

**Site Location Study
Pursuant to Bylaw 7188
for
Valley Line-West Light Rail Transit (LRT)
Crossing at Groat Ravine
and
Activities Near MacKinnon Ravine**

Final Report

Prepared for:

**LRT Delivery
Integrated Infrastructure Services
Edmonton, Alberta**

Prepared by:

**Spencer Environmental
Management Services Ltd.
Edmonton, Alberta**

Under contract to:

**AECOM
Edmonton, Alberta**

Project Number EP-715

September 2018

EXECUTIVE SUMMARY

Much of the VL-W alignment follows existing Stony Plain Road (SPR). At two SPR locations the alignment traverses or is adjacent to a natural ravine that forms part of the North Saskatchewan River Valley Area Redevelopment Plan (NSRV ARP) (Bylaw 7188): SPR over Groat Ravine; and, SPR between 147 Street and 149 Street north of MacKinnon Ravine. Pursuant to the NSRV ARP, each of these VL-W intersections with Bylaw 7188 lands triggers the need for a Site Location Study (SLS), this document, and an Environmental Impact Assessment (EIA) for the intersecting proposed project components. Separate EIAs have been prepared as companion documents to this SLS.

The Groat Ravine crossing involves replacement of the existing SPR bridge with a wider bridge that will accommodate LRT infrastructure. The VL-W Reference Design shows the bridge type as a Single Span Steel Haunched Girder Bridge. New infrastructure to be located within the ravine will be limited to bridge abutments and one area of fill on the upper east ravine slope, to support the widened roadway and new sidewalk, held in place by an MSE wall. Approximately half of the retaining wall and associated fill will be situated within the bylaw boundary, the remainder will extend back into some parcels that have been acquired for this by the City.

Addition of LRT north of MacKinnon Ravine requires a localized widening of the roadway to the south, subsequent widening of the south sidewalk, and some transit infrastructure adjustment. A short retaining structure will be required. In this case, all proposed *new* infrastructure will be located inside the existing ROW except a short segment of sidewalk, to the east of the bus turnaround, but the sidewalk is not located within the ravine proper. However, some of this construction requires a temporary work area beyond the existing road ROW and into the upper margin of MacKinnon Ravine. In addition, the north end of an existing pedestrian bridge that crosses the ravine at this location must be modified slightly to tie into the new sidewalk. The existing bus turnaround, fully situated within the existing roadway ROW, will be decommissioned and replaced with a new bus bay and sidewalk; excess lands will be reclaimed to a natural plant community.

Alternatives to the Groat Ravine crossing and the temporary incursion into MacKinnon Ravine were examined and found to be unsuitable. Project design at both locations found several ways to reduce encroachment into the ravines. For example, use of retaining walls.

Unlike many recreational or utility projects proposed for river valley system lands, this project is not dependent on a river valley location. Rather, this project happens to intersect with bylaw lands, as part of a larger tablelands project. The VL-W is a current City priority project and the location of the VL-W within the existing SPR ROW is consistent with City transportation master planning. The long planning history of the selected VL-W alignment has led to selection of an alignment that intersects with bylaw lands. This corridor and alignment planning history, followed by more specific LRT planning, amounts to an institutional and a social constraint that requires some permanent and temporary encroachment in Bylaw 7188 lands.

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1.0 INTRODUCTION AND PROJECT LOCATION

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 complete preliminary design (which had been taken to 30% in 2013) 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 (the 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 urban areas of the city, and much of the alignment is within Stony Plain Road (SPR) (Figure 1). In two locations on SPR, the alignment traverses or is adjacent to a natural ravine that forms part of the North Saskatchewan River Valley Area Redevelopment Plan (NSRV ARP) (Bylaw 7188): SPR over Groat Ravine; and, SPR between 147 Street and 149 Street adjacent to and north of MacKinnon Ravine (Figure 1). Pursuant to the NSRV ARP, each proposal for the development of a major facility that is publicly owned or is developed on public lands is subject to a Site Location Study (SLS) detailing costs, and social, environmental and institutional constraints that make a river valley location essential. Consultation with City Planning indicated that each of the VL-W intersections with Bylaw 7188 lands triggers the need for a SLS. The two project components are addressed together in this SLS. The report format and content follow a project-specific Terms of Reference developed through scoping discussions held between the environmental consultant, LRT Delivery and City Planning, informed by a brief description of project activities, preliminary engineering drawings, the project location and anticipated project activities. In addition, a separate Environmental Impact Assessment (EIA) has been prepared for each of those two project segments (Spencer Environmental 2018a, 2018b).

2.0 VL-W PROJECT SCOPE

Preliminary design is complete for the entire VL-W alignment. That design, referred to as the Reference Design, will be carried forward into the project procurement phase and beyond to be advanced to final design by the successful Proponent. The City is currently developing the Project Agreement (PA) that will govern Proponent scope and practices.

The VL-W alignment follows SPR from 121 Street to 156 Street. To enable LRT integration into this existing arterial road, several locations require road reconfiguring, bus stop adjustments, new LRT stops, new or improved sidewalks, modified intersections or approach roads etc., and, ultimately, some local widening of the road right-of-way (ROW). Two locations needing adjustments are the SPR crossing of Groat Ravine, and, SPR north of and immediately adjacent to MacKinnon Ravine. The proposed project scope at each of these two locations is described separately below.

2.1 *Groat Ravine Project Scope*

The Groat Ravine crossing involves replacement of the existing bridge with a wider bridge to tie in with the wider approaching roads and accommodate two vehicle lanes, LRT infrastructure and pedestrian walks. Retrofitting the existing bridge is not feasible. New infrastructure to be located within the ravine is limited to a new bridge and associated support. There are no ancillary LRT facilities required at this location. The specific project location and design in relation to Bylaw 7188 lands is provided in Figure 2.

2.1.1 *Proposed Bridge*

The proposed new bridge will be wider than the existing bridge (25.4 m wide compared to 18.4 m wide) (Figure 3). The vertical profile of the bridge remains the same, the horizontal alignment will be slightly curved, with the east abutment slightly shifted to the south. The new bridge is designed to accommodate two centre LRT tracks, two outside vehicle lanes and two 4.2 m wide sidewalks (Figure 4). The Reference Design shows the bridge type as a Single Span Steel Haunched Girder Bridge (Figure 3). 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 3). The existing Shared Use Path (SUP) in the ravine along the west side of Groat Road, including the retaining wall forming the west boundary of that path, will be maintained as is.

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 5). Approximately half of the MSE wall and associated fill will be situated within the bylaw boundary, the remainder extends back from the ravine edge into some sloped, treed parcels that have been acquired by the City.

The delineated project area (which also represents the construction limits) within and outside of the Bylaw boundaries is shown on Figure 2.

2.1.2 Landscaping

The Reference Design includes a preliminary (conceptual) landscape plan for the full alignment. The landscape plan for the Groat Ravine segment (Figure 6) 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 shows that some areas that to be cleared will be landscaped with “new natural areas” and “new shrub beds”. The EIA elaborates on measures to be taken in these planned new natural areas.

2.2 MacKinnon Ravine Project Scope

The second bylaw location affected by the VL-W is between 147 Street and 149 Street, where SPR runs immediately parallel to the steep north margin of MacKinnon Ravine (Figure 7). Here the bylaw boundary was generously drawn in the 1980s to include much of SPR, which is clearly outside of the ravine. It is MacKinnon Ravine that is most relevant to the SLS. Addition of LRT infrastructure north of MacKinnon Ravine requires a widening of the roadway to the south in this location, subsequent widening of the south sidewalk, and some transit infrastructure adjustment (Figures 7 and 8). In this case, all proposed *new* infrastructure will be located inside the existing ROW except a short segment of sidewalk, to the east of the bus turnaround. That sidewalk segment is not located within the ravine proper (Figure 8). However, some of the associated *work activities* have potential to encroach beyond the existing road ROW and into MacKinnon Ravine. Following are brief descriptions of the key project components relevant to MacKinnon Ravine.

2.2.1 Sidewalk Widening and Retaining Structure

The existing sidewalk is so close to the steep ravine slope that the slight adjustment south needed by this project requires a small area of fill to support the sidewalk (Figure 9a-c). To avoid permanent encroachment into the ravine, the Proponent will be required to install a short retaining structure (e.g., a wall) to retain the fill rather than a tapered slope (Figure 9). All sidewalk, fill, and retaining structures will be located within the existing roadway ROW. There is, however, a need for a temporary work area at the top of the ravine in support of these works. This will be limited to a maximum 3 m wide strip (Figure 8). This temporary work area is the primary incursion into MacKinnon Ravine and Bylaw 7188 lands.

2.2.2 Existing Pedestrian Bridge Modification

Because the existing pedestrian bridge that crosses MacKinnon Ravine at this location directly terminates at the south edge of the existing sidewalk, the north end of that footbridge must also be modified (Figure 10). The bridge work is very localized and expected to be straightforward. The bridge work details will be finalized by the Proponent, but it appears that the first concrete beam would be affected, and the beam and foundation would need to be replaced. The bridge would be marginally shorter and stringers of the first span would need to be cut. The last city bridge report indicated the pedestrian bridge

to be in good condition (Marzan, *pers. comm.*) The bridge work would be located within MacKinnon Ravine.

2.2.3 *Decommissioning of Bus Turnaround*

The existing bus turnaround, fully situated within the existing roadway ROW, will be replaced with a new bus bay and sidewalk along SPR (Figure 7 and 8). The turnaround area will be used as a laydown area and then decommissioned, through removal of the existing asphalt, and reclaimed to a natural area according to a detailed reclamation plan to be developed by the Proponent. Reclamation boundaries will respect the established temporary work limit (also the roadway ROW in this case).

2.2.4 *Landscaping*

The landscape plan for the MacKinnon Ravine segment (Figure 11) indicates that the full length of the temporary work area associated with construction of the sidewalk and retaining wall within Bylaw 7188 lands will be reclaimed to a new natural area. That natural area will extend west from the former turnaround in a thin band to the corner of 149 Street and Summit Drive. A few ornamental trees are shown planted near the new bus bay adjacent the sidewalk in the ROW. The EIA elaborates on landscaping requirements in those areas as mitigation for impacts to natural vegetation near the pedestrian bridge.

3.0 VL-W LOCATION ANALYSIS AND JUSTIFICATION

3.1 *Alternative Location Review*

3.1.1 *VL-W Alignment*

The LRT network in general, and the VL-W specifically, is an important City priority project. Planning of corridors and specific alignments has been a long-term, complex process that involved extensive public engagement and Council approval at multiple key planning stages. Planning for the VL-W line has been in consideration for many years but became more focused in 2008/2009 with the initiation of alignment evaluation and associated key Council decisions. In 2009, the City officially adopted the LRT Network Plan, which defined the future size, scale and operation of Edmonton's LRT system. Specifically, the plan identified a six-legged LRT system to serve all sectors of the city, with the VL-W as one component leg. Following approval of the Network Plan, a subsequent important planning step was evaluation of several alternative VL-W (and SE) corridors to arrive at a recommended corridor. The resultant Concept Plan that specified the Valley Line Southeast to West corridor, track alignment and station locations for the majority of the Valley Line (LRT) was approved by City Council in January 2011, with the downtown segment approved in February 2012. The alignment now being assessed that utilizes SPR and crosses over Groat Ravine and near MacKinnon Ravine has thus been the accepted alignment with periodic minor revisions, since 2011.

3.1.2 *Groat Ravine Crossing Alternatives*

Adjusting the VL-W alignment to avoid crossing Groat Ravine would have necessitated shifting the alignment north to 107 Avenue. That option did not achieve LRT service goals and was not pursued. Retrofit or rehabilitation of the existing SPR bridge to accommodate the required LRT added that was width technically not feasible. It happens that the existing SPR bridge is more than 50 years old and nearing the end of its lifespan. Therefore, regardless of the LRT, a new bridge at SPR was inevitable in the near future (Marzan *pers.comm.*). The VL-W project, if it proceeds in the next few years, has only slightly expedited that bridge replacement. Incorporating the LRT into the new SPR crossing eliminated the need for yet another LRT-specific crossing over the ravine, which represents good environmental practice.

During preliminary engineering, several design alternatives were examined with a view to minimizing the project footprint in the ravine. The following decisions resulted: a bridge design that removed piers in the ravine; locating construction laydown areas out of the ravine and away from parkland near the top-of-ravine at Connaught Drive; use of a retaining wall at the area of fill rather than use of a tapered slope. Adoption of a bridge design that eliminated abutments in the ravine was not technically possible. This would have required a deeper superstructure and a raised road profile which would have negatively impacted adjacent residential properties and local drainage (Marzan *pers.comm.*).

3.1.3 MacKinnon Ravine Alternatives

At MacKinnon Ravine, LRT-related temporary encroachment into the ravine could only have been avoided by either deviating from City design standards for infrastructure such as sidewalks, or shifting new infrastructure to the north and encroaching on private properties. Widening to the south, with the temporary encroachment on the ravine was selected as the less intrusive option. Requiring a retaining structure along the new sidewalk was then deliberately adopted to reduce the encroachment into the ravine.

3.2 River Valley Dependencies

Unlike many recreational or utility projects proposed to be located within the river valley system, this project is not dependent on a river valley location. Rather, this project happens to intersect with bylaw lands, as part of a larger tablelands project.

3.3 Overview of Bylaws/Plans/Policies

In addition to the various LRT plans that have been approved by Council for this alignment, the proposed project is consistent with the following City plans: The Way We Grow: Municipal Development Plan (Bylaw 15100); The Way We Live: Edmonton's People Plan; The Way We Move: Transportation Master Plan. Furthermore, because it limits transportation crossings and reduces encroachment in the river valley system to the degree possible, the project is also consistent with the goals of the North Saskatchewan River Valley Area Redevelopment Plan (Bylaw 7188).

4.0 CONSTRAINTS ANALYSIS GROAT RAVINE AND MACKINNON RAVINE

Following is an analysis of the social, financial, environmental and institutional constraints that make this project's intersections with Bylaw 7188 boundaries essential.

4.1 Social Constraints

The long corridor and alignment planning history led to a VL-W alignment that fulfills the City's objective of an urban style LRT extension to west Edmonton. That history and those multiple objectives amount to a social constraint that has led to the need to intersect with bylaw lands. This is particularly true of Groat Ravine. Furthermore, the City's objective to always minimize the need to acquire private property to realize civil capital projects has contributed to the decision to widen the SPR to the south near MacKinnon Ravine rather than to the north where private properties could be affected.

4.2 Financial

There are no cost estimates available that are directly relevant to this SLS. There are no apparent financial constraints that require the two bylaw land intersections. It can be argued that combining the near-future need for replacing the SPR bridge with the VL-W project has financial benefits.

4.3 Environmental Constraints

While environmental considerations resulted in careful design and slightly reduced project footprints within Bylaw 7188 lands, there were no environmental constraints that required the project to intersect with bylaw lands. However, the geography of the two ravines did influence design in those locations. At Groat Ravine, the established SPR vertical alignment at the approaches to the ravine did constrain available bridge design options and required the bridge abutments to be situated on the ravine slopes. At MacKinnon Ravine, the proximity of the sidewalk to the ravine slope necessitated the temporary encroachment into the ravine.

4.4 Institutional Constraints

The VL-W is a current City priority project and the location of the VL-W within the existing SPR ROW is consistent with City transportation master planning. This high-level planning followed by more specific LRT planning is an institutional constraint that has led to the alignment as presented here.

5.0 CONCLUSION

The selected VL-W alignment and Reference Design does encroach into Bylaw 7188 lands at two locations. VL-W planning over the last decade has confirmed that this alignment is the optimal alignment, the one that best meets City values and objectives. This report briefly examines the high-level alternatives that were rejected and describes the finer scale design alternatives that were integrated into the project to reduce encroachment into bylaw lands. This document also identifies the financial, social, environmental and institutional constraints that affected the project at these bylaw land locations. The primary constraints making these intersections with bylaw lands essential are related to the social and institutional constraints associated with the City's LRT network servicing vision.

6.0 REFERENCES

6.1 Literature Cited

Spencer Environmental. 2018a. Environmental Impact Assessment Pursuant to Bylaw 7188 for Valley Line West Light Rail Transit (LRT) Crossing at Groat Ravine. Prepared for the City of Edmonton. Edmonton, Alberta.

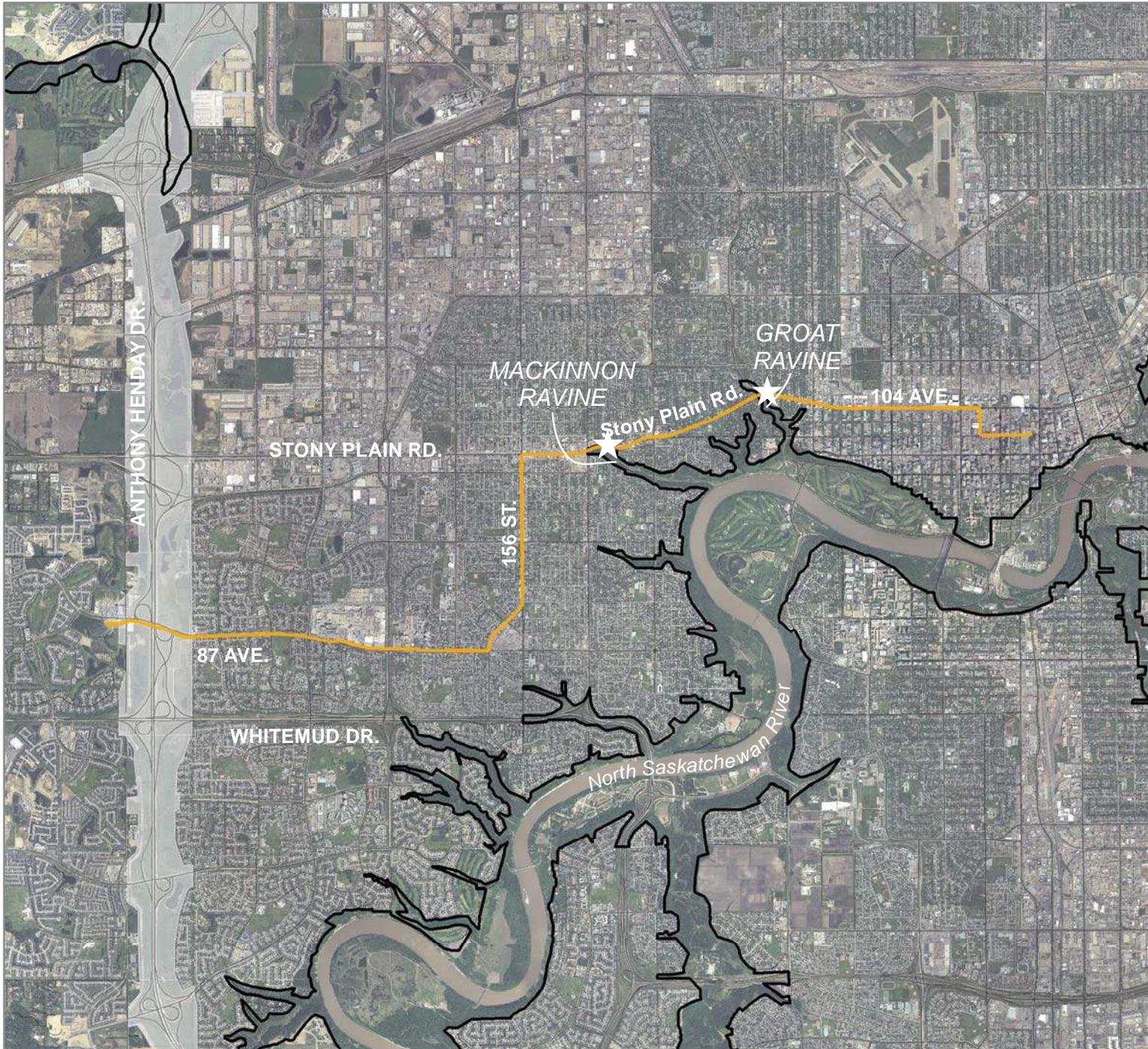
Spencer Environmental. 2018b. Environmental Impact Assessment Pursuant to Bylaw 7188 for Valley Line West Light Rail Transit (LRT) Activities near MacKinnon Ravine. Prepared for the City of Edmonton. Edmonton, Alberta.

6.2 Personal Communications

Marzan, Roleza Jean, P.Eng., Senior Civil Engineer, Integrated Infrastructure Services, LRT Delivery.

Appendix A: Figures

Figure 1.
Project Location
 Groat Ravine &
 MacKinnon Ravine
 Valley Line West SLS



Legend

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

INSET - GROAT RAVINE



INSET - MACKINNON RAVINE



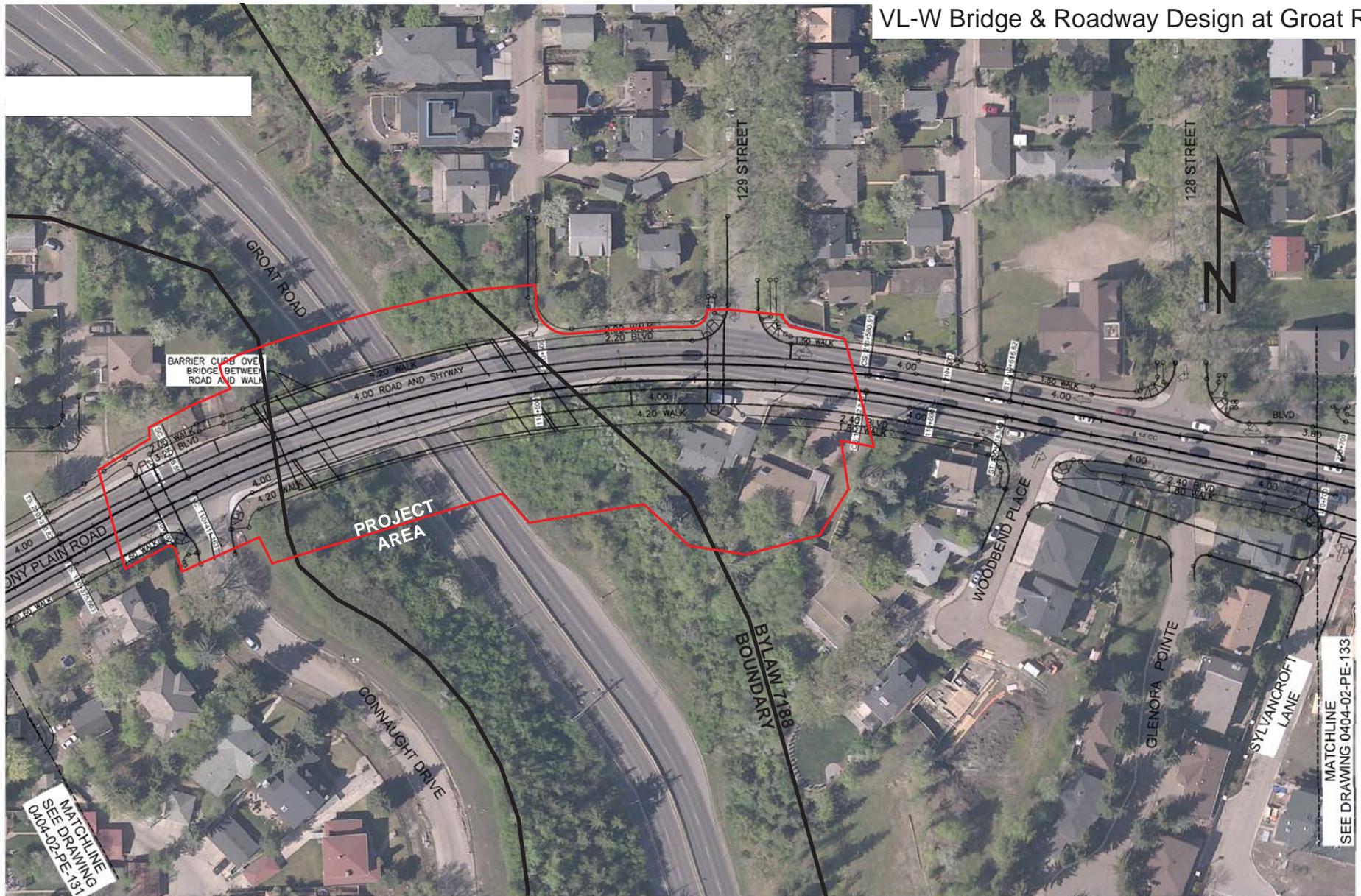
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 Aerial Photograph Date: May 2017

1:70,000 0 500 1,000 2,000 Meters



Figure 2.

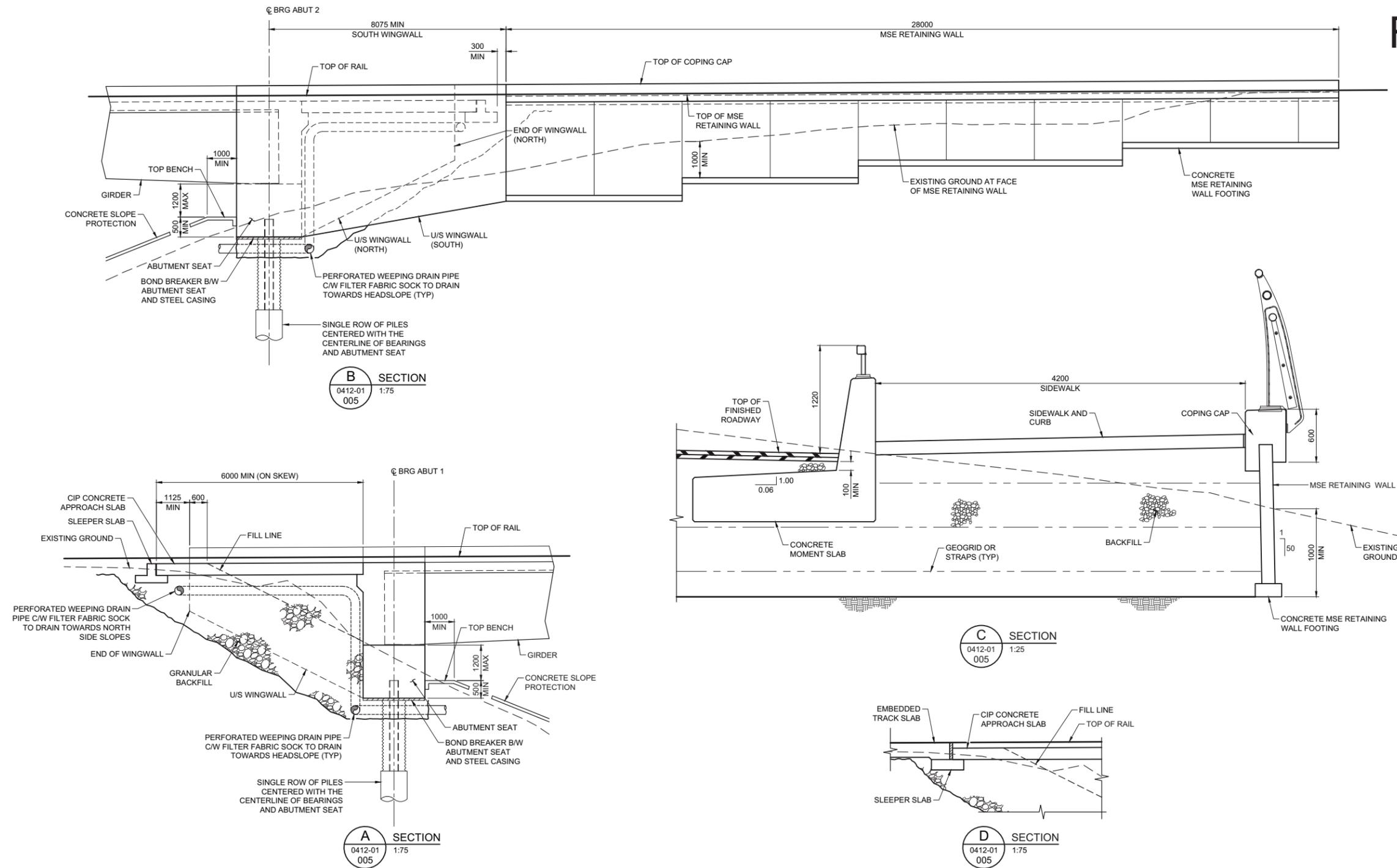
VL-W Bridge & Roadway Design at Groat Ravine



*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 5.



AMANDOC / April 5, 2018 / P:60528911/000-CAD_GIB910-CADD/SHEETS/SBT05 - SHEETS/STONY PLAIN ROAD BRIDGE/VLW04-12-01/PE/006.DWG

C	ISSUED FOR FINAL PRELIMINARY DESIGN	05-04-18	R.L.
B	ISSUED FOR 90% REVIEW	23-11-17	R.L.
A	ISSUED FOR 60% REVIEW	31-07-17	R.L.
no.	description	date	appd
issue data			

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: *B. Ramsay*
Date: *April 5, 2018*
PERMIT NUMBER: P10450
The Association of Professional Engineers and Geoscientists of Alberta

seal

PROFESSIONAL ENGINEER ALBERTA
RICHARD LEE
APRIL 5, 2018

AECOM Prime Consultant

Edmonton

prime consultant job no. 60528911

HATCH

PRELIMINARY ENGINEERING DRAWINGS NOT FOR CONSTRUCTION

prime consultant reviewed by M. PERRY

ISL Engineering and Land Services

DIALOG

M M MOTT MACDONALD

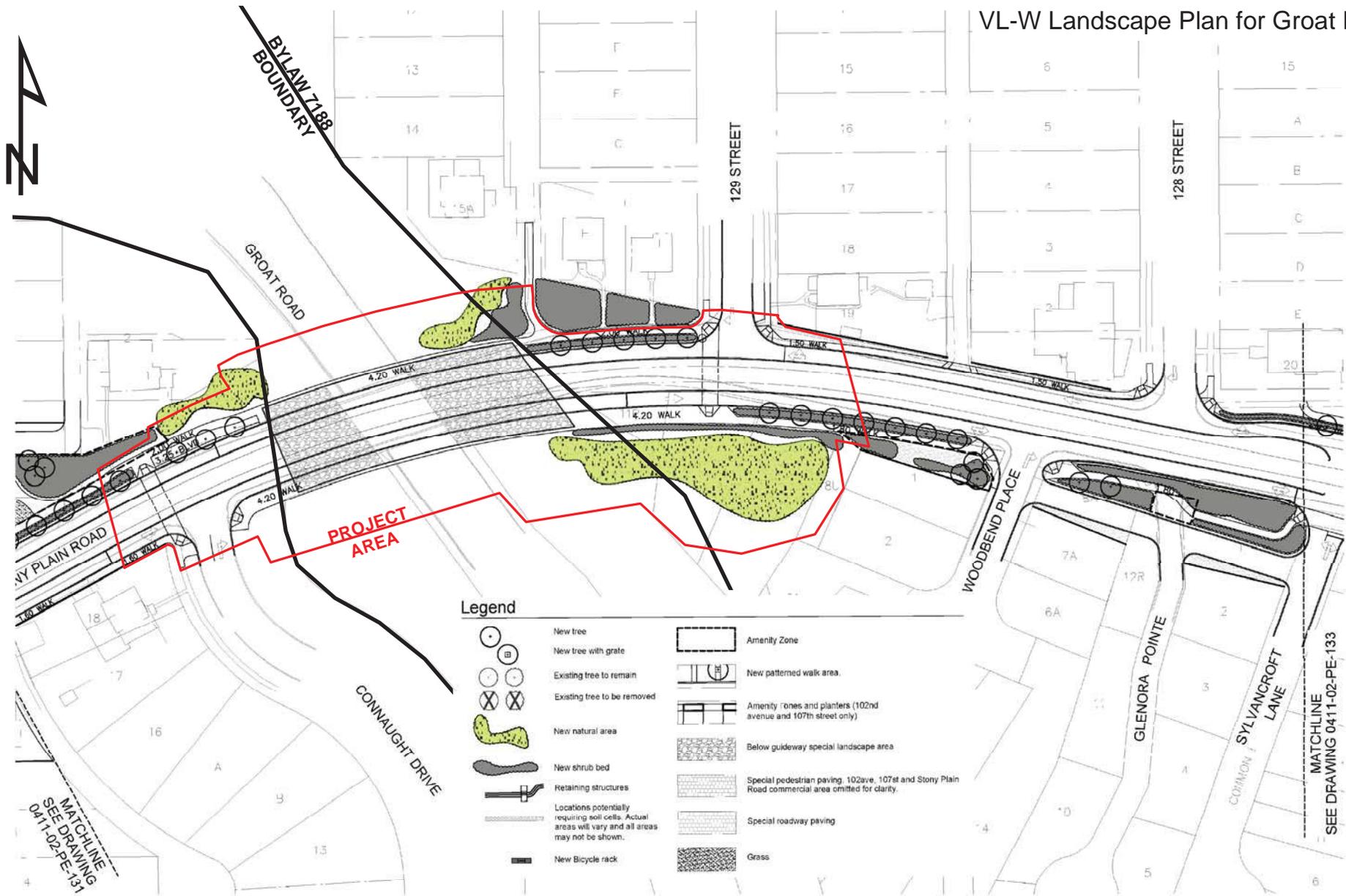
drawing title
STONY PLAIN ROAD OVER GROAT ROAD BRIDGE
ABUTMENT SECTIONS AND DETAILS

VALLEY LINE WEST LRT
LEWIS FARMS TO DOWNTOWN

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

Figure 6.

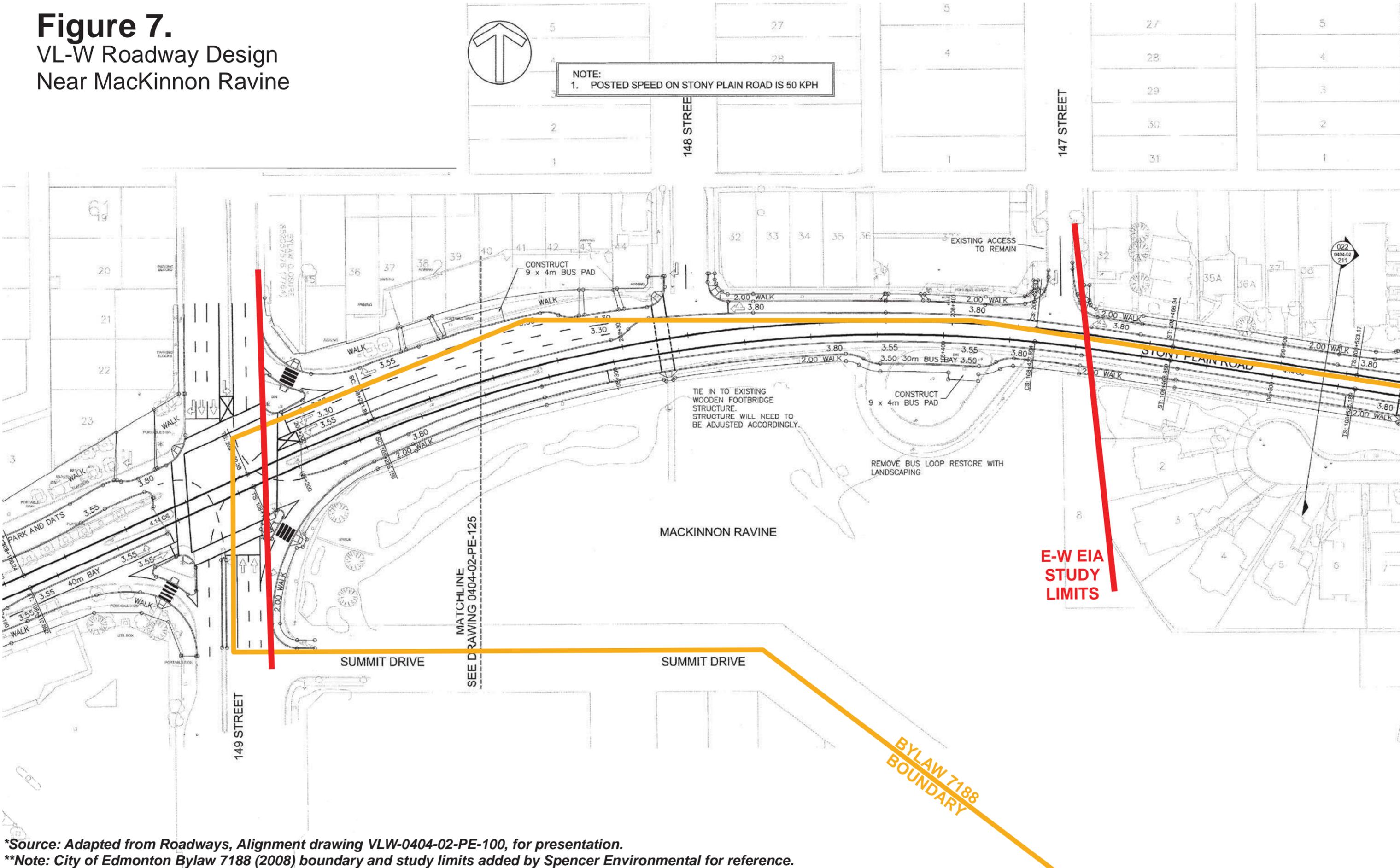
VL-W Landscape Plan for Groat Ravine



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

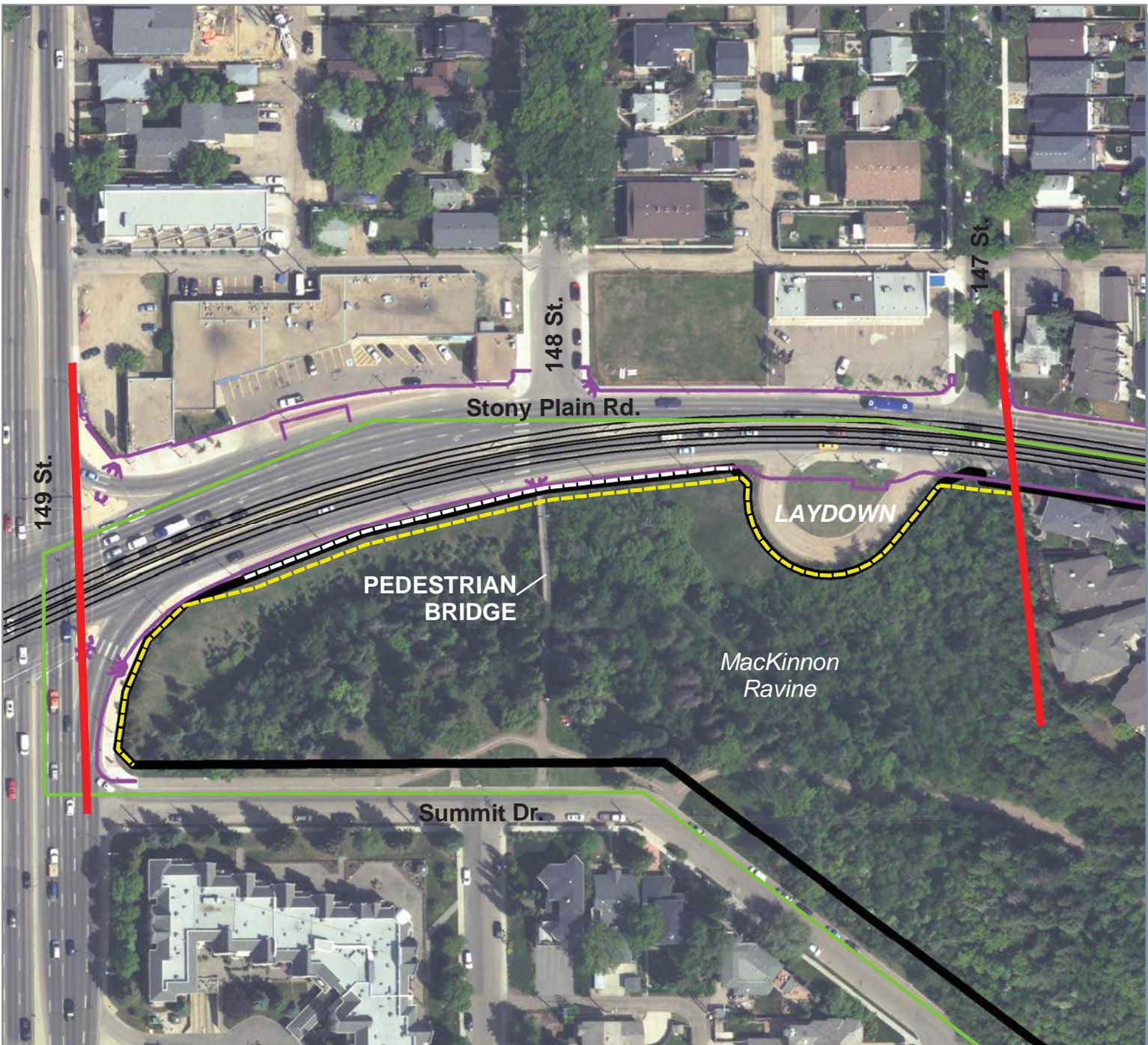
**Note: City of Edmonton Bylaw 7188 (2008) boundary and project area boundary added by Spencer Environmental for reference.

Figure 7.
VL-W Roadway Design
Near MacKinnon Ravine



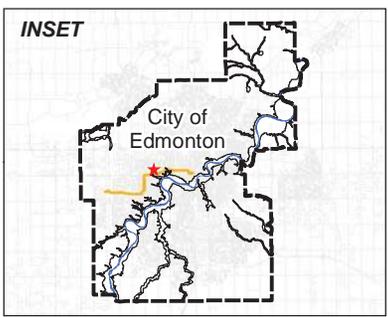
*Source: Adapted from Roadways, Alignment drawing VLW-0404-02-PE-100, for presentation.
**Note: City of Edmonton Bylaw 7188 (2008) boundary and study limits added by Spencer Environmental for reference.

Figure 8.
MackInnon Ravine
Project Components
and Temporary Limits
Groat Ravine &
MackInnon Ravine
Valley Line West SLS



Legend

- E-W EIA Study Limits
 - Bylaw 7188 Boundary
 - Road ROW
- Proposed:*
- Track Alignment
 - Back of Walk (BOW)/Edge of future sidewalk
 - Retaining Structure
 - Limits of Temporary Work



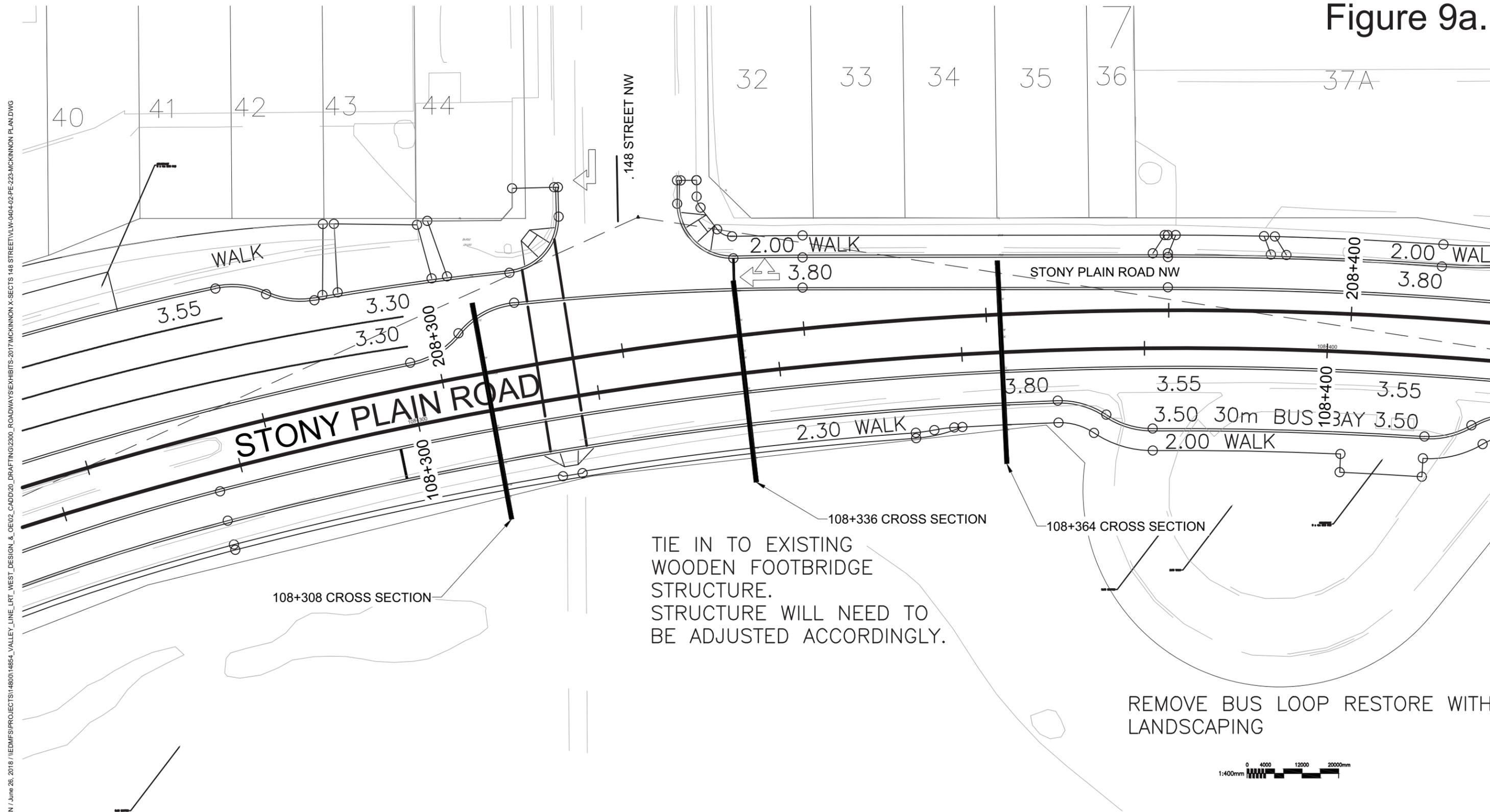
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Figure 9a.

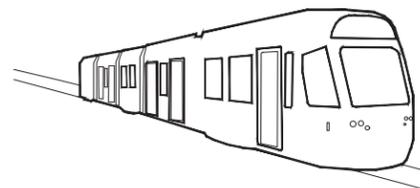


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Prime Consultant



Associate Consultants



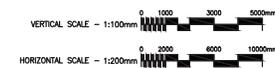
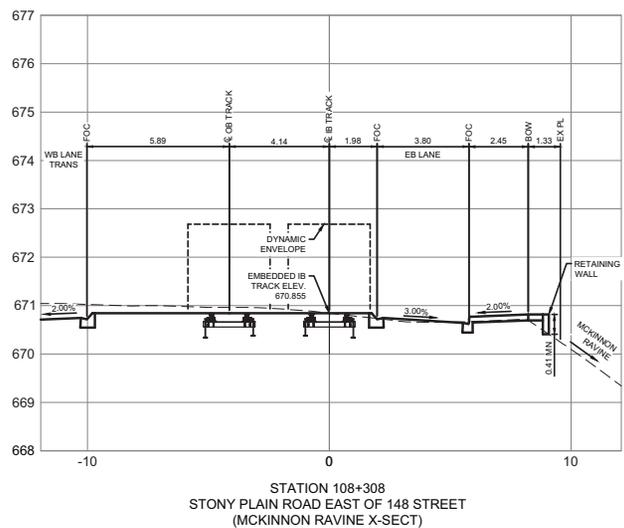
VALLEY LINE WEST LRT

Drawn By: S.A.M.
 Designed By: R.M.
 Checked By: J.M.
 Date Issued: 26-06-2018

MCKINNON RAVINE CROSS SECTIONS

FIGURE 1.0

Figure 9b.



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Prime Consultant

AECOM

Edmonton

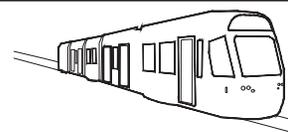
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Associate Consultants



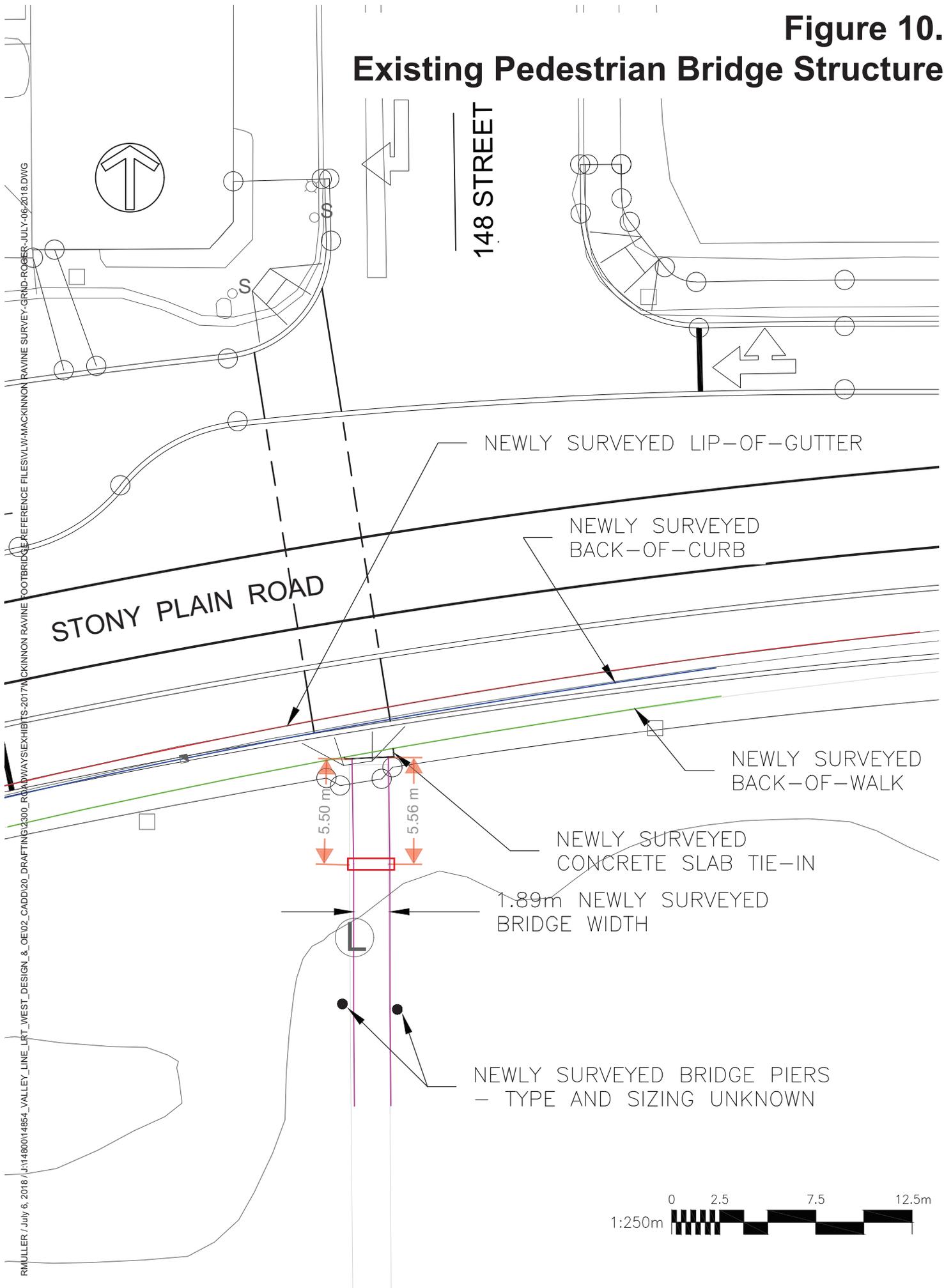
VALLEY LINE WEST LRT

Drawn By: S.A.M.
Designed By: R.M.
Checked By: J.M.
Date Issued: 26-06-2018

MCKINNON RAVINE CROSS-SECTIONS

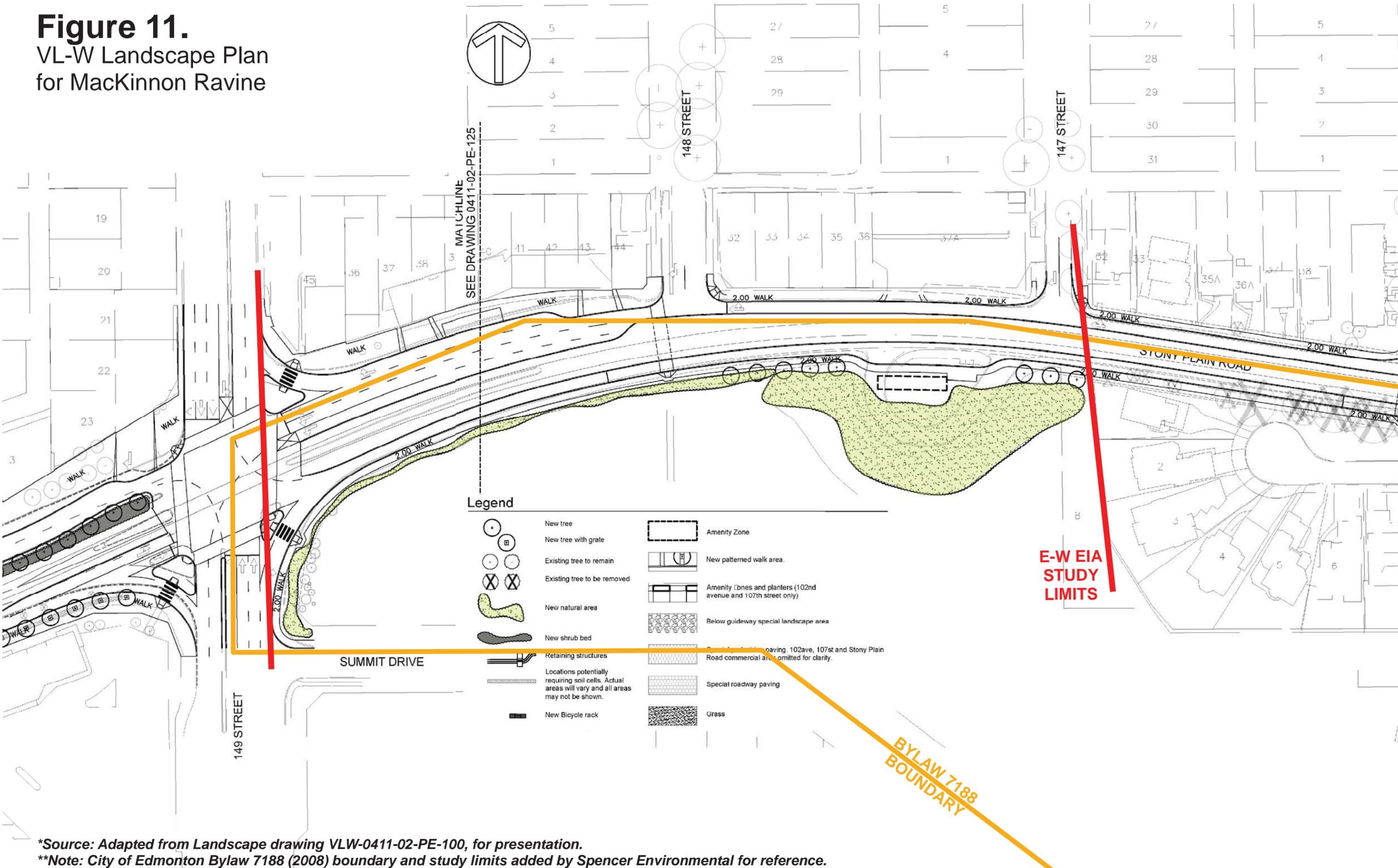
FIGURE 2.0

Figure 10. Existing Pedestrian Bridge Structure



RMULLER / July 6, 2018 / J:\148001\4854_VALLEY_LINE_LRT_WEST_DESIGN_&_OE02_CADD\20_DRAFTING\2300_Roadways\EXHIBITS-2017\KINNON RAVINE FOOTBRIDGE REFERENCE FILES\VIWA\MACKINNON RAVINE SURVEY-GRND-ROEBR-JULY-06-2018.DWG

Figure 11.
VL-W Landscape Plan
for MacKinnon Ravine



*Source: Adapted from Landscape drawing VLW-0411-02-PE-100, for presentation.

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