residences. These six properties have been acquired by the City (Figure 3) and the buildings will be demolished. Some of those parcels also extend into the area to be filled and retained by an MSE wall. East of the fill area, the remainder of those parcels will be used as a construction laydown area (Figure 14). The laydown area will be centred on currently developed lands and will not extend into natural vegetation. Additional laydown areas inside bylaw lands will not be permitted. The PA will describe the boundaries of these designated areas. Nearby trees outside of the project area will be protected from disturbance according to PA specifications.

4.6 Landscaping

The Reference Design includes a preliminary landscape plan for the full alignment. The plan shows many landscaping aspects including where new trees shall be planted. All existing individual boulevard/ornamental trees in the study area have been identified and and condition assessed and valued by the City. These are recognized in the landscaping plan and trees requiring removal are identified. This inventory did not include natural vegetation at Groat Ravine. Ravine vegetation will be inventoried and assessed by the City at a later date, to calculate the value pursuant to the Corporate Tree Management Policy. The PA includes measures intended to satisfy compensation pursuant to the Corporate Tree Management Policy and also includes specific and detailed City tree protection requirements for trees in the vicinity of construction. Those same measures will apply to tree protection in adjacent undisturbed areas of Groat Ravine. The landscape plan for the Groat Ravine segment (Figure 12) indicates that the roadside approaches to the bridge will be newly landscaped and will receive some new trees and some new shrub beds. Shrubs and trees are shown planted in front of the new MSE wall. Within the bylaw boundaries the landscape plan acknowledges that some areas that were cleared will be landscaped with "new natural areas" and "new shrub beds". Figure 12 shows the laydown area converted to a new natural area. This EIA will elaborate on landscaping requirements in those areas as mitigation for lost natural vegetation communities.

Abutment slopes under the replacement bridge are shown on the plan as "special landscaped areas to be developed". As shown on Figure 9, the abutment slopes will be concrete and not vegetated. In addition, as part of this but not shown specifically on the

plans, preliminary engineering has made allowance for installation of a critter crossing on each abutment slope to accommodate mammalian wildlife movement (Figure 13). This EIA will elaborate on this measure in the wildlife impact mitigation section.

4.7 Other Utilities

Some additional utilities are located on or near the bridge and within Bylaw 7188 lands. These include some storm sewer and water lines in the SPR right-of-way (ROW) that require relocation and/or upgrading and some existing telecom duct banks that are to be abandoned. Privately-owned utilities are the responsibility of the utility owners and those relocations/abandonments will take place prior to the lands being turned over to the Proponent. Timing of this utility work is not currently known but some VL-W utility work is already underway. This EIA does not cover utility work to be undertaken by private sector utility owners.

4.8 Project Phases and Associated Key Activities

This EIA covers several project phases and assumed associated key activities (Table 4.1). For purposes of this assessment, site preparation activities have been acknowledged separately; however, some clearing may in fact be deferred to after demolition, since Proponent activity sequencing is unknown. ESC measures will be in place as part of any site clearing/preparation activities. The operations phase is not covered in this assessment for the following reasons: LRT operations will be entirely within urban infrastructure, there are no LRT stops on the bridge, there will be no LRT maintenance at or near the bridge, LRT operation will not affect general bridge maintenance, and bridge maintenance practices will not change from existing practices. The replacement bridge and associated supporting infrastructure is the key new infrastructure component assessed in this EIA. LRT infrastructure, such as track, is not specifically assessed.

Table 4.1. Groat Ravine Crossing Project Phases and Key Associated Activities.

Project Phase	Key Activities
Site Preparation	• Develop all required environmental plans. • Delineate and install Erosion and Sediment Control system along the construction limits and in construction laydown areas. • Protect trees. • Clear vegetation, as scheduled activities allow. • Establish lay down area.
Bridge Demolition	• Remove existing bridge drainage infrastructure. • Establish laydown areas (outside of Bylaw 7188 lands). • Demolish bridge using methods to be determined by Proponent; but with the following certainties: the PA will prohibit blasting; the PA will require that demolition methods ensure protection of Groat Road such that minimal debris escaping onto roads and other surfaces; and the PA will prohibit substructure demolition to cause excessive noise and dust; the existing piles will be cut off at a specified depth and the remainder • It is anticipated that work would involve cutting the superstructure in sections and hoisting away. • It is unknown, at this time, if the existing bridge contains any hazardous materials but since the bridge is more than 50 years old and contains embedded communication conduits, the bridge will be tested for asbestos and other hazardous materials content prior to demolition and if containing hazardous material, will be handled and disposed accordingly. • Demolition will require working from the edges of the ravine and from within the ravine and this is assumed to require some slope vegetation clearing. • The existing west abutment retaining wall is to be retained. The sidewalk west of Groat Road is to be retained.
Bridge Construction	• Methods to be determined by Proponent. • Construction assumed to require: full vegetation clearing of project area, equipment access down both ravine slopes; pile drilling at all four bridge corners, concrete and steel work. • Owing to close proximity to residential areas, piles will be drilled rather than driven. • Construction of MSE wall and fill placement on SE bridge corner.
Reclamation/Landscaping	• Full reclamation of all disturbed lands not occupied by infrastructure, according to the landscaping concept shown here and more specific EIA mitigation recommendations.

4.9 Consideration of Environmental Sensitivities

During preliminary design and PA development the project team was cognizant of the need to minimize activities occurring within protected Bylaw lands. They were also aware of the sensitivities associated with working on steep ravine slopes, the presence of colluvial subsoils and the slope stability contribution of the existing vegetation. The following key decisions contributed to minimizing the project's footprint within Groat Ravine: locating staging/laydown areas outside of the Bylaw lands and other adjacent park-like lands; specifying a bridge that spanned the ravine (no piers); use of an MSE wall to reduce the footprint of localized fill; prescribing the smallest possible temporary work area while respecting obvious constructability issues. In addition, the project has acknowledged Groat Ravine as a sensitive area and included a requirement to facilitate mammalian wildlife movement and reclaim select areas to new natural areas.

With respect to environmental controls during construction, for the entire VL-W project, the City will be requiring the Proponent to comply with ENVISO and act in a manner that does not jeopardize their ISO 14001 registration. In addition, for the construction period, the following project-wide measures will be required of the Proponent.

- Prepare an EMS that is ISO 14001 compliant. Prepare a project-wide ECO Plan to City of Edmonton specifications that includes, at a minimum, the following:
    - a temporary ESC plan to City of Edmonton specifications
    - a Groat Ravine site-specific ESC plan.
    - a spill prevention and emergency response plan, that includes measures that comply with City of Edmonton and provincial spill reporting requirements.
    - a site-specific water management plan
    - a soil and contaminated soil management plan
    - general and hazardous waste management plan

- A Groat Ravine, site-specific reclamation plan. That plan shall provide for reclamation of all ravine lands not supporting infrastructure to native plant communities, with a goal to provide for biodiversity and long-term slope stability and erosion control such that the dominant appearance of all reclaimed areas is that of a native plant community.

- All disturbed parkland will be reclaimed or restored.

5.0 PROJECT IMPACTS AND MITIGATION MEASURES

5.1 Assessment Methods

5.1.1 Potential Impact Identification and Analysis

Based on the environmental context described in Chapter 3, the following Valued Ecosystem Components (VECs) were identified for impact assessment; surface water quality, ravine slope stability, vegetation, wildlife and wildlife habitat, ecological connectivity. For each VEC, potential impacts to be examined were identified by overlaying the project drawings on mapped resources, reviewing project activities, conferring with the multi-disciplinary project team members, review project reports and applying our professional experience with impact assessment and construction performance auditing in other similar projects. This filtering resulted in identification of specific potential impacts that warranted assessment.

In addition, we separately examined the potential for the following select project incidents to occur and impact natural resources:

- release of hazardous/deleterious substances on or outside of the project area and potential for migration off-site
- release of sediment or other debris on or outside of the project area and potential for migration off-site

5.1.2 Impact Characterization

Identified impacts were characterized according to guidance received from the EIA Terms of Reference (Table 5.1). Potential impacts were characterized regarding nature (positive or negative, direct or indirect), magnitude (negligible, minor, or major), duration and timing (temporary, permanent or seasonal), geographic extent and likelihood. These criteria were defined as shown in Table 5.1.

Table 5.1. Impact Descriptor Definitions.

Nature of Impact	
Positive Impact	An interaction that enhances the quality or abundance of physical features, natural or historical resources.
Negative Impact	An interaction that diminishes the abundance or quality of physical features, natural resources or historical resources.
Direct	An interaction that results in the loss or reduction of a resource/feature.
Indirect	An interaction that results in off-site impacts, such as sedimentation off-site
Magnitude	
Negligible Impact	An interaction that is determined to have essentially no effect on the resource. (Such impacts are not characterized with respect to direction duration or confidence.)
Minor Impact	An interaction that has a noticeable effect but does not eliminate a local or regional population, physical feature or affect it beyond a defined critical threshold (where that exists).
Major Impact	An interaction that affects a local or regional population, resource, or physical features beyond a defined critical threshold (where that exists) or beyond the normal limits of natural perturbation.
Duration and Timing	
Temporary Impact	A change that does not persist indefinitely.
Permanent Impact	A change that persists indefinitely.
Seasonal Impact	A change that will terminate or diminish significantly after one season.
Geographic Extent	Extent of area affected. Quantify where feasible.
Likelihood	What is the probability that the impact will occur? Is it likely or unlikely?

When applying these descriptors, we considered the practices and requirements that were described in Section 4 to be built-in mitigation measures. No additional mitigation measures were applied at the time of potential impact characterization.

5.1.3 Mitigation Development and Residual Impact Assessment

Mitigation measures were developed for all identified negative impacts. Any impact anticipated to remain following mitigation implementation was termed a residual impact. As with potential impacts, residual impacts were characterized in the following ways: nature, magnitude, duration and timing, geographic extent and likelihood.

5.2 Impact Assessment Results and Mitigation Measures

5.2.1 Surface Water

Considering the absence of natural water courses, potential construction impacts to surface water are limited to effects on water quality in the NSR as a result of accidental releases into the storm sewer system. Any spills or mobilized sediment on site could find its way to one of the six catch basins in Groat Road or one of several catch basins on the bridge or on the bridge approaches. These types of impact are assessed below as part of sections 5.2.6.1 and 5.2.6.2.

5.2.2 Ravine Slope Stability

Impacts

The City acknowledges that the project has potential to result in ravine slope instability and that in-depth geotechnical investigations have not yet been completed for VL-W at Groat Ravine. The desktop investigation concluded that the slopes are considered sensitive to cuts, fills, vegetation clearing, and altered drainage patterns. On that basis, at this point in project planning, the potential for the project to result in ravine slope instability and for instability to have far reaching consequences for existing infrastructure and natural resources is rated as a negative, direct, major, permanent, local to Groat Ravine, likely impact.

Mitigation and Residual Impact

The City acknowledges that the potential for ravine slope instability is a key project issue that requires additional investigation. Mitigation of this potential will be fully addressed through the PA. The project team is currently developing a series of PA specifications designed to ensure short and long-term slope stability at Groat Ravine. PA specifications will cover the following key Proponent requirements:

- Undertake detailed geotechnical studies to evaluate slope stability, using methods acceptable to the City, and develop appropriate stabilization measures to ensure the integrity and serviceability of completed infrastructure.
- The evaluation must account for stability of the Groat Ravine slopes from crest to toe within an area extending from 10 m north of the north edge of the replacement bridge to 10 m south of the south edge of the replacement bridge and implement stabilization measures to meet minimum factor of safety criteria.
- The Proponent will be responsible for identifying their preferred means of slope stabilization but their design must be approved by the City.

- The analysis shall address both shallow and deep-seated failure mechanisms and shall take into consideration the potential impacts of grading works, removal of vegetation cover, changes to natural drainage patterns, and rise in groundwater levels resulting from precipitation and/or urban development on slope stability and shall cover all lands within specified geographic limits.
- New slopes cannot be steeper than existing slopes.
- Attain specified long-term slope factor of safety prior to the undertaking of construction activities such as the placement of additional fill onto ravine slopes.
- Prepare a geotechnical report, for presentation to the City, demonstrating that slope stabilization measures will be sufficient to attain the required factor of safety;
- Develop and implement an instrumentation program to monitor key slope conditions, that meets PA requirements for scope, frequency and reporting.
- As required by the PA, develop and implement mitigation measures to arrest any lateral or vertical slope displacement and prevent slope degradation and damage to the SPR over Groat Ravine.
- Repair any existing erosion features on the east and west slopes of Groat Ravine, within specified geographic limits.

This EIA recognizes that the final PA specifications will necessarily be more detailed and specific. With the above issues covered in the PA to the satisfaction of the City, the project's residual impact on slope stability is expected to be reduced to negligible.

5.2.3 Vegetation

The following potential impacts to vegetation were identified as warranting examination:

- Loss or alteration of natural plant communities/rare plants
- Establishment of invasive or weedy species
- Incidental tree damage

5.2.3.1 Loss or Alteration of Natural Plant Communities/Rare Plants

Impacts

Direct loss of plant communities, both permanent and temporary, will result from construction of VL-W at Groat Ravine. The maximum possible area to be cleared is shown in Figure 14. Areas that will not support new infrastructure will be revegetated and so are shown as temporary losses. As the figure shows, there will be temporary and permanent losses of both natural plant community types. Views of the affected plant communities on the east and west sides of the ravine to the north and south of SPR bridge are shown in Plates 13-16. Clearing calculations are shown in Table 5.2. Impacts to the Deciduous Mixedwood – Mixed Shrub (DLM.1) community will be greatest on the east facing slopes of Groat Ravine. Impacts to the Non-forested – Caragana, Steep Slopes (NF.1) community will be greatest on the west-facing slopes. Small, localized impacts to Manicured (M) plant communities are anticipated in the west end of the project area.

Table 5.2. Summary of Permanent and Temporary Vegetation Loss Inside and Outside the Bylaw 7188 Boundary.

	Permanent Vegetation Loss (m^2)			Temporary Vegetation Loss (m^2)		
	Inside	Outside	Total Area	Inside	Outside	Total Area
DLM.1 Community	264	247	511	1155	340	1495
NF.1 Community	276	40	316	662	110	772
Total Area Loss (m^2)	**540**	**287**	**827**	**1817**	**450**	**2267**

The calculated permanent loss of natural plant communities is rated as negative, direct, minor, permanent, and likely impact and will amount to approximately 827 $m^{2,}$ with 540 m^2 of that inside bylaw lands. The impact of temporary loss of natural plant communities is rated as negative, direct, major, temporary and likely. That loss is rated as major because of the larger affected area (2267 m^2). Most of the temporary loss is inside bylaw lands (1817 m^2 of the 2267 m^2). Total permanent and temporary vegetation loss will be 3094 m^2.

As no rare plants have been recorded on site, there is no anticipated impact on rare plants. Additional surveys are not warranted and mitigation is not required.

Plate 13. View of vegetation southwest of Stony Plain Road bridge - Deciduous Mixedwood – Mixed Shrub (DLM.1) and Non-forested – Caragana, Steep Slopes (NF.1).

Plate 14. View of vegetation northwest of Stony Plain Road bridge - Deciduous Mixedwood – Mixed Shrub (DLM.1).

Plate 15. View of vegetation southeast of Stony Plain Road bridge and future location of MSE wall - Deciduous Mixedwood – Mixed Shrub (DLM.1) and Non-forested – Caragana, Steep Slopes (NF.1).

Plate 16. View of vegetation northeast of Stony Plain Road bridge - Deciduous Mixedwood – Mixed Shrub (DLM.1) and Non-forested – Caragana, Steep Slopes (NF.1).

Mitigation and Residual Impacts

Permanent and temporary loss of natural communities will be mitigated through the following measures:

- As was done for VL-SE, City of Edmonton Forestry will undertake canopy valuations for affected natural vegetation stands to calculate the value pursuant to the Corporate Tree Management Policy.
- In consultation with City of Edmonton Forestry, PA specifications will be developed to ensure compliance with the Corporate Tree Management Policy.
- The PA will require the Proponent to comply with specific tree removal and protection specifications (see section 4.9).
- All trees within 25 m of construction and laydown area will be protected using measures specified in the PA.
- Vegetation losses will be mitigated through landscaping and reclamation as shown on Figure 15.
- Areas shown as "new natural areas" will be landscaped to naturalized stands of native trees and shrubs. Areas shown as "Reclaim to Native Forest" will be reclaimed to a native, vertically complex, deciduous-leading mixed wood-shrub community.
- Reclamation areas will be situated within the bylaw lands; new natural areas will be situated outside the bylaw lands.
- The Proponent will be responsible for producing an acceptable suitable, detailed, naturalization plan for these areas that results in the establishment of a community comprising only native species; with total canopy that is 60% tree and 40 % shrub; has a natural community aesthetic and meets all objectives set out in the PA.

- The Proponent will be responsible for preparing an acceptable suitable reclamation plan.
- All reclamation and naturalization plans will be prepared by individuals having specified subject matter expertise in similar reclamation, forest establishment, or naturalization projects.
- All reclamation and naturalization plans will be reviewed by the City or a City representative having suitable subject matter expertise.

- Each reclamation plan will be required to meet the following objectives:
    - provide appropriate habitat for local wildlife species documented as present in
    - Groat Ravine;
    - minimize establishment of exotic and weed species;
    - provide security cover for wildlife moving under the replacement bridge
- In addition, as was done for VL-SE, the PA will include additional, more specific objectives such as final native species richness, to be developed in consultation with C of E Forestry and nautal Areas Operations.
- Non-native species will not be acceptable in reclaimed communities at handback and the Proponent will be required to take special measures to discourage re-establishment of prohibited noxious weeds, noxious weeds and exotic species.
- Unless slope stability would be compromised, prescribed measures will include removal of all soils that could harbor non-native species propagules.

With the exception of meeting or exceeding the PA standards associated with landscaping soil quality and depth, the reclamation and naturalization plan goals and objectives will override the City of Edmonton landscaping standards and the PA landscaping standards, in recognition that these are specialized areas that demand a different approach.

The total area of vegetation loss and the total area to be reclaimed and to be naturalized are reconciled in Table 5.3.

Table 5.3. Mitigation Achieved Through Reclamation to Native Forest and New Naturalization Areas

	Area Lost (m^2)	**Area Gained (m^2)**	
		Reclamation	**New Natural Area**
Permanent Vegetation Loss (m^2)	827		955
Temporary Vegetation Loss (m^2)	2267	2046	
Total Area (m^2)	**3094**	**3001**	

As Table 5.3 shows, the combination of reclaiming bylaw lands and creating new natural areas on adjacent lands comes very close to fully mitigating all vegetation losses. There will be a net loss of 93 m^2 of vegetation. Considering the degraded nature of the existing communities (for example, 71% of recorded species in the existing NF.1 community were non-native and 41% of species recorded in the existing DLM.1 community were non-native), and the above PA specifications, the reclaimed and naturalized areas will eventually support communities that are more natural, more diverse and provide higher quality habitat. In addition, in compliance with the Corporate Tree Management Policy, the value of the lost tree/shrub canopy in the ravine will be included in the overall project canopy loss calculations and the project will install replacement canopy elsewhere along the alignment. With implementation of all of the above measures, the vegetation loss is expected to be fully mitigated over time. The residual impact on vegetation is rated negligible.

The PA will also include specifications to cover the unlikely event that a rare plant species is observed on site by the Proponent's team. The Proponent shall verify the occurrence, assess ACIMS status of the observed plant, notify the City and enquire regarding appropriate action.

5.2.4 Establishment of Invasive or Weedy Species

Impacts

One prohibited noxious weed (common buckthorn) and five noxious weed species (common mullein, common tansy, creeping bellflower, creeping thistle, and sow thistle were detected in the project area, many of them frequently and throughout both treed/shrubby plant communities. A particularly large patch of creeping thistle and sow thistle was observed approximately 20-25 m north of Stony Plain Road on the east side of Groat Road (Plate 9) This patch is outside of the project area but still represents a nearby source population for the disturbed areas. Caragana will creep in from adjacent areas. Even with careful removal of poor quality soil in reclamation areas, surface disturbance associated with the demolition and construction phases of the project, could create ideal conditions for the spread of these and other noxious and prohibited noxious weeds. The potential spread of common buckthorn is of particular concern. Preventing weed establishment in the first place may be the best and most economical opportunity for weed management. Without appropriate mitigation in place, the establishment and spread of invasive or weedy species within reclaimed areas is expected, and the impact will be negative, direct, minor, permanent, local and likely.

Mitigation and Residual Impacts

The tendency for disturbed areas to harbor weeds during construction and for increased weeds in an area post-construction will be controlled and reduced through the following measures:

- Cleaning of all equipment before entering the construction area.
- Removal of weedy soils from reclamation areas.

- Cleared areas will be revegetated as soon as possible following construction with fresh topsoil and aggressive plantings, as detailed in the Proponent's reclamation plan and as approved by the City.
- The Proponent will be required to implement aggressive weed control and to monitor weeds during construction, during reclamation and during reclamation warranty.
- All weed control measures and implementation frequency will be outlined in the Proponent's Environmental Construction Operations (ECO) Plan and reclamation plan.

With careful implementation of the above measures, weeds can be controlled, and the end result could be a net reduction of weeds in the area. There will be a need for the City to undertake weed control in the early years following handback of reclaimed areas. Assuming diligent attention to this issue, the residual impact related to weeds is rated as negligible.

5.2.4.1 Incidental Tree Damage

Impacts

The project will require clearing portions of extended natural plant communities. This leaves adjacent trees vulnerable to limb, trunk and root damage during clearing or construction activity. The potential for additional tree loss as a result is rated as a negative, indirect minor, permanent, local and likely impact.

Mitigation and Residual Impacts

Impacts related to incidental tree damage will be mitigated as follows:

- PA requirements will include the environmental controls noted in Section 4.9 Among these is the requirement for the Proponent to prepare a Tree Protection Plan, compliant with City specifications. That plan will include measures to physically protect the ravine and tableland trees on the margins of the cleared areas.
- This measure will also reduce accidental clearing beyond the prescribed clearing margins.
- Monitoring of tree protection efficacy and recording of incidental damage, will be required of the Proponent.

With these measures successfully applied, the residual impact is rated as negligible.

5.2.5 Wildlife and Wildlife Habitat

The following potential impacts to wildlife and wildlife habitat were identified as warranting examination:

- Loss of terrestrial habitat due to clearing activities
- Habitat alienation during construction and operation
- Breeding bird mortality due to construction activity during breeding season
- Mortality or disturbance of special status wildlife species

5.2.5.1 Loss of Terrestrial Habitat Due to Clearing Activities

Impacts

Any loss of natural vegetation in the project area represents an associated loss of natural habitat. Areas of natural habitat to be cleared, based on the established construction limits are:

- Deciduous leading mixedwood (2006 m^2)
- Shrubby, caragana-dominated (1088 m^2)

The remainder of disturbance is in manicured areas that have little to no wildlife habitat value. As noted in the vegetation discussion, the majority of habitat loss will be temporary; a minor portion will be permanent. The habitat value of areas to be cleared is moderate to low. As a result, the anticipated combined permanent and temporary habitat loss is rated as a negative, direct, minor, local in scale (3094 m^2), and likely impact.

Mitigation and Residual Impacts

Applying all mitigation measures outlined in the vegetation section will result in establishment of areas of native deciduous-leading mixedwood forest, with a reduced exotic/weedy component and additional smaller naturalized areas supporting native trees and shrubs. This represents a loss of total habitat area but a net gain in overall habitat quality. This is considered to fully mitigate for the loss, over time. The residual impact is rated as negligible.

5.2.5.2 Habitat Alienation During Construction

Impacts

Activities and noise associated with demolition and construction phases have potential to disrupt wildlife species using adjacent habitat, leading to habitat alienation in those areas. This effectively reduces the amount of usable habitat available to individuals. However, this potential impact is rated as minor for the following reasons:

- Most wildlife species in the area are likely already adapted to human disturbance.
- Additional disturbance caused by construction activity is expected to be a minor contribution to the existing (baseline) human presence in the study area.
- Construction disturbance will be periodic over the construction period, and location specific within the project area.
- Construction will typically occur during daylight or early evening hours, leaving adjacent areas relatively undisturbed for nocturnal species.

Considering all the above, the impact of habitat alienation during demolition and construction activities is rated as negative, indirect, minor, long-term, temporary, local and likely.

Mitigation and Residual Impacts

Few mitigation measures are available. Work crews will be instructed not to harass wildlife and the Proponent's ECO plan will include worker/wildlife encounter protocols. The residual impact of habitat alienation during demolition and construction activities is therefore also rated as negative, indirect, minor, long-term, temporary, local and likely.

5.2.5.3 Breeding Wildlife Mortality Due to Construction Activity During Breeding Season

Impacts

Clearing of natural vegetation, can cause wildlife mortality, particularly during the spring and summer breeding season when the mobility of many species is restricted. During those times, adults remain close to dens and nest sites, and young are restricted to nests or not yet able to move long distances. To protect wildlife, and particularly nesting birds protected by the *Migratory Birds Convention Act* and *Wildlife Act*, current best management practice guidance provided by Environment Canada recommends avoiding vegetation clearing during the period when there is a high probability of nesting activity (i.e., high risk period). This extends to removal of individual ornamental trees and weedy, grassy areas because commonly-occurring species such as the American robin and clay-colored sparrow, which may use those areas for nesting, respectively, are covered by the legislation. When this practice is not adopted and in the absence of other mitigation measures, there can be a high potential for nest disturbance. Further, owls that occur in Edmonton are protected by the *Wildlife Act*, and are early nesters. Clearing during the period 15 February and 20 April without regard for nesting owls can result in owl nest disturbance and nestling mortality. Additionally, northern flying squirrels nest in tree cavities and are protected by the *Wildlife Act*. There is some potential for birds to nest on the underside of the existing SPR bridge. Active nests on the bridge during demolition could be in conflict with the MBCA. Should clearing due diligence not be employed, wildlife mortality resulting from clearing could occur. This would be a negative, direct, major, permanent, local and likely impact. It is rated as major because it represents contravention of the law.

Mitigation and Residual Impacts

In this region, wildlife mortality from vegetation clearing (including brush piles and tall grass) is best avoided by scheduling clearing outside of the period 20 April to 20 August. In addition, to respect the possibility of nesting owls being present, clearing of mature trees during the period 15 February and 20 April should be avoided. Therefore, if possible, this project will avoid any tree and shrub clearing/removal during the period 15 February and 20 August. If stripping/clearing must occur between 20 April and 20 August, the PA will require nest sweeps by a qualified biologist to identify active nests and appropriately buffer them. In this case, if clearing during this period is required, the Proponent will be held to the following specifications:

- a qualified biologist must provide an opinion regarding the feasibility of an effective sweep, based on the areal extent and vegetation type present;
- if feasible, the biologist will complete a nest sweep in advance of clearing and provide recommendations; and
- all observed nests of species protected by legislation must then be avoided and buffered appropriately until the nest is no longer active.

If clearing of *mature trees* must occur between 15 February and 20 April, the Proponent will be required to first have by a qualified biologist inspect treed areas for owl use and apply protective measures as above to all observed nests.

Other mitigative measures will include:

- Marking the clearing limits with snow-fence or other highly-visible means, such as tree protection measures, to minimize the extent of incidental damage and clearing and associated harm to nesting wildlife
- If bridge demolition is to occur during the nesting season, the Proponent must implement effective measures to ensure compliance with all relevant legislation

With these measures in place, wildlife mortality should be avoided and the residual impact would be negligible.

5.2.5.4 Mortality or Disturbance of Special Status Wildlife Species

Impacts

One special status species, the little brown myotis, has a high likelihood of occurrence in the project area during the summer months. Suitable foraging and roosting habitat, including maternity roosting colony habitat, is located in the deciduous leading mixedwood habitat areas east and west of Groat Road as well as on the existing SPR bridge over Groat Road and in nearby buildings, including those that will be demolished for this project. Clearing of natural vegetation and bridge and building demolition can cause bat mortality. The potential for mortality of individual, solitary bats roosting during daylight hours is low and of limited concern to bat conservation. However, there is also potential for clearing and demolition during the summer months to disturb maternity colonies and result in significant mortality as a result of females and pups exhibiting restricted mobility at these roosts. In this case, as discussed in section 3.6.2, there is a moderate to high probability of the presence of little brown myotis maternity roosts within the proposed project area. In this area, pregnant females can occupy maternity roosts as early as early May and there is potential for young flightless and/or dependant bats to be present in maternity roost colonies between late June and late August. Moreover, maternity roosts are sometimes active until mid-September, even after independence of the young (L. Wilkinson, *pers. comm.*). In the absence of mitigation, there is, therefore, potential for the proposed project to result in little brown myotis mortality if vegetation clearing or bridge demolition occurs between early May and mid-September. Should this occur, it would be a direct, negative, major, permanent, local and likely impact. It is rated major because of the species' provincial and federal rankings.

Mitigation and Residual Impacts

While the project area is not on federal lands and maternity and individual day roosting sites for this species are not yet identified by SARA as critical habitat nor are they protected by the provincial *Wildlife Act*, best management practices for conservation of this special status species are still warranted, particularly for maternity roost colonies.

VL-W construction, including utility relocation, could begin as early as 2019. To maximize planning ability, following AEP recommendations, LRT Delivery will undertake maternity roost surveys in the project area in early July 2019, when survey results can be most definitive, to determine the presence/absence of a maternity roosting colony in the project area. The survey will be done by qualified personnel using industry accepted

survey protocols. At that time, if construction is anticipated to begin in this area within the next five years, and a maternity colony is present, the City will proactively place bat houses/maternity chambers nearby so the bats have an alternate site available when the existing roost site becomes unavailable (L. Wilkinson, *pers comm.*). This early, proactive measure will also allow the bats to become accustomed to the presence of the bat houses as alternative roost sites. . Regardless of the 2019 survey results, in recognition of the fact that maternity roosts can establish at any time, the following measures will also apply to the Proponent.

As a first option, the PA will require the Proponent to schedule vegetation clearing, bridge demolition and any required building demolition during the period 16 September to 30 April, inclusive. This will avoid all potential to impact little brown myotis. In the event that the above-noted proactive mitigation is not possible, and clearing and/or demolition is required during the time when maternity roost sites may be active with pregnant females and/or flightless/dependent young, the following mitigation measures will be required and specified in the PA:

- The PA will require the Proponent to comply with all environmental laws. This will cover any future changes in legislation that afford more protection to bats.

- Clearing of native plant communities in the project area, bridge demolition, and building demolition in the project area, may be undertaken during the period May 01 and September 15, inclusive, but only following conduct of bat maternity roost surveys.

- All bat maternity roost surveys must be undertaken by biologist(s) meeting PA specified qualifications and using recognized industry best practices, including survey timing.

- In all cases, if bat maternity roosts are found, the Proponent must consult with AEP and ECCC regarding appropriate protection measures and must provide the City with a record of all correspondence with these agencies including the resulting agency recommendations.

- The Proponent must then prepare a bat mitigation plan to be submitted to the City for acceptance.

- The proponent must implement the accepted plan and provide a report documenting survey results and subsequent plans of action to the City.

- If the Proponent chooses to mitigate the risk of disturbance of bat maternity roosts by scheduling the above-noted clearing and demolition outside of the period 01 May to September 15, the Proponent will submit their intentions, in advance, in the form of a mitigation plan, signed off by qualified professionals, to the City for approval.

- If suitable roosting tree habitat is determined to be present in the project area the Proponent will attempt to leave identified mid-stage deciduous trees in the project area, to mature into future bat roosting habitat. The City recognizes that this may not be feasible but there may be potential for this to be adopted at clearing margins.

- Reclamation of the project area will include planting of larger suitable deciduous trees to accelerate bat roosting habitat replacement, in a number commensurate with maternity roost survey results.

- If the City has not already done so, if roosting colonies were found in the project area, establish a commensurate number of bat houses/maternity chambers at appropriate locations in the project area.

With these measures in place, the residual impact to little brown myotis from the proposed project will be negligible.

5.2.6 Ecological Connectivity/Wildlife Movement

The potential for the project to change ecological connectivity/wildlife movement patterns was examined.

Impacts

During demolition and construction, the associated noise and activity and possibly the presence of site fencing, will likely deter animals from moving through the ravine in this location. This is rated as a negative, indirect, minor, temporary, local and likely impact.

Our preliminary assessment is that the replacement bridge has potential to result in a slightly reduced wildlife permeability under the bridge, in the following ways. While the bridge will have the same vertical clearance in the ravine as the existing bridge it will have a slightly shorter horizontal clearance (by about 8 m). The existing informal narrow benches on the upper abutment slope will be removed and the abutment slopes under the bridge will be concrete rather than organic exposed soil, both of which will be less attractive to small and medium-sized animals. Further, the abutment slope will be about 7 m wider and, in the short term, there will be less mature vegetation (cover) at the margins of the abutment slopes. Conversely, the removal of the piers is a positive change. With the change from soil slopes to concrete slopes, ecological connectivity in general between functional habitat patches to the north and south of the bridge will be reduced. These changes are all permanent changes. Considering the above, impacts to ecological connectivity/wildlife movement as result of the replacement bridge are rated as negative, direct, minor, permanent, local and likely. Species anticipated to most affected are medium to small species, such as porcupine, snowshoe hare, white-tailed jack rabbit, fox, voles and mice.

These impacts are rated as minor not major, because at this location and increasingly further north, the habitat and corridor is reduced in quality and importance relative to the ravine reach closer to the river. Furthermore, not far north of SPR, the corridor terminates in developed neighborhoods.

Larger species, such as deer and coyote, that may regularly (although likely not frequently) move through this ravine, would likely do so at night and are capable of moving though the ravine either closer to the road, or moving up and successfully crossing over SPR. These species may currently cross over that road. The impact of this project on larger species such as deer using Groat Ravine was not considered, as part of the above impact rating, because the ravine soon terminates to the north and larger, wider-ranging species are generally perceived as incompatible in the non-park built environment. Coyotes are also not perceived as requiring assistance with moving through Edmonton neighbourhoods and are more welcome within the larger ravine network.

Mitigation and Residual Impacts

The project has acknowledged Groat Ravine as a sensitive area and at this location as serving as a medium to small species wildlife movement corridor. Preliminary design has included a requirement to reclaim certain areas as new natural areas and to facilitate small and medium-sized mammalian movement under the replacement bridge through installation of critter crossings.

The PA will include detailed guidance for critter crossing design that will include but not be limited to the following specifications:

- Installation of a critter crossing on each abutment slope to accommodate small and medium terrestrial design groups as described by the CoE Wildlife Passage Engineering Design Guidelines (Stantec 2010) (but not targeting coyotes, a member of the medium design group).
- The critter crossing shall provide a minimum 0.5 m wide level surface, positioned approximately mid-slope to provide enough head room for passage by most species.
- The critter crossing should not create a tunnel effect, but rather shall provide a flat surface having cover on the outside half of the surface for small animals such as mice and voles and leave the other side of the passage structure open (uncovered) for larger animals, such as hares.

With the above measures in place, residual impacts to wildlife movement resulting from bridge replacement are provisionally rated as positive, direct, minor, permanent, local. The rating is provisional in recognition that a formal wildlife passage assessment, following the City's Wildlife Passage Engineering Design Guidelines (WPEDG) was not undertaken. LRT Delivery commits to preparing a wildlife passage assessment, following the WPEDG and including consideration of all Ecological Design Groups known to occur, or with high likelihood to occur, in the study area and to provide the assessment to the City's ecological planners during PA development. The assessment will be of a scope suitable for a replacement bridge in this location. Final critter crossing specifications included in the PA will reflect the assessment results.

5.2.7 Project Incidents

5.2.7.1 Release of Hazardous/Deleterious Substances On or Off-Site

Impacts

Fuels, lubricants and other hazardous substances are anticipated on-site hazardous materials. Spills can occur during refueling or because of equipment failure (e.g., broken hydraulic hose) or accidents, or at storage sites. Spills can cause localized contamination of soils, plant communities, wildlife habitat on and off site and if they enter catch basins, they could travel to the NSR. Most spills would likely be small in nature, but if uncontrolled, spills could spread over large areas. Small spills are anticipated at most construction sites. Large spills are more preventable. Spill migration is particularly likely on Groat Ravine steep slopes. Unprotected catch basins in the project area that lead into the City's storm sewer system have the potential to capture unmitigated releases of deleterious materials and transmit them to downstream water bodies. Catch basins are especially vulnerable where they are situated at the foot of unprotected slopes where long slopes produce higher flow velocities and can capture higher flow volumes that could overwhelm insufficient protective measures.

If appropriate plans and practices are <u>not</u> put into place, the impact of a hazardous or deleterious substance spill could be negative, direct, minor, permanent, local and likely.

Mitigation and Residual Impacts

As noted in Section 4.9, the City will be requiring the Proponent to comply with ENVISO and act in a manner that does not jeopardize their ISO 14001 registration. In addition, for the construction period, the Proponent will be required to provide a high-performance spill prevention and emergency response plan and a hazardous waste management plan. Those plans will include specific measures related to securely protecting all roadway catch basins in the project area. The plans must also include monitoring protocols and frequency. With these in place the residual impact should be negligible.

5.2.7.2 Release of Sediment or Other Debris On or Off-Site

Impacts

Site preparation during demolition and construction activities will result in the removal of vegetation and exposing of bare soil surfaces, likely for extended periods of time. Demolition and construction activities on exposed soils can result in erosion and loss of top-soils and sub-soils, degradation of top-soil quality, weakened slope stability, or introduce sediments into downstream waterbodies via the City's storm sewer system. In areas where existing vegetation cover is cleared, exposed soils are susceptible to fluvial (surface water) erosion in wet conditions, and, to a lesser extent, aeolian (wind) erosion in dry conditions. The clearing of vegetation on steep slopes will expose soils that are especially susceptible to erosion resulting from surface runoff given high slope gradients. Eroded soils can accumulate in downslope undisturbed vegetated areas and in the ravine bottom. The unmitigated downslope movement of erodible soils or the mass wasting of a steep slope also has the potential to impact Groat Road resulting in impacts to infrastructure and traffic. If mitigation measures (controls and clean-up measures) are not put into

practice, the impact on vegetation, habitat and the NSR would be negative, direct, minor to major, permanent, local and likely.

In addition, until otherwise determined, demolition of the SPR bridge (parts of which date back to the 1950s) has potential to encounter hazardous materials. Improper attenuation and handling could result in adverse effects on vegetation, habitat and surface water. Unmitigated, the impact could be negative, direct, minor to major, permanent, local. It is, however, deemed unlikely.

Mitigation and Residual Impacts

As mentioned in Section 4.9 the City will require the Proponent to comply with ENVISO and act in a manner that does not jeopardize their ISO 14001 registration. In addition, for the construction period, the Proponent will be required to prepare a Groat Ravine site-specific temporary ESC plan, to City of Edmonton specifications, and a site-specific water management plan. These plans will also include monitoring protocols and frequency. With these plans in place the residual impact of sediment or debris release should be negligible.

The City will also ensure that a hazardous materials assessment is completed for the bridge and appropriate handling and disposal measures prescribed and implemented. With these measures in place the residual impact of hazardous materials associated with bridge demolition should be negligible.

5.3 Cumulative Effects

The cumulative effects assessment study area was defined as Groat Ravine, including the confluence with the river valley.

5.3.1 Past Projects

As noted in the historic overview provided in Section 2, Groat Ravine bottom has historically been subject to many modifications up to the 1960s. While ravine slopes have been temporarily disturbed in the process, they were generally left in, or reclaimed to, natural condition. More recent past projects in the ravine include refurbishment of the SPR bridge and replacement of 102 Avenue bridge. Neither of those projects significantly altered the built footprint in the ravine.

5.3.2 Present Projects

Currently, the City is rehabilitating Groat Road bridge over the NSR. Ancillary project works include some minor road and other bridge modifications in the north river valley. These works are linked to Groat Road and close to the ravine confluence. They may, therefore, be relevant from the perspective of Groat Ravine as a wildlife movement corridor. On that topic, the EIA for that project concluded that the proposed modifications to the three bridge structures that will be realized as a result of the proposed rehabilitation project will not modify any of the subject bridges in a manner that could influence wildlife movement. The aperture (height and width of the opening under the bridge) of all bridges will remain relatively unchanged. Accordingly, the impact to wildlife movement from

operation of the proposed Groat Road Bridges Rehabilitation Project is rated as negligible. That project did not alter any vegetation in Groat Ravine.

5.3.3 Future Planned Projects

The City also plans to slightly reconfigure the interchange (several ramps and approaching roadways), situated immediately north of Groat Road Bridge, in the NSR valley. Planned changes are minor and the resulting overall interchange footprint will be similar to what is now present. An EIA was prepared for this project, but the construction start is not yet scheduled. The EIA concluded that areas of naturally vegetated habitat situated at both the north and south edges of that study area will remain physically undisturbed and available as wildlife movement routes during construction. The reconfigured interchange was not expected to increase challenges to wildlife movement nor significantly alter the potential for wildlife-vehicle collisions. Accordingly, the potential impact of operation of the modified interchange on wildlife movement was rated as negligible.

We are unaware of any other projects planned for Groat Ravine. The proposed project represents a stand-alone intersection with Groat Ravine and will not lead to additional future development in this area. We are not aware of any proposed or planned restoration projects for Groat Ravine.

5.3.4 Conclusion

The proposed project has no potential to result in impacts that act cumulatively with impacts of past, planned or future projects.

6.0 ENVIRONMENTAL MONITORING

At present, there are no project monitoring conditions linked to regulatory approvals. However, this EIA makes several specific monitoring recommendations and the PA will require the Proponent to self-monitor throughout construction and reclamation. To do this, the Proponent will be required to engage an environmental monitor to oversee Proponent environmental performance during the full contract term. Monitoring will target meeting PA requirements, meeting specific plan requirements, particularly EMS and ECO plan requirements (e.g., monitoring of temporary ESC measures), and ensuring mitigation measures have been effectively implemented and are performing well.

In addition, the Owner's Engineer team will be responsible for PA compliance auditing during the PA term. The environmental lead will audit the Proponent environmental performance during construction and warranty periods. This will involve review of submitted plans and field oversight. The PA Non-Conformance process will be followed for any deficiencies noted.

All specific monitoring requirements included as mitigation measures in Section 5 of this EIA will be included in the PA. In addition, many of the environmental plans required of the Proponent have associated monitoring components. Monitoring details will be fleshed out as the Proponent prepares their environmental plans. Key construction monitoring requirements specified in Section 5, summarized by VEC, include:

- Ravine Slope Stability
    - Monitor ravine slope stability
- Vegetation
    - Monitor performance of Tree Protection Plan.
    - Monitor weeds/exotic species on site.
    - Monitor reclamation performance.
- Wildlife/Ecological Connectivity/Wildlife Movement
    - There are no monitoring requirements for these VECs.
- Project Incidents
    - Monitor performance of all temporary ESC measures, including at catch basins.
    - Monitor project area margins to ensure there is no migration of deleterious substances or other debris off site.
    - Monitor all spill clean up efforts.

7.0 PUBLIC CONSULTATION

Public input has played an essential role in shaping the Valley Line LRT, from the identification of the corridor in 2009, through the development of the concept plan, to the completion of preliminary design in 2013. With the initiation of the latest phase (advancement of preliminary design and procurement readiness), public engagement has continued.

The City has established five Citizen Working Groups along the VL-West LRT alignment. These groups are a major method of engaging with neighbouring communities during the updating of preliminary design, procurement, detailed design and construction of the Valley Line West LRT. Groat Ravine is situated at the boundary of two Citizen Working Groups - G (Stony Plain Road) and F (Downtown/Groat). Initial meetings of these working groups took place in fall 2017 and continue in 2018. Meetings are open to the public. The most recent meetings were in April 2018.

The City provides regular webpage project updates and in October 2017 published a VL-W booklet, in which the crossing of Groat Ravine was clearly shown. Several VL-W open houses have been held in 2017 and 2018, some overarching and some targeting specific issues or locations.

- On November 15 and 16, 2017 a public open house was held to share refinements to the LRT preliminary design. Results of the recent assessment of LRT crossings at key intersections were also provided, including what we heard during the previous engagements.
- On June 21 and 29, 2017, residents were asked to provide input on any issues and opportunities to consider for the crossing assessments at 149 Street and 178 Street along the alignment.
- On January 24, 2018 a public information and engagement session was held to further update the community on planned adjustments and refinements to the preliminary design, including LRT crossings and to collect additional public input. Displays included a board highlighting two locations where VL-W would intersect with Bylaw 7188 lands: Groat Ravine and MacKinnon Ravine and informed the public of environmental assessment preparation.
- On July 26, 2018, Citizens were invited to view possible design options for SPR one way, 149 St to 156 St and to share their feedback and perspectives.
- On 28 August 2018, a public information session was held to share information about project plans affecting areas within the River Valley Bylaw boundaries and invite comments. EIA findings to date were displayed. Results of that session will be included in the report to Council for their review of the Groat Ravine Crossing EIA, MacKinnon Ravine EIA and joint SLS.

8.0 CONCLUSIONS

8.1 Impacts and Sensitivities

This EIA has shown that with the described mitigation measures applied, all but two impacts related to the construction phase can be mitigated such that adverse residual impacts are reduced to negligible.

Key sensitivities identified for this proposed project are:

- slope stability, and
- loss of ravine vegetation that is integral to shallow slope stability, wildlife habitat and wildlife movement.

Importantly, all of the natural vegetation communities that would be removed to accommodate construction have been degraded by high abundances of exotic species and frequent incidences of weed species. The clearing required for this project represents an opportunity for reclamation efforts to establish a native forest community and result in a net gain in biodiversity and habitat quality. This will be achieved through a significant reclamation effort, guided by a detailed plan to be prepared by the Proponent to the City's specifications. Reclaimed areas would be handed back to the City as young communities and would therefore need stewardship for several years on.

The project is anticipated to result in two temporary negative residual impacts related to wildlife. Construction activities and related noise have the potential to result in habitat alienation in adjacent areas, and to block wildlife passage. Both impacts were rated as negative, indirect and temporary. Few mitigation measures are available for this type of impact. Work crews will be instructed not to harass wildlife and the Proponent's ECO plan will include worker/wildlife encounter protocols. These temporary and minor unmitigable impacts will persist for the duration of the project but will cease upon construction completion.

Conversely, preliminary design has included a requirement to facilitate small and medium-sized mammalian movement under the replacement bridge through installation of wildlife passage features (critter crossings). These permanent measures will result in a minor improvement to ecological connectivity upon project delivery. A more formal wildlife passage assessment remains to be undertaken to satisfy the City's WPEDG.

Considering all of the above, and that communication with City stakeholders remains open during PA development, we are of the opinion that the proposed project does not require additional modifications to proceed responsibly.

8.2 EIA Limitations

This EIA was founded on preliminary design drawings and reports and little construction methodology information. This potential limitation was countered by the ability to develop mitigation measures that will be fleshed out and incorporated into the PA. The EIA was predicated on the knowledge that the City is developing a targeted PA that will include

significant environmental controls intended to induce excellent environmental performance by the Proponent.

8.3 Summary of Key Mitigation Measures

The following represents a list of key mitigation measures selected to itemize important action items for future project stages.

- The City must ensure that the PA captures all the mitigation measures listed in detail in *Section 5.2.2* and summarized here, to address slope stability:
  - Undertake detailed geotechnical studies
  - Prepare a geotechnical report for acceptance by the City
  - Implement a slope movement monitoring program
  - Repair any existing slope erosion features

- The City must ensure that the PA captures all the mitigation measures listed in *Section 5.2.3* and distilled here, to address vegetation loss and ensure compliance with the Corporate Tree Management Policy:
  - Prepare a detailed landscape plan
  - Prepare a detailed reclamation plan
  - Prepare a detailed tree protection plan
  - Remove soils harbouring non-native species propagules, if slope stability allows
  - Revegetate cleared areas promptly
  - Discourage weed establishment
  - Implement weed control and monitoring

- In addition, the City is responsible for undertaking a canopy inventory and valuation for Groat Ravine vegetation to support the PA requirements and Tree Protection Plan approach.

- The City must ensure that the PA captures all the mitigation measures listed in *Section 5.2.4* and *5.2.5* to mitigate potential wildlife impacts and ensure compliance with all Provincial and Federal Acts pertaining to wildlife. Note that vegetation clearing timing is a critical issue. Several recommendations have been made to definitively avoid harm to breeding bats and birds. Wildlife passage concerns will be more fully explored.

- The City must ensure that the PA includes all mitigation measures listed in *Section 5.2.6.1* and distilled here, to ensure compliance with ENVISO and all environmental regulations.
  - Prepare a detailed spill prevention plan
  - Prepare a detailed emergency response plan
  - Prepare a detailed hazardous waste management plan

- The City must ensure that the PA captures all mitigation measures listed in *Section 5.2.6.2* and distilled here to ensure compliance with ENVISO and all environmental regulations:
  - Prepare a detailed temporary ESC plan
  - Prepare a detailed water management plan
  -

9.0 REFERENCES

9.1 Literature Cited

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9.2 Personal Communications

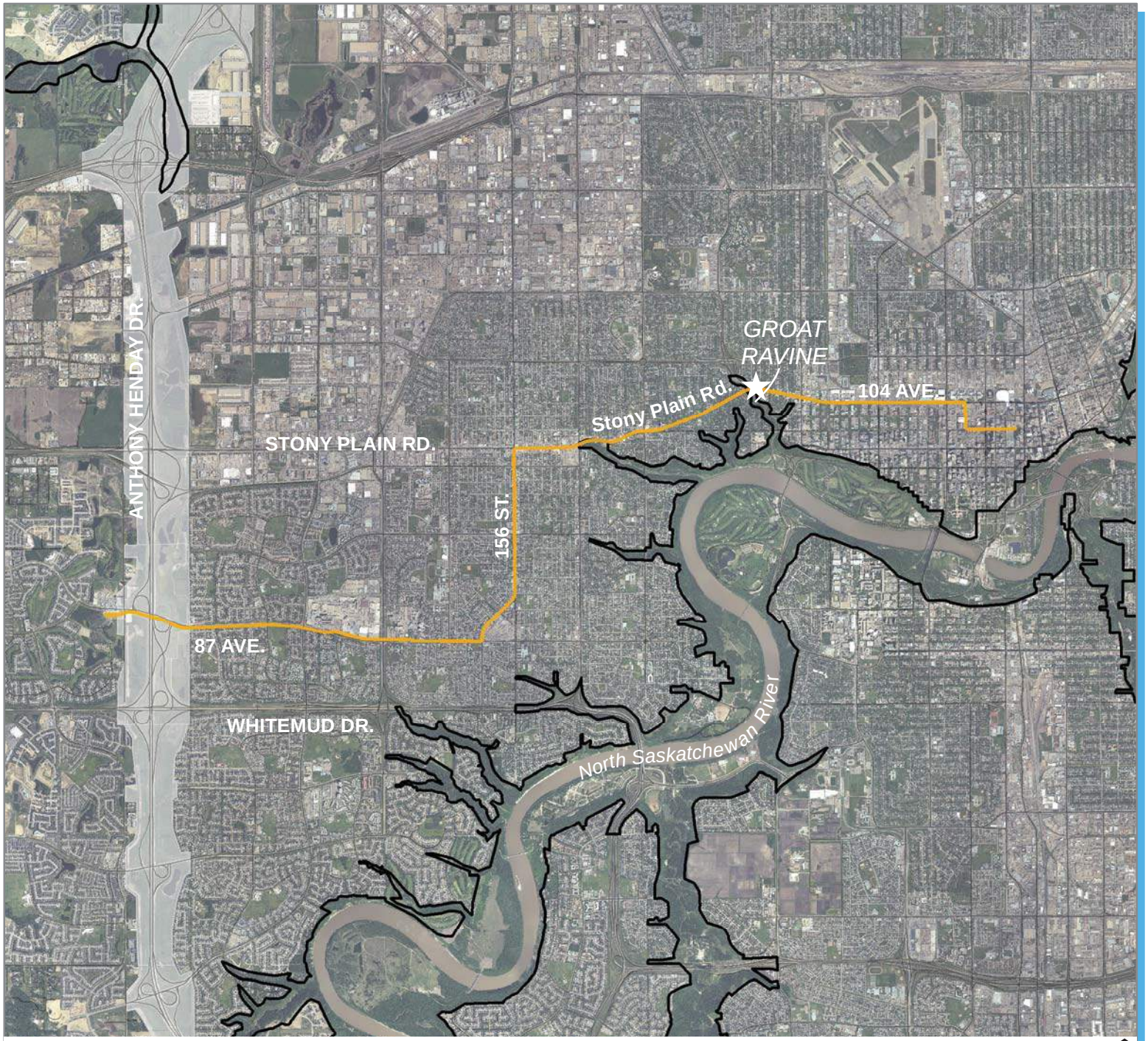
Pybus, Margot, Ph.D. Provincial Wildlife Disease Specialist. AEP (formerly AESRD). Communication in 2015 with Elly Knight of Spencer Environmental and Communication in 2018 with Andra Bismanis of Spencer Environmental. Edmonton, Alberta

Maslen, Lynn, M.Sc, P.Biol. Vice President, Science Practice. Spencer Environmental Management Services Ltd. Communication in 2015 with City Root for Trees Program administrators. Edmonton, Alberta

Wilkinson, Lisa, M.Sc., Provincial Bat Specialist. AEP. Communication in 2018 with Andra Bismanis of Spencer Environmental. Edmonton. Alberta.

Appendix A: Figures

Figure 1.
Project Location
Groat Ravine
Valley Line West EIA



Legend

- Proposed Track Alignment
- Bylaw 7188 Boundary
- TUC & Anthony Henday Drive

EIA PROJECT AREA

Date Map Created: 10 September 2018
Aerial Photograph Date: May 2017

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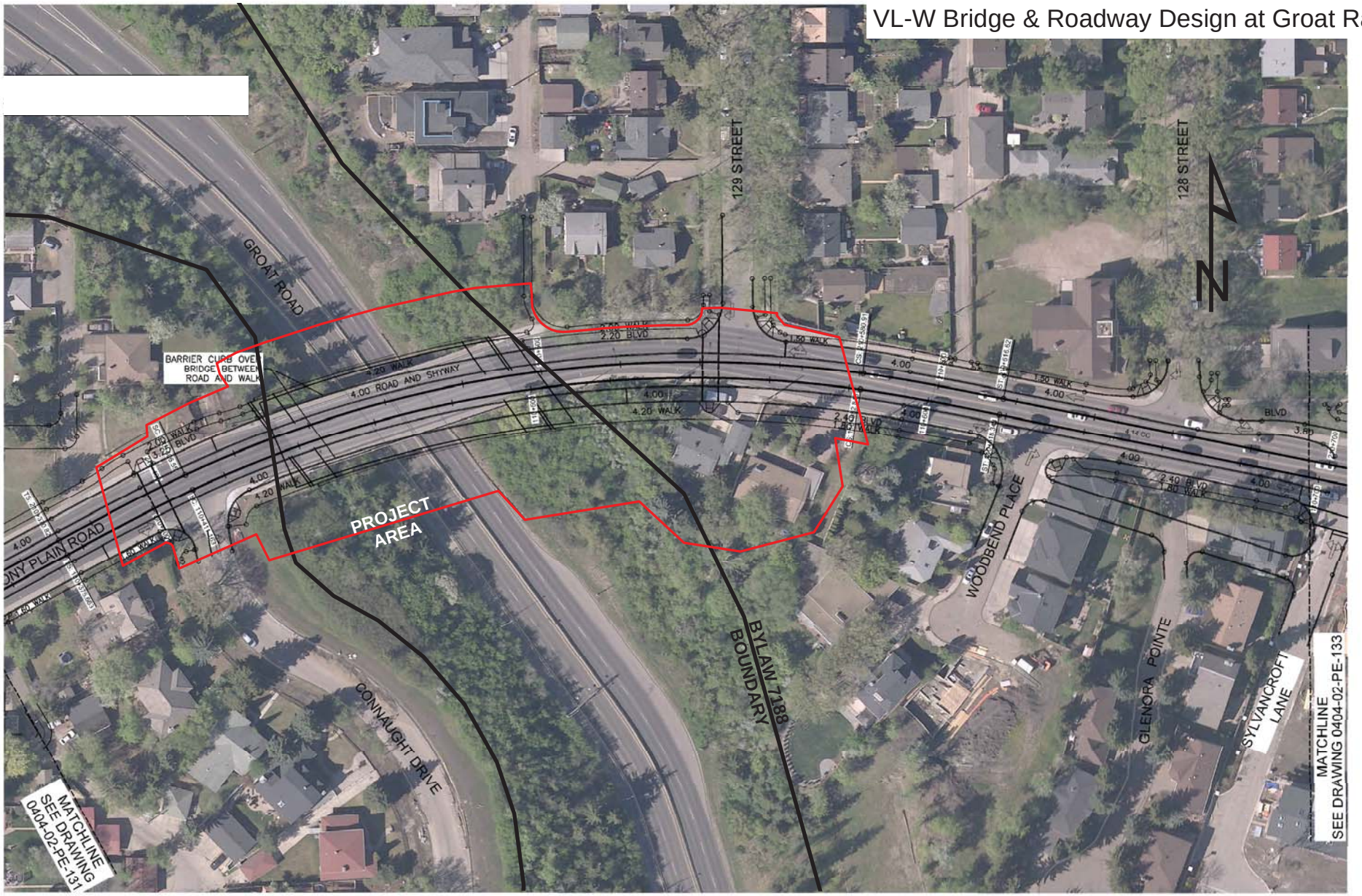
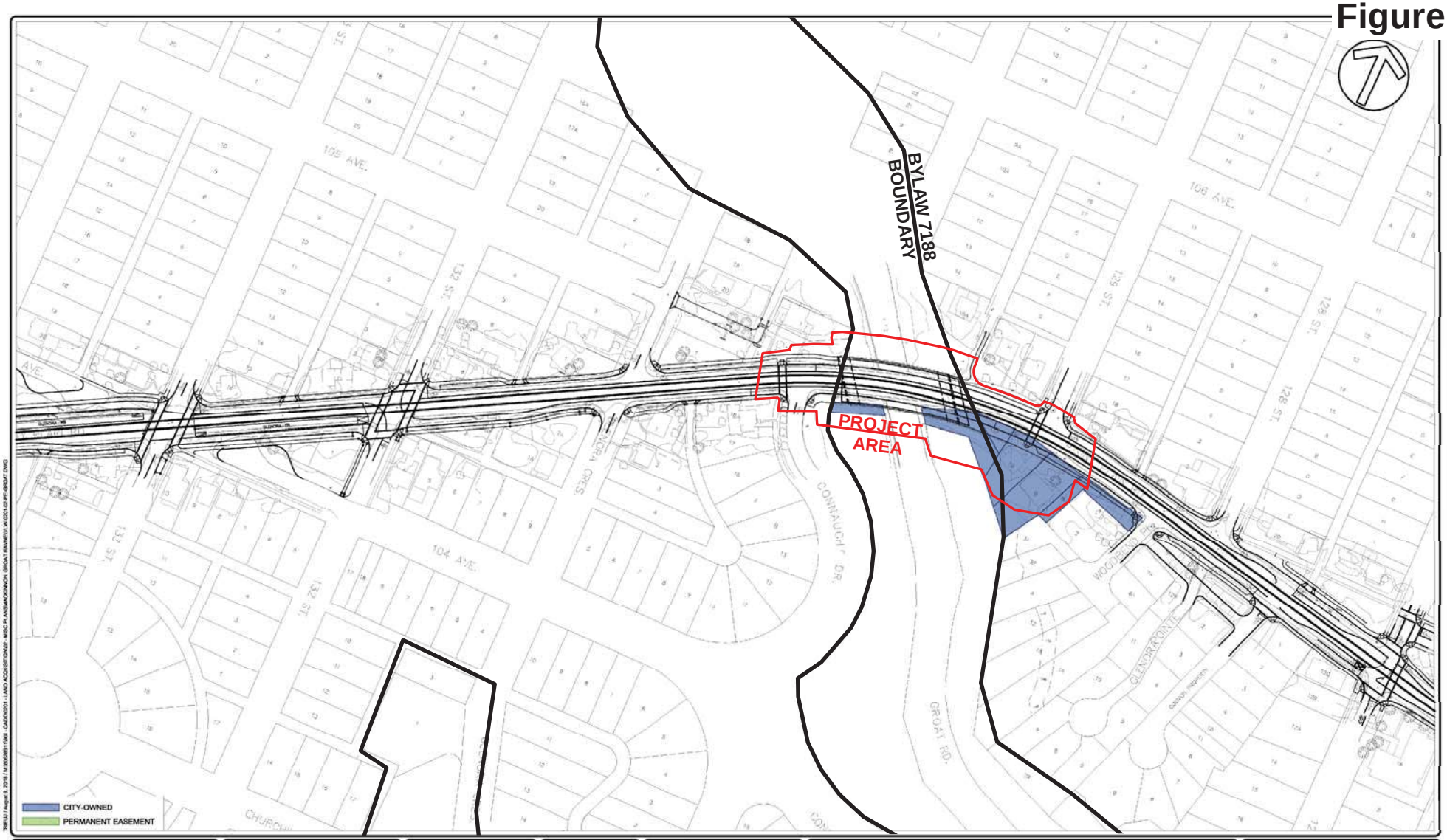
Figure 2.

VL-W Bridge & Roadway Design at Groat Ravine



**Source: Adapted from Roadways, Alignment drawing VLW-0404-02-PE-132, for presentation.*
***Note: City of Edmonton Bylaw 7188 (2008) boundary and project area boundary added by Spencer Environmental for reference.*

Figure 3.



AECOM Consultant | AECOM Prime Consultant | HATCH | ISL Engineering and Land Services | DIALOG | MOTT MACDONALD

Edmonton

PRELIMINARY ENGINEERING DRAWINGS NOT FOR CONSTRUCTION

LRT CIVIL WORK
LEWIS FARMS STOP TO CENTRE WEST STOP
GROAT RAVINE
CITY–OWNED PROPERTIES

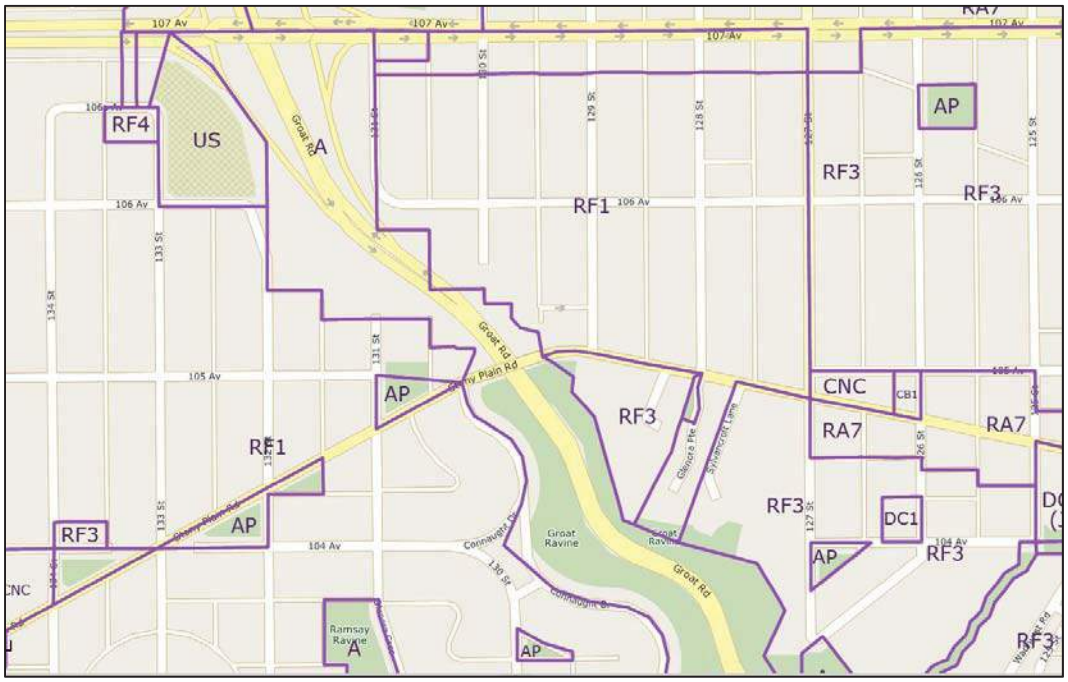
VALLEY LINE WEST LRT
LEWIS FARMS TO DOWNTOWN

Note: City of Edmonton Bylaw 7188 (2008) boundary and project area boundary added by Spencer Environmental for reference.

Figure 4.

Project Vicinity Zoning

- A (Metropolitan Recreation Zone)
- RF (Residential)
- AP (Park)



**Source: City of Edmonton: SLIM Maps – Zoning. Accessed August 2018. https://maps.edmonton.ca/map.aspx?lookingFor=Zoning*

Figure 5. Environmental Sensitivities - Original (2016)

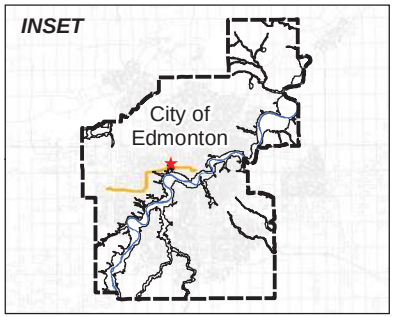
Groat Ravine
Valley Line West EIA

Legend

- Expanded Study Area
- Project Area
- Bylaw 7188 Boundary
- Contours

City of Edmonton Environmental Sensitivity*

- Extremely High Value
- Very High Value
- High Value
- Moderate Value



Date Map Created: 17 September 2018
Aerial Photograph Date: May 2017

SPENCER ENVIRONMENTAL MANAGEMENT SERVICES LTD.

*Data subset: Solstice Canada, 2016. Environmental Sensitivity Project, Model data. Prepared for: The City of Edmonton, Alberta. Prepared by: Solstice Canada. Edmonton Alberta.

Figure 6. Environmental Sensitivities - Updated

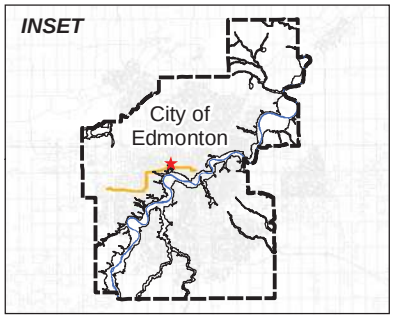
Groat Ravine
Valley Line West EIA

Legend

- Expanded Study Area
- Project Area
- Bylaw 7188 Boundary
- Contours

City of Edmonton Environmental Sensitivity*

- Extremely High Value
- Very High Value
- High Value
- Moderate Value



Date Map Created: 17 September 2018
Aerial Photograph Date: May 2017

SPENCER ENVIRONMENTAL MANAGEMENT SERVICES LTD.

*Updated by Spencer Environmental, based on 2017 site-specific survey data.

Figure 7.
Existing Natural Plant Communities - Expanded Study Area

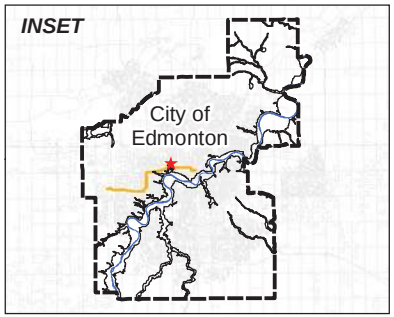
Groat Ravine
Valley Line West EIA

Legend

Bylaw 7188 Boundary

Plant Communities*

- Deciduous Mixedwood - Mixed Shrub (DLM.1)
- Non-Forested - Caragana, Steep Slopes (NF.1)
- Manicured (M)



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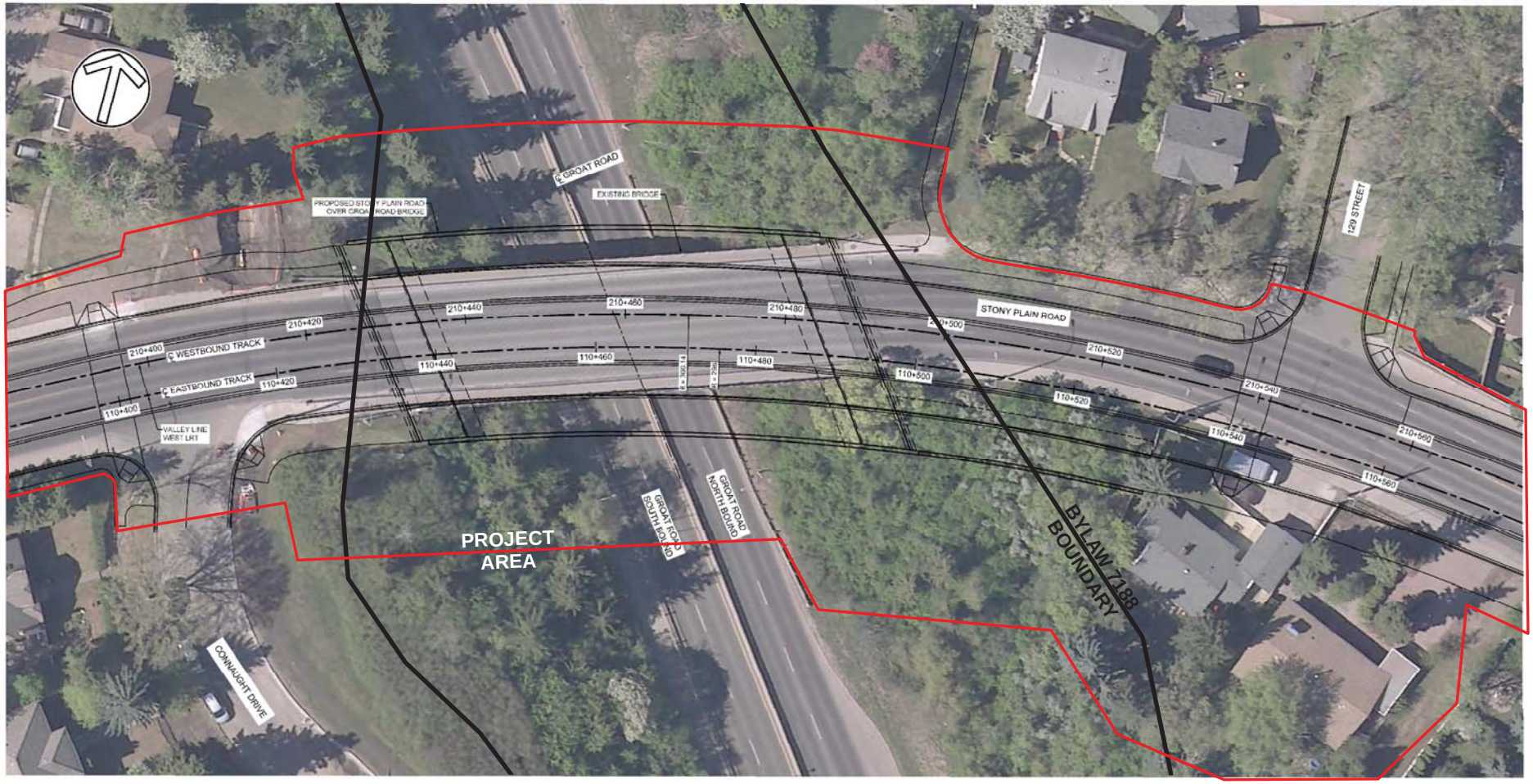
SPENCER ENVIRONMENTAL MANAGEMENT SERVICES LTD.

*Classification based on the Urban Ecological Field Guide for the City of Edmonton (2015).

Figure 8.



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B	ISSUED FOR 90% REVIEW	23-11-17	R.L.
A	ISSUED FOR 60% REVIEW	31-07-17	R.L.

issue date

no.	description	date	checked

revisions

AECOM Consultant

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drawn by C. AMANDO | designed by n. LEE

checked by B. RAMSAY | date 05-04-2018

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consultant job no 60528911

seal: PROFESSIONAL ENGINEER RICHARD LEE ALBERTA APRIL 6, 2018

consultant reviewed by B. RAMSAY

AECOM Prime Consultant

Edmonton

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prime consultant job no 60528911

prime consultant reviewed by M. PERRY

PRELIMINARY ENGINEERING DRAWINGS NOT FOR CONSTRUCTION

drawing title: STONY PLAIN ROAD OVER GROAT ROAD BRIDGE

SITE PLAN

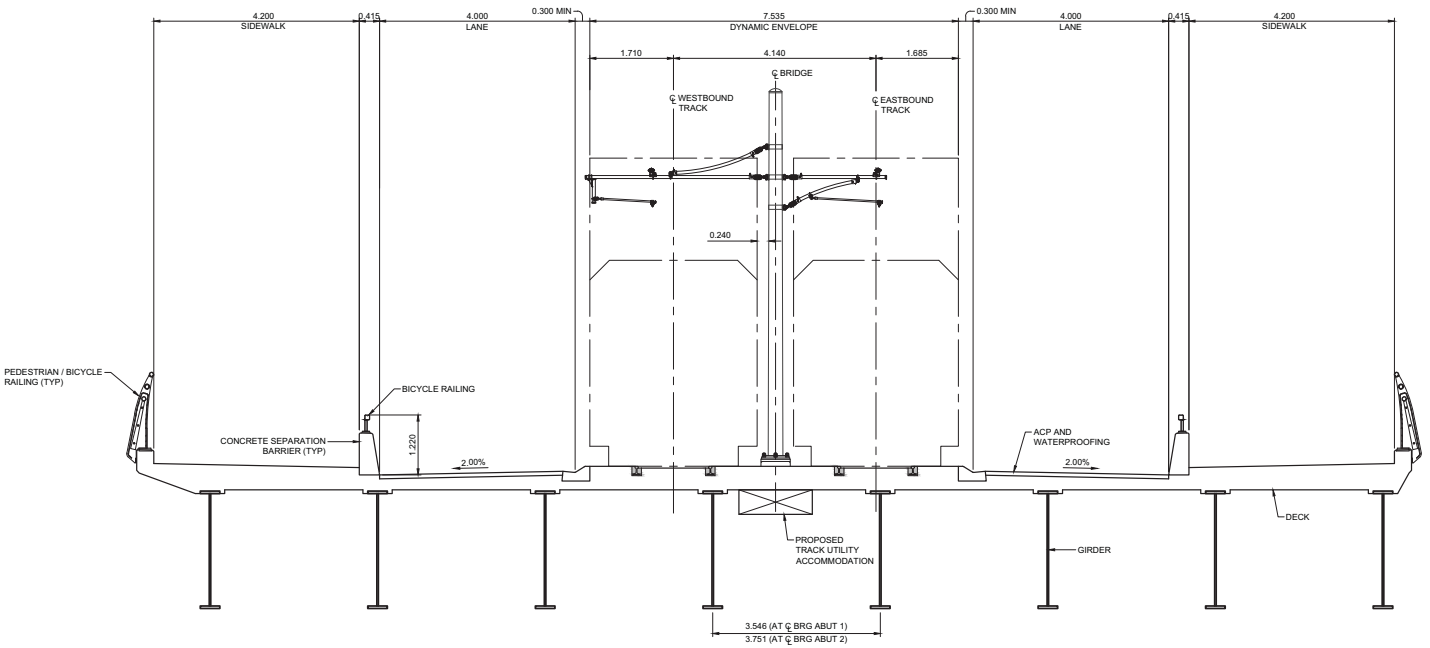
VALLEY LINE WEST LRT

LEWIS FARMS TO DOWNTOWN

drawing no. VLW-0412-01-PE-001 | REV 0 | SHT 2

Note: City of Edmonton Bylaw 7188 (2008) boundary and project area boundary added by Spencer Environmental for reference.

Figure 9.



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	issue data		

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	revisions		

AECOM Consultant

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checked by B. RAMSAY | date 05-04-2018

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consultant reviewed by B. RAMSAY

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Edmonton

prime consultant job no 60528911

prime consultant reviewed by M. PERRY

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PRELIMINARY ENGINEERING DRAWINGS NOT FOR CONSTRUCTION

drawing title
STONY PLAIN ROAD OVER GROAT ROAD BRIDGE
CONCRETE DECK WITH STEEL GIRDERS
TYPICAL DECK CROSS SECTION

VALLEY LINE WEST LRT
LEWIS FARMS TO DOWNTOWN

drawing no. VLW-0412-01-PE-004 | REV 0 | SHT 5

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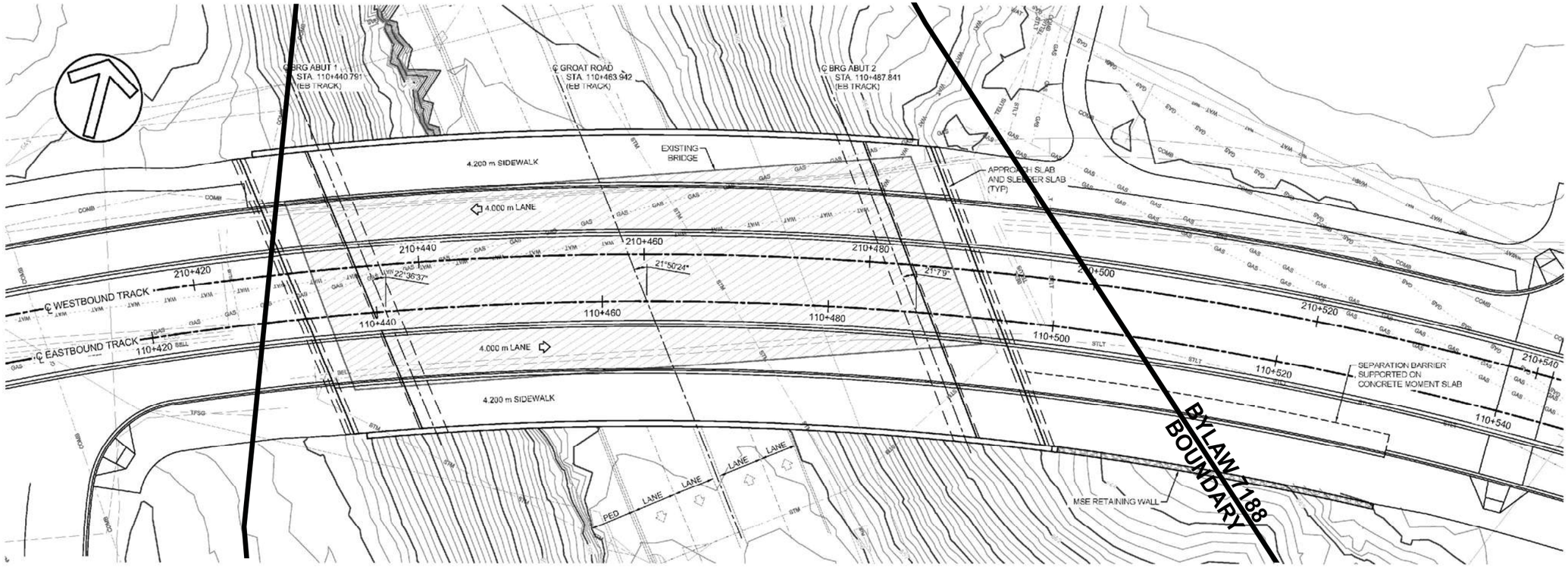

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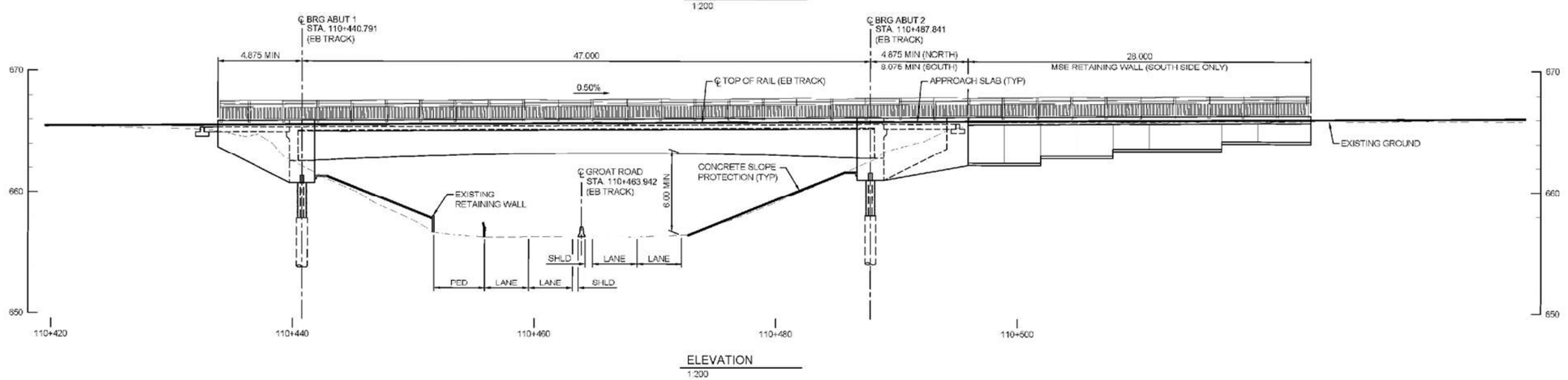

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no.	revisions	date	checked

AECOM Consultant

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checked by B. RAMSAY | date 05-04-2018

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Date APR 25, 2018
PERMIT NUMBER: P10450
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consultant job no 60528911

seal
PROFESSIONAL ENGINEER ALBERTA RICHARD LEE
APRIL 5, 2018

consultant reviewed by B. RAMSAY

AECOM Prime Consultant

Edmonton

prime consultant job no 60528911

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PRELIMINARY ENGINEERING DRAWINGS NOT FOR CONSTRUCTION

prime consultant reviewed by M. PERRY

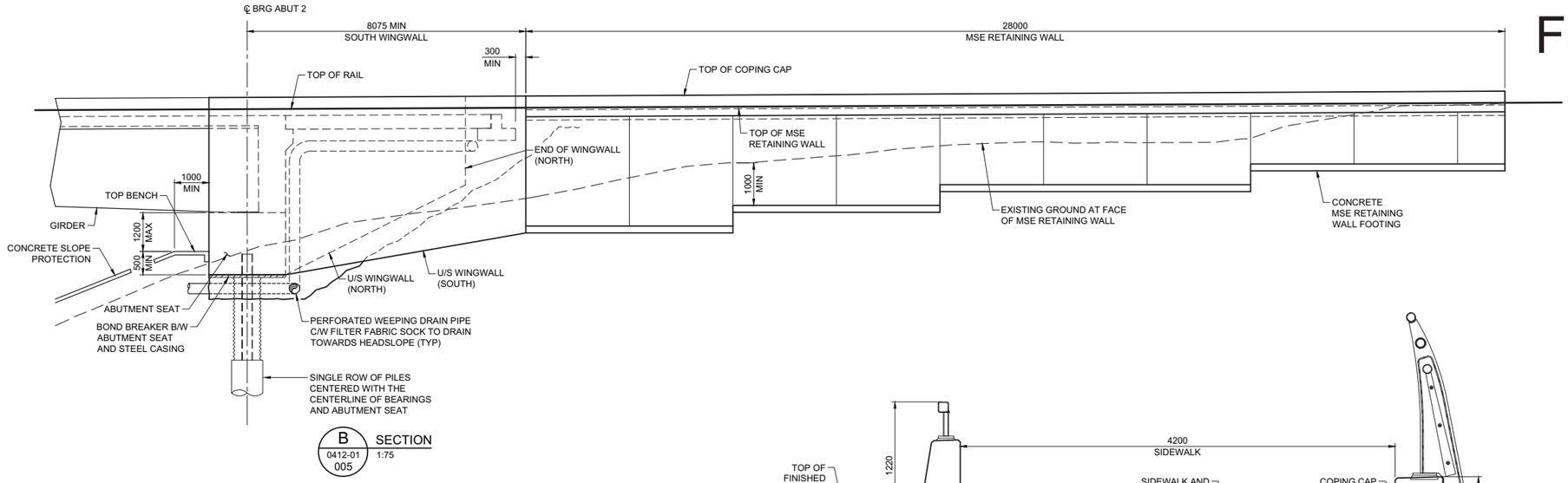
drawing title
STONY PLAIN ROAD OVER GROAT ROAD BRIDGE
GENERAL ARRANGEMENT PLAN AND ELEVATION

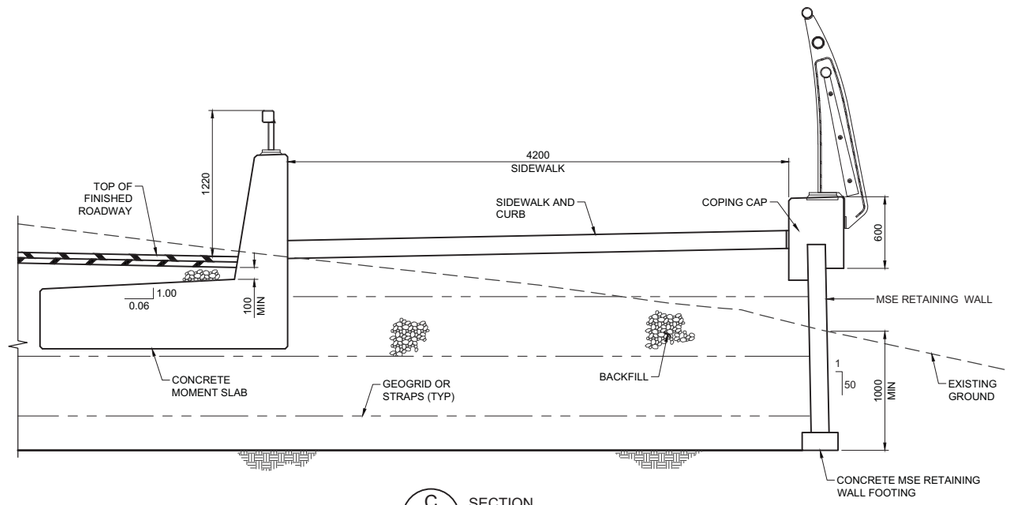
VALLEY LINE WEST LRT
LEWIS FARMS TO DOWNTOWN

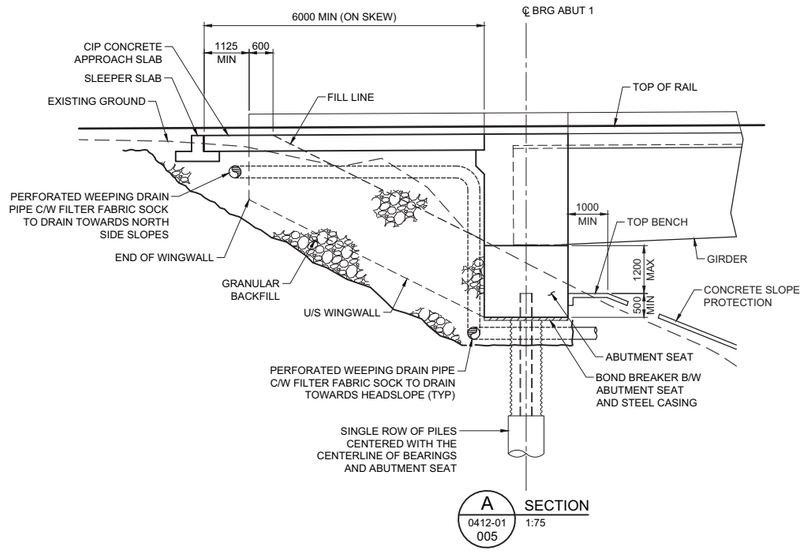
drawing no. VLW-0412-01-PE-003 | REV 0 | SHT 4

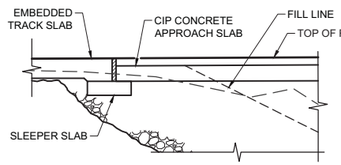
Note: City of Edmonton Bylaw 7188 (2008) boundary added by Spencer Environmental for reference.

Figure 11.









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A	ISSUED FOR 60% REVIEW	31-07-17	R.L.

no.	description	date	checked
	revisions		

AECOM Consultant

A1 bar scale: AS SHOWN

drawn by: C. AMANDO | designed by: R. LEE

checked by: B. RAMSAY | date: 05-04-2018

permit: PERMIT TO PRACTICE AECOM CANADA LTD. Signature Bob Ramsay Date APR 5, 2018 PERMIT NUMBER: P10450 The Association of Professional Engineers and Geoscientists of Alberta

consultant job no: 60528911

seal: PROFESSIONAL ENGINEER ALBERTA RICHARD LEE APRIL 5, 2018

consultant reviewed by: B. RAMSAY

AECOM Prime Consultant

Edmonton

prime consultant job no: 60528911

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PRELIMINARY ENGINEERING DRAWINGS
NOT FOR CONSTRUCTION

prime consultant reviewed by: M. PERRY

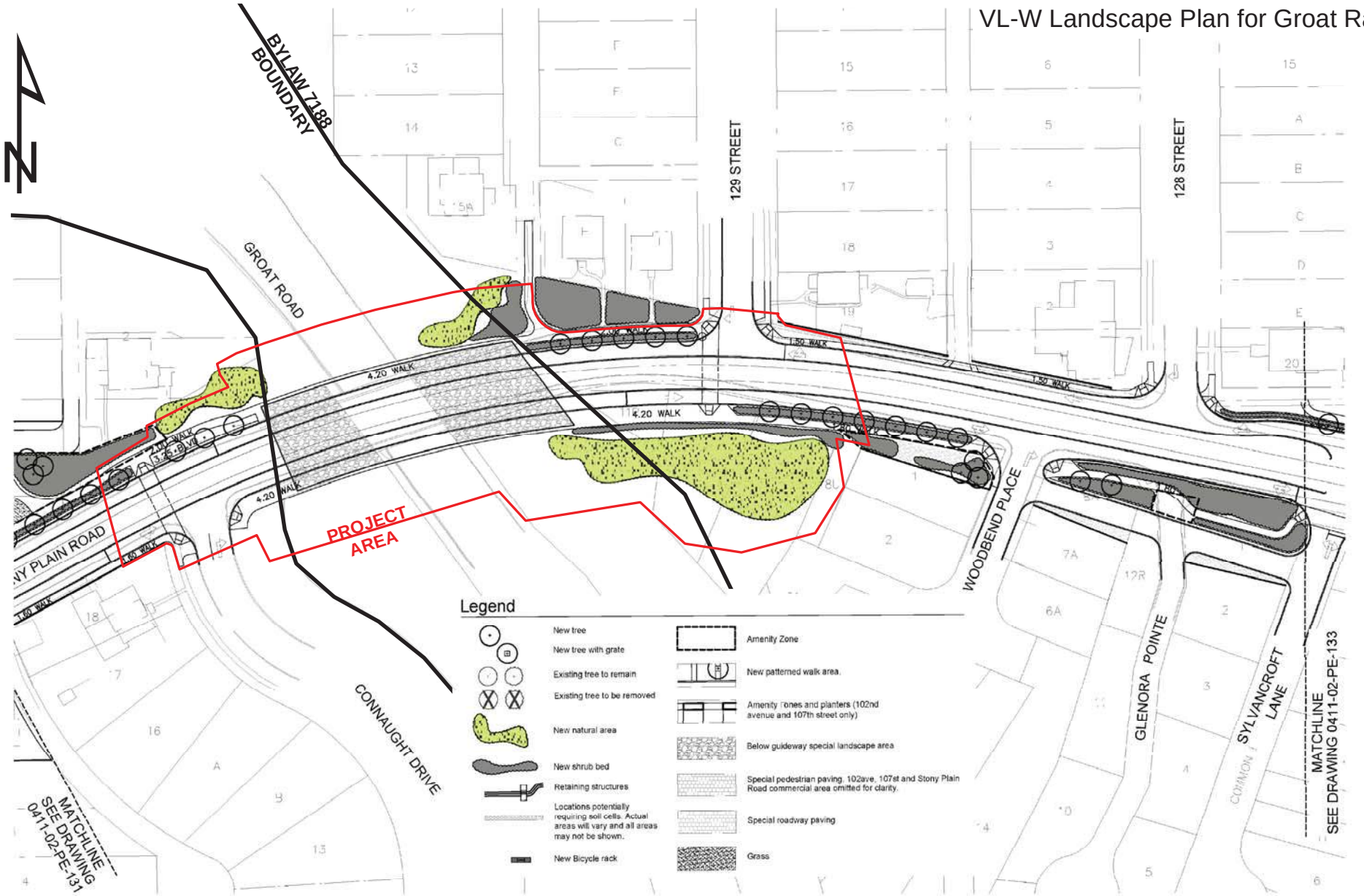
drawing title
STONY PLAIN ROAD OVER GROAT ROAD BRIDGE
ABUTMENT
SECTIONS AND DETAILS

VALLEY LINE WEST LRT
LEWIS FARMS TO DOWNTOWN

drawing no. VLW-0412-01-PE-006 | REV 0 | SHT 7

Figure 12.

VL-W Landscape Plan for Groat Ravine



**Source: Adapted from Landscape, Alignment drawing VLW-0411-02-PE-132, for presentation.*

***Note: City of Edmonton Bylaw 7188 (2008) boundary and project area boundary added by Spencer Environmental for reference.*

Figure 13.

Conceptual Critter Crossing

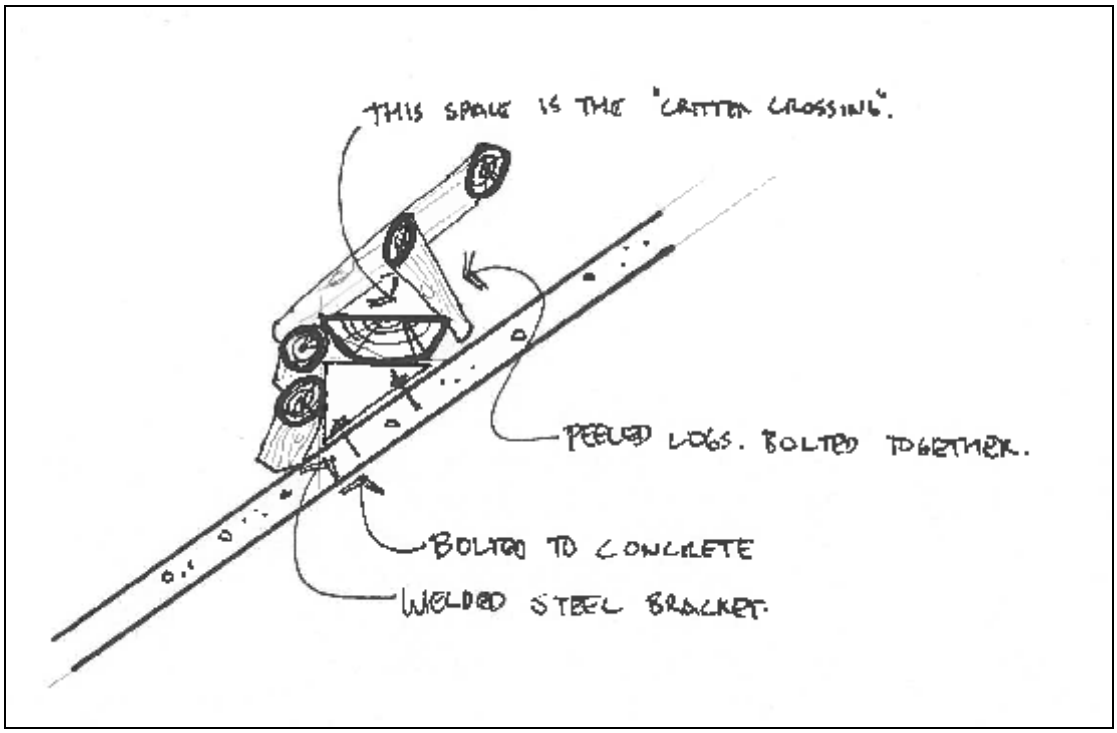
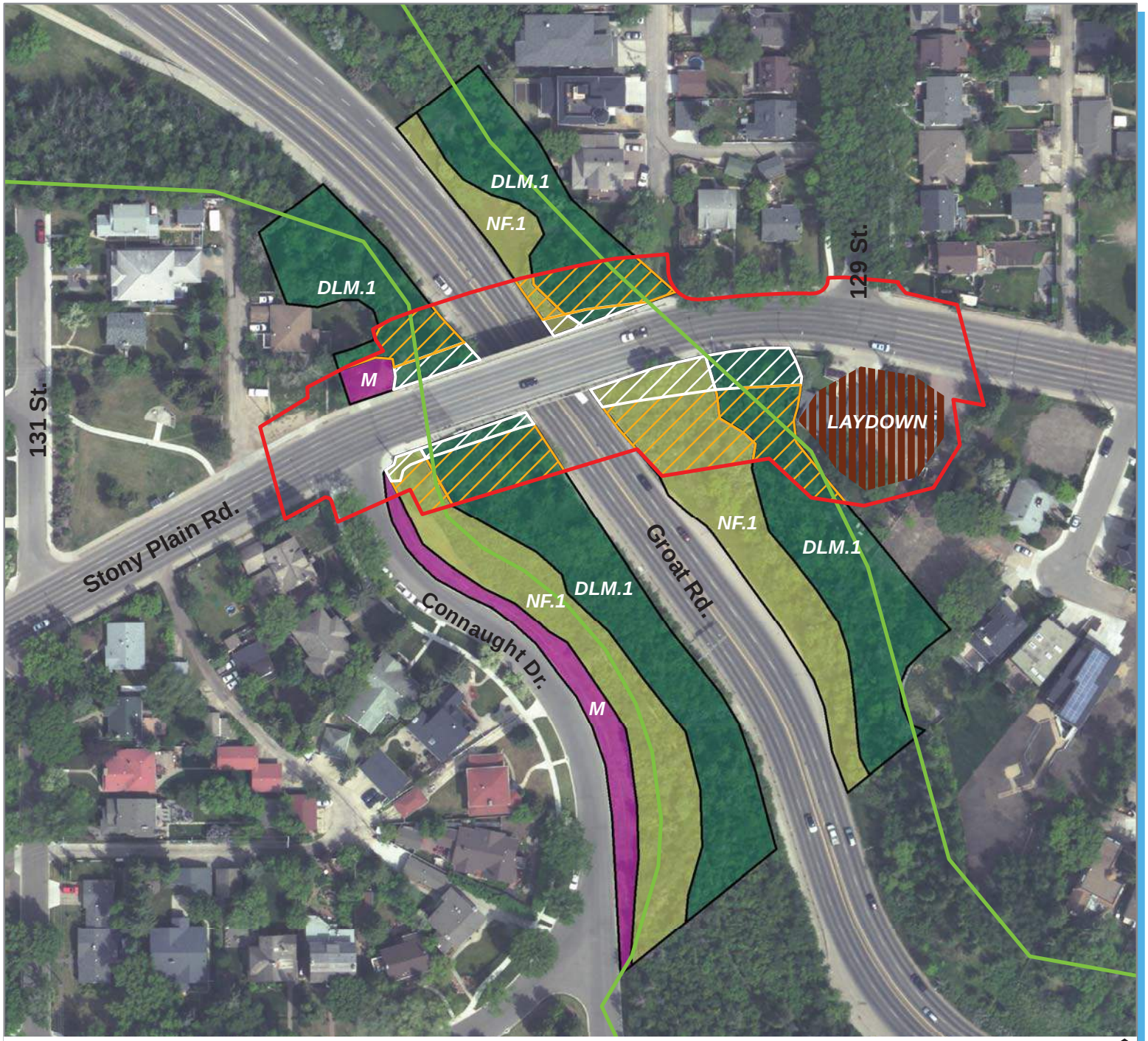


Figure 14. Permanent & Temporary Natural Vegetation Loss

Groat Ravine
Valley Line West EIA



Legend

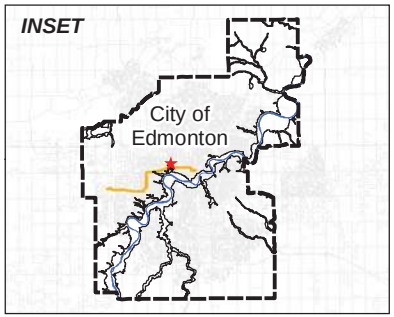
- Project Area
- Bylaw 7188 Boundary

Natural Vegetation Loss

- Permanent
- Temporary

Plant Communities*

- Deciduous Mixedwood - Mixed Shrub (DLM.1)
- Non-Forested - Caragana, Steep Slopes (NF.1)
- Manicured (M)



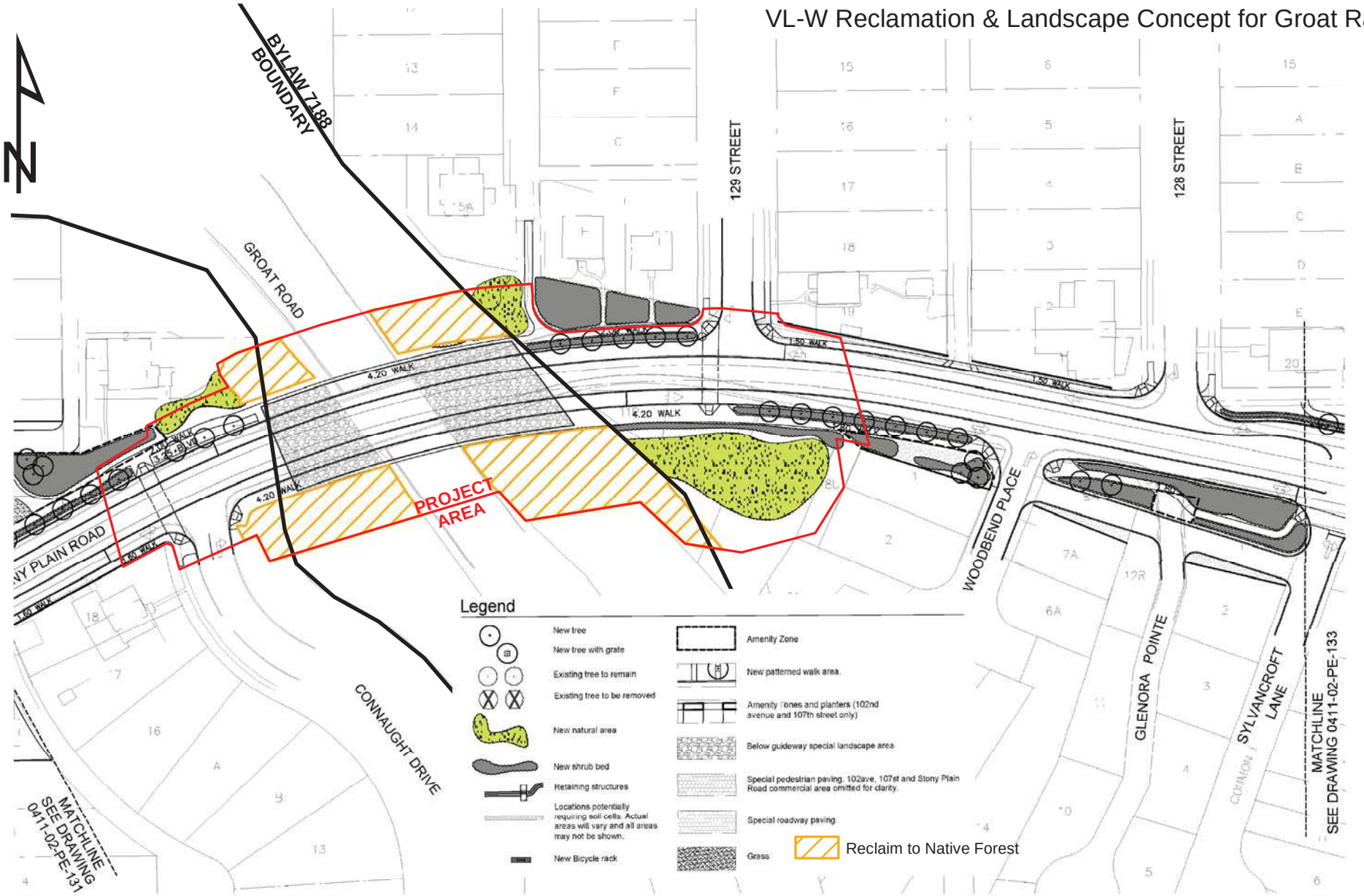
Date Map Created: 10 September 2018
Aerial Photograph Date: May 2017

SPENCER ENVIRONMENTAL MANAGEMENT SERVICES LTD.

*Classification based on the Urban Ecological Field Guide for the City of Edmonton (2015).

Figure 15.

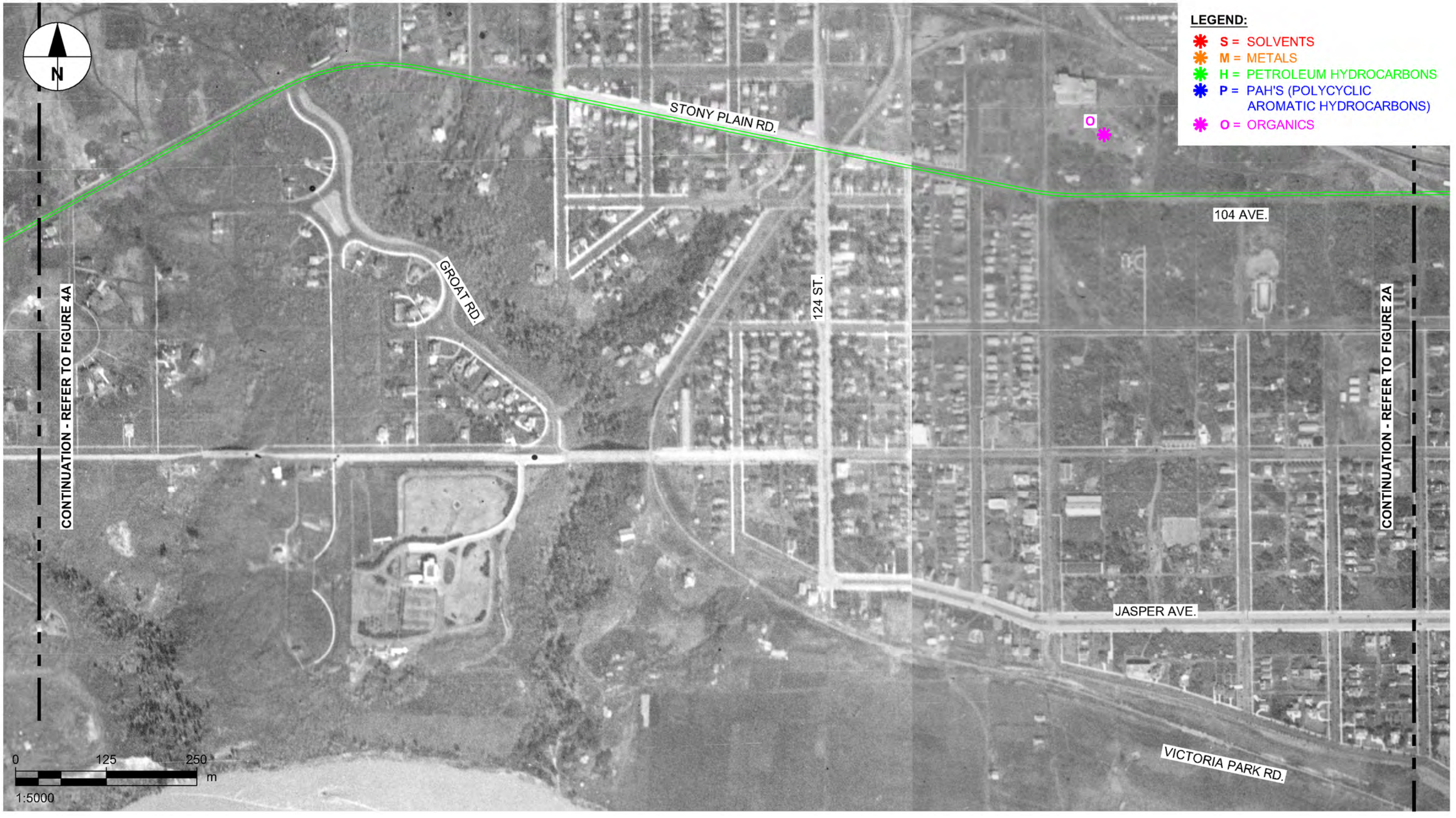
VL-W Reclamation & Landscape Concept for Groat Ravine



**Source: Adapted from Landscape, Alignment drawing VLW-0411-02-PE-132, for presentation.*

***Note: Reclamation area, City of Edmonton Bylaw 7188 (2008) boundary and project area boundary added by Spencer Environmental for reference.*

Appendix B: Historical Aerial Photographs (AECOM 2017)



LEGEND:

- **S =** SOLVENTS
- **M =** METALS
- **H =** PETROLEUM HYDROCARBONS
- **P =** PAH'S (POLYCYCLIC AROMATIC HYDROCARBONS)
- **O =** ORGANICS

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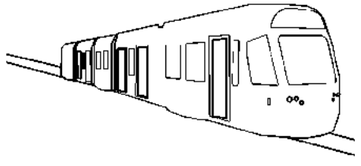

VALLEY LINE WEST LRT

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Date Issued: October 16, 2017

Historical Aerial Photographs - Oliver and Westmount Segment
Phase I Environmental Site Assessment
1920 Aerial Photographs

FIGURE 3A

**Excerpted from: AECOM (ConnectedEd Transit Partnership). 2017. Valley Line West Light Rail Transit Limited Phase I Environmental Site Assessment. Prepared for City of Edmonton. Edmonton, Alberta.*

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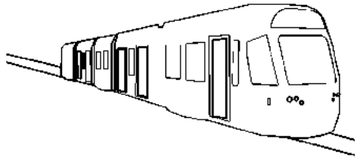

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Historical Aerial Photographs - Oliver and Westmount Segment
Phase I Environmental Site Assessment
1949 Aerial Photographs

FIGURE 3B

Excerpted from: AECOM (ConnectedEd Transit Partnership). 2017. Valley Line West Light Rail Transit Limited Phase I Environmental Site Assessment. Prepared for City of Edmonton. Edmonton, Alberta.

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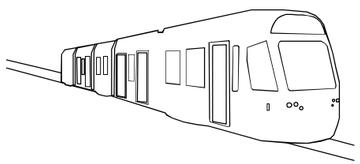

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Historical Aerial Photographs - Oliver and Westmount Segment
Phase I Environmental Site Assessment
1952 Aerial Photographs

FIGURE 3C

Excerpted from: AECOM (ConnectedEd Transit Partnership). 2017. Valley Line West Light Rail Transit Limited Phase I Environmental Site Assessment. Prepared for City of Edmonton. Edmonton, Alberta.

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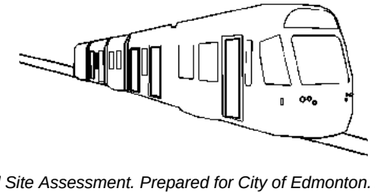

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Historical Aerial Photographs - Oliver and Westmount Segment
Phase I Environmental Site Assessment
1962 Aerial Photographs

FIGURE 3D

Excerpted from: AECOM (ConnectedEd Transit Partnership). 2017. Valley Line West Light Rail Transit Limited Phase I Environmental Site Assessment. Prepared for City of Edmonton. Edmonton, Alberta.

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- **M =** METALS
- **H =** PETROLEUM HYDROCARBONS
- **P =** PAH'S (POLYCYCLIC AROMATIC HYDROCARBONS)
- **O =** ORGANICS

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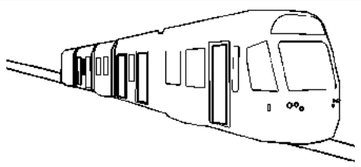

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Date Issued: October 16, 2017

Historical Aerial Photographs - Oliver and Westmount Segment
Phase I Environmental Site Assessment
1967 Aerial Photographs

FIGURE 3E

**Excerpted from: AECOM (ConnectedEd Transit Partnership). 2017. Valley Line West Light Rail Transit Limited Phase I Environmental Site Assessment. Prepared for City of Edmonton. Edmonton, Alberta.*

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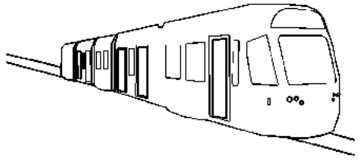

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Date Issued: October 16, 2017

Historical Aerial Photographs - Oliver and Westmount Segment
Phase I Environmental Site Assessment
1975 Aerial Photographs

FIGURE 3F

Excerpted from: AECOM (ConnectedEd Transit Partnership). 2017. Valley Line West Light Rail Transit Limited Phase I Environmental Site Assessment. Prepared for City of Edmonton. Edmonton, Alberta.

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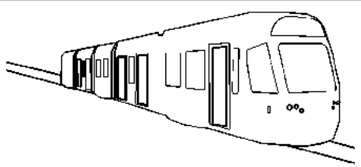

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Historical Aerial Photographs - Oliver and Westmount Segment
Phase I Environmental Site Assessment
1979 Aerial Photographs

FIGURE 3G

Excerpted from: AECOM (ConnectedEd Transit Partnership). 2017. Valley Line West Light Rail Transit Limited Phase I Environmental Site Assessment. Prepared for City of Edmonton. Edmonton, Alberta.

FIGURE3J / October 17, 2017 / P-60528811\900-CAD_GIS\910-CADD2\FIGURES\H00\60528811-FIG-00-0000-H-00H.DWG

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Date Issued: October 16, 2017

Historical Aerial Photographs - Oliver and Westmount Segment
Phase I Environmental Site Assessment
1982 Aerial Photographs

FIGURE 3H

Excerpted from: AECOM (ConnectedEd Transit Partnership). 2017. Valley Line West Light Rail Transit Limited Phase I Environmental Site Assessment. Prepared for City of Edmonton. Edmonton, Alberta.

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- **O =** ORGANICS

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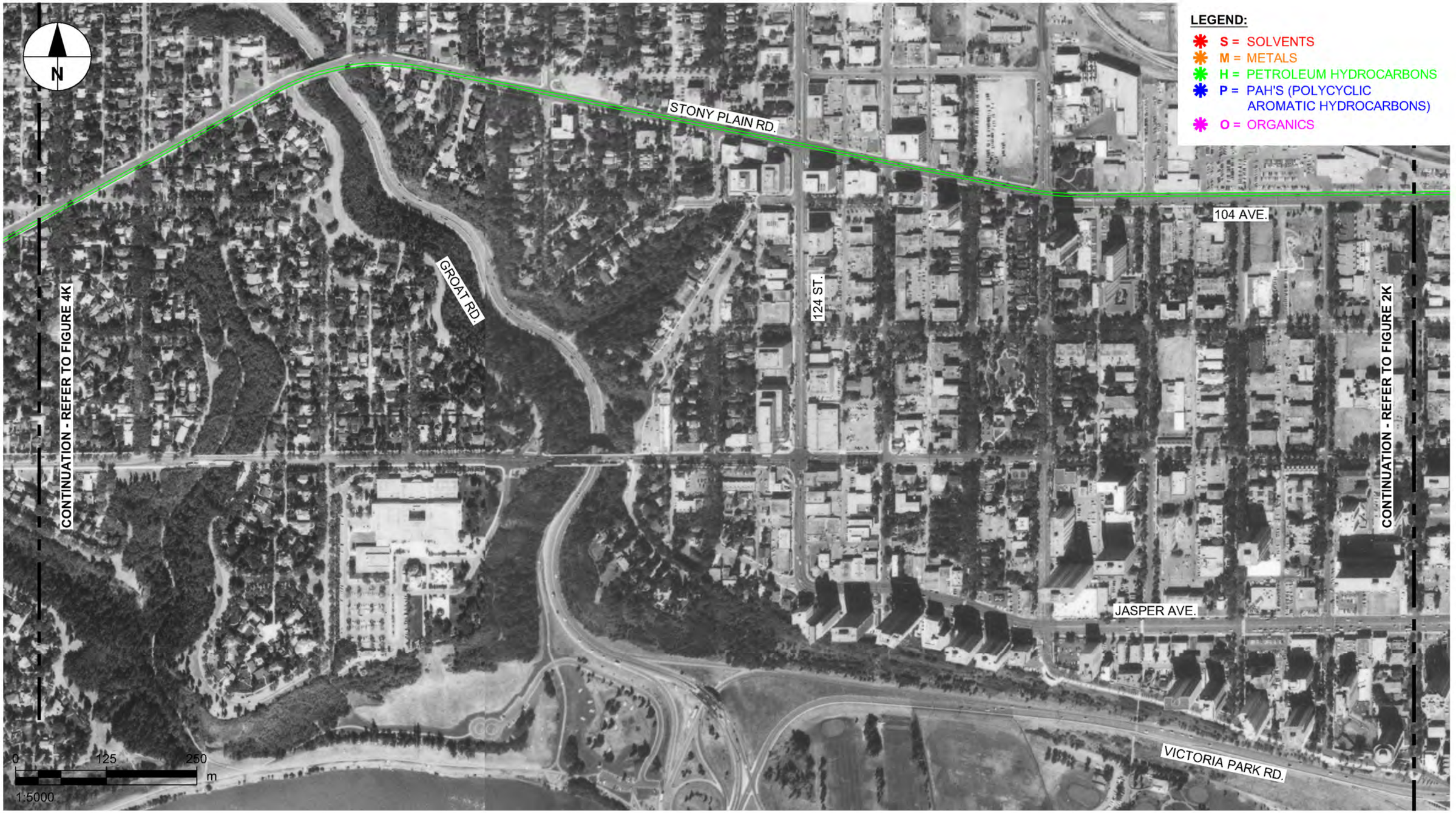
Historical Aerial Photographs - Oliver and Westmount Segment
Phase I Environmental Site Assessment
1987 Aerial Photographs

FIGURE 3J

**Excerpted from: AECOM (ConnectedEd Transit Partnership). 2017. Valley Line West Light Rail Transit Limited Phase I Environmental Site Assessment. Prepared for City of Edmonton. Edmonton, Alberta.*



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Historical Aerial Photographs - Oliver and Westmount Segment
Phase I Environmental Site Assessment
1992 Aerial Photographs

FIGURE 3K

Excerpted from: AECOM (ConnectedEd Transit Partnership). 2017. Valley Line West Light Rail Transit Limited Phase I Environmental Site Assessment. Prepared for City of Edmonton. Edmonton, Alberta.

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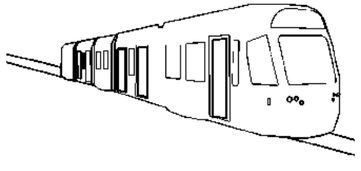

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Date Issued: October 16, 2017

Historical Aerial Photographs - Oliver and Westmount Segment
Phase I Environmental Site Assessment
1996 Aerial Photographs

FIGURE 3L

Excerpted from: AECOM (ConnectedEd Transit Partnership). 2017. Valley Line West Light Rail Transit Limited Phase I Environmental Site Assessment. Prepared for City of Edmonton. Edmonton, Alberta.

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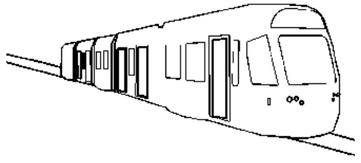

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Date Issued: October 16, 2017

Historical Aerial Photographs - Oliver and Westmount Segment
Phase I Environmental Site Assessment
2000 Aerial Photographs

FIGURE 3M

Excerpted from: AECOM (ConnectedEd Transit Partnership). 2017. Valley Line West Light Rail Transit Limited Phase I Environmental Site Assessment. Prepared for City of Edmonton. Edmonton, Alberta.

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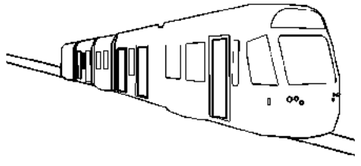

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Date Issued: October 16, 2017

Historical Aerial Photographs - Oliver and Westmount Segment
Phase I Environmental Site Assessment
2005 Aerial Photographs

FIGURE 3N

Excerpted from: AECOM (ConnectedEd Transit Partnership). 2017. Valley Line West Light Rail Transit Limited Phase I Environmental Site Assessment. Prepared for City of Edmonton. Edmonton, Alberta.

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Historical Aerial Photographs - Oliver and Westmount Segment
Phase I Environmental Site Assessment
2010 Aerial Photographs

FIGURE 3P

Excerpted from: AECOM (ConnectedEd Transit Partnership). 2017. Valley Line West Light Rail Transit Limited Phase I Environmental Site Assessment. Prepared for City of Edmonton. Edmonton, Alberta.

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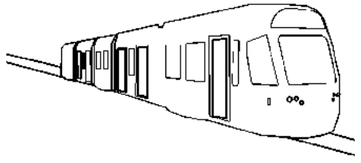

VALLEY LINE WEST LRT

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Date Issued: October 16, 2017

Historical Aerial Photographs - Oliver and Westmount Segment
Phase I Environmental Site Assessment
2014 Aerial Photographs

FIGURE 3Q

Excerpted from: AECOM (ConnectedEd Transit Partnership). 2017. Valley Line West Light Rail Transit Limited Phase I Environmental Site Assessment. Prepared for City of Edmonton. Edmonton, Alberta.

Appendix C: Environmental Approvals Table

Summary of Potential Environmental Approvals for VL-W Groat Ravine Crossing

Legislation or Policy	Regulatory Agency	Relevance to Project	Authorization/ Approval/ Permit Required	VL-W Steps in the Regulatory Process	Approval Timeline or Potential Schedule Impact
Municipal					
North Saskatchewan River Valley Area Redevelopment Plan (Bylaw 7188)	City Planning	Bylaw regulates all activities on City lands in the North Saskatchewan River Valley. VL-W Groat Ravine Crossing requires an Environmental Impact Assessment and Site Location Study.	EIA and SLS must be approved by City Council.	EIA and SLS to be submitted to City Planning for review and sign off, then to Council Committee and City Council for approval.	Committee/Council date planned for October/November 2018.
Corporate Tree Management Policy C456	City Forestry	Policy provides protection for City tree/shrub inventory and a mechanism for monetary compensation for lost canopy. Prior to removal, trees are assessed by City's Urban Forestry Department.	None, but compensation for lost canopy must be arranged with CoE.	Project team working with City of Edmonton Urban Forester to assess ornamental trees. Ravine vegetation currently unassessed. Project-specific compensation program in development.	LRT Delivery to arrange for City forestry assessment of affected natural vegetation. Compensation to be realized as part of the project as a whole. The PA will ensure compliance regarding protection of retained trees.
City of Edmonton Drainage Bylaw 18100	EPCOR	Bylaw aims to manage surface drainage on public and private land and to foster the well-being of the environment by prohibiting the release of dangerous or hazardous matters into the sewerage system.	No prohibited, restricted or hazardous waste may be released into the sewerage system without written consent from EPCOR.	Application for a permit and payment of fees.	Proponent responsibility.
City of Edmonton Parkland Bylaw 2202	City of Edmonton	Bylaw to protect and preserve natural ecosystems for the benefit of all citizens of the City	Approval required to stage construction equipment or other use in park-space.	Application for a permit.	Proponent responsibility.
ENVISO, City Policy C505, City Policy C512	City of Edmonton	Based on the ISO 14001 Standard, ENVISO provides a framework for a strong environmental management system aimed at legal/regulatory compliance, pollution prevention and continual improvement.	• Proponent must be compliant with all aspects of ENVISO. An Enviso Design Environmental Permit Approval checklist must be	• LRT Delivery to implement process as project is underway.	• Checklist to be completed by LRT Delivery prior to tender.

Legislation or Policy	Regulatory Agency	Relevance to Project	Authorization/ Approval/ Permit Required	VL-W Steps in the Regulatory Process	Approval Timeline or Potential Schedule Impact
			completed for all City projects prior to tender. • Review of the Enviso Proponent's Environmental Responsibility Package and City Policy C512. • Signing Proponent's Environmental Acknowledgement Form		Proponent responsibility. Proponent responsibility.
Provincial					
Historical Resources Act	Alberta Culture and Tourism (ACT)	All projects with potential to disturb historical, archaeological and paleontological resources are regulated under this Act and require Clearance from ACT.	*Historical Resources Act* Clearance. OBTAINED in 2010	None.	Not applicable.
Public Lands Act	Alberta Environment and Parks (Land Management Branch)	Use of Crown lands, including the bed and shore of all bodies of water, are regulated under this Act. Act requires proponents wishing to work on, alter or occupy Crown land to obtain a disposition or amend existing dispositions.	No Crown lands involved - not applicable	• None.	Not applicable.
Water Act	Alberta Environment and Parks (Water Approvals Branch)	Under Section 36 of the *Act*, an approval is required for all activities that may impact water and the aquatic environment, including realigning a watercourse and constructing within a watercourse.	No watercourses in project area – not applicable.	• None.	Not applicable.
Wildlife Act	Alberta Environment and Parks	This Act applies to most species of wildlife. The willful molestation, disruption, or destruction of a	Although permitting for clearing is not required under the Act, violations of Act, e.g.	Avoid vegetation clearing during the period 20 April to 20 August. Contingent approach is to have a	Not applicable if vegetation clearing is completed before the

Legislation or Policy	Regulatory Agency	Relevance to Project	Authorization/ Approval/ Permit Required	VL-W Steps in the Regulatory Process	Approval Timeline or Potential Schedule Impact
		wildlife nest or den is prohibited by this Act. Special provisions provide for the protection of raptors and their nests/habitats. Project requires clearing of vegetation that may support nesting/denning wildlife.	disturbances of breeding wildlife such as flying squirrels, may result in fines.	qualified biologist undertake a nest sweep of project area to avoid disturbance of active nests and dens. Abide by findings to ensure compliance. In addition, if clearing vegetation after 15 February, undertake a sweep for active owl nests.	start of the nesting season (February 15). Nest sweeps undertaken between February 15 and 20 August have potential to result in findings that delay clearing.
Federal					
Fisheries Act	Fisheries and Oceans Canada (DFO)	All activities with potential to cause harm to fish or fish habitats are regulated under this Act. Project area drains directly to NSR, which is fish bearing.	No watercourses supporting fisheries in project area.	Ensure project does not release deleterious substances into NSR.	Not applicable.
Migratory Birds Convention Act,	Environment and Climate Change Canada	This Act prohibits the disturbance of nests and individuals of most migratory bird species and prohibits release of deleterious substances into waters or areas frequented by migratory birds. Project requires clearing of migratory bird nesting habitat.	The *Act* provides guidelines for enforcement only; it is not linked to formal approvals required for construction. Violation of the *MBCA* may, however, result in penalties.	Avoid vegetation clearing during the period 20 April to 20 August. Contingent approach is to have a qualified biologist undertake a nest sweep of project area and to then avoid disturbance of any noted nesting birds. (See related notes for *Wildlife Act*)	Nest sweeps undertaken between February 15 and 20 August have potential to result in findings that delay clearing.
Navigation Protection Act	Transport Canada	Not relevant to this project as Groat Ravine is not a navigable water body.	No navigable watercourses in project area.	None	Not applicable.
Species At Risk Act	Environment and Climate Change Canada	This Act prohibits disturbance to listed species and, in some instances, listed species' habitat on federal lands. On private lands, the Act applies to disturbance to listed aquatic species and migratory birds. The project area supports migratory bird habitat.	Although no approvals or permits are required, violation of the *SARA* may result in penalties.	If any federally listed species are identified as present within or adjacent to the construction area, best practice is to consider the impact of the project on that species in consultation with Environment and Climate Change Canada.	Schedule impacted only if *SARA* species are found in the area.

Appendix D: Vegetation Data

Groat Ravine Plant Species Inventory

(survey completed 29 August 2017)

Species				Community[1]	
ACIMS Scientific Name	**ACIMS Common Name**	**ACIMS Rank**	**Origin**	**Caragana Community**	**Deciduous-Leading Mixedwood**
Tree					
Acer negundo	Manitoba maple	SU	exotic	F	F
Picea glauca	white spruce	S5	native	F	A
Picea pungens	Colorado blue spruce	SNA	exotic		O
Populus balsamifera	balsam poplar	S5	native		D
Populus tremuloides	aspen	S5	native	O	D
Ulmus americana	American elm	SNA	exotic		O
Shrub					
Amelanchier alnifolia	saskatoon	S5	native		F
Caragana arborescens	common caragana	SNA	exotic	D	F
Caragana pygmaea	pygmy caragana	SNA	exotic		O
Cornus stolonifera	red-osier dogwood	S5	native	O	A
Corylus cornuta	beaked hazelnut	S5	native		O
Cotoneaster lucidus	Peking cotoneaster	SNA	exotic		O
Lonicera tatarica [2]	tatarian honeysuckle	SNA	exotic		O
Prunus virginiana	choke cherry	S5	native		O
Rhamnus catharticus	common buckthorn	SNA	prohibited noxious	O	R
Ribes oxyacanthoides	northern gooseberry	S5	native		O
Ribes triste	wild red currant	S5	native		F
Rosa acicularis	prickly rose	S5	native		A
Salix sp. (horticultural)	willow (horticultural	SNA	exotic		O
Sambucus racemosa	red elderberry	S4	native		O
Sorbus aucuparia	European mountain-ash	SNA	exotic		O
Symphoricarpos occidentalis	snowberry	S5	native		F
Syringa vulgaris	lilac	SNA	exotic	O	R
Viburnum opulus	high-bush cranberry	S3S4	native		R
Forb					
Actaea rubra	red and white baneberry	S5	native		O
Aralia nudicaulis	wild sarsaparilla	S5	native		A
Campanula rapunculoides	creeping bellflower	SNA	noxious	F	F
Capsella bursa-pastoris	shepherd's-purse	SNA	exotic	R	
Chamerion angustifolium	common fireweed	S5	native		F
Chenopodium album	lamb's-quarters	SNA	exotic	O	O
Chenopodium capitatum	strawberry blite	S5	native		R

Species				Community[1]	
ACIMS Scientific Name	**ACIMS Common Name**	**ACIMS Rank**	**Origin**	**Caragana Community**	**Deciduous-Leading Mixedwood**
Cirsium arvense	creeping thistle	SNA	noxious	O	F
Eurybia conspicua	showy aster	S5	native		F
Galium boreale	northern bedstraw	S5	native		O
Lactuca serriola	prickly lettuce	SNA	exotic		O
Lappula squarrosa	bluebur	SNA	exotic	R	
Lathyrus ochroleucus	cream-colored vetchling	S5	native		F
Maianthemum stellatum	star-flowered Solomon's-seal	S5	native		F
Malva sylvestris [2]	high mallow	SNA	exotic	O	
Mertensia paniculata	tall lungwort	S5	native	F	A
Potentilla norvegica	rough cinquefoil	S5	native		O
Senecio eremophilus	cut-leaved ragwort	S5	native	O	O
Solidago lepida	elegant goldenrod	S4	native		O
Sonchus arvensis	perennial sow-thistle	SNA	noxious	O	O
Tanacetum vulgare	common tansy	SNA	noxious		O
Taraxacum officinale	common dandelion	SNA	exotic	F	F
Trifolium hybridum	alsike clover	SNA	exotic	O	
Urtica dioica	common nettle	S5	native		F
Verbascum thapsus	common mullein	SNA	noxious	R	
Vicia americana	wild vetch	S5	native	F	F
Graminoid					
Agropyron cristatum spp. pectinatum	crested wheatgrass	SNA	exotic	O	
Bromus inermis	smooth brome	SNA	exotic	A	A
Elymus repens	quackgrass	SNA	exotic	A	A
Phalaris arundinacea	reed canary grass	S5	native		R
Poa pratensis	Kentucky bluegrass	S5	native	F	A
Total				24	49
Native				7	29
Noxious				4	4
Prohibited Noxious				1	1
Exotic				12	15

1 D: Dominant, A: Abundant, F: Frequent, O: Occasional, R: Rare

2 Additional plant species identified during 31 August 2018 survey.

Appendix E: Potential Wildlife Species

List of Species with Potential to Occur in the VL-W Groat Ravine Crossing Project Area

Common Name	Scientific Name	Provincial Status (General Status of AB Wild Species 2015)	Wildlife Act Designation and New Species Assessed by ESCC	COSEWIC Designation	SARA Designation	Observed/ Previous Record	Likelihood of Occurrence	Potential Habitat Use
Common Garter Snake	*Thamnophis sirtalis*	Sensitive		LP Candidate (SSC)			Low	Foraging/ dispersal
Gray Partridge	*Perdix perdix*	Exotic/Alien						
Sharp-shinned Hawk	*Accipiter striatus*	Secure		Not at Risk				
Cooper's Hawk	*Accipiter cooperii*	Secure		Not at Risk				
Merlin	*Falco columbarius*	Secure		Not at Risk				
Rock Pigeon	*Columba livia*	Exotic/Alien				Millenium (2012); AECOM (2013)		
Ruby-throated Hummingbird	*Archilochus colubris*	Secure						
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Secure						
Downy Woodpecker	*Dryobates pubescens*	Secure						
Hairy Woodpecker	*Dryobates villosus*	Secure						
Northern Flicker	*Colaptes auratus*	Secure						
Pileated Woodpecker	*Dryocopus pileatus*	Sensitive					Low	Foraging
Red-eyed Vireo	*Vireo olivaceus*	Secure				AECOM (2013)		
Blue Jay	*Cyanocitta cristata*	Secure				Millenium (2012)		
Black-billed Magpie	*Pica hudsonia*	Secure				Millenium (2012); AECOM (2013); Spencer (2017)		
American Crow	*Corvus brachyrhynchos*	Secure				AECOM (2013)		
Common Raven	*Corvus corax*	Secure				AECOM (2013)		
Black-capped Chickadee	*Poecile atricapillus*	Secure				Spencer (2017)		
Boreal Chickadee	*Poecile hudsonicus*	Secure						
Red-breasted Nuthatch	*Sitta canadensis*	Secure						
White-breasted Nuthatch	*Sitta carolinensis*	Secure						
House Wren	*Troglodytes aedon*	Secure						
American Robin	*Turdus migratorius*	Secure				Millenium (2012); AECOM (2013); Spencer (2017)		
Gray Catbird	*Dumetella carolinensis*	Secure						

Common Name	Scientific Name	Provincial Status (General Status of AB Wild Species 2015)	Wildlife Act Designation and New Species Assessed by ESCC	COSEWIC Designation	SARA Designation	Observed/ Previous Record	Likelihood of Occurrence	Potential Habitat Use
European Starling	*Sturnus vulgaris*	Exotic/Alien						
Bohemian Waxwing	*Bombycilla garrulus*	Secure						
Cedar Waxwing	*Bombycilla cedrorum*	Secure				Spencer (2017)		
Yellow Warbler	*Setophaga petechia*	Secure				Millenium (2012); AECOM (2013); Spencer (2017)		
Cape May Warbler	*Setophaga tigrina*	Sensitive	In Process			AECOM (2013); FWMIS(2018)	High	Migrating
Yellow-rumped Warbler	*Setophaga coronata*	Secure				AECOM (2013)		
Bay-breasted Warbler	*Setophaga castanea*	Sensitive	In Process			AECOM (2013); FWMIS(2018)	High	Migrating
Chipping Sparrow	*Spizella passerina*	Secure				Millenium (2012); AECOM (2013); Spencer (2017)		
Clay-colored Sparrow	*Spizella pallida*	Secure				AECOM (2013)		
Vesper Sparrow	*Pooecetes gramineus*	Secure				AECOM (2013)		
Song Sparrow	*Melospiza melodia*	Secure						
White-throated Sparrow	*Zonotrichia albicollis*	Secure						
White-crowned Sparrow	*Zonotrichia leucophrys*	Secure						
Dark-eyed Junco	*Junco hyemalis*	Secure				Spencer (2017)		
Brown-headed Cowbird	*Molothrus ater*	Secure						
Pine Grosbeak	*Pinicola enucleator*	Secure						
Purple Finch	*Haemorhous purpureus*	Secure						
House Finch	*Haemorhous mexicanus*	Secure						
Common Redpoll	*Acanthis flammea*	Secure						
Hoary Redpoll	*Acanthis hornemanni*	Secure						
Pine Siskin	*Spinus pinus*	Secure						
American Goldfinch	*Spinus tristis*	Secure						
House Sparrow	*Passer domesticus*	Exotic/Alien				Millenium (2012); AECOM (2013)		
Masked Shrew	*Sorex cinereus*	Secure						
Pygmy Shrew	*Sorex hoyi*	Secure						

List of Species with Potential to Occur in the VL-W Groat Ravine Crossing Project Area

Common Name	Scientific Name	Provincial Status (General Status of AB Wild Species 2015)	Wildlife Act Designation and New Species Assessed by ESCC	COSEWIC Designation	SARA Designation	Observed/ Previous Record	Likelihood of Occurrence	Potential Habitat Use
Little Brown Myotis	*Myotis lucifugus*	May Be At Risk		Endangered	Endangered (Schedule 1)	AECOM (2013); FWMIS(2018)	High	Roosting, foraging
Northern Myotis	*Myotis septentrionalis*	May Be At Risk	Data Deficient	Endangered	Endangered (Schedule 1)		Low	Roosting, foraging
Silver-haired Bat	*Lasionycteris noctivagans*	Sensitive		HP Candidate			Low	Roosting, foraging
Big Brown Bat	*Eptesicus fuscus*	Secure				AECOM (2013)		
Hoary Bat	*Lasiurus cinereus*	Secure		HP Candidate		AECOM (2013)	Low	Roosting, foraging
Snowshoe Hare	*Lepus americanus*	Secure				AECOM (2013)		
White-tailed Jack Rabbit	*Lepus townsendii*	Secure						
Least Chipmunk	*Tamias minimus*	Secure						
Red Squirrel	*Tamiasciurus hudsonicus*	Secure				AECOM (2013); Spencer (2017)		
Deer Mouse	*Peromyscus maniculatus*	Secure						
Southern Red-backed Vole	*Clethrionomys gapperi*	Secure						
Meadow Vole	*Microtus pennsylvanicus*	Secure						
House Mouse	*Mus musculus*	Exotic/Alien						
Meadow Jumping Mouse	*Zapus hudsonius*	Secure						
Common Porcupine	*Erethizon dorsatum*	Secure						
Coyote	*Canis latrans*	Secure						
Striped Skunk	*Mephitis mephitis*	Secure						
Cougar	*Puma concolor*	Secure						
Canada Lynx	*Lynx canadensis*	Sensitive		Not at Risk			Low	Dispersal
Moose	*Alces alces*	Secure						
Mule Deer	*Odocoileus hemionus*	Secure						
White-tailed Deer	*Odocoileus virginianus*	Secure						
Unidentified Deer sp.	*Odocoileus sp.*	Secure				AECOM (2013)		